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A Corpus-driven Approach toward Teaching Vocabulary and Reading to English Language Learners in U.S.-based K-12 Context through a Mobile App

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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

A CORPUS-DRIVEN APPROACH TOWARD TEACHING VOCABULARY AND
READING TO ENGLISH LANGUAGE LEARNERS IN U.S.-BASED K-12 CONTEXT
THROUGH A MOBILE APP

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF PHILOSOPHY

in

CURRICULUM & INSTRUCTION

by

Seyedjafar Ehsanzadehsorati

2018

To: Dean Michael R. Heithaus
College of Arts, Science and Education

This dissertation, written by Seyedjafar Ehsanzadehsorati, and entitled A Corpus-driven Approach toward Teaching Vocabulary and Reading to English Language Learners in U.S.-based K-12 Context through a Mobile App, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Florida International University, 2018

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DEDICATION

I dedicate this dissertation to my mother, Leila, ليلا

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I would like to give my endless thanks to my supervisor, Eric S. Dwyer, who taught me how to write a dissertation. He has given me huge support over the past four years of my PhD and I am greatly indebted to him, thank you.

ABSTRACT OF THE DISSERTATION

A CORPUS-DRIVEN APPROACH TOWARD TEACHING VOCABULARY AND
READING TO ENGLISH LANGUAGE LEARNERS IN U.S.-BASED K-12 CONTEXT
THROUGH A MOBILE APP

by

Seyedjafar Ehsanzadehsorati

Florida International University, 2018

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Professor Eric Dwyer, Major Professor

In order to decrease teachers' decisions of which vocabulary the focus of the instruction should be upon, a recent line of research argues that pedagogically-prepared word lists may offer the most efficient order of learning vocabulary with an optimized context for instruction in each of four K-12 content areas (math, science, social studies, and language arts) through providing English Language Learners (ELLs) with the most frequent words in each area. Educators and school experts have acknowledged the need for developing new materials, including computerized enhanced texts and effective strategies aimed at improving ELLs' mastery of academic and STEM-related lexicon.

Not all words in a language are equal in their role in comprehending the language and expressing ideas or thoughts. For this study, I used a corpus-driven approach which is operationalized by applying a text analysis method. For the purpose of this research study, I made two corpora, Teacher's U.S. Corpus (TUSC) and Science and Math Academic Corpus for Kids (SMACK) with a focus on word lemma rather than inflectional and derivational variants of word families. To create the corpora, I collected and analyzed a

total of 122 textbooks used commonly in the states of Florida and California. Recruiting, scanning and converting of textbooks had been carried out over a period of more than two years from October 2014 to March 2017. In total, this school corpus contains 10,519,639 running words and 16,344 lemmas saved in 16,315 word document pages.

From the corpora, I developed six word lists, namely three frequency-based word lists (high-, mid-, and low-frequency), academic and STEM-related word lists, and essential word list (EWL). I then applied the word lists as the database and developed a mobile app, Vocabulary in Reading Study – VIRS, (available on App Store, Android and Google Play) alongside a website (www.myvirs.com). Also, I developed a new K-12 dictionary which targets the vocabulary needs of ELLs in K-12 context. This is a frequency-based dictionary which categorizes words into three groups of high, medium and low frequency words as well as two separate sections for academic and STEM words. The dictionary has 16,500 lemmas with derivational and inflectional forms.

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Definitions of key terms

For this dissertation, the following definitions are put forward:

Academic vocabulary: Are words that appear constantly across all four content areas, math, language arts, science, and social studies. Academic words are also words whose meaning often change across different subject matters (Baumann & Graves, 2010).

Corpus: A large body of written or spoken natural language which is analyzed via computer-assisted programs (Stubbs & Halbe, 2013).

Corpus-based research: The goal here is to investigate the systematic patterns that governs the linguistic features. This method of research is a top-down approach in which grammatical features are described (Biber, 2012).

Corpus-driven research: Corpus-driven analysis uses the unique features of a text to determine linguistic categories. Therefore, all linguistic categories are systematically derived from frequency distributions (Tognini-Bonelli, 2001).

Elaboration: Elaboration enhances encoding processes in WM through linking a new item to the conceptually related schemata in LTM. Elaboration improves word retrieval through linking a new word to the network of active vocabulary knowledge (Schunk, 2012).

Incidental learning: Incidental L2 learning is defined as learning that takes place without either intentionality or awareness. The line of research on incidental learning argues that L2 vocabulary learning does occur through reading (Chen & Truscott, 2010).

Intentional learning: Ellis (1994) argues that intentional learning requires focal attention to be placed on linguistic form. Intentional learning is directly focusing on the learning item.

Learning burden: Is defined as the amount of effort that a learner usually puts to learn a word (Nation, 2016).

Lemma: Is the school dictionary that comes with some but not all the derivational and inflectional forms; however, word family has all the forms.

Retrieval: The ability to use the learned materials in everyday conversation. Retrieval is different from learning (Schunk, 2012).

Threshold level: A minimum amount of vocabulary knowledge that marks the boundary for gaining a successful comprehension (Nation, 2001).

Text coverage: Is the number of words that the target students at a particular level of proficiency know. Nation (2013) claims that students should know every eight out of ten words in a text to be able to reach a successful reading comprehension.

CHAPTER I

Introduction

K 12 textbooks critique

Imagine a kindergarten class where a new immigrant child has to study phonics, a lesson plan requiring students to learn swatches of words that rhyme. The initial assumption for most teachers is that children know the words. English Language Learners (ELLs), however, do not necessarily know these words. Here, not only do teachers then foist new language upon them; they pound them with words that all sound alike (Wyse & Goswami, 2008), asking them to parse among them without assistance.

In a traditional teaching sequence, a lesson or chapter starts with new words and ends with vocabulary as a reference (Jameson, 2012). The reading passage is the first step that students are required to read followed by study questions and discussion materials. *Florida Reading/Writing for Grades 4-5* (p. 69) is a good example of such a teaching sequence. The sequence is difficult for ELLs because they do not have the required cultural or even background knowledge needed for understanding the reading material; meanwhile, this method of presenting the content is in contrast with Krashen's (1989) ' $i + 1$ ' that claims that input should be a little higher than the current proficiency level of the learners. However, this teaching sequence seems to be ' $i + \text{many}$ ' for ELLs. According to Center of Applied Linguistics (Jameson, 2012), a possible answer to the above-mentioned problem is to Teach-the-Text-Backward in which teachers are recommended to first discuss the material in class in order to activate the ELLs' schemata. Study questions should be

answered following the discussions and finally reading the text should be the last part of the class instruction.

Lexicon in a second language in K-12 context

Lexicon is one of the key building blocks in learning a language. The path toward vocabulary development in a second language (L2) takes time and requires enormous effort. To many language learners, vocabulary learning may seem endless, as they encounter new unknown words every day.

Moreover, many words that ELLs encounter in school are less common words that represent rare elements of a child's home life, but they may still only be selectively pertinent words to very specific situations that put further challenges in front of the ELL's learning path (Townsend and Collins 2009). The above-mentioned scenario seems to worsen as language learners, including EFL and international students, move toward advanced level of language proficiency.

Context of K-12 vocabulary learning in a second language

It is generally agreed that ELLs need more than five years, at least, to gain a fair command of academic English (Cummins, 1981; Hakuta, Butler, & Witt, 2000). Since ELLs may have less experience with English language, as well as a lack of receiving proper academic English prior to their matriculation in mainstream classes, they could face additional challenges in the K-12 context compared to their peers who speak English as their first language.

Unlike ELLs' orthographic knowledge in the L2 that apparently develops like native speaker¹s (Chiappe, Siegel, & Wade-Woolley, 2002), Bialystok, Luk, and Kwan (2005) claim that young foreign language learners' semantic proficiency is far behind native speakers at the same age in K-12 setting. Since the ELLs' dual task of learning content area subjects while developing their language proficiency can be such a huge task, doing so may cause ELLs to score below state average on key standardized tests (Bialystok, et al., 2005). According to the Institute of Education Sciences (2007), ELLs' grades fourth, eighth, and twelfth in 2013 were constantly below the mean scores for the age groups. The gap that I explained here, as a result, yields to a higher rate of drop-out of ELLs and students from minority backgrounds (Snow & Biancarosa, 2003).

In the same vein, the Sheltered Instruction Observation Protocol (SIOP) (2018), a commonly implemented instruction model for K-12, has repeatedly claimed the eminent need of academic language for K-12 ELLs and has practically shown the significance of addressing such a need in helping ELLs to move effectively toward their school success. SIOP workshop leader, Lydia Stack, (personal communication with Eric Dwyer,² November 2017) reports that teachers regularly ask her what academic language is and what content and language objectives are. In other words, many teachers may feel insecure in their ability to select appropriate vocabulary on their own.

1-see Chapter 2 for a detailed description of lemma

2-the supervisor of this dissertation

3-gap refers to systematic difference between two entities including cultures or languages

Academic vocabulary

Since, one's academic prowess in English language discourse (à la Cummins, 1981, and Cook, 1989) seemingly is the crux of success with ELLs, academic vocabulary may be presumed to be an integral part of academic language, a register on its own which seemingly are the foundation of academic materials (Nation & Kyongho, 1995; Scarcella, 2003). Academic words tend to be non-concrete words, low in frequency, carrying a semantically opaque nature that inadvertently pose a comprehension challenge for ELLs (Corson, 1997). More importantly, though, students' challenge with academic vocabulary appears to be one of input: Students tend only to encounter such language through texts—not everyday conversation or even public media. Thus, even mainstream students with good conversational skills who lack enough exposure to academic texts need the sources for improving academic vocabulary.

General academic vocabulary (known as academic vocabulary in this study) refers to the category of words that appear in a wider range of disciplines or subject matter. Townsend (2009) defined academic vocabulary as words that are a serious challenge for learners to master because they have abstract definitions. Hiebert and Lubliner (2008), however, focused on the semantic aspect of general academic vocabulary, defining it as words whose meanings regularly change across different subject matters. Textbook writers and teachers assume that ELLs notice this meaning change and know different meanings across content areas (Townsend & Collins, 2009; Vacca & Vacca, 1996), however, most ELLs fail to notice. In her study, Coxhead (2000, p. 218) defines academic vocabulary as

words—e.g., estimates, overestimate, and underestimate—that uniformly occur in several academic subjects.

STEM-related vocabulary

For many outsiders—and even K-12 teachers—the difference between academic vocabulary and STEM-related words is confusing. Marzano and Pickering (2005) used domain-specific academic vocabulary to refer to STEM-related words. They believe that it is the most common kind of academic vocabulary that appears in academic settings. They suggest that direct teaching of STEM-related vocabulary is the most appropriate classroom teaching activity that a teacher could apply to make sure that students, including ELLs, have the required academic knowledge to grasp the subject matter they encounter through school textbooks (p. 1). *Central tendency, mode, median, and range* are examples of domain-specific academic words used in the subject matter of statistics.

However, Fisher and Frey (2008) use the term *technical vocabulary* to refer to these words; meanwhile, *content-specific vocabulary* is the term Hiebert and Lubliner (2008) use in referring to STEM-related vocabulary. In Figure 1, an academic vocabulary classification system for the present study is presented. As seen in the figure, the classification is founded on two criteria: meaning and frequency. Semantic aspects of words are applied to determine academic and STEM-related vocabulary; however, the frequency criterion is used to categorize words into three levels of high, mid, and low frequency.

Figure 1. Academic vocabulary classification system.

Fundamental issues with respect to vocabulary teaching and learning

Teachers are under heavy pressure to cover all the materials in textbooks during a limited amount of time over the school year (Snow & Biancarosa, 2003; Townsend & Collins, 2009). Therefore, teachers have many tasks to accomplish during class time rather than solely focusing on vocabulary. This pressure is compounded for ELLs in content area classes where they must learn the subject matter while simultaneously developing L2. Thus, class lesson plans can be so packed that adding in a vocabulary module almost seems inconceivable for most teachers. As vocabulary is generally considered a self-directed phenomenon (Nation, 2013; Nation & Webb, 2011), there has been evidence that teachers sacrifice vocabulary instruction for other language related activities (Nation, 2016). As a result, learners are left to learn vocabulary and improve their mental lexicon on their own in most cases.

A further issue related to vocabulary instruction is the choice of strategy domain. Ellis (1990) and Long (1998) argue that intentional vocabulary instruction has always yielded a better learning outcome in terms of breadth of word knowledge rather than only sticking to vocabulary developing through receptive modes of language. Incidental learning, however, is sometimes misinterpreted as unconscious way of learning new words. Therefore, Gass (1999) believes that the learner is not inactive in incidental learning, claiming that incidental learning should be the side effect of other learning activities. Along the same line, R. Ellis and Shintani (2014) investigated incidental vocabulary learning through exposing learners to input data. They argue that learners have acquired some L2 linguistic properties as a result of the indirect exposure.

Likewise, Nation (2001) distinguishes intentional learning from that of incidental learning, arguing that intentional learning is form-focused while incidental learning is message-focused. However, N. Ellis (1999) sees the scenario from a different viewpoint, claiming that the type and amount of attention that students put on every lexical item makes a distinction between incidental and intentional learning. He further argues that, in incidental learning, students put their focal attention on meaning rather than on linguistic form in intentional learning.

In a nutshell, mainstream teachers with ELLs in their classes seemingly lack resources for assisting emergent bilinguals with vocabulary development. They also seemingly and simply may not feel they have the time to work on vocabulary as part of their content lesson planning. A key goal of this dissertation is create a tool that can potentially assist these teachers, and more importantly, their students when lexical features become impediments in students' work toward content understanding.

Statement of the research problem

Having reviewed the recent literature on vocabulary, one might wonders which vocabularies should be taught first. A further issue then would be what new academic and STEM-related word lists are designed for teaching vocabulary and reading that could work as a versatile tool for both teachers and learners? These questions point toward a focus on classified word lists and sub-lists (frequency-based, academic and STEM-related word lists) that may be matched with the common needs of K-12 students in heterogeneous classes. However, none of the existing word lists (Coxhead, 2000; De Gardner & Davis, 2013, West, 1950) has ever focused on the K-12 context. Hopefully the current research

study covers the gap of the existing lack of a validated word list for ELLs in the K-12 context and will advance field of vocabulary instruction.

On a pedagogical and curricular level, we should set reasonable goals at each level through which learners will be able to use an L2 efficiently. Such a goal should have a clear and meticulous plan in terms of the number of words that should be taught through a language course. However, there is not a fixed reasonable number of vocabulary words to pick up as an optimal number that should be covered during a particular time; the number of words is related to the learners' proficiency level and motivational aspects, as well (Waring & Takaki, 2003). Research (for example, Goulden, Nation, & Read, 1990) indicates that the vocabulary size of an educated native speaker is approximately 20,000 word families, including inflectional and derivational forms. Nation (2013) posits that, in each year of one's early years in life, native speakers add 1,000 word families to their vocabulary size. This statistical scenario would be different for ELLs with learning fewer words (Nation, 2013) at each level.

Another issue, in this regard, is that most mainstream classes are heterogeneous; in other words, students' language proficiency levels and their needs differ. Therefore, teachers will find it difficult to give a task to the whole class with the focus on a specific theme, and in some cases there is no other option but to use individualized instruction. Meanwhile, the lack of an appropriate diagnostic placement test in some schools even worsens the scenario. Also, teachers will not have access to a diagnostic test which yields an assessment of ELLs' proficiency. Or, even if they do, they may not have a sense of the degree to which their proficiency helps or harms their progress in a mainstream class. In such heterogeneous classes, teachers are then left with no option but to imagine the

vocabulary that could be the common need of all students. As a result of teachers' decisions, language learning is not efficient and may discourage learners.

In order to improve teachers' decisions on which vocabulary should be the focus of the learning, recent lines of research (Greene & Coxhead, 2015; Nation & Webb, 2011; Nation, 2016) argues that pedagogically-prepared word lists can offer the most efficient way to learn English vocabulary with an optimized context for instruction in each of four K-12 content areas through providing ELLs with the most frequent words in each area. The present dissertation examines word frequency in K-12 textbooks and how they may potentially foster effective vocabulary learning order.

Research questions

The purpose of the dissertation study is to develop new word lists as well as a mobile app alongside a website. The following research questions have been identified that will be the focus of the rest of this research study.

- 1) What is the frequency distribution of vocabulary in U.S.-based K-12 textbooks?
 - a) To what extent are
 - i) K1 (1,000 most frequent words),
 - ii) K2 (second 1,000 most frequent words),
 - iii) academic words, and
 - iv) off-list wordsrepresented in U.S.-based K-12 textbooks?

- 2) What are the most commonly used lemmas in U.S.-based K-12 textbooks?
 - a) To what extent are
 - i) high-frequency,
 - ii) medium frequency, and
 - iii) low frequency lemmas,used in U.S.-based K-12 textbooks?
 - b) What are the new academic and STEM-related word lists in U.S.-based K-12 content area textbooks?
- 3) What is a new mobile app alongside a website to teach vocabulary and reading to ELLs as well as mainstream students?

Overview of methods

For the purpose of this research study, I created two corpora, the Teacher's U.S. Corpus (TUSC) and the Science and Math Academic Corpus for Kids (SMACK). Each corpus yielded key vocabulary lists with lexical items ordered according to each item's frequency within each corpus. To create these corpora, I collected and analyzed a total of 122 textbooks. The recruiting, scanning and converting of textbooks had been carried out over a period of more than two years from October 2014 to March 2017. In total, this school corpus contains 10,519,639 running words and 16,344 lemmas saved in 16,315 word document pages (see Chapters 3 and 4 for information on the methods employed in the current study).

Finally, the resulting lists have been operationalized into a mobile app. Cooperating closely with a computer team over the past two years, I designed and developed a mobile

app (Vocabulary in Reading Study – VIRS, available on iOS, Android, and Google Play) alongside a website (www.myvirs.com) that apply these new corpora and word lists to teach reading and vocabulary through a color coded system. The development of that app is described in Chapter 5.

CHAPTER II

Conceptual framework and literature review

Introduction

This corpus-driven study covers several topics ranging from word retrieval, text density and corpus development to word list validation. In this chapter, I review important theories that form the conceptual framework for this study. Specific topics include the following:

- 1) Typology of academic vocabulary,
- 2) Word frequency studies in the context of vocabulary instruction strategies and lexical development,
- 3) The necessity of new school word lists for ELLs, seminal studies on threshold level and text density,
- 4) Processes through which human being learns and develops vocabulary,
- 5) Problems with current word lists,
- 6) Academic word lists, and
- 7) A detailed definition of corpus linguistics and its application in classroom

Conceptual framework for this dissertation

The conceptual framework of this study is founded on three pillars: 1) text coverage and learning burden, 2) typology of vocabulary, and 3) a vocabulary learning model including word frequency.

Text coverage as a criterion for learning burden

How much vocabulary does anyone need to know in order to read a text?

According to Chall (1987), there is a bilateral relationship between vocabulary knowledge and successful reading. Koda (1989) examined the correlation between linguistic knowledge and reading comprehension. Results show that vocabulary knowledge has a correlation of $r = .74$, which accounts for 55% of successful reading. In another study, Komori, Mikuni, and Kondo (2004) reported that 47% of reading success is accounted for by word knowledge.

Bernhardt (2005) claims that vocabulary knowledge accounts for 30% of successful comprehension. Hu and Nation (2000), however, claim that learners need to know 98% of the text to gain a reasonable comprehension. In this regard, we can relate text coverage, which is defined as the coverage percent of a text by different levels or tiers of vocabulary (Nation, 2013), to learning from meaning focused input which could be achieved by 95% text coverage (Nation, 2001). Thus, text coverage is an invaluable quantitative measurement to assess the value of a level of words as a sublist or domain-specific vocabulary (Coxhead & Hirsh, 2007). Indeed, reading comprehension in L2 can be relatively improved by controlling vocabulary through word lists (Nation, 2016).

Learning burden

The same causal relationship has also been claimed with *learning burden*, as a low text coverage has a heavier learning burden (Nation, 2001). Nation (1990) argues that the amount of energy needed to learn a word is its *learning burden*. He thinks that L2 previously learned information and learners' L1 are the main sources that lead to learners'

familiarity with word patterns which lightens the learning burden. If every word and every word part in the world were different, then the vocabulary learning burden would be abundantly thick. However, fortunately, words are made up of different parts, inflectional and derivational affixes, as well as a stem; thus, word knowledge involves composing the word parts. In terms of word coverage, then, many words with a low frequency of occurrence that have different parts will be reformed each time they are used. For example, the word *unpleasantness* is reformed from its parts (*un*, *pleasant*, and *ness*) where all the parts can work independently but also compose into a usable word.

Learning burden of words in a second language

There is evidence that the scenario of vocabulary learning is even worse at advanced levels of language learning. According to the ACTFL model of inverted pyramid (ACTFL Proficiency Guidelines, 2012), five proficiency levels have been delineated, namely *distinguished*, *superior*, *advanced*, *intermediate*, and *novice*. ACTFL model claims that progress from one proficiency level to the next requires a higher vocabulary size and sophisticated lexical network as well.

In my experience as an English language learner, which was the initial impetus leading me to this dissertation study, I remember that I was faced with more challenges when I was at my advanced level because I felt that I did not have reasonable progress in learning English. My own experience corresponds with the approach taken by ACTFL, not only as a student, but also as a language instructor. Years later, when I became an English teacher, I often heard that my students complained about their slower learning rate and heavier burden that they had in reading comprehension. To this end, indeed, some theorists

(e.g., Nassaji, 2012; Nation, 2013) suggest that the phenomenon of heavy learning burden among second/foreign language learners is the result of a decrease in text coverage.

Lemma vs. word family

Lemma

Francis and Kucera (1982) argue that a headword is the main part of a lemma alongside only some of inflectional forms and reduced forms as well. Therefore, all the words that go under the platform of lemma are the same part of speech. Past tense, past participle, plural form, comparative and superlative are the major English inflections.

Lemma has been used in the literature on lexicon studies as the unit of counting. Thorndike & Lorge (1944) used lemma in their study for frequency counts. Francis and Kucera (1982) developed a lemmatized list from a computerized version of Brown corpus. In the present study, comparative and superlative forms were not included in the definition of lemma. However, different spellings are considered as the same lemma (e.g., *favor* and *favour*).

Nation (2013) believes that the learning burden of lexical items is correlated with the use of lemma and inflectional system. For example, if a learner knows the meaning of *mend*, the learning burden of *mends* then would be negligible. However, a challenge with regard to the definition of lemma and the question that which forms should go under a headword in lemma is our decision about irregular forms like *best*, *mice*, and *went*. There is no doubt that the learning burden of such irregular forms is heavier than that of regular verb forms such as *talked*, *typed*, *cats*, and *easiest*. However, it is still open whether irregular forms should be taken as a separate lemma or put under the same lemma group.

A further issue with regard to the definition of lemma is the separation made between the adjective, noun and verb forms of related items such as *bank*, *original*, and *display*.

A further issue with regard to lemma in the lemma-based classification is the choice of headword whether it should be the base form of the entry or the most frequent one. Because lemma has fewer forms, applying lemma as the unit of counting of entries in a corpus will reduce the number of entries and consequently the final learning burden of a particular lexical item. Bauer and Nation (1993) converted the 61,805 word type-based corpus to a 37,617 lemma-base corpus showing an approximate 40% reduction.

Word family

Word families consist of a base word alongside its inflectional and closely related derivational forms. Some derivational forms in a word family such as *-ness*, *-ly* and *un-* are the affixes that reduce the learning burden of words containing these derivational forms by being used systematically in word formation process.

A major issue with regard to the use of word family is the fact that the lexical items that should be included under a word family are not clear. In this respect, Nation (2013) claims that learners are different in terms of their current proficiency level; meaning that, second language learners' knowledge of suffixes and prefixes are different. Nation then argues that in developing a scale of word families in a corpus, we should start from easier words (words with less affixes) to more complicated ones.

In this regard, Nation (2013, p. 15) argues that the text coverage of first most frequent 1,000 lemmas (which refers to a particular form of a word family that represents the lexeme and is the main dictionary entry for a word family) is between 71-85% in Brown

corpus; however, this range plunges to 4-6% for the second most frequent 1,000 lemmas. Therefore, while one's vocabulary learning rate is most probably consistent at the advanced level, a huge drop in text coverage results in fewer encounters with learned words, consequently imposing a poor return on one's language learning effort, particularly with respect to vocabulary learning. While vocabulary coverage is problematic enough, one's retention rate in both intentional and incidental vocabulary learning can also be low (Ehsanzadeh, 2012; Nassaji, 2012; Nation, 2013), a phenomenon that indisputably affects students' learning motivation in general and their language learning passion in particular.

Causes of vocabulary learning burden in a second language

Frequency of lemma

Bauer and Nation (1993) used the criterion of *frequency* (among other criteria) to organize the patterns of word construction into different proficiency levels. They argue that the learning burden of a word is related to the knowledge of its word parts and the frequency of lemma. Therefore, one may argue that an important part of learning burden is related to the frequency of word family (Nation, 2013). Along the same line, Nagy, Anderson, Schommer, Scott, and Stallman (1989) believe that the total frequency of a word family (total frequency of all forms of a lemma including affixes and the word root) is a reliable predictor of the speed of word recognition.

Word retrieval

Word retrieval is the memory function that also causes a heavy learning burden. Baddeley (1990) argues that repeated opportunity is important to word retrieval. He

believes that word frequency improves the quality of retrieval and thus strengthens the form-meaning link which subsequently leads to enhanced retrieval in future. With regard to learning vocabulary in an L2, word lists can be helpful tools in providing learners with the proper opportunity to encounter new words and strengthen its memory trace before it is sent deep down into long-term memory.

Patterns of word appearance

According to Schmitt (2014), depth is the quality of knowledge about how well different aspects of a word are known, while breadth of knowledge is the number of known words at a particular point. In other words, knowing a word is not unidimensional, as knowledge about a word involves syntagmatic and paradigmatic information about depth and breadth of word knowledge. As a result, another aspect of learning burden of words could be attributed to systematic patterns of word appearance.

A rule of thumb is that not all words in a language are equal in their role in comprehending the language and expressing thoughts. Word frequency research (Coxhead, 2011; D. Gardner & Davies, 2013; Nation & Webb, 2011) reveals that some high frequency words are more beneficial in helping learners to use an L2 effectively. Alongside, there is a small group of high frequency words that covers a big portion of everyday language use. This group should indisputably be the starting point in vocabulary instruction. While examining the Brown corpus, Nation (2013) claims that Level 1 vocabulary is the 1,000 most frequent words whose text coverage is about 72%. This frequency level in Cobb's (2017) classification (Vocab profile through Lextutor website) is known as K1, which is the most frequent words (see later in this chapter for a detailed description of Cobb's

classification). However, Level 2, the second 1,000 most frequent words that is known as K2 in Cobb's classification, covers only about 7.7% of data. Not surprisingly, the trend takes a downward movement by hitting 4.3% of text coverage for Level 3 of 1,000 most frequent words.

Threshold level and the necessity of word list

The question regarding whether there is a minimum amount of vocabulary knowledge that marks a make-or-break boundary for whether one achieves successful comprehension has always been an interesting issue for reading and vocabulary researchers. The boundary is referred to as a *threshold level*. Nation (2001) believes that a threshold level can be defined in either of these two ways: The first view is the strong view, and Nation argues that threshold level is an either-or (all or nothing) level; in other words, the learner will understand the text if he passes the threshold level; otherwise, he will have a vague comprehension of the text. The second view, however, takes the threshold level as a "probabilistic boundary" (p. 238) and states that if a learner passes the threshold level, then he stands a good chance for a successful comprehension.

Laufer and Sim (1985a) took the second view of threshold level and attempted to examine it with interviews and comprehension questions. Results of their research show that the threshold level is roughly 65 to 70% of text coverage. They further claim that vocabulary knowledge is the learners' primary need for successful comprehension. Laufer (1989b) later examined the needed percentage of vocabulary for successful comprehension. Results of her study show that a score of 95% and above on vocabulary will likely lead to the full comprehension of a text. However, results also show that the score of 90% on

vocabulary did not result in successful comprehension. Moreover, Laufer attempted to determine the amount of vocabulary size which is needed to reach the score of 95% on vocabulary. She agrees with Ostyn and Godin (1985) claiming that knowledge of 4,839 words will result in a text coverage of 95 to 98% of newspaper articles in Dutch. In regard to this claim, however, there are three major problems: First, results of vocabulary studies in Dutch do not necessarily apply to English. The second issue is that the unit of measurement is not clear of what a *word* is: whether it's an individual word, a lemma, or a word family (Further discussion of these distinctions will be clarified in Chapter4. The final problem is the genre of the corpus as newspaper articles may not be a proper representative of academic language. Nevertheless, Laufer did not stop there: In another study (1992b), she investigated the effect of vocabulary size on reading comprehension. She looked at the issue from different angles (known/unknown word ratio and level of comprehension) and finally claimed that the 3,000 level of word family on the Nation's (2001) scale of word size (1,000, 2,000, 3,000, 5,000, and 10,000 word levels) is the confirmed threshold level.

Hu and Nation (2000) believe that the coverage of 80% of the text is the threshold level for the all-or-nothing view (the ELL will be on the verge of losing the meaning of the text) and 98% for the probabilistic threshold level. They further claim that 95% is the threshold level for a minimum of adequate comprehension in which the ELL will comprehend the basics of the text. Nation then argues that the type and length of the text are main factors which affect desired text coverage (Nation, 2001). In a recent study, Schmitt, Jiang, and Grabe (2011) believe that there should be a positive relationship between reading scores and text coverage; however, they doubt the existence of a

confirmed threshold level. Although precursory research is not clear about the existence of a numerical threshold level and the minimum number of needed vocabulary, we may wonder if the use of word lists might have a direct correlation with improving text coverage.

Typologies of academic and STEM-related vocabulary

The most recent typology of academic vocabulary divides into three categories, which have common grounds as well as some differences. Below, I give a brief description of these three typologies.

Fisher and Frey (2008) argue that words in a language should be grouped into three main categories: 1) general words which are high frequency words that people basically need for reading; 2) specialized words whose meanings are domain-specific and appear in a wide range of texts; and 3) technical words that are content-specific terms and appear only in a few content areas.

Harmon, Wood, and Hedrick (2008) divide academic vocabulary into four classifications: 1) word clusters; 2) symbolic representations; 3) academically technical terms; and 4) nontechnical terms. Their last two groups of words are similar to Fisher and Frey's (2008) technical and specialized vocabulary. The first category, word clusters, refers to clusters or phrases of words that appear only in a particular domain. Symbolic category are also symbols and special abbreviations related to a domain.

Taking a different point of view with regard to academic vocabulary, Hiebert and Lubliner (2008) classified the vocabulary system on the basis of frequency and dispersion. They define frequency as the number of times that a word appears in a given text.

Dispersion, however, refers to how widely a word is used across different subject matters. A low dispersion value, thus, shows that a word appears within only a few content areas.

Hiebert and Lubliner's (2008) classification system includes four vocabulary categories: 1) school task vocabulary, 2) general academic vocabulary, 3) content-specific vocabulary, and 4) literary vocabulary. The content-specific vocabulary in this system is close to domain-specific academic vocabulary. Hiebert and Lubliner's general academic vocabulary is also analogous to Coxhead's academic vocabulary.

Among the four classifications proposed by Hiebert and Lubliner's (2008), school task vocabulary is more related to my dissertation. This category includes the words appearing within English language arts as well as terms and expressions that classroom teachers use in their teaching. School task vocabulary also covers language that textbook writers use to describe educational concepts.

Since 1994, Tom Cobb has been developing a website—LexTutor (see Chapter 3 for a description of the website)—which gives a variety of options for lexical and textual analysis. Cobb argues that a comprehensive vocabulary profiler should divide a text into four basic word groups, including both frequency-based and content-based classification. Cobb's frequency-based classification has two categories—K1 which is 1,000 most frequent words, and K-2, the second 1,000 most frequent words. On his website's vocabulary profiler, K1 words are color coded as blue and K2 in green. Cobb's content-based classification, AWL, mostly follow Coxhead's Academic Word List (AWL) and comes in yellow. In Cobb's classification system, there's also a category known as Off-list, which comes in red in the website's profiler, and presents words that are not represented in the K1, K2, or AWL.

Vocabulary classification system for this study

The line of literature on academic vocabulary divides it into two major categories: 1) domain-specific or content-specific words particularly used in a content area such as biology, geometry, physics, and algebra, and 2) general academic vocabulary which is an all-purpose category of academic words that appear across a range of academic content areas; however, their meanings may vary from one discipline to the other. For the purpose of this dissertation, I classify academic words into 1) academic vocabulary and 2) STEM-related words.

Word frequency list and vocabulary instruction

Mental lexicon and word frequency

The mental mechanism of vocabulary learning through intentional learning (word list) and incidental learning (lexical inferencing) does not yet stand both theoretically and empirically clear. Within this line of research, as Baddeley (1998) claims, the mental status of lexical items and their retrieval is the area of neurological research that lags behind other related areas and needs more bodies of research. In this regard, an influencing factor on both incidental and intentional learning is word rehearsal. Alongside, there is a gap in literature with respect to the retrieval of learned lexical items through word lists. The line of research on lexical inferencing is fairly rich (Nassaji, 2004; Nation, 2001; Soria, 2001); however, few research studies on the effect of word lists on the retrieval of learning in the mental lexicon are available the mental dictionary represented in the mind through which individuals are able to engage in everyday processes of language use.

Word Frequency and vocabulary development

One possible reason for a low rate of vocabulary learning might be a result of one's little exposure to language. Sometimes, L2 classroom exposure is the only chance that learners have in the process of language learning (Chen & Truscott, 2010; Schmitt, Jiang, & Grabe, 2011; Waring & Takaki, 2003; Webb, 2007; Webb & Chang, 2014). Zipf (1949) proposed a linear relationship between frequency rank and probability of its usage. He argued that more frequently used words are easier to process. Also, psycholinguistic research has repeatedly confirmed the influence of word frequency on language processing phenomena such as lexical decision tasks (Rubenstein, Garfield, & Millikan, 1970), word naming tasks (Ellis, 1991; McLaughlin, 1990), phoneme monitoring (Nation, 2001), and lexical access (Balota & Spieler, 1999). Gass, Behney & Plonskey (2013) believe that the first encounter with a word may draw a learner's attention to that item. Subsequent encounters provide learners with further opportunities to determine relevant semantic and syntactic information. This further means that the salience of a word through frequency helps learners become aware of the word as an item they need. Nagy, Herman, and Anderson's (1985) study shows that native English speakers have about a 10% chance of learning the meaning of a new word in their home language from context given a single exposure; however, second language learners likely require many exposures to a word in a context before understanding its meaning.

To explore the relationship between word frequency and retention trend, Rott (1999) argues that exposure frequency is the variable that influences the forgetting pattern of word learning. In another study on retention rate, Brown (1993) found a clear relationship between general word frequency and the words learned by learners. He used

the Brown corpus as a norm of reference. Nation (2001) argues that word frequency directly affects learner's noticing through the salience of a word in the context. However, a key question arising from the research can lead one to propose that one should have a great deal of exposure, but only if one actually notices it before learning it. As a result, word salience and frequency seemingly affects a learner's realization that a word is significant in filling an existing gap in any person's knowledge (Schunk, 2012).

Webb (2007) examined the effect of word repetition of developing word knowledge. Participants were 121 Japanese EFL learners assigned randomly to one control group and four experimental groups. The design of the study uses one vocabulary comprehension task with 10 tests to measure different aspects of vocabulary knowledge, namely syntax, grammatical function, and association. Webb used pseudowords with 1, 3, 7, and 10 frequency of occurrences. Results of the study showed that repetition has a positive effect on at least one aspect of vocabulary knowledge. However, Webb claims that 10 encounters with a word or maybe more are required to learn all aspects of a word.

As a follow-up to Webb's (2007) study, Chen and Truscott (2010) also investigated the effects of repeated encounters with target words on the development of seven aspects of word knowledge. They used seven measures in their study, immediately after the treatment and again after a two-week delay. The design of the study was a follow-up of Webb's (2007) study but emphasized ecological validity over control and presenting genuine words in meaningful reading passages. Results for repetition largely supported Webb's findings while suggesting that the nature of his study led to an overestimation of learning. Chen and Truscott (2010) also argued that in the immediate posttest, repetition

affected productive vocabulary knowledge somewhat more than receptive one, but this relation reversed on the delayed posttest.

Literature on optimal word frequency (Laufer, 2003; Nation, 2001; Nation & Webb, 2011) argues that a range of 8 to 12 exposures of new words are needed for a learner to start using new lexical items in L2. Other studies (Kweon & Kim, 2008; Waring & Takaki, 2003) also reported that word frequencies greater than 20 are needed for incidental learning. In their study, Waring and Takaki used a multiple-choice, immediate posttest measure and found that of 25 new words available for learning in a graded reader, 11 words were learned, indicating a gain of 44%. However, some studies have shown that vocabulary learning occurs from as few as five exposures (Webb, Newton, & Chang, 2013) and even two exposures (Bisson, van Heuven, Conklin, & Tunney, 2015).

With regard to word attrition trends in vocabulary learning, Ellis (2002) argues that incidental learning from extensive reading can sometimes be connected to the short-term memory processes, and the learner may be unable to recognize or use the word on future occasions. However, Ellis also suggests that higher frequency words in the incidental learning will create connections between short-term memory (STM) and long-term memory (LTM) which would diminish the word attrition trend. The rationale behind this is that the first few encounters serve as an attention raiser—that is, noticing. The subsequent encounters direct the learner's attention toward the word, and thus lead to the acquisition of the word meaning. Ellis argues that multiple rehearsals in unique situations will connect STM with LTM. He claims that if constructing word meaning through lexical inferencing is connected to STM, the reader cannot recognize the word and would not be able to retrieve it in future.

Schunk (2012) argues that rehearsal is one of the situated factors that has a direct correlation with word learning. Also, Laufer (2003) believes that rehearsal should occur at least eight to 12 times in order for a learner to be able to retrieve an item. She thinks that the rehearsals should be in different situations through different learning activities. In a similar study, Horst (2005) claims that the reason behind this may be because the first few rehearsals attract the attention of the reader and further rehearsals give the chance to the reader to construct the meaning on the basis of the available clues that he/she has of the situation, the co-text of the reading passage. The further rehearsals of the word in different situations allow the reader to confirm or reject earlier inferences.

A model for learning vocabulary in another language

There are a number of studies attempting to formulate a model for the role of frequency categories in vocabulary learning and retrieval process (Coxhead, 2000; Crossley, Cobb, & McNamara, 2013; D. Gardner & Davies, 2013; De Bot, Paribakht, & Wesche, 1997; Nation & Webb, 2011; Schunk, 2012). In the present study, I focus on word frequency and the role of academic and STEM-related lists that provide learners with a content choice through corpus. The learning context in the model I designed for the purpose of the research study is reading in which K-12 students, including ELLs, receive input and can utilize contextual and situated clues to construct meaning. My perception is that the process of the development of lexicon through reading is a holistic process starting with inferring the meaning of unknown words. Successful inferencing seemingly leads to the comprehension of the reading text (in our case, K-12 textbooks). When students achieve comprehension and are able to synthesize and construct the whole meaning of the reading

passage, this then means that they learned the unknown lexicon passively. It is here is where word frequency comes to play. Learning the new lexical items and transforming them into LTM occur simultaneously (Schunk, 2012). This does not necessarily guarantee that comprehension leads to the retrieval of lexicon for future use; thus, learners should encounter the word on an organized and regular basis. As is illustrated in the diagram below, vocabulary learning and its retrieval for future use are two distinct constructs (Schunk, 2012).

A number of factors seem to affect the retrieval of lexical items through both intentional and incidental learning, among which inferencing, depth of processing in the mental lexicon, and word frequency outstand the others. How word frequency affects the learning process is presented in the model in Figure 2.

Encoding and internal specification

Analyzing the new information in working memory (WM) and breaking it down in chunks to be stored in long term memory (LTM) is technically known as encoding (Schunk, 2012). Matlin (2009) believes that encoding is initially accomplished by giving a code to the received information and then that code is linked to the existing codes in the LTM. Meaningful encoding improves the retention rate of stored information in LTM and learning occurs even with meaningless encoding. Although teachers attempt to present words in meaningful ways and most students also attend to teachers' explanation (Greene & Coxhead, 2015), there are things that still go unlearned in class—for example, ELLs' poor use of academic words in their writing samples). With this regard, Schunk (2012)

argues that *organization* and *elaboration* are two main factors that affect encoding and internal specification.

Organization: Organization, as shown in Figure 1, has a direct effect on encoding and internal specification through depth of word processing (Schunk, 2012). Research (Anderson, 1990; Miller, 1956) showed that the more materials are organized, the easier they will be retained. When smaller bits of a whole information are linked together systematically and are also linked to stored information in LTM, remembering of one chunk stimulates other related items and thus makes it easier to recall the whole information. Using a hierarchy of information in which chunks are integrated is one way to organize the information.

Figure 2. A model for learning vocabulary in another language.

Elaboration: Schunk (2012) believes that elaboration is the procedure that enhances encoding processes in WM through linking a new item to the conceptually related schemata in LTM. Today, neurologists believe that elaboration improves word retrieval through linking a new word to the network of active vocabulary knowledge. In this regard, Anderson (1990) argues that sometimes people forget the message but elaboration helps to recall the key content. Elaboration is important because a problem that many students, including English language learners, have in developing their word knowledge is that they cannot appropriately elaborate the new vocabulary items because it is not easy to link every new vocabulary to the network of lexical repertoire Anderson, 1990).

Depth of processing theory

Depth of processing theory, also known as the Levels Theory, defines human memory on the basis of the nature or the type of the required processes through which brain receives information rather than the place of the information (Craik & Tulving, 1975; Lockhart, Craik, & Jacoby, 1976). Lockhart et al (1976) argued that depth of processing in learning vocabulary will occur better if students understand materials and process them at a deeper level. They further claimed that drawing on students' schemata will enhance learners' retrieval. According to depth of processing theory, one significant method in improving retrieval is through providing further processing at the same level. In this regard, Nelson (1977) provided his students with either one or two additional rehearsal for each word. He argued that two repetitions produced much better rehearsal.

Anderson (1990) in his activation model of memory rejected two separate structures and instead argued for a holistic model of memory with two activation states, namely as

active and *inactive*. At every point of time, information may be processed at the active or inactive states of mind. According to Anderson's model, frequently encountering new words keeps the memory of the word traceable in the active state of the memory which consequently leads to a higher chance of learning. However, by shifting the direct attention, the memory activation state will then change.

Rehearsal theory

Spaced rehearsal strengthens the trace of memory. Schunk (2012) argued that rehearsal is of two types: maintenance rehearsal and elaborative rehearsal. *Maintenance rehearsal* is reviewing the new material repeatedly which could be accomplished through putting an exponential space between each rehearsal. In *elaborative rehearsal*, students relate the new information to what they already know and stored it in their LTM. A mnemonics approach to developing vocabulary (Ellis, 1994) is a form of elaborative rehearsal. For example, if a student is studying U.S. history, and for a number of times “D-Day” is repeated that “D-Day” was June 6, 1944, this is maintenance rehearsal. However, if he relates it to the information that he knows (e.g., Roosevelt was selected for the fourth time in 1944), this will be elaborative rehearsal. When it comes to word learning, this process is more difficult because we have a huge number of abstract words whose linking to schemata needs students' effort and teachers' creativity, as well.

Corpus linguistics

Corpus-based research

Corpus-based research has been shown to provide us with tools for explaining variation and use of linguistic patterns (Tognini-Bonelli, 2001). This means that the goal here is to investigate the systematic patterns that governs the linguistic features. Biber (2012) argues that corpus-based research has systematically illustrated that any language variant is distributed with a different frequency across different registers. The use of computer programs has caused corpus-based research to be highly reliable and with an acceptable validity (McEnery & Hardie, 2013).

Corpus-based study is a top-down approach in which grammatical features are described. The term *corpus-based* is used to refer to a methodology that avails itself of the corpus mainly to expound, test, or exemplify theories and descriptions that were formulated before large corpora became available to inform language study. In this regard, Biber (2012) argues that corpus-based research is criticized for ignoring the evidence that fails to fit through the confirmed theories while mostly attaching to existing pre-corpus theories.

We could say, therefore, that corpus-based linguists adopt a “confident” stand with respect to the relationship between theory and data in that they bring with them models of language and descriptions which they believe to be fundamentally adequate, perceiving and analyzing the corpus through these categories and sifting the data accordingly. The corpus is considered useful because, on occasions, it indicates where minor corrections and adjustments can be made to the model adopted, and it can also be valuable as a source of quantitative evidence (Hunston, 2006). In this case, however, corpus evidence is brought in as an extra bonus rather than as a determining factor with respect to the analysis, which

is still carried out according to pre-existing categories; although it is used to refine such categories, it is never really in a position to challenge them as there is no claim made that they arise directly from the data.

Corpus-driven research

Corpus-driven analysis uses the unique features of a text to determine linguistic categories. This means that corpus-driven research considers corpus evidence (Tognini-Bonelli, 2001). Therefore, all linguistic categories are systematically derived from frequency distributions. Unlike corpus-based research, corpus-driven analysis only deals with words and syntax, and grammar has no place in this approach so that all inflectional and derivational morphemes of a single lemma are treated differently. This, however, does not mean that all cases of corpus-driven studies are the same. They are different in one of these three ways: whether they analyze lemma or word family, the extent to which they use linguistic constructs, and the role of frequency in analyzing the data (Biber, 2012).

A corpus-driven approach aims to derive linguistic categories systematically from recurrent patterns and frequency distributions emerging from language in context (Tognini-Bonelli, 2001). This approach is similar to a holistic approach to language in that the cumulative effect of repeated instances is taken to reflect the semiotic system; the text is seen as an integral part of its verbal context and, ultimately, no discontinuity is assumed between this and the wider context of learning situation, and the even wider context of culture.

Using corpus evidence as the main source of analysis makes the corpus-driven research a bottom-up approach in which the researcher starts the analysis with having no

assumption in mind. As a result, a major criticism to corpus-driven study is that it wholly adheres to the obtained data from the corpus, which in some cases is not necessarily a pure display of real language (Leech, 1991).

Current word lists

In curriculum design and material development, making word lists to provide new tools for teaching different genres of vocabulary has a long history. Early lists (non-frequency lists) did not implement a frequency calculation. The word selection criterion then was determined by the word's significance in meaning conveyance. The Basic English word list (Ogden, 1936), for example, is one such attempt that focused on the words learners need to produce a wide range of linguistic output. In the Ogden's list, however, most words are high-frequency words (Nation, 2016).

The latest version of such non-frequency based lists is Carter's (1987) core vocabulary. His point of view is that determining core vocabulary with only a linguistic focus is insufficient. Carter believes that making pedagogical word lists needs a clear decision over which words should be taught first. He further claims that a rigorous selection of core vocabulary in making word list will lead to the grading of reading materials and lexical richness.

In the second category of word lists, frequency-based lists which emerged as a result of a collected corpus, the best known is West's (1953) General Service List (GSL) that presents levels of what he claimed were the 2,000 most frequent academic words in English. The GSL had been used extensively in ESL and ESP classes. West also used other criteria beyond the frequency in developing his list as he was busy with developing graded

readers. Ultimately, West included words that were not high frequency words but turned out to be words that are essential in producing basic meaning.

In an attempt to develop a content area corpus, Salager (1983) created a corpus of medical English with 100,000 running words. He divided the corpus into three subcorpora: basic English, fundamental medical words, and technical words. In developing his word list, Salager compared her medical corpus with another diverse corpus to analyze the role of semi-technical vocabulary in academic discourse.

In the hope of making a stronger word list with a higher text coverage, Xue and Nation (1984) combined four word lists developed by Campion and Elley (1971), Praninskas (1972), Lynn (1973), and Ghadessy (1979), thereby composing the University Word List (UWL). In developing the UWL, Xue and Nation for the first time used two computer programs, Vocabulary Profile and Range Program, developed by Nation and his colleagues. The list has 836 word families and had been widely welcomed and used for more than 15 years in academic settings.

Similarly, Farrel (1990), in his study, focused on semi-technical words and made a list that contains 467 family types and 160,000 running words. Farrel defines semi-technical words as those that are context independent and are beyond the words found in basic English courses. He attempted to exclude all general words from the list.

However, Ward (1999) criticized the idea of dividing a corpus into three subcategories of general, technical, and academic word levels. In other words, his notion was that dividing was not necessary—only context. Ward created an engineering corpus (Ward, 2009) from which he derived a list of frequent words. He then compared his list with a collection of engineering texts. Results of his study show that a list of 2,000 word

families covering 95% of engineering texts. Ward claims that the coverage of his list is more effective than that of GSL.

Academic word lists

All the word lists developed after the GSL have never gained the reputation of Coxhead's (2000) Academic Word List (AWL), a seminal academic word list widely used in ESP programs. Through the process of developing the corpus, Coxhead applied four main criteria:

- a) representation (a corpus must be a collection of texts that are representative of a variety of genres),
- b) organization (words in a corpus should be selected evenly across subject areas),
- c) size (word families with at least 100 occurrences were included in the corpus), and
- d) word selection (the word family as the word unit for the corpus).

Coxhead collected 414 texts with approximately 3.5 million running words. She divided the corpus into four main areas of arts, law, science, and commerce. Each area contained roughly the same number of running words. In developing the academic word list, Coxhead used the Range program (Heatley & Nation, 1996) to rank order the words of the corpus alphabetically. The Range program is software that accepts 32 different files and produces a list of individual words with their frequency. Coxhead then applied three criteria for choosing the words of the AWL. According to the first criterion, *specialized occurrence*, word families should not be any of the members of the first 2,000 words of the West's

(1953) GSL. *Range* was Coxhead's second criterion, which placed a minimum of ten occurrences in each of the four areas for a word to be included in the word list. Through the third criterion, *a minimum*, Coxhead put a minimum of 100 occurrences in the Academic Corpus for all the members of a word family to be considered as a candidate for the AWL. After running the RANGE program (Nation, 2001) and comparing the results with West's GSL, 570 word families met these three criteria for inclusion in the AWL.

The AWL text coverage accounts for 10.0% of the total tokens of the Academic Corpus. Among the four subcorpora, commerce has the highest AWL coverage with 12.0%. This amount is approximately the same for law and arts subcorpora with percentages of 9.4 and 9.3, respectively. Science, however, has the lowest AWL's coverage (9.1), revealing that science seems to be easier than other areas, in other words, the more AWL abstraction in a text, the more difficult the text is considered.

In order to validate the AWL, Coxhead further developed another corpus of fiction texts containing more than 3.5 million running words. In this corpus, the AWL covers only 1.4 % of the total tokens, demonstrating that most of the word families in the AWL carry concepts that are mainly associated with academic genres.

Over the past decade, Coxhead's AWL has been used widely in efforts to reduce the gap between high and low second or foreign language learners in terms of academic word knowledge. However, Gardner and Davies (2013) argue that Coxhead's list suffers from two main problems. The first issue concerns the use of word family as the base for making the corpus and counting the items of the AWL. Gardner and Davies believe that all the members of a word family do not share the same meaning and this would be more intense across different academic disciplines. They posit that this problem is caused

because word families in the list do not have parts of speech. Instead, they suggest that an academic word list should be arranged by lemmas (words which are from the same parts of speech and are related together through different grammatical inflections). Ultimately, they claim that a new academic core vocabulary is needed.

A further issue with respect to the validity of the AWL is its relationship to the GSL (West, 1953), as Coxhead extracted the words that were beyond the GSL's first 2,000 high-frequency word level. Gardner and Davies, however, argue that the GSL is old and the corpus from which West made his list is from early 1900s. Therefore, Gardner and Davies believe that the AWL should not be attached to the GSL as the AWL is a category of the high-frequency words of recent English, while the GSL is not a meticulous reflection of the high-frequency words.

They further argue that a validated list should be drawn from a large and representative corpus that covers significant academic disciplines to be able to distinguish high-frequency words from academic technical words as well as from academic core vocabulary. Materials chosen from contemporary English are the characteristics that Gardner and Davies emphasize, proposing that texts and materials from 20 to 100 years ago would not make a valid word list. Moreover, they think that the best way to determine the validity of a word list is through comparing it to both academic and non-academic corpora. In doing so, Coxhead tested the AWL against a corpus of fiction texts, while Gardner and Davies also tested their list against a subcorpus of non-academic texts from the Corpus of Contemporary American English (COCA) which is a public domain and free corpus of English. Davis (2012) argues that the COCA is the only balanced and representative corpus of contemporary American English widely used by researchers.

COCA now has about 560 million words and Davis claims that 20 million words have been added to COCA annually since 1990 when it had first been appeared. COCA is also related to other existing corpora of English and contains different sections for fiction, magazines, newspapers, and spoken and academic texts. In developing their academic vocabulary list (AVL), Gardner and Davies (2013) used a corpus of 120 million words, taken from the academic subsection of the COCA. The AVL corpus is approximately 35 times larger than that of the AWL. Furthermore, the AVL corpus is 20% larger than the British National Corpus (BNC) (BNC has 100 million words and includes samples of both written and spoken language which is designed to represent British English) in terms of academic portion. Like the AWL, a limitation to the AVL is that there is no spoken sample of academic language.

In addition, Gardner and Davies (2013) excluded all high-frequency words and technical academic words. In making their list, they included the lemmas whose frequency were at least 50% higher in academic corpus compared to that of non-academic corpus (ratio criterion). In the next step, they collected the word lemmas that occurred in at least 20% of the expected frequency in seven domains. Gardner and Davies then chose lemmas with a dispersion of at least 0.80. The final measure that they used in developing the list was the exclusion of all the domain specific words from the final list.

Sight word lists

Sight words are the highest frequency vocabularies. These are common words that no one needs focused attention to recognize and decode them. In school materials and especially for young children, sight vocabulary usually accounts for 75% of the written

texts so that these are the words that should be the focus of early vocabulary instruction (Flesch, 1955).

There are a few sight word lists, among which Dolch's sight words (Dolch, 1936) list was developed in 1930s and '40s by examining the words that most frequently appeared in the books written for children. Dolch's word list contains 220 basic words alongside 95 high frequency nouns. Dolch's sight word list is the most famous one of such lists. However, his list is dated. No current sight word lists are recent or methodologically validated. To the best of my knowledge, no sight word list has ever been developed from recent K-12 school textbooks.

Problems of current word lists

A major problem of all the word lists, except than the one developed by Gardner and Davies (2013), is the fact that they use small size corpora, smaller than 5 million entries. Therefore, they lack the representative criterion. As a result of this small size, none of them, hence, is seemingly derived from a balanced corpus. A further issue is that texts from which these lists are made are relatively old and can not meet the needs of 21st century language learners. Therefore, this criterion might disqualify Nation and Hwang's (1995) claim that GSL still works reasonably well. Seemingly, then, as a result of technological changes in the past two decades, no replacement to GSL and other word lists can result in a validated word list with a high text coverage and the scenario is much worse when it comes to K-12 settings.

The third problem concerns the way that the corpus materials were collected and analyzed. The scrutiny of most of these corpora had been affected because they were

compiled by hand because of limited computer programs at the time. For example, Campion and Elley (1971) and Praninskas (1972) used basic principles of frequency in developing their lists. Meanwhile, Lynn (1973) and Ghadessy (1979) only collected words for which learners annotated in their first language in the academic texts. Another major problem of all the existing word lists is the lack of textbooks from which these corpora have been taken.

Over the past decade, learner autonomy (Gardner & Miller, 1996; Holec, 1981) has attracted a good deal of attention as both a means and a goal in education. While learner autonomy in language learning has gained different forms, self-directed vocabulary learning through word lists has become a key in improving the lexical knowledge of children with limited proficiency as well as adults in ESP programs.

Research on vocabulary assessment (Read 1998; Schmitt, Schmitt, & Claphan, 2001) indicates that high frequency words are seemingly learned first. Therefore, a word list based on frequency order can be valuable in determining the amount of vocabulary needed for an acceptable proficiency at a particular learning stage as well as mapping the best learning order.

Teaching/learning implications of using word lists

Principle of least effort in language learning

There is a general law in every language (Nation, 2013) that some words appear in spoken language and written texts more frequently than other. Initial data analysis for the present dissertation, alongside other corpus-driven studies (Coxhead, 2000; Nation & Webb, 2011), reveal that a small percentage of words are *high frequency* and have a wide

range of usage covering a larger part of written texts. Still, there is a large number of *low frequency* words whose text coverage is relatively small. This is also in alignment with the “principle of least effort” (Zipf, 1949, p. 5) which states that a constant figure will be gained if the rank order of an item is multiplied by its frequency. Thus, if we follow Zipf’s general cost/benefit law which claims that the effort of learning high frequency words first will repay better compared to that of learning low frequency words, it stands reasonable that teaching high frequency words first will improve learners’ reading proficiency and their general language comprehension. High frequency words are encountered more often and learning these words first may be more beneficial to learners.

Significance of using word lists in language learning

As a result, it is crucial for curriculum developers and textbook writers to know which words and core academic vocabularies should be given first at a particular proficiency level. To this end, and given the significance of teaching high frequency and core academic words through word lists, I review the significance of word list research here.

Nation and Web (2011) believe that word lists have clear benefits for learners, teachers, and textbook writers. They list seven values of word lists and argue that these values are not limited to only these seven:

1. *Designing courses:* Word lists provide us with the most valid source of sequencing words at different levels of language learning; therefore, learners will receive the most suitable content in accordance to their age and proficiency level.

2. *Setting learning goals*: Each sub-list has a certain number of words and can be set as a goal for learners to achieve at the end of a stage. Nation (2006) attempted to find how many word lists with 1,000 words are needed to reach the goal of 98% coverage of a text.
3. *Guiding the creation of simplified texts*: Graded readers have been created and have become a form of simplified texts, which may be valuable sources for improving second language learner' reading proficiency (Woodinsky & Nation, 1998). This further emphasizes the role of word lists in developing materials within a controlled vocabulary.
4. *Analyzing the vocabulary in texts*: Adjusting the vocabulary load of texts to the learners' proficiency level can be accomplished through frequency word lists. There are some websites (Cobb, 2017; Davies, 2012) that are used to analyze the text density in terms of word tiers.
5. *Creating specialized word lists*: Word lists are highly valuable in designing English for Specific Purposes (ESP) programs such as Business English, Medical English, Hotel English, Plumber English, English for Scuba Diving, and so forth.
6. *Analysis of lexical richness*: The learner corpus or texts produced by learners can be used as an educational tool through which we can gain a better understanding of learners' lexical repertoire (Granger & Rayson, 1998). In doing so, word lists are used to analyze the learner corpus and will help us to know the amount of vocabulary the learners actively or passively use at a particular proficiency level.

7. Guiding the construction of vocabulary tests: The Vocabulary Levels Test and the Vocabulary Size Test (Nation, 2001) are two procedures examining breadth of vocabulary knowledge that are constructed based on frequency lists.

Beyond these seven values listed by Nation and Webb (2011), the line of research on breadth of word knowledge (Beglar, 2010; Nation, 2001; Read, 1998) reports that there is a positive correlation between the frequency of a word and the possibility of knowing that word. This further substantiates the significance of frequency-based word lists in improving the retention rate of incidental vocabulary acquisition. In this regard, Ehsanzadeh (2012) found that words with a minimum text exposure of 20 stand a good chance (13.4%) of being acquired incidentally through reading. Results of his study show that a word list of sight vocabulary can exponentially improve the text coverage and reading comprehension as well.

Significance and purpose of this dissertation

The line of research on reading comprehension (Gass, Behney, & Plonskey, 2013; Nagy & Townsend, 2012; Webb & Chang 2012; Webb & Chang, 2014) argues that academic vocabulary knowledge is the prerequisite ability for gaining an adequate understanding from academic texts. It seems that digesting academic texts has a direct correlation with academic achievement and future prosperity. This further emphasizes the key role of academic and STEM-related vocabulary knowledge in students' future career. It also argues that the significant role of this knowledge has been well credited in primary

school (Chall, 1996; Biemiller, 2010), middle school (Townsend & Collins, 2009), and high school (Vacca & Vacca, 1996).

In the meantime, educators and school experts have acknowledged the need for developing new materials and effective strategies aimed at improving ELLs' academic and STEM-related lexicon (Beck, McKeown & Kucan, 2002; Biemiller, 2010; Carter, 2012; Gardner, 2013). Materials focusing on academic vocabulary instruction, including academic word lists which are specifically designed for K-12 are highly needed (Gardner & Davies, 2013; Graves, 2006). It seems that little evidence of the breadth of academic vocabulary learning has been dealt with in K-12. An outgrowth of this study, then, may be the extent to which academic vocabulary shows up throughout the K-12 world.

CHAPTER III

Developing the corpora: TUSC & SMACK

Introduction

As I explained in Chapter 2, using word lists have several benefits for ELLs in school contexts. In order to make a validated word list, it is essential to base the lexical data on a large representative corpus. Meanwhile, word lists provide data that can help vocabulary test developers in making new tests. Vocabulary tests that assess biased lexical data will lead to distorted results. Also, word lists can be beneficial in assessing the difficulty level of a text for ELLs. In the first step, therefore, it is important to create a corpus which is representative of the target domain and is derived from the learning purpose of K-12 ELLs. This chapter is built on these three pillars:

- a) empirical examining language used in K-12 textbooks,
- b) following the typology of words in creating the corpora with different purposes,
and
- c) using computer programs and software in compiling the corpora.

In Chapter 3, I review some main features in developing a corpus. Then, in Part 1, I explain the procedures for collecting textbooks, scanning and converting them into readable files for computer programs. LexTutor and AntConc software were used in the analysis of the lexical data. In Part 2 of Chapter 3, I delineate the method of developing the K-12 corpora: TUSC and SMACK. In the result section, I examine the statistical information of the corpora. I also report the coverage of STEM-related and academic words in each corpus.

Research questions

As a review, I offer this reminder of the research questions:

- 1) What is the frequency distribution of vocabulary in U.S.-based K-12 textbooks?
 - a) To what extent are
 - i) K1 (1,000 most frequent words),
 - ii) K2 (second 1,000 most frequent words),
 - iii) academic words, and
 - iv) off-list wordsrepresented in U.S.-based K-12 textbooks?
- 2) What are the most commonly used lemmas in U.S.-based K-12 textbooks?
 - a) To what extent are
 - (i) high-frequency,
 - (ii) medium frequency, and
 - (iii) low frequency lemmas,used in U.S.-based K-12 textbooks?
 - b) What are the new academic and STEM-related word lists in U.S.-based K-12 content area textbooks?
- 3) What is a new mobile app alongside a website to teach vocabulary and reading to ELLs as well as mainstream students?

TUSC and SMACK

For the purpose of answering the first three questions, I compiled two K-12 corpora, The Teacher's U.S. Corpus (TUSC) and the Science and Math Academic Corpus for Kids SMACK (see later this chapter for a detailed description of the corpora).

Procedure for developing the corpora – TUSC and SMACK

Conrad (1996) believes that the goals of a research study should be reflected in the design of the corpus. The primary goal of the present dissertation is to make an academic core vocabulary list and a list of STEM-related words. In the next step, I focus on what is hopefully the most appropriate path through which such lists should be incorporated into technology to teach reading to ELLs. To this end, I adopted a corpus-driven approach in designing and developing the corpora with a focus on word lemma rather than inflectional and derivational variants of word families (see Chapter 2 for a detailed reason for choosing lemma as the unit of analysis).

Textbooks and materials were recruited from two sources, representing the K-12 textbooks of States of Florida and California. The four most populated states in the U.S., California, Texas, New York, and Florida, lead textbook decisions, and I initially hoped to compile a K-12 corpus representing all the four states. As a result of many limitations in recruiting and converting the textbooks, I created the corpus using the textbooks from California and Florida.

In my first step, I collected as many K-12 textbooks as possible from State of Florida, covering the subject domains of language arts, social studies, science, and math from all grades from kindergarten to twelfth grade. However, the grades are not equally

represented in textbooks. Then, I scanned the textbooks by using scanner machines and converted them into word document files with the ADOBE Reader Professional software. The recruiting, scanning and converting of Florida State textbooks were carried out over a period of more than two years from October 2014 to December 2016.

In the next step, I used the online library of CK-12 Foundation (www.ck12.com) to download the math and science textbooks of State of California. The content of the library is a free public domain and available for public use. The CK-12 Foundation was established in 2007 in California and is a non-profit organization whose mission is to facilitate the access to STEM education in the United States. During summer and fall of 2016, I converted the California State textbooks. After a meticulous analysis of a total of 122 textbooks from states of California and Florida, in the first stage of data coding, I filed the data into groups using subject matter and state. Then I ordered the total number of words (10,519,639) according to the frequency of lemmas alongside their inflectional and derivational forms. Through the remainder of this chapter, I will explain in details the procedures of developing TUSC and SMACK.

Table 1. Number of books and running words of Florida and California textbooks.

States/ corpus	No. of books	No. of running words
Florida	49	3,298,508
California	73	7,272,551
TUSC	49	3,247,088
SMACK	102	8,522,864
		10,571,059 (total words)

Main issues in developing a corpus

Authenticity. It is clear that the linguistic materials is the starting point in the field of corpus research. Johansson (1995) argues that corpus linguistics deals with authentic language or language in use. Therefore, the need for updating the educational corpora and word lists for the purpose of authentication is a significant task (Biber, 1994, Gardner & Davies, 2013).

Nation (2016) argues that there are two sources of authentic data that can be used for corpus research: written materials such as journal articles, newspapers, and textbooks. In this study, I use K-12 textbooks as the authentic materials that ELLs use in schools. Research (Nation & Webb, 2011) claims that K-12 textbooks is the main source through which ELLs receive academic words. Learner corpus (a corpus developed from learners' language) is another source that is used in corpus-based research and its focus is mainly on discovering the structural problems in learners' language.

Sampling. Biber (1994) claims that the most important issue in designing a corpus is defining the population for which the corpus is aimed to develop. In this way, the corpus will be also representative. Therefore, issues like the type of textbooks, the number of books at each level, the number of collected words are all sampling issues about which a corpus linguist should make a very clear decision before starting data collection.

Academic and STEM-related corpora

Sinclair (2005) argues that compiling a corpus founded on a principled foundation is the key idea behind the creation of any kind of corpus. To Sinclair, four core design principles of a corpus are 1) concepts that the corpus represents, 2) representativeness,

3) communicative purpose of the content, and 4) controlling the subject matter of the corpus by comparing it with other corpora. In addition, Flowerdew (2004) suggests a set of parameters that could be used to identify and classify specialized corpora:

- 1) Size of the corpus (a range of 1-5 million words are required)
- 2) A particular variety of English
- 3) Specialized purpose for the compilation of the corpus
- 4) Type of the text and topic of the subject matter
- 5) Context of the corpus (setting and communicative purpose).

As a result, Sinclair (2005) divides the continuum of corpus into general and specialized corpora. A general corpus is compiled to investigate language use and reveals the holistic patterns of language. The *National British Corpus (NBC)* and the *Corpus of Contemporary American English (COCA)* are examples of general corpora. A specialized corpus, however, is designed to describe a particular register or variety of language (Sinclair, 2001). A major difference with regard to design characteristics between general and specialized corpora is that specialized corpora are designed for early human intervention (EHI) research. However, general ones are compiled for delayed human intervention (DHI) studies (Sinclair, 2001). In the case of EHI, the compiler has a particular goal in mind and then creates a corpus accordingly, whereas in DHI the researcher does not have a particular goal in mind and patterns of the whole language is intended.

A specialized corpus (academic and STEM-related corpora in the case of the present dissertation) focuses on technical words which belongs to a special area of knowledge featured in the related word lists (Sinclair, 2005). Beyond the genre of the corpus, the proportion of subcorpora and the type of texts should also represent the kind of

language that ELLs meet in K-12 context. On average, the amount of reading for mainstream students varies but is under 100,000 tokens a year and about 2,000 tokens per day (Cunningham, 2005). Token is the number of words plus their repetitions. Therefore, this accounts for a small part of the language that they encounter and particularly the academic language that they receive (Nation, 2016). As a result, a corpus designed for ELLs should fill this gap and meet their school needs in K-12 contexts.

Table 2 represents seminal academic and STEM-related corpora since 2000. Table 1 also documents the text distribution with regard to Coxhead's AWL across the seminal academic and STEM-related corpora developed since 2000. Among the 15 corpora, the corpora number 12, 14, and 15 (Coxhead, Stevens, & Tinkle, 2010; Dwyer & Ehsanzadeh, 2017; Ehsanzadeh & Dwyer, 2017) have been derived from K-12 textbooks. As shown in the table, the AWL, on average, covers 10% of most the written academic corpora. However, this number is 7.05 for Coxhead, Stevens, and Tinkle's (2010) corpus of secondary school science textbooks. Surprisingly enough, the AWL's coverage is 6.05 in Ehsanzadeh and Dwyer's (2017) STEM-related corpus of California and Florida K-12 textbooks. This coverage again plunges down to 5.25 in Dwyer and Ehsanzadeh's (2017) corpus of Florida K-12 textbooks, showing that there is a clear gap of about 5% in regard to academic vocabulary coverage between K-12 textbooks and texts written for adults at college level.

Both corpora are written and there is no sample of spoken language data in regard to the K-12 context. As a result, the domain of research questions is limited to the word knowledge that ELLs need for reading comprehension, in other words, written receptive

vocabulary knowledge. All the research questions of this dissertation study are answered in chapters 4, 5, and 6, accordingly.

Table 2. An overview of academic corpora

Study	Corpus genre	# of words	WAL Coverage
1-Coxhead (2000)	Arts, commerce, law, & science	3,513,330	AWL
2-Cobb & Horst (2004)	Learned section of Brown Corpus	14,283	11.6
3-Hyland & Tse (2007)	Sciences, engineering, & social sciences	3.292,600	10.6
4-Chen & Ge (2007)	Medical texts	190,425	10.073
5-Konstantakis (2007)	Business texts	1 million	11.51
6-Coxhead & Hirsh (2007)	Science texts	1.5 million	8.96
7-Dwyer (2005)	Florida K-12 textbooks	156,000	3.97
8-Ward (2009)	Engineering texts	271,000	11.3
9-Martinez, Beck, & Panza (2009)	Agricultural texts	826,416	9.06
10-Vongpumivitch, Huang, & Chang (2009)	Applied linguistics	1.5 million	11.17
11-Li & Qian (2010)	Finance	6.3 million	10.46
12-Coxhead, Stevens, & Tinkle (2010)	Pathway series of secondary science textbooks	279,733	7.05
13-Davies & Gardner (2013)	Academic journals, humanities, & education	120 million	Not reported
14-Dwyer & Ehsanzadeh (2017)	<i>Florida K-12 textbooks</i>	3,298,508	5.25
15-Ehsanzadeh & Dwyer (2017)	<i>California K-12 math & science textbooks</i>	8,522,864	6.05

Research question 1

The first research question focuses on the coverage distribution of Cobb's (2017) word classification (see Chapter 2) across K-12 textbooks. The academic vocabulary knowledge in this classification follows Coxhead's (2000) AWL. K1 and K2 (first and second most common words) represent the extent to which words in K-12 books are from first 1,000 (K1) most frequent words or the second 1,000 (K2). Having a clear picture of these categories in K-12 textbooks will be an invaluable guide in designing supplementary materials. Here is the first question:

- 1) What is the vocabulary frequency distribution based on Cobb's (2017) classification in U.S.-based K-12 textbooks?
 - a) To what extent are
 - (i) K1 (first one thousand most frequent words),
 - (ii) K2 (second one thousand most frequent words),
 - (iii) academic words, and
 - (iv) off-list wordsrepresented in U.S.-based K-12 textbooks?

Analysis software used for developing the corpora

LexTutor

LexTutor (www.lextutor.ca) is a vocabulary search tool. It is a complex and powerful web-based engine designed by Tom Cobb in late 1990s. He developed and has maintained the page since 1990s. The page has three main entries: tutorial, research, and teachers. The research section is where a student can begin his data analysis. The tutorial

section provides the learner with interactive tools for self-directed learning, and teachers section is a source of classroom activities for teachers.

Vocab profile (VP) is the subsection of LexTutor that I have often used in making my initial word lists for the Florida textbooks. Vocab profile accepts files in rtf format and has a limited analysis capacity of no more than 30,000 words at a time. Vocab profile produces a statistical table of four tiers of vocabulary, namely as: K1 (1-1,000 most frequent words), K2 (1,001-2,000 most frequent words), AWL (a list of academic words mostly derived from Coxhead's AWL), and Off-list (words not appeared in any of these three tiers). Vocab profile is a versatile tool for evaluating the text difficulty. It can also be used for reviewing the core vocabulary.

AntConc (version 3.5.2.)

AntConc (Anthony, 2017) is a multiplatform software developed to conduct research in corpus linguistics and analyze corpus-driven data. The software may be run on both Microsoft Windows and Macintosh. To produce executables for a variety of operating systems, AntConc was developed in Perl, using different compilers.

AntConc is a versatile software with seven main analysis tools:

1. Concordance Tool (which analyzes the text and gives the results in a KWIC, Key Word In Context),
2. Concordance Plot Tool (which searches the text and gives the results in a barcode format or plotted), File View Tool (gives the results of the text in individual files),

3. Clusters/N-Grams (which scans the whole corpus and then gives the results produced in the Concordance Tool or Concordance Plot Tool and the main feature of this tool is that it allows the researcher to find common expressions and words in a corpus),
4. Collocates Tool (which gives collocates and allows to examine the non-sequential patterns in a corpus),
5. Word List (which allows the researcher to find the most frequent words in a corpus and I used it for the analysis of frequency distribution of lemma in research question 2, and
6. Keyword List (which compares the frequency distribution of words in the corpus with a target corpus).

Results

For the result of this chapter, I answer the first research question which asks about a classification of K-12 textbooks in terms of Tom Cobb's first and second thousand most common words plus academic vocabulary. The research question is in line with Cobb's classification in the K-12 context in USA. With respect to the classification of vocabulary in this study and the definition of academic and STEM words, I used AntConc software. Academic words are words that appear commonly in three out of four content areas (math, language arts, science, and social studies). Therefore, I extracted all common words in three content areas by the use of the software and label them academic words in AntConc. STEM words, however, are domain-specific words appearing mainly in one of the four

content areas (see Chapter 4 for a complete list of academic and STEM-related words in this study).

Teachers' U.S. Corpus – TUSC

The Teachers' U.S. Corpus (TUSC) is the corpus of Florida State textbooks which contains 49 books. Teachers' U.S. Corpus is a general-purpose corpus representing all four K-12 content areas (language arts, math, science, and social studies). As a result of the heavy burden of recruiting textbooks and other related limitations that I had, TUSC is skewed towards middle school textbooks. With regard to the content area, TUSC represents more language arts and social studies. Table 3 gives more information about TUSC. The distinction of books is based on K-12 content areas.

Table 3. An overview of TUSC.

Content area	No. of books	No. of running words
Math	15	741,950
Science	14	559,783
Social Studies	9	951,338
Lang Arts	11	1,045,437
		3,298,508 (total)

Tables 4 and 5 give detailed information regarding the number of words in four tiers of word frequency according to LexTutor in the subject matter of Language Arts and Social Studies. I divided the textbooks in these content areas (11 textbooks in Language Arts and

nine textbooks in Social Studies) into four grade groups, namely as K-2, 3-5, 6-8, and 9-12.

The total number of words in Language Arts and Social Studies is 1,996,775.

Table 4. Language Arts in TUSC.

Lang & Arts (11 books)	AWL	K1	K2	OFF-LIST
K-2 (1 book)	290	14,942	1,632	864
3-5 (3 books)	4,261	87,331	7,046	4,017
6-8 (4 books)	3,756	91,113	7,504	8,531
9-12 (3 books)	37,062	698,929	56,038	22,137
Lang. Arts total:	45,371 (4.33%)	892,315 (85.35%)	72,220 (6.90%)	35,531 (3.39%)
Total words: 1,045,437				

Table 5. Social Studies in TUSC.

Social Studies (9 books)	AWL	K1	K2	OFF-LIST
K-2 (1 book)	575	16,438	1,167	1,392
3-5 (3 books)	3,860	65,004	4,819	2,431
6-8 (3 books)	8,191	127,124	8,026	3,612
9-12 (2 books)	53,318	591,427	37,440	26,514
Social total:	65,944 (6.93%)	799,993 (84.09%)	51,452 (5.40%)	33,949 (3.56%)
Total words: 951,338				

Tables 6 and 7 represent STEM-related domain of TUSC with a total of 29 textbooks (15 Math and 14 Science textbooks) and a total number of 1,250,268 words. As could be seen in Table 6 and 7, Math is more intense than Science in terms of academic language. Surprisingly enough, Science has the least intensive academic language among the four content areas in Florida school system. Figure 2 shows the academic vocabulary trend in TUSC across four content area.

Table 6. Math in TUSC.

Math (15 books)	AWL	K1	K2	OFF-LIST
K-2 (1 book)	1,885	58,452	4,269	3,006
3-5 (3 books)	3,217	99,912	8,423	1,418
6-8 (6 books)	15,736	282,612	17,254	4,901
9-12 (5 books)	13,171	213,926	10,107	3,661
Math total:	34,009 (4.58%)	654,902 (88.26%)	40,053 (5.39%)	12,986 (1.75%)
Total words: 741,950				

Table 7. Science in TUSC.

Science (14 books)	AWL	K1	K2	OFF-LIST
K-2 (1 book)	1,267	50,506	4,775	2,616
3-5 (3 books)	3,901	82,713	8,240	10,366
6-8 (7 books)	13,327	201,843	19,271	30,971
9-12 (3 books)	8,771	98,283	9,122	13,811
Science total: (559,783)	27,266 (4.87%)	433,345 (77.41%)	41,408 (7.39)	57,764 (10.31)

Figure 3. Academic words in TUSC.

Science/ Math Corpus for K-12 Kids – SMACK

The Science/Math Corpus for K-12 Kids (SMACK) is a STEM-related corpus containing 102 books from States of California and Florida with only 29 books from Florida and 73 from California. The Science/Math Corpus for K-12 Kids is a corpus of middle and high school textbooks. In sampling the corpus, I attempted to choose the books from a wide range of STEM-related subject areas to make SMACK as representative as possible. The Science/Math Corpus for K-12 Kids includes the following subjects from school math and science domains: Math (15 books), Algebra (12 books), Analysis (2 books), Calculous (3 books), Geometry (8 books), Probability (6 books), Trigonometry (2 books), Astronomy (1 book), Biology (14 books), Chemistry (3 books), Earth science (4 books), Engineering (3 books), Science (19 books), Life science (2 books), Physical science (2 books), Physics (5 books), and Technology (1 book). All the textbooks are written for K-12 U.S. mainstream students.

Table 8. Composition of SMACK.

Content area			
	Math	Science	SMACK
Total text token	4,547,909	3,974,955	8,522,864 Words
Number of books	48	54	102 Books
Subject areas	Math	Astronomy	17 Subjects
	Analysis	Biology	
	Algebra	Chemistry	
	Calculus	Earth science	
	Geometry	Engineering	
	Probability	Science	
	Trigonometry	Life science	
		Physical science	
		Physics & Technology	

When it comes to academic vocabulary in STEM-related domain in school textbooks, Math seems to be more intense than Science. As seen in Figure 4, the academic vocabulary in both Math and Science is less than 10%. Though, there is no surprise that SMACK is richer than TUSC with respect to academic vocabulary.

Figure 4. Academic vocabulary in SMACK.

Figure 5. STEM words in TUSC and SMACK.

CHAPTER IV

The word lists

Introduction

Research question

The main research question that I will answer in Chapter 4 is the second one of the study through which I will develop three frequency word lists, one academic and STEM-related, as well.

- 2) What are the most commonly used lemmas in U.S.-based K-12 textbooks?
 - b) To what extent are
 - i) high-frequency,
 - ii) medium frequency, and
 - iii) low frequency lemmas,used in U.S.-based K-12 textbooks?
 - b) What are the new academic and STEM-related word lists in U.S.-based K-12 content area textbooks?

As discussed in Chapter 2, incorporating word lists can offer many advantages into our second language classes. Gardner and Davies (2013) suggest that developing specialized word lists can be an essential step toward shortening the learning time and teaching ELLs words that they need for a particular purpose. For younger learners, such may be based on a corpus that reflects K-12 domains. Simultaneously, frequency rankings that consider dispersion seem to be an appropriate manner of learning vocabulary (Nation, 2013).

Over the past decade, various word list have been developed for teaching academic and core vocabulary (see Chapter 3 for a detailed review). These lists (AWL, ALV, and UWL), however, have faced critique (see Chapter 2). To achieve the teaching implications and purposes mentioned above and earlier in this dissertation for teaching reading through a color-coded system, as featured in LexTutor, and making vocabulary instruction more efficient, I developed five word lists, namely three frequency lists (high, mid, low), academic, and STEM-related word lists to answer the second research question.

Chapter 4 is divided into two parts. In Part 1, I review the procedure and main techniques for making a word list. The guideline developed by Nation and Webb (2011) and Nation (2016) are also reviewed in the next step. A significant section in this part is the examination of what should be included in the word lists. I also give some examples showing the main pattern of the set criteria. Part 2 is the explanation of the validating method of the word lists and the final products as the word lists. The text coverage method is used to examine the validity of each word list.

Procedure for making a word list

Considering the proposed research questions for the present dissertation, a corpus-driven approach was selected as an appropriate model. In this dissertation, I followed text analysis design to develop and validate the word lists. Text analysis is not the same as content analysis design, whose focus is on linguistic properties and is mostly used in corpus-based research studies.

Nation and Webb (2011) and Nation (2016) are principal sources who explain how to make word lists and validate them. Nation and Webb argue that creating an effective word list includes the following steps:

1. We should have a good reason for making a word list as well as appropriate research questions.
2. The unit of counting is the next important decision that a researcher should make before embarking the word selection process. As I explained in Chapter 2, the counting unit for this dissertation is lemma.
3. A corpus should be compiled according to the needs of the people who will use the word list. The makeup of the corpus should be representative and large enough to have an acceptable text coverage. In regard with the size of the corpus, Brysbaert and New (2009) believe that a corpus of 1,000,000 running words is acceptable for high frequency words. For low frequency words, however, at least 30,000,000 tokens will be an acceptable size of the corpus.
4. Decisions regarding definitions of a words, as well as word types, and which ones should be counted as a word to be included in the corpus should be considerations. For example, should propositions or proper nouns be included in the corpus?
5. The criteria for ordering the words in the word list are an important issues that shape the form of the final product. There do exist frequency-based word lists (Campion & Elley, 1971; Praninskas, 1972; Lynn, 1973; Ghadessy, 1979). Therefore, the decision about how to order words on the list based on whether frequency or dispersion is a critical issue in making a word list.

6. Word lists should be examined against other independent corpora or word lists to check whether there may be any improper placement of words in a wrong list.

As mentioned in Chapter 2, there are many word lists in different languages, and most of them are frequency-based lists (BLI, 1986; Eaton, 1940; Juilland, Brodin, & Davidovitch, 1970; Juilland & Chang-Rodrigues, 1964; NLRI, 1962, 2006; Thorndike & Lorge, 1944; Xiao, Rayson, & McEnery, 2009). Additionally, some guidelines have been prepared on how to use or adjust these word lists (Gries, 2008; 2010). Most guidelines, however, explain procedures on how the word lists were made and argue for their validity and reliability. Particular issues with regard to word lists, including how they should be developed and validated alongside the teaching implications, have been extensively discussed in Nation and Webb (2011) and Nation (2016) which are the guidelines used in developing and validating the word lists for this study. Of the six steps involved in making and validating word lists, three of them—unit of counting, criteria for counting words and separate lists, and criteria for ordering words— are explained in further detail:

Unit of counting

The three main units of counting for designing a word list are word type, lemma, and word family (Nation, 2016). A good example of *word type* as the unit of counting is Carroll, Davies, and Richman's (1971) study. Leech, Rayson, and Wilson (2001), however, used *lemma* as the unit of counting and it only considers inflections. In another study, Vermeer (2004) also applied lemma as the unit of counting to assess productive knowledge. For the purpose of this study, I will use lemma as the unit of counting. To count receptive knowledge, a *word family*, which is an inclusive unit of counting is the best option (Nation

& Webb, 2011). When a learner knows one or two members of a word family, little learning burden will be needed to use other family members receptively in reading comprehension. For example, if a learner knows the word *accesses*, understanding *accessed*, *accessible*, *accessibility*, or *inaccessible* and *inaccessibility* will not be difficult tasks for the learner. Many word lists have been developed with the word family as the unit of counting. Nation's (2004) word list developed from British National Corpus is a good example of this type.

With regard to derivational and inflectional forms, the main issue with this unit of counting is that it is difficult to be consistent about which forms should be included under a headword. However, it stands clear that all forms that require little learning should go under the related word family.

Another important issue with respect to counting is the concept of *multiword*, which is a sequence of two or three words like *in spite of* and *so that*. In this regard, Leech, Rayson, and Wilson (2001) argue that multiwords should be counted as single words, because in English grammar they are considered single words. Nation and Webb (2011) believe that learning of multiwords requires additional learning effort because these words do not have transparent meanings and learners should guess their meanings. However, a main problem with regard to multiword units is the lack of unified and consistent judgment about which words should be counted as a multiword. When it comes to a large-scale corpus, it would not be a feasible task for a researcher to go through it manually. Even if they are considered as single words, an additional problem would be counting the frequency of each of the components of a multiword. Without using a proper computer program, this would be a very tedious and time consuming task.

Criteria for counting words and separate lists

Nation (2016) argues that the learning burden principle (see Chapter 1 for more details) determines whether a word should be considered as a headword. In other words, if a learner does not need previous knowledge to learn the meaning of a form (e.g., proper nouns), or if the learner can construct the meaning from previous knowledge (e.g., derivational and inflectional forms), then this form of the word should not be considered as a headword in the word list. As a result, Nation and Webb (2011) and Nation (2016) decided to look for non-words, proper names, abbreviations, marginal words (e.g., *eh*), homonyms and homographs (e.g., *sow*), transparent compounds (e.g., *lifespan*), foreign words (e.g., *précis*) to make a separate word list for these items. Nation (2016) believes that separate word lists are invaluable educational tools that allow learners to read what they need and make adjustments without referring to other word lists.

Criteria for ordering words

A main goal of this research study is to show what the best order of learning vocabulary should be for ELLs in K-12 context. In this regard, the criteria for ordering words, which is mostly applied for frequency word lists, will guide us in ordering the words. Nation and Webb (2011) and Nation (2016) argue, simply, that the best criterion is that the more words learners know, the more effective reading will be.

The implication, however, can be monumental with respect to list development: that a higher text coverage will certainly lead to a stronger chance for reading comprehension. Therefore, frequency is an important criterion for deciding what the most efficient word learning order may be. The question arising then is how frequency should

be measured. Nation (2016) believes that compiling a corpus for each learner and then checking the frequency of each word would be the best strategy that suits the learners' needs. Creating a means for each person to develop their own word list ahead of their learning may be a valuable goal but is beyond the scope of this study. However, it may be more immediately possible to categorize the needs of learners and then create a corpus for each category of needs.

How to count words for inclusion in a word list

Among the first decisions that a researcher should make before taking any step in developing a word list is the decision about which words should be included in the word list as the final product. This decision itself is a complicated one that would no doubt affect the nature and quality of a word list. For example, do digits like 12 and 1397 showing up in math textbooks count as words? What about abbreviations like *Max*, *Min*, or *HQ* that appear in science textbooks? Do forms mixing numbers and letters like Apollo13 or P3.4 showing up in math and science books count as separate words?

In sections below, I address these questions and other issues related to how to deal with what should be counted as a word and included in the word lists that I am developing in this study. Also, I will explain the rules and regulations that I applied in deciding whether a particular word should be included or not.

Assumed known words

Assumed known words (Nation & Webb, 2011) are specific nouns and/or proper names, including geographical places and historical nouns, that require very little or no

background knowledge to be understood in reading a text passage. Nation and Webb (2011) argue that whether a word should be counted in a list is mainly based on the degree to which the word contributes to the principle of learning burden (see Chapter 1 for definition of learning burden). Accordingly, Nation (2006) created separated word lists for known words of compounds and proper nouns. Since a goal of this dissertation is to establish lists that address learning burden, I did not include *known words* in the final word lists.

Homoforms

Lexicographers (Gardner, 2013; Nation, 2016) define homonyms as words that have the same spoken and written form but with different meanings (for example, bridge, miss, rest). Homographs, however, are words that have different spoken form with unrelated meanings that have the same written form (for example, *lead*, *present*, *row*). Also, homophones are words with the same oral form but with different written form and meaning (for example, *eye/I*, *peace/piece*). To put these three types under one platform, Nation (2016, p. 41) uses the term *homoform*. Homoforms (all three types) are the linguistic features that are common and pervasive in any language including English. As a result, having a clear thought and well-decided approach towards the inclusion policy of homoforms in the word list is among the very first steps.

Table 9. Three categories of homoform.

	Written form	Spoken form	Meaning	Example
Homograph	same	different	different	<i>lead, minute, row</i>
Homonym	same	same	different	<i>case, miss, rest</i>
Homophone	different	same	different	<i>peace/piece write/right</i>

In an analysis of homoforms included in word lists, Wang and Nation (2004) reported that Coxhead's AWL has 60 homographs and homonyms (for example, *decline, issue, volume*). Considering the fact that AWL has 570 word families, it means that approximately one tenth (one word in every ten word family) contains a homoform. This further demonstrates that all three types of homoforms would have a considerable effect on the total number of entries in a word list. Because homophones have exactly the same written forms, they are usually put under different entries in written corpora. This would consequently increase the number of items in a word list. Nation (2016) argues that homonyms and homographs should be counted as two different lemmas, especially when the word list maker is interested in teaching and learning vocabulary in a second language, because each form of homograph or homonym has a different meaning and requires learning a new concept or recognizing one form with different meanings. One further issue here is the frequency of occurrence of pairs of homographs and homophones with one member of the pair has a much higher frequency compared to the other members. According to what I discussed in this section, I use different forms of homonyms and homographs as different items in my word lists.

Table 10. Examples of homoform in K-12 corpus.

Homoform	Freq.	Meaning
Bar	201	pub, to exclude, bar exam, beam of steel
Charge	1094	officially accuse of crime, electrical charge, a rushing attach
Coast	598	coastline, move easily, not work hard
Country	2098	far from city, nation
Date	680	to see romantically, someone's age, a fruit
Fall	1023	autumn, to descend
Just	310	only, fair
Kind	3019	gentle, a class
Nature	4012	the natural world, inherent quality
Park	1029	public area, to bring a car to a halt
Passage	2027	travel, a passageway, passing (a law)
Patient	198	a doctor's client, to have patience
Second	5210	related to time, after the first
Stage	2013	a place for actors, a part of development

Some corpus linguists and word list makers (Biemiller, 2010) took a step further, distinguishing members of homoforms by claiming that related senses of one word should be distinguished and counted as different words in a word list. For example, *court* in *court of appeal* should be seen as a different word from *appeal* relating to a *request*. In favor of this argument, Nation (2016) believes that different senses of a word might be translated using different words in a foreign language; therefore, for word lists developed for the purpose of teaching vocabulary in another language, including the ones that I am making through this dissertation, this could be a reasonable idea. However, Nation further argues that distinguishing different senses of one word will not help ELLs apply contextual clues while reading and therefore should not be used separately in a word list.

Proper nouns

In written English, *proper nouns and names* are usually identified by their first letter being capitalized; however, not every capitalized word is a proper noun. It seems that proper nouns are straightforward, but they have complications as well. For example, the first word of a sentence is capitalized and this should be distinguished from a proper noun in a word list. A further issue is that there is not consistency in the use of capitalization for some proper nouns like the game *Monopoly* is capitalized while *chess* is not.

The main feature of proper nouns is that they do not contribute to the comprehension of the text as they do not carry the key meaning beyond the meaning of the thing that they refer to. In this respect, Nation (2016) argues that ELLs require very little previous knowledge to learn some of proper nouns. According to National British Corpus (2018), the names of geographical and historical places, personal names including the

names of famous people, and enterprises account for the biggest part of proper nouns in written texts. An important part of this category of proper nouns is the names of festivals and events, including wars, hurricanes, sporting events, and TV shows (Kobeleva, 2008). However, not every proper noun needs previous knowledge in order to be understood. Nagy and Anderson (1984) argue that there might be approximately 1000 of these proper nouns that you need to have a background knowledge to understand them in a sentence. These sentence are good examples of these proper nouns: “He is not *Einstein*. He is not another *Gandhi*.” As a result, Nation (2016) argues that a list of such proper nouns will help improve ELLs reading and literacy because they entail stable meanings that ELLs need to learn. Some of these words are even unknown to mainstream students.

Table 11 Examples of proper nouns in K-12 corpus.

Idiom or phrase	frequency	word list type
America	2013	high freq.
April	48	mid freq.
Bishop	26	mid freq.
Britain	109	high freq.
Europe	173	high freq.
Hong Kong	6	low freq.
King	938	high freq.
New York	61	high freq.
Obama	23	mid freq.
Saturday	83	high freq.
South America	79	high freq.
White House	103	high freq.

Unlike the idea that most teachers think proper nouns do not create problems for ELLs in reading comprehension, Brown (2012) argues that this is not true. Similarly, Kobeleva (2012) reported that in a listening comprehension test of news texts, having previous knowledge of proper nouns improves the ELLs' comprehension significantly.

Nation and Webb (2011) carried out a careful analysis, focusing on words not included in the National British Corpus. They reported that almost half of the words not

appearing in BNC/COCA were proper nouns. Fortunately, all proper nouns in English are distinguishable through AntConc WordProfiler (a free software I used for the purpose of text analysis in this dissertation) by using lists of proper nouns that have been uploaded into the software.

Compounds and hyphenated words

Hyphenated words are two words joined together with a hyphen (for example, life-span, wife-less, long-term). Nation (2013) argues that the main reason for using a hyphen is to show that the two words are closely related. Interestingly enough, we have more than 10,000 hyphenated words with a frequency of at least 2 or higher in BNC.

A main issue in dealing with hyphenated words in developing a word list is a lack of consistency in the form of compound words. Sometime they appear with a hyphen (e.g., *short-term*), sometimes they appear without a hyphen (*shortterm*), and also in some cases they occur as spaced compound words (*short term*). Therefore, Nation (2016) argues that compound words shouldn't be taken as a grammatical category of items because there are three variations in whether they are written as two separated words, or with no space, or even as a hyphenated word. As a result, this makes the decision about how to include them in word lists very complicated. For example, *lifespan*, *railway*, *shareholder* are the compound words that have both hyphenated and non-hyphenated forms in BNC but with a considerable difference in terms of frequency between the two forms.

Table 12. A sample of hyphenated words in the five word lists in this study.

Idiom or phrase	frequency	word list type
Full-time	51	mid freq.
Large-scale	29	mid freq.
long-term	108	high freq.
middle-class	118	high freq.
part-time	23	high freq.
video-taped	41	high freq.
short-term	81	mid freq.
so-called	211	high freq.
vice-president	15	mid freq.
well-known	1723	high freq.

As a solution in counting compound words, Brysbaert, Stevens, Mander and Keuleers (2016) split all the compound words that they collected in their corpus into their parts and count each component as a separate word so that their occurrences are counted separately. However, one problem to this approach is making a decision about which family the compound words should be counted under. For example, should we count *weekend* under *end* or *week*? Another issue is that it will misrepresent the frequency of *weekend* if we ignore the frequency of one component, for example, *end* in *weekend*. In this dissertation, I used compound nouns as a single word without hyphen or space with a separate frequency in the word lists. As a valuable source of compound nouns for making

a word list, the Range and AntWordProfile programs have a list of more than 3,000 compound words, with about two members for each family. This list accounts for 0.1% of the text types and 0.36% of the text tokens in BNC.

Idiomatic and phrasal expressions

Idioms and phrases are a group of words that come together frequently. They are also called formulaic sequences or lexical bundles. The main issue with regard to making a word list for ELLs and considering idiomatic expressions is coming up with a clear definition of what should be counted as an idiom and how to apply it consistently across the whole corpus (Nation, 2016). In order to decide about the inclusion of such expressions in a word list, Nation (2016) claims that we should consider these factors: 1) number of components of the expression, 2) discontinuity and adjacency of the components in the expression, 3) being grammatically fixed or variable, and 4) being cable of using lexically variable items.

Shin and Nation (2008) found that frequent idioms and phrases tend to be shorter than less frequent ones. They further claimed that the frequency of idiomatic expressions follow Zipf's law (see Chapter 1 for definition of this law) in that they tend to be more economic in terms of components. According to the nature of the K-12 corpora in this dissertation, there is not a high number of idiomatic expressions in the corpora, and I included most of the expressions in the high frequency word list.

Table 13. Examples of idiomatic and phrasal expressions.

Idiom or phrase	Freq.	Word list type
a bit	1091	high freq.
as a result	1230	high freq.
as well	901	high freq.
by and large	219	high freq.
for instance	711	high freq.
in addition to	315	high freq.
on the other hand	211	high freq.
out of hand	124	high freq.
pulling your leg	1	low freq.
the Big Apple	3	low freq.

Acronyms and abbreviations

An acronym is a word made of a group of letters that each is the first letter of a word. Acronyms and abbreviations usually do not contribute toward the core meaning of a text and consequently do not carry the significant meaning. Many acronyms refer to a unique entity and therefore they could be taken as proper nouns. Nation (2016) argues that acronyms that are a reduced form of a word (*Rd* for *Road*) should go under the items of that word family. When an acronym is used very often and is also easy to pronounce, it could stand as an independent word, for example, NASA and laser. In order to be included in a word list, Nation (2016) argues that 1) acronyms should be made of the first letters of

a series of words, 2) all the words should be known by adult native speakers, and 3) the pronunciation of the acronym should sound out the letters (MIT), or pronounce it as a word (UNESCO). Below is a list of most frequent acronyms (above 2,000 frequency in BNC) that are considered high frequency words in the word lists in this study.

One argument in favor of having a separate list of acronyms (Nation and Webb, 2011) is that they are made of a series of words that are usually known and a separate list of acronyms will be helpful in improving the ELLs' receptive knowledge. However, another argument against the inclusion of acronyms is that such a list will be confusing without coming alongside homonymy words (Nation, 2016).

Table 14. Sample acronyms in the word lists.

Word	Freq.	Word list type
e.g.	128	high freq.
CD	23	mid freq.
DC	119	high freq.
Ib	4	low freq.
IBM	9	low freq.
i.e.	97	high freq.
NASA	680	high freq.
MA	2	low freq.
Mp	1	low freq.
PC	70	high freq.
PM	1	low freq.
ph	11	mid freq.
PLC	2	low freq.
VAT	1	low freq.
UNESCO	7	low freq.
UK	49	high freq.
USA	924	high freq.

Function words

Lexical words in English are divided into two basic categories: *content words* and *function words*. Content words include verbs, nouns, adverbs, and adjectives. Function words, however, are the grammatical categories in English that include prepositions, articles, conjunctions, etc. (Merriam Webster, 2018). Function words have no meaning on their own and perform the grammatical functions of the language. However, some content words such as *nevertheless* and *according to* that play the role of function words. Another important feature of function words in making a word list is that it is a closed grammatical category where no new item will be added to it.

The strongest argument in favor of developing a separate list of function words is the idea that function words are qualitatively different from content words (Nation, 2016); the way that a content word is acquired is different from how a function is learned because learning function words is more dependent to acquiring grammatical knowledge (Nation, 2016). A further issue is that function words account for 51% of the token words in BNC showing that they are frequent. In Coxhead's AWL, there are six function words: *albeit*, *despite*, *notwithstanding*, *plus*, *via*, and *whereas*. However, eight function words are not in most of the English high frequency words: *albeit*, *notwithstanding*, *whence*, and *whether*. In this study, most function words in K-12 textbooks are placed in the high frequency list. Below is a random sample of such function words.

Table 15. English function words.

Word	Freq.	Word list type
above	5859	high freq.
across	2385	high freq.
between	13713	high freq.
can	50510	high freq.
every	3831	high freq.
few	3616	high freq.
however	4650	high freq.
neither	627	high freq.
over	2381	high freq.
though	1708	high freq.
upon	1079	high freq.
unless	363	high freq.
via	120	high freq.
what	47797	high freq.

Developing and validation of word lists

The line of research on word lists has applied two major validation methods. Coxhead (2000), Coxhead and Hirsh (2007), Nation (2006), and Gardner and Davies (2013) are principal studies using text coverage as the validation method. The other method, however, used psychological reaction behavior to validate a word list (Gries, 2010; New, Brysbaert, Veronis, & Pallier, 2007). Beyond frequency in this second method, reaction time is affected by a number of factors like eye movement ability, letter decoding speed, and semantic complexity, to name a few. As a result, the latter method doesn't fit the requirements of a corpus-driven approach in making a word list. Therefore, I used the text coverage type (see chapter 2 for a definition and literature review) as the validation method for the present dissertation study. In doing so, I used AntWordProfiler software (Anthony, 2014) to examine the text coverage provided by the word lists of this study.

AntWordProfiler software

AntWordProfiler is a software developed by Anthony (2014) to analyze corpus data on lexical profiling. The software has two main tools. The first one that appears in the middle of the window of the software is a tool for developing general vocabulary profiling. I used this tool to run the analysis in this section of the dissertation. Through this tool, I generated word lists statistics and frequency information about the five word lists of this study. This tool also uses the results of the research of Nation to compare the text coverage of a word list against a group of level lists that can be based on either word family or lemma. I also used vocabulary profile tool, the second main tool of the software, to load

baseword files into the analysis section of the software. This tool also allows to search the words across a corpus.

Results

Research Question #2 entails the following: What are the most commonly used lemmas in U.S.-based K-12 textbooks? Further subquestions incorporate

To what extent are

- iv) high-frequency,
 - v) medium frequency, and
 - vi) low frequency lemmas,
- used in U.S.-based K-12 textbooks?

What are the new academic and STEM-related word lists in U.S.-based K-12 content area textbooks?

This Results section, therefore, presents five word lists—High Frequency, Mid Frequency, Low Frequency, Academic, and STEM-related word lists, which address the research question. It also includes an Essential Word List (EWL). These six word lists include 17,565 lemmas from K-12 textbooks. The High Frequency Word List includes words appearing 100 times or more in the K-12 textbooks corpus. For the Mid Frequency Word List, the range of appearance through K-12 textbooks is between 99 and 10 occurrences. For the Low Frequency Word List, the range of appearance is between 9 occurrences and a single occurrence. The Academic and STEM-related word lists are also divided into two sub-lists of higher and lower frequency words. In High, Mid, Low, and EWL word lists, words are ordered in respect of frequency. In addition, all word lists with

derivational and inflectional forms of lemmas are available at www.myvirs.com/dictionary/.

High Frequency Word List

The rationale behind the frequency word lists is based on frequency count (Sinclair, 2005; Nation & Webb, 2011). Words appearing 100 times or more in the whole K-12 corpus are included in the high frequency word list. Coxhead (2000) also picked 100 as the baseline for the text token in her AWL. I decided to take 100 as the border line of high frequency words such that data would not skew toward sight words in my high frequency list. The middle frequency words are words with 10 to 99 tokens in both TUSC and SMACK. All words in low frequency word list have fewer than 10 text tokens.

The High Frequency Word List contains 3,606 lemmas. A complete list with derivational and inflectional forms is available at www.myvirs.com/dictionary/. The High Frequency List is shown in Table 16. In the table, the term *freq.* refers to the number of times each lemma appeared in the corpus.

Table 16. The High Frequency List.

Freq.	Word	Freq.	Word
775747	the	431	eclipse
378097	be	430	pollinate
361295	of	429	kinetic
297511	a	429	prize-giving
247446	and	428	beside
243373	to	428	excite
185046	in	428	fresh
118803	way	428	gain
107940	you	428	tens
105481	that	427	border
73894	have	427	pizza
63724	this	426	geography
63014	use	425	huge
62504	they	423	beat
61359	or	423	modeled
59402	we	423	recycle
56463	by	423	American
55294	as	422	definite
55130	on	421	astronomy
50510	can	421	expose
49647	with	421	quartile
47797	what	420	everyday
45749	from	420	haploid

44462	home	419	preimage
41166	at	418	aquatic
41010	how	418	catch
35937	he	418	puberty
35336	not	418	re-assign
33120	will	417	coffee
32618	one	416	fall
31693	if	415	night-club
30657	each	415	sub-sector
29789	example	414	diamond
28771	equate	414	diet
27267	find	413	amplitude
26131	make	413	decline
25125	when	412	desire
24169	point	412	please
23958	which	412	shore
22929	other	412	smile
22798	more	412	tropics
22668	do	411	archaea
22455	about	411	soft
22401	all	410	mercury
20163	so	409	homeostasis
18698	these	407	flowed
18504	there	406	fiber
18461	many	405	feat
18412	differ	404	biochemist
18356	write	404	endpoint

18231	nobody	404	title
18185	time	403	breathing-space
17947	water	403	immediacy
17807	value	403	justice
17728	form	403	succession
17561	line	403	whenever
17458	figure	402	cry
17171	than	402	lipid
17041	cell	401	bread-winner
16934	would	401	stream-water
16855	function	400	non-document
16464	answer	400	soldier
16396	but	399	thermal
16323	may	399	voluntary
16069	solve	398	corn
15915	energy	398	expanse
15882	also	398	football
15855	into	398	pet
15664	first	398	route
15631	graph	397	medical
15553	see	397	micro-instruction
15519	like	396	butterfly
15402	problem	395	commute
15091	it	394	cream
15085	out	394	motor-vehicle
15082	below	393	hydrocarbon
14445	some	392	deposit

14414	up	392	induction
14344	give	392	magma
13714	follow	392	mantle
13713	between	392	network
13626	angle	392	push-bike
13444	same	392	teacher-researcher
13311	area	391	semi-conductor
12884	need	391	wet
12829	people	390	sir
12772	work	389	chordate
12660	numbers	389	grain
12377	state	389	migration
12258	table	389	photo-cd
11751	take	389	tidal
11737	system	388	secure
11557	get	387	argue
11538	change	387	non-executive
11347	add	385	exterior
11186	look	385	toxin
11183	plant	384	fence
11122	because	384	slide
11020	help	383	immigrant
10970	year	383	repair
10913	most	383	steel-worker
10829	left	382	debate
10778	quarter	382	drink
10609	both	382	fund

10568	data	382	perspective
10439	call	382	swim
10299	where	381	museum
10151	she	380	sensor
9899	show	380	terminal
9885	explain	380	wavelength
9874	why	379	alter
9872	lesson	379	sec
9613	such	379	stock-take
9590	through	378	conic
9515	right	378	decade
9487	move	378	mar
9487	new	378	nest
9354	relate	378	ounce
9354	order	378	stone-thrower
9297	image	377	confuse
9277	only	377	elephant
9258	view	377	gray
9238	part	377	strand
9214	super-power	376	propose
9153	no	376	vitamin
8935	simple	375	deck
8839	term	375	thank
8720	could	374	alcohol
8705	now	374	pie
8647	word	374	postulate
8622	include	373	beneath

8572	good	373	loose-liver
8537	unit	373	workbook
8418	open	372	enclose
8387	earth	372	photo-copy
8357	live	372	poison
8273	set	372	re-mark
8270	any	372	review
8208	self-review	371	authority
8175	over	371	comprehend
8143	read	371	lab
8125	represent	371	load
8051	factor	371	mistake
7927	describe	370	split
7829	day	369	capability
7821	force	369	solubility
7758	square	369	whatever
7660	determine	368	target
7655	two-step	367	ensure
7645	place	367	prize
7602	per	366	alike
7533	group	366	anyone
7520	after	366	dinosaur
7493	direct	366	disagree
7428	know	366	multicellular
7394	great	365	allergen
7388	grow	365	secrete
7367	cause	364	configure

7366	much	364	giant
7330	chapter	364	skeletal
7318	length	363	unless
7311	who	362	calcium
7296	probable	362	sight
7272	divide	361	bicycle
7247	high	361	govern
7170	test	361	para-legal
7129	body	360	commerce
7019	result	360	flood
6984	life	360	narrow
6965	must	358	fun
6948	equal	358	mention
6943	let	358	sit-up
6912	triangle	358	stimulant
6894	side	358	utilize
6836	org	357	audience
6835	draw	357	rely
6785	common	355	nucleotide
6752	still-large	354	bacterial
6735	very	354	button
6716	food	354	exposed
6685	another	354	rose-pink
6657	learn	353	appearance
6634	world	353	capillary
6618	real	353	council
6450	law	353	revisit

6429	here	352	memory-jogger
6413	express	351	currant
6375	down	351	voltage
6375	multiply	350	fell
6370	atom	350	shop
6362	small-animal	350	triple
6308	process	350	verb
6249	compare	350	warn
6227	student	350	I
6129	object	349	cotton-spinner
6126	importance	349	happy
6103	long	349	lava
6093	measure	349	suffer
6085	sub-process	348	doctor
6081	distance	348	formal
6073	just	348	minor
6060	formula	348	reservation
6049	product	348	command
5920	name	347	declaration
5859	above	347	discriminate
5795	identified	347	feather
5790	amount	347	push-button
5757	population	347	replacement
5738	should	346	mouse
5686	human	346	rubber-stamp
5650	temperature	346	self-assessment
5647	scientific	345	declare

5635	contain	345	punch-bowl
5630	light	344	insulate
5629	even	344	permission
5624	total	343	impulse
5623	rate	343	momenta
5598	theory	343	verify
5592	complete	342	displace
5572	next	342	inclination
5553	standard	342	prompt
5536	practice	342	tape
5528	increase	341	improper
5513	occur	341	radio-isotope
5454	personalize	340	edit
5440	define	340	near-miss
5428	since	340	panel
5388	means	340	steam-train
5384	thing	340	swing
5353	found	339	constellation
5303	end	338	destruct
5300	become	338	electronics
5291	gas	338	fine
5280	re-found	338	meat
5230	surface	338	vegetable
5218	start	337	bounce
5197	fraction	337	excrete
5189	role-model	337	hammer-blow
5188	base	337	hemisphere

5186	chemical	337	monthly
5167	mean	337	saturate
5076	during	336	airplane
5072	center	336	spin-up
5039	hour	335	diploid
5037	go	335	equipment
5023	render	335	excess
5018	explore	335	mollusks
5005	circle	335	symptom
4982	less	334	passenger
4981	token	334	penny
4948	blood	333	convection
4947	type	333	hurricane
4930	begin	332	participate
4923	direction	332	sense
4911	around	331	fusion
4907	therefore	331	mold
4891	small-scale	331	phenomenon
4883	organic	330	echinoderm
4877	want	330	explode
4876	domain	330	gradual
4849	social-science	330	holiday-camp
4838	self-concept	330	lion
4825	gene	330	online
4811	cost	330	outlier
4772	act	329	refuse
4767	produce	329	sevens

4760	mass-murderer	329	tight
4745	non-event	329	trick
4742	slope	328	moist
4733	foot	328	obtuse
4692	electron	328	play-pen
4683	sub-section	328	whereas
4665	sub-rule	327	criterion
4663	summarize	327	that-clause
4650	however	327	tower
4647	check	327	lift
4605	government	326	fur
4605	watch	326	package
4585	similar	326	patient
4567	before	326	small-holding
4548	create	325	spore
4538	understand	325	television
4536	click	324	equilateral
4511	happen	324	mom
4504	molecule	323	deal
4503	low	323	hint
4498	man	323	ignorance
4450	together	323	pacific
4438	ratio	322	compress
4431	well	322	downward
4423	re-heat	322	dramatic
4418	hydro-carbon	322	peace-treaty
4402	element	322	seafloor

4357	calculate	322	self-antigen
4332	pair	322	vice
4315	inequality	321	depress
4314	back	321	tough-guy
4314	tie-back	320	credit
4270	true	320	escape
4255	sample	320	whom
4252	ask	319	beach-hut
4250	re-calculate	319	chicken
4249	apply	319	couple
4242	far	319	gasoline
4238	volume	319	incorrect
4230	speed	319	rigid
4220	scale	319	stream
4218	idea	319	tube-nose
4207	mile	318	adopt
4207	public	318	advice
4181	trust-me	318	church-warden
4157	land	318	excellence
4157	often	318	privacy
4151	list	318	tension
4140	type-case	317	cent
4115	semi-negative	317	cheese
4111	structure	317	fiction
4091	sin	317	skeleton
4081	wrist	317	tank
4067	subject	316	asexual

4053	compound	316	loop
4050	re-consider	316	severe
4049	three-inch	316	slice
4045	box	315	duty
4034	root	315	emerge
4028	resource	314	farm
4027	cos	314	hand-bell
4024	twin-car	314	juice
4020	material	313	domesticate
4008	species	313	enable
4007	subject-matter	313	grammar
4004	level	312	blank
3989	rock	312	sick-room
3963	sun-worshipper	312	sky-rocket
3950	able	312	virtual
3941	possible-world	311	asteroid
3936	original	311	clay
3920	always	311	democracy
3913	page	311	near-collision
3910	class	311	pitch
3882	distribution	310	backbone
3869	keep	310	irrational
3831	every	310	truck
3823	without	308	star-cluster
3815	study	307	constrain
3801	co-worker	307	fee
3798	red	307	strange

3783	charge	306	cross-appeal
3780	those	306	disperse
3777	choose	306	phenotype
3770	human-being	306	preserve
3739	ocean	306	three-pack
	thought-	306	trouble
3706	experiment	305	accident
3702	close	305	basketball
3690	early	305	otherwise
3685	positive	304	impossible
3683	half	304	sea-battle
3668	property-owner	304	steep
3660	under	303	notebook
3659	analyze	303	sitting-room
3656	develop	303	tech
3648	involve	303	gap
3633	height	302	amaze
3628	while	302	pipe
3616	few	302	trout-rod
3611	eat	301	fetus
3577	plot	301	struggle
3559	particle	300	arise
3558	space	300	counter-attraction
3548	re-unit	300	fortunate
3520	reason	300	jump
3488	exponent	300	non-noble
3484	provide	300	stack
3477	off		

3474	continue	299	invent
3457	ordinate	299	metabolic
3453	try	299	promise
3436	picture	298	attitude
3434	respond	298	officer
3431	notice	298	sulfur
3422	allow	297	spinner
3394	re-charge	296	non-employee
3388	decimate	296	specify
3377	activity	296	sweat
3363	guide	296	tee-shot
3353	again	296	trinomial
3350	plan	295	spectrum
3311	put	295	wise
3302	limit	294	chair
3283	refer	294	goods
3253	diagram	294	tea
3245	zero	293	combust
3243	lead	293	ramp-up
3226	parallel	292	proceed
3197	foundation	292	requirement
3177	sound	292	worry
3174	effect	291	baseball
3171	last	291	cardiovascular
3162	plane	291	comment
3138	average	291	extract
3132	press	291	forget

3111	mini-city	291	police
3110	member-country	291	sedimentary
3104	affect	291	terrestrial
3094	linear	290	agency
3088	note	290	blow
3078	too	290	despite
3071	correct	290	manner
3071	property	290	monitor
3069	pattern	290	shift
3065	size-class	289	aware
3045	depend	289	reverse
3044	tale	289	t-switch
3041	usual	288	exclusive
3037	song-cycle	288	journey
3036	color	288	peer
3030	story	288	self-injury
3012	leaf	287	clarify
3010	support	287	facility
3005	acid	287	indeed
2994	small	287	toe-nail
2989	frequency	287	vibrate
2983	break	286	anti-viral
2982	select	286	fission
2977	within	286	register
2976	natural	286	trig
2968	house	286	turtle
2967	still-room	285	chocolate

2965	sub-region	285	commission
2964	main	285	covering
2963	protein	285	humid
2956	best-seller	285	straw
2949	remember	285	dance
2924	control	284	coat
2916	oppose	284	everywhere
2915	connect	284	tie-beam
2908	take-away	283	comfort
2906	least	283	hexagon
2902	money-winner	282	beak
2897	math	282	finance
2890	disease	282	myself
2885	electricity	282	re-confirm
2883	book	282	regulate
2878	actual	281	ant
2875	predict	281	intermediate
2871	come	281	scatterplot
2871	sit-com	280	acute
2853	manage	280	kg
2848	several	280	placenta
2836	north	280	producer-entrepreneur
2826	tree	280	recess
2824	whole	279	approve
2823	top	279	broad
2823	travel	279	interfere
2822	remain	279	pig

2815	congruence	279	sharp-shooter
2811	constant	278	accuse
2809	commons	278	descend
2807	observe	278	genotype
2788	rectangle	278	prefix
2786	substance	278	raw
2765	once	278	secant
2756	two-piece	277	enormity
2751	field	276	bee
2749	denominate	276	cavity
2738	detail	276	feeding-point
2733	map	276	inter-county
2714	certain	276	quiet
2710	free	276	rock-climb
2707	sentence	275	adjust
2698	special	275	depict
2698	child	275	dice
2695	age	275	ferment
2691	solidify	275	genus
2666	vector	274	cite
2663	student-teacher	274	classroom
2660	current	274	spin
2649	hold	273	dream
2644	old	273	lens-clip
2639	paper	273	mid-career
2634	million	273	shine
2633	families	273	shopping-basket

2629	either	272	acidic
2626	work-situation	272	cartilage
2620	whether	272	caught-and-bowled
2586	song	272	migrate
2574	fill	272	teen
2564	oxygen	272	turbine
2563	for	271	bubble
2558	week	271	pentagon
2550	reduce	271	roof-tree
2547	moon	271	super-regional
2542	minute	271	uranium
2526	cannot	270	alpha
2525	fish	270	jack
2524	weight	270	menu
2522	subtract	270	restaurant
2510	kind	269	curve
2499	head	269	numerous
2489	separate	269	valence
2486	basic	268	drag
2481	division	268	experienced
2480	random	268	pre-wash
2478	degree	268	soldier-husband
2478	rational	268	tie
2475	carry	267	channel
2467	sometime	267	grand
2466	vocabulary	267	loud-speaker
2465	require	267	mined

2463	social-service	267	soup-kitchen
2462	inside	266	chord
2462	odd-job	266	liters
2461	sing-along	266	micro-film
2457	conclude	266	reactor
2447	mid-late	266	rhombus
2447	wind	266	telephone-call
2445	liquid	265	freshwater
2445	stamping-ground	265	gift
2443	cover	265	pore-canal
2431	protect	265	secrecy
2429	tennis-court	264	coast
2421	history	264	disappear
2417	design	264	hybrid
2412	secretary-general	264	larva
2410	re-form	264	shake
2407	vertical	264	southeast
2405	ball	263	absence
2395	bird	263	tract
2394	quadratic	262	coral
2387	bacterium	262	gender
2385	across	262	ordinary
2384	teach	262	pea
2382	horizon	261	peak-hour
2373	reach	261	quest
2360	enter	261	shelter
2359	inverse	261	tough

2352	polynomial	260	gamma
2350	discuss	260	negate
2349	individual	260	stuff
2342	text	259	attribute
2340	muscle	259	highlight
2336	introduction	259	shelter-belt
2332	specific	258	filter
2331	technology	258	handle
2322	purple-blue	257	collapse
2316	mark	257	illness
2313	major	257	shallow
2313	room-key	256	dress
2312	bond	255	john
2304	record	255	music-hall
2298	little	255	recycling
2294	rotate	254	clothes
2293	two-pound	254	condense
2287	sure	254	elasticity
2286	independence	254	rice
2285	pay	253	assemblies
2276	presidency	253	catalyze
2272	video	253	margin
2269	white	253	stead
2265	woman	253	suspend
2263	consist	253	tear
2261	axis	253	tour
2260	outgoing	252	lightness

2252	tell	252	methane
2250	interval	252	governor
2244	easy	251	faith
2239	pseudo-operation	251	helium
2237	friend	250	classic
2236	enough	250	entry
2236	exact	250	bat
2234	characterize	250	hence
2230	something	250	mph
2227	west	250	roundworm
2226	war	249	basin
2221	temple-complex	249	convince
2209	balance	249	hazard
2205	today	249	imply
2204	over-correct	249	rush
2197	indicate	249	uniform
2197	lonely-heart	248	agent
2196	metal	248	former
2192	letter	247	annelid
2185	self-interest	247	guarantee
2185	variety	247	hurt
2180	sex-role	247	pastry-cook
2179	environment	247	presentation
2178	chromosome	247	quart
2175	symbol	247	rose-bush
2174	intercept	247	tribute-payment
2165	out-flow	246	honor

2165	sense-organ	246	puzzle
2163	evolution	246	sack-artist
2162	cross	246	skew
2154	vote	245	carrier
2153	decide	245	clothing
2150	feel	245	flame
2149	life-choice	245	flatworm
2148	build	245	re-check
2148	motion-picture	245	slip
2139	pass	244	angiosperm
2138	warm	244	brand
2133	share	244	finite
2127	light-curve	244	homework
2127	until	244	queen
2122	building	244	rainforest
2122	soil	243	categorize
2122	station-building	243	dad
2117	release	243	laugh
2116	three-month	243	monkey
2115	re-appear	243	quasi-academic
2110	micro-electric	243	sea-cliff
2103	green	242	barrier
2102	behave	242	fighting
2096	self-control	242	pulley
2093	evidence	241	birthday
2088	member	241	pendulum
2085	approximate	241	revolve

2076	drive	240	cartoon
2076	lose	240	manipulate
2072	big-wig	240	pathway
2071	sea-wind	240	re-appoint
2069	magnet	239	adolescent
2067	lifter	239	pregnancy
2065	over-balance	239	proposal
2063	sell	238	strip
2049	am	238	aluminum
2048	primary	238	enemy
2031	hydrogen	238	inscribe
2029	atmosphere	238	nice
2028	gravity	238	noun
2027	heart	238	pretty
2027	position	237	adultery
2018	transport	237	house-cow
2008	normal	237	invention
2003	dense	236	multi-vitamin
2001	super-store	236	re-creation
1999	ice	236	sub-rent
1997	integer	236	textbook
1996	fact	235	collide
1991	egg	235	igneous
1990	receive	234	cine-camera
1985	plate	234	codon
1978	hear	234	determinate
1976	membrane	234	grandmother

1973	proportion	234	hydroxide
1958	eye	234	meal
1955	round	234	rat
1951	river	234	revenue
1950	run	234	savings-and-loan
1940	chart	233	hand
1940	exist	233	rid
1931	card	232	anaerobic
1931	flower	232	canyon
1929	perform	232	cation
1928	discover	232	heat
1928	reflect	232	ore
1927	meaningful	232	shut
1925	quick	232	spiral
1921	hard	231	classmate
1917	vertex	230	candle-stub
1915	source-text	230	deer
1912	pie-chart	230	internet
1912	row	230	luck
1908	south-westerly	230	over-extension
1907	meter	229	bay-window
1906	never	229	clockwise
1906	rise	229	contaminate
1895	suppose	229	harvest
1893	plate-layer	229	mission
1892	self-seed	229	over-buy
1883	spend	229	refract

1876	fossil	229	rent
1875	physical	229	somewhat
1873	particular	229	stock-pile
1869	t-short	228	dozen
1868	middle	228	household
1865	meet	228	jaw
1864	planet	228	lymph
1861	believe	228	over-borrow
1857	tissue	228	spinning-top
1853	weather	228	toe-cap
1851	widen	227	defeat
1849	algebra	227	diabetes
1845	collect	227	symbiosis
1845	house-hold	226	encounter
1845	six-year-old	226	exam
1840	bar	226	lord
1837	substitute	226	railroad
1828	life-history	226	sea-pink
1823	instead	226	stiff-upper-lip
1822	meaning	225	consecutive
1822	think	225	mon
1819	lot	224	groundwater
1818	decrease	224	laboratory
1815	translate	224	re-draft
1810	face	224	republican
1810	micro-climate	224	uncle
1810	micro-fossil	223	indirect

1798	parent	223	infinitely
1796	count	223	mid-afternoon
1795	present	223	overview
1792	multiplication	223	pot
1791	author	223	quote
1781	deviate	223	scalar
1778	female	223	sweet
1777	previous	222	aerobic
1775	re-write	222	dinner
1767	non-local	222	glycolysis
1764	extend	222	occasion
1763	care	222	spill
1763	game	221	afford
1763	room	221	aim
1763	block	221	poet-critic
1762	pre-condition	220	export
1762	short-fall	220	fits
1761	mix	220	flex
1760	play	220	intend
1758	near	220	mill
1752	nerve	220	moon-landing
1751	non-national	220	potassium
1750	focus	220	snow-drift
1747	clear	220	zero-crossing
1747	geometry	219	antibiotic
1745	repeat	219	deposition
1740	bring	219	emergence

1724	health	219	rainfall
1724	necessitate	219	re-grant
1723	research	219	toy
1719	prose-character	218	antibody
1718	seem	218	august
1708	though	218	disturb
1708	waste	218	entropy
1705	die	218	exhibit
1705	non-male	218	step-ladder
1704	segment	217	activate
1695	against	217	bend
1689	young	217	convenience
1680	re-buy	217	vaccine
1676	culture	217	vesicle
1673	potential	216	debt
1672	bone	216	inform
1672	organize	216	owe
1670	walk	216	semi-permanent
1666	obtain	216	side-pond
1665	prove	215	con
1663	politic	215	empirical
1655	full	215	henry
1654	spread	215	highway
1651	statistic	215	mysterious
1650	stop	215	re-insert
1650	strong	215	squeeze
1647	octave- combination	214	numbered

1646	correspond	214	resemble
1646	significance	214	sing
1645	machine	214	table-mat
1642	run-up	213	comet
1641	near-synonym	213	mine-sweeper
1640	absolute	213	telephone
1639	east	212	flag-pole
1637	expect	212	master
1625	sense-unit	212	nutrition
1624	outside	212	pine-needle
1623	label	212	pour
1623	radius	212	spider-web
1622	re-connect	212	suffice
1621	top-to-bottom	212	tally
1616	over-fill	211	ace
1615	definition	211	carbonate
1615	over-exercise	211	minimalist
1615	strategic	211	semi-professional
1613	convert	210	aquifer
1604	skin	210	mini-budget
1599	advance	210	noon
1597	black	210	protractor
1594	locate	210	reef
1594	step-mother	210	relieve
1593	multiple-unit	210	somewhere
1593	stage	209	accomplish
1592	boy	209	criminal

1590	although	209	endocrine
1587	among	209	kid
1584	concentrate	209	overcome
1577	treat	209	republic
1572	cut	209	sublevel
1571	send	209	temporary
1568	semi-double	209	turbo-generator
1562	tide-mark	208	marry
1559	quantify	208	salary
1557	criticize	208	tomb-chest
1556	biology	208	wage
1556	brain	207	feasibility
1549	grade	207	flour
1543	elect	207	non-criminal
1542	evolve	207	remind
1542	side-chain	207	test-pressing
1539	essence	206	bracket
1538	night	206	calendar
1537	purpose	206	interview
1536	solar	206	sandwich
1535	insect	206	street
1534	generate	206	suit
1533	digest	206	transverse
1533	equivalence	205	apparent
1531	median	205	artificial
1530	already	205	tsunami
1530	bill	204	beetle

1527	language	204	gentle
1525	dioxide	204	pocket-borough
1521	turn	204	re-phrase
1520	pollute	204	scenario
1519	oil-spill	204	shell-burst
1518	due	204	tribe
1516	mineral	203	cnidarian
1514	cold-store	203	conjecture
1513	construct	203	crest
1509	nucleus	203	minister
1509	slave-girl	203	out-accelerate
1506	two-leg	203	quantum
1502	location	203	rub
1496	tool	202	anatomy
1487	safe	202	cold
1486	rest	202	herbal
1484	dimension	202	mate
1484	say	202	roll
1483	cup	201	assist
1482	replace	201	binary
1478	efficiency	201	biotechnology
1475	stem	201	desk
1474	ever	201	till
1474	pdf	201	trail
1471	score	200	anywhere
1468	polar	200	dry
1467	trade	200	emotion

1467	serve	200	min
1463	coefficient	200	spell
1460	perpendicular	200	spinal
1452	thousand	200	track
1447	skill	199	concave
1441	survey	199	shark
1440	talk	199	tap
1437	removable	198	slant
1434	bear	197	crater
1432	dog	197	era
1426	component	197	hatch
1420	contrast	197	moral
1418	display	197	out-compete
1413	earthquake	197	sac
1408	ago	197	stage-coach
1392	accord	196	advertise
1388	ray	196	drought
1388	return	196	quiz
1384	deep	195	admit
1384	outline	195	china
1379	resist	195	dirt
1378	asymptote	195	exceed
1376	virus	195	landform
1374	thus	195	self-administration
1372	socialism	194	drawings
1371	succeed	194	non-expert
1370	fit	194	over-commit

1364	recall	194	over-exert
1361	party	194	participant
1358	tone-poem	194	presidential
1357	nature	194	resolve
1354	available	194	sad
1354	leave	193	feedback
1352	tax	193	filament
1351	thought-content	193	multiplicative
1350	typical	193	pause
1344	column	193	soda
1340	entire	193	tubule
1339	team	192	childhood
1338	super-company	192	pursuance
1337	front	192	ridge-walk
1333	death	192	space-fiction
1333	finality	192	tectonic
1333	shall	191	astronaut
1330	pseudo-objective	191	exclude
1330	raise	191	menstrual
1330	respiration	191	moss
1329	citizen	191	narrate
1328	stay	191	non-lawyer
1325	match	191	potato
1324	engineer	191	sign
1322	vary	191	sparrow-hawk
1320	win	191	tornado
1318	generalize	190	biomass

1313 lake	190 cardiac
1310 parabola	190 chip
1309 continent	190 lack
1308 review-article	190 quark
1308 super-computer	190 scarce
1307 retro-fit	189 hotspot
1305 throughout	189 intelligence
1304 branch	189 loud
1304 polygon	189 stone
1304 toward	189 tilt
1301 photo-pass	189 vacuole
1300 fungus	188 bucket
1293 fly	188 campaign
1291 self-reflection	188 heaven
1290 notable	188 heterotroph
1289 derive	188 molar
1288 topic-shift	188 odds
1287 large	188 passive
1285 almost	188 seal
1285 item	188 soul
1285 trouser-front	188 suck
1282 source	188 taxonomy
1281 run-past	187 ahead
1281 tall	187 conceptualize
1277 rain	187 deny
1276 dissolve	187 feed
1276 link	187 ionize

1275	account	187	lady-friend
1274	associate	187	max
1269	mammal	187	multiple
1266	short-change	187	re-hire
1264	agree	187	uterus
1264	wood	186	angular
1261	photo	186	flavor
1261	yes	185	append
1255	sexuality	185	athlete
1248	matrix	185	gradient
1243	electromagnet	185	lighter
1241	combine	185	nickel
1240	log	185	projectile
1240	recognition	185	soup
1238	course	185	stream-line
1236	extreme	184	bur
1235	tail	184	dear
1233	saw-mill	184	geothermal
1229	wall	184	hemoglobin
1228	fire	184	homogeneity
1228	wide	184	metamorphic
1226	non-essential	184	monarch
1224	accelerate	184	mushroom
1224	prevent	184	physiological
1218	rule	184	rocky
1218	supply	184	soccer
1216	appropriate	184	weapon

1216	pump	184	winner
1215	soil-nutrient	183	automate
1212	cancer	183	book-binding
1212	visit	183	deposited
1208	over-extend	183	dictionary
1207	converge	183	landscape
1207	tangency	183	lit
1205	ease	183	lone-pair
1203	re-discover	183	motor-habit
1202	industrial	183	nineteenth
1202	short-circuit	183	owl
1202	wiki	183	recommend
1201	adult	183	roller-blind
1193	tri-gram	183	side-drum
1192	spring	183	terminate
1188	non-identity	183	turkey
1188	re-build	183	tutor
1188	semi-final	182	condensate
1188	symmetry	182	fellow-creature
1187	change	182	polymerase
1183	numerator	181	convex
1178	mechanic	181	discount
1178	sugar	181	microorganism
1177	pine-cone	181	photon
1176	ion	181	rust
1176	pull	181	silent
1176	yellow	181	tortoise

1174	re-assume	181	trunk
1173	bag	181	urine
1173	trait	180	awl
1170	volcano	180	phloem
1166	town	180	phosphate
1164	decay	180	sweep
1162	interpret	179	rose-petal
1161	congress	179	screw
1159	drop	179	sheep-track
1157	sunlight	178	captain
1155	religion	178	infinity
1155	stand	178	royal-watcher
1153	three-iron	178	software
1151	miss	178	thermometer
1147	sea-salt	178	tommy-gun
1146	net	177	engage
1146	rather	177	limb
1145	experience	177	refrigerator
1144	lie	177	semi-pro
1143	digit	177	spoon
1138	difficulty	177	throat
1138	hair	177	trigger
1136	weigh	176	anion
1134	composite	176	essay
1133	shade	176	helix
1126	billion	176	irregular
1126	error	176	judicial

1125	semi-colony	176	plenty
1119	apart	175	capacitor
1117	trouser-press	175	eagle
1116	ride	175	endotherm
1115	tube	175	envelop
1111	issue	175	foil
1108	hearing-aid	175	devil
1107	slow-match	175	lifetime
1105	favor	175	manager
1104	king	175	rack-mount
1103	love	175	runoff
1100	long-hair	175	wax
1099	floor	174	concrete
1097	non-native	174	confederate
1096	sea-floor	174	noise
1095	transfer	174	queue
1094	classified	174	sensitive
1091	dark	174	temple
1090	iniquity	173	joy
1088	train	173	dam
1081	maintain	173	insight
1080	amendment	173	spider
1080	damage	173	sunny
1079	modern	172	messenger
1079	upon	172	search
1078	yet	172	stove
1073	report	172	format

1072	guidance	172	tail-gate
1069	courtesy	171	affair
		171	afraid
1065	totem-pole	171	crack
1063	fair	171	hanging
1062	suggest	171	initiate
1060	re-combine	171	re-arm
1060	reproduction	171	ribbon
1058	storage	171	slime
1057	sub-project	171	wetland
1050	pseudo-device	170	citizenship
1050	re-examine	170	grandfather
1047	lung	170	possess
1045	whose	170	scheme
1043	swimming-pool	170	switch
1042	straight-jacket	170	tobacco
1039	chance	169	alveoli
1039	semi-regular	169	epidermis
1037	sky	169	mere
1036	cool	169	protozoa
1030	non-decision	169	suspect
1029	fruit	168	non-migrant
1027	business	168	recipient
1024	sine	168	redox
1024	trigonometry	168	stamp
1023	rain-forest	168	witness
1022	communicate	167	cactus

1022	hi	167	census
1022	respect	167	emphasize
1022	trunk-road	167	aunt
1021	goal	167	insulin
1020	establish	167	mild
1020	influence	167	side-line
1020	rewrite	167	skin-diver
1019	circulate	167	sub
1018	salt-burn	167	tongue
1018	spirit	167	voyage
1017	mode	166	assemble
1016	speak	166	bundle
1015	non-writer	166	entertain
1012	over-dry	166	newly-wed
1012	radiance	166	plural
1009	visual	166	resolute
1007	reproduce	166	seed
1006	perfect	166	static
1001	parenthesis	166	walker
998	short	165	incidence
995	yard	165	invite
992	hit	165	judgment
992	step-father	165	lean
991	diameter	165	phrase
991	extra	164	dime
990	vision	164	nonvascular
988	glass	164	outdoor

986	settle	164	terrible
981	contribute	164	testis
981	expand	163	compact
981	introduce	163	conjugate
980	ship	163	conscience
980	kill	163	enhance
978	island	163	heading
978	themselves	163	membership
975	attract	163	ourselves
975	organization	163	pad
974	attend	163	relax
973	fat	163	semi-dwarf
973	pyramid	163	stage-dive
971	integral	163	swim-bladder
969	unique	163	table-lamp
968	century	162	cable
966	core	162	circumstance
966	eukaryote	162	over-concentrate
966	thunder-cloud	162	pint
966	wire	162	re-launch
963	centimeter	162	roller-towel
963	petro-dollar	162	snail
962	date	162	tomato
962	interest	162	underground
961	opinion	161	bowl
959	summer	161	gymnosperm
959	harm	161	hummingbird

957	hormone	161	iron-founder
957	literacy	161	minus
957	velocity	161	starch
954	ten-foot	161	submit
952	park	161	wake
952	re-fuel	160	convey
951	exercise	160	hammer
951	fast	160	lunar
951	site	160	mucus
950	benefit	160	non-earning
950	gold	160	nut
949	earn	160	oblique
949	winter	160	outward
947	someone	160	partly
947	universe	160	phyla
946	save	160	re-classify
945	cosine	159	breakfast
943	message	159	director
942	habitat	159	embed
940	twice	159	facilitate
936	snow-bank	159	harmonic
934	binomial	159	inertia
933	interact	159	jar
931	principle	159	milliliter
931	trial	159	poll
929	fertility	159	re-acquire
928	tend	159	swallow

927	eventuality	159	traffic
927	go-fast	158	chlorophyll
927	path	158	don't
926	fix	158	guilt
925	except	158	microwave
924	magnitude	158	self-doubt
921	voice	158	sock
920	challenge	157	massive
918	consumption	157	penny-farthing
917	surround	157	photovoltaic
916	hole	157	re-fold
914	cube	157	repetition
912	immune	157	semi-dome
908	inter-connection	157	senior
908	proof	156	cholesterol
907	loss	156	custom
905	photosynthesis	156	graduate
905	six-hit	156	longitude
904	tiny	156	participant-observer
903	self-description	156	repel
900	dominance	156	role-mapping
900	isolate	156	skateboard
899	office	156	tent
897	vessel	156	territory
895	six-cylinder	156	treasure
893	prism	156	wheat
892	intersect	155	angry

890	big	155	consent
890	mountain-top	155	ethane
889	recent	155	lobe
888	proton	155	motion
887	arrive	155	psycho-drama
886	interior	155	reflex
885	technique	155	thread
883	histogram	155	vein
883	prokaryote	154	ash-tray
882	built-in	154	cleaner
882	sub-program	154	disk
882	ton	154	fight
881	plug	154	five-aside
880	bind	154	flash
879	dead	154	gill
879	shape	154	philosopher
878	wear	154	rabbit-warren
875	pan	154	reservoir
873	improve	154	retain
873	door	153	absorbance
872	nation-state	153	butter
870	minimum	153	fever
867	danger	153	halfway
866	sphere	153	hungry
865	setting	153	khan
863	publish	153	restore
862	riding-crop	153	strain

862	sand	152	apparatus
861	trumpet-player	152	carboxylate
856	advantage	152	cerebrum
856	counter-argument	152	curiosity
856	rough	152	employ
855	especial	152	exert
854	enzyme	152	firm
853	bad	152	hearth-fire
853	theme	152	non-metallic
852	arm	152	serving-woman
852	glucose	152	warren
852	revolt	151	cheap
851	future	151	dipole
851	quadrilateral	151	donate
849	invert	151	explicit
849	window	151	ink
848	rose-garden	151	platform
847	partner	151	refuge
846	heavy	150	award
844	behind	150	pore
844	trouble-spot	150	sole
841	edge	150	torture-chamber
840	seven-year-old	150	tumor
839	instance	149	appreciate
838	risk	149	celebrate
837	accept	149	crowd
837	customer	149	hang

837	dimensional	149	incomplete
837	touch	149	marc
835	empire	149	segregate
835	slave	149	strict
834	pathogen	149	verbal
830	boundaries	148	crowd-puller
830	erode	148	kite
830	tying	148	pituitary
829	input-output	148	spontaneity
828	trip	148	wasp
827	internal	147	affiliation
827	polka-dot	147	cellulose
827	race	147	double
827	signal	147	gulf
826	hill	147	nonliving
825	fish-farm	147	premise
825	freeze	147	trash
825	sand-hill	146	cytokinesis
824	coin-op	146	enthalpy
824	gallon	146	hate
823	subtraction	146	ingredient
819	shadow	146	koala
818	infinite	146	biologist
818	power	146	non-resistant
818	station	146	peripheral
817	battery	146	prohibit
816	conserve	146	shoulder-width

815	education	146	verse
814	host	145	axle
814	intersection	145	bloom
814	poor	145	chromatid
813	adapt	145	counterclockwise
809	thin	145	follicle
804	bisect	145	innovate
804	steam-engine	145	memorize
802	outer	145	mg
801	molecular	145	orientation
800	tradition	145	ox-cart
797	join	145	doubled
797	super-market	145	soap
796	allele	144	brake
796	jpg	144	calling-card
795	sales-force	144	cave
795	semi-desert	144	contour
793	poet	144	dig
793	representative	144	disadvantage
791	ear	144	flashlight
791	hypotenuse	144	footprint
790	mind-reader	144	molted
790	orbit	144	punishment
789	art	144	sage
789	spy-fly	144	website
788	ancient	143	amp
788	deliver	143	assign

788	prepare	143	comprise
786	avoid	143	dish
784	coal-tip	143	homologue
784	offer	143	obey
781	license	143	penetrate
780	diverse	143	phospholipid
780	perimeter	143	pioneer
780	throw	143	ratification
780	invest	143	self-cure
779	mountain	143	soviet
779	style	143	thesis
777	leader	142	bury
775	clean	142	jet
775	plus-point	142	lymphatic
774	ellipse	142	moderate
774	tide	142	ovule
773	distinguish	142	space-probe
773	sperm	142	theater
772	diagonal	142	trust
772	extinct	141	destiny
772	music	141	educate
772	soon	141	endoplasmic
770	still-birth	141	forever
769	demand	141	hotel
769	reproductive	141	knock
768	amino-acid	141	mail-shot
767	unlike	141	optical

767	vertebrate	141	shout
766	ready	141	sing-song
766	topic	141	tick
765	everything	141	tomorrow
764	anything	140	autotrophy
764	red-brown	140	backward
761	strike	140	backwards
760	ax	140	bare
760	output	140	cathode
759	option	140	delay
759	sea-flat	140	discharge
758	geology	140	grassland
758	season	140	heredity
757	gland	140	lecture-demonstration
757	numeric	140	magazine
755	else	140	mood-swing
754	distinct	140	pod
752	kingdom	140	re-impose
752	minute-book	140	scoop
751	paragraph	140	southwest
750	classification	140	tremendous
750	ion-exchange	140	wolf
750	midpoint	139	blue-jean
750	southern	139	diary
748	re-arrange	139	fool
748	renewable	139	japan
745	thick	139	mini-holiday

744	election	139	remarkable
744	god	139	self-quotation
740	meiosis	139	sentence-fragment
739	supplement	139	shuttle
734	colonize	139	weed
734	ticket	138	abolish
733	eliminate	138	carnivore
731	familiar	138	cot
730	defend	138	defect
730	guess	138	hurry
727	official	138	lever
726	mole	138	metalloid
725	marble	138	oak-wood
725	sea-coast	138	reticulum
724	sketch-pad	138	cloth
724	union	138	tooth-brush
723	dilate	137	crew
723	mouth	137	esophagus
722	fuel	137	faculty
721	re-gain	137	house-guest
720	cm	137	receiving-station
719	board	137	self-improvement
719	nation	137	stain
719	over-control	137	super-tyrant
719	physician	137	thumb
717	consume	136	amniotes
717	self	136	caterpillar

716	erupt	136	cattle-yard
712	babies	136	disaster
712	formation	136	hollow
708	destroy	136	hook
708	emit	136	inventor
707	distribute	136	oil
707	neighbor	136	six-bedroom
707	northern	136	social-revolutionary
707	radio-phone	136	sporophyte
703	endings	135	altogether
701	sunshine	135	arrest
701	tan	135	beta
698	boil	135	diatom
697	snow-wreath	135	editor
696	foreign	135	lateral
696	sex-war	135	likewise
695	re-attach	135	liter
694	attack	135	polymer
694	breathe	135	quilt
693	step-son	135	shield
692	web	135	trophic
691	pick-up	135	welcome
690	proper	135	shower
689	fluid	134	bite
689	popular	134	cumulate
689	quality	134	filter-feeder
689	ring	134	instruct

688	reactant	134	lymphocyte
686	efficient	134	pancreas
686	friction	134	petroleum
685	non-consumer	134	quake
685	push	134	re-hang
685	screen	134	smart
683	strength	134	swell
682	puppet	133	bony
681	overall	133	calorie
680	whisker	133	cardboard
679	lay	133	explorer
678	tenant-farmer	133	hospital
677	gamete	133	mud
676	bounded	133	ohm
676	everyone	133	poverty
673	flip	133	supervise
673	hope	133	tin
673	rapid	132	collinear
673	speaker	132	cough
673	thunder-storm	132	droplet
672	partial	132	honesty
672	quotient	132	marsupial
671	buy	132	silence
670	representation	132	smith
670	toilet-roll	132	stroke
669	copyright	132	transparent
669	permutation	132	victory

668	mega-deal	132	whisper
667	belong	131	biography
666	fold	131	chimney-breast
666	microscope	131	cortex
666	progress	131	counter-claim
666	speech	131	dive
666	upper	131	exothermic
662	inherit	131	brick
661	pre-adaptation	131	pascal
661	substitution	131	raccoon
660	prefer	131	sliding-scale
659	quite	131	testosterone
656	bottle	131	thunderstorm
655	milk-yield	131	worldwide
654	checkpoint	130	announce
653	weak	130	axon
652	honey-guide	130	bold
649	nothing	130	delegate
648	fail	130	epicenter
648	slight	130	guideline
648	vehicle	130	inconsistent
646	offspring	130	priority-dispute
646	purchase	130	pulmonary
646	toffee-apple	130	sea
646	toss	130	staff
645	exchange	130	vast
645	investigation	129	bunch

645	perhaps	129	dash
643	background	129	furnish
643	compute	129	josh
643	stand-alone	129	jumping
642	environ	129	misleading
642	yield	129	rabbit
641	profit	129	seismogram
640	onto	129	shock-wave
636	diffuse	129	singular
635	procedural	129	skate
635	self-interaction	129	tune
634	eating-disorder	129	yeast
634	regression	128	amuse
634	wheel	128	biofuel
632	sit	128	blade
632	wonder	128	cereal
631	concern	128	crush
630	moment	128	flagella
629	experiment	128	gametophyte
629	possibility	128	re-amend
628	precise	128	remote
627	animate	128	scaffold
627	equilibrate	128	shelf
627	neither	128	side-shoot
627	trapezoid	127	admire
626	news-stand	127	align
626	predator	127	commander

624	galaxy	127	cytoskeleton
623	orange	127	earthworm
622	diverge	127	excessive
622	majority	127	land-crab
622	non-ionic	127	sea-adventure
621	nearly-silence	127	secretary
619	organelle	127	suitable
617	benchmark	127	tunicate
616	transmit	127	vagina
615	integrate	126	alienate
614	correlate	126	attain
613	pure-bred	126	biotic
612	poster- opportunity	126	demography
612	undergo	126	endoskeleton
611	complement	126	lizard
611	mature	126	milk-crate
611	reptile	126	refine
609	daughter	126	stir-fry
609	discrete	126	texture
609	wait	126	trench
608	flash-bulb	126	wool
608	policy	125	berry
608	sponge	125	bloodstream
608	step-daughter	125	chess-player
607	identical	125	devote
607	satisfy	125	fox
606	instrument	125	genital

605	college	125	hydroelectricity
605	crust	125	informal
605	intestinal	125	moreover
603	ideal	125	near-contemporary
603	serious	125	originate
603	smoke	125	pot-lid
601	tip	125	retire
600	wish	125	spacecraft
599	prey	125	stage-manage
597	tom-cat	125	strawberry
596	candy	125	stripe
596	daily	124	benzene
596	quadrant	124	complain
594	telescope	124	curriculum
593	over-determine	124	dip
593	vapor	124	golf
591	candidate	124	grandpa
590	biome	124	micro-electrode
590	pencil	124	radial
590	sheet	124	rearrange
589	crystal	124	regularity
589	sample	124	rift
589	sleep	124	topography
588	modify	123	array
588	transit	123	calm
587	nitrogen	123	chaparral
587	re-group	123	chi

586	mass	123	designate
585	covalent	123	elsewhere
585	international	123	goggle
585	p-orbital	123	lily
584	string	123	notochord
583	confide	123	sand-dune
583	depth	123	single-coil
583	tit-bit	123	sore
583	university	123	stat
582	brighten	123	tessellate
581	biodiverse	123	urchin
581	literature	123	youth
578	mid-year	122	anti-woman
578	re-absorb	122	coelom
578	scatter	122	genre
577	alga	122	heterozygote
577	drug	122	infancy
577	push-up	122	inhabit
577	vascular	122	magnify
576	media	122	sickle
576	parameter	122	troop
576	step-sister	121	abundance
575	intense	121	ammonia
575	mitosis	121	blood-bead
575	portion	121	bureau
575	smart-drug	121	busy-body
574	investigate	121	urge

574	stick	121	watt
573	felt	120	approval
573	regard	120	bi-focal
573	sixth-former	120	crash
572	space-arc	120	crucial
571	beyond	120	deform
571	reciprocal	120	guard
571	paint	120	infrared
571	passage	120	novel
571	slow	120	semi-colon
570	brother	120	spindle
569	arrow	120	via
568	conduct	120	video-recording
568	wrong	119	banana
567	balloon	119	expedition
567	melt	119	fracture
567	smooth	119	headed
566	circumference	119	millar
565	capital	119	mind
565	trace	119	photosynthetic
564	own	119	sigma
563	solute	119	spot-kick
562	morning	119	capsule
559	coming	119	welfare
556	adjacent	118	counterexample
556	precipitate	118	cruelty
555	income	118	diagnose

555	metric	118	dilemma
555	pack	118	preview
554	cancel	118	scope
553	prep	117	ben
553	sport	117	carrot
553	tile	117	centripetal
552	newton	117	ether
552	truth-claim	117	funny
551	compete	117	hike
551	spoon-feed	117	lemon
550	mirror	117	syndrome
550	pick	116	abuse
550	print	116	acre
550	zone	116	contraption
549	bake	116	coyote
549	grass	116	decorate
549	radio-wave	116	diaphragm
548	detect	116	echo
548	revise	116	elementary
547	price	116	glossary
546	size	116	meteor
545	valley	116	nonpolar
544	empty	116	reply
544	lock	116	scholar-critic
544	pre-arthropod	116	stargaze
544	village	116	weekend
543	ten-year-old	115	chew

542	district	115	evil
542	himself	115	fantasy
542	manufacture	115	funds
542	restrict	115	high-explosive
542	ribosomal	115	nonrenewable
541	fundamental	115	phosphoric
541	obvious	115	polyp
541	wing	115	re-cast
540	land-bridge	115	robot
540	sub-shell	115	salad
539	fault	115	seismic
539	rolling-pin	115	systematic
539	wash	114	cage
538	radioactive	114	confine
537	re-arrangement	114	crustacean
536	movie	114	equiangular
535	carbohydrate	114	fern
534	flight	114	shah
534	listen	114	steal
533	agriculture	114	wedge
532	stomach	113	adequacy
531	violate	113	clip
530	fear	113	everybody
529	grid	113	flu
528	compose	113	hey
527	rich	113	lithosphere
526	cook	113	medication

525	street-woman	113	mollusk
524	para-military	113	motivate
524	band	113	multimedia
522	attempt	113	spittle-bug
522	plastic	112	anxiety
522	sea-grass	112	anyway
522	simulate	112	cherry
521	effort	112	clot
521	ended	112	fork
520	inner	112	geyser
520	rope	112	hypothalamus
518	hunt	112	invisible
517	mentally	112	metamorphosis
516	oxidation	112	paw
516	realize	112	proud
516	wild	112	salt-marsh
515	justify	112	troposphere
515	soft-drink	112	twist
514	oxide	111	bud
514	san	111	creep
513	proctor	111	enlarge
511	altitude	111	fright
511	copper	111	induce
510	index	111	issued
510	tooth	111	jury
509	clue	111	mobile
509	newspaper	111	salt

509	oh	111	sandy
507	nine-year-old	111	scissors
506	inquire	111	semi-vowel
506	km	111	shrink
506	sudden	111	silk
505	bed	111	versus
505	contact	111	whale
505	senate	111	wine
504	sort	110	cargo
503	copy	110	estate
502	anniversary	110	ode
502	two-shoe	110	otter
502	promote	110	qualitative
501	decompose	110	fuse
501	factory	110	truncate
501	logarithm	109	abiotic
501	secondary	109	airport
501	supreme	109	arbitrary
501	threat	109	bilayer
500	embryo	109	psychological
500	prior	109	punish
500	seat	109	school-fellow
500	silver	109	self-rescue
500	synthesis	109	stairs
500	hat	109	tone
499	army	108	blend
498	operate	108	cousin

498	reveal	108	intent
498	search-party	108	interrupt
497	cord	108	master-manufacturer
497	isosceles	108	mow
497	satellite	108	program
497	worth	108	swimming-bath
496	contract	108	vacation
496	expend	108	yesterday
495	burn	107	cape
495	lack-of-pulse	107	crow
495	photo-story	107	embody
494	assess	107	encyclopedia
494	bus-ticket	107	exoskeleton
494	houses	107	germ
494	sodium	107	malaria
493	radian	107	meteorite
492	aspect	107	meteorologist
492	surprise	107	non-emergency
490	colonial	107	nurse
490	non-customer	107	orient
490	transcribe	107	precede
489	parasite	107	sting
489	staging-post	107	tail-fin
488	cytoplasm	107	top-knot
488	pump-prime	107	urban
487	wrap	106	climb
485	neutron	106	electrolyte

484	glacier	106	equidistant
483	crime	106	jelly
483	persuade	106	machinery
483	pollen	106	milk
482	address	106	municipal
482	carrying-on	106	octagon
482	medium	106	peanut
482	purple	106	phylogenetic
482	reverse-punch	106	seize
481	chloroplast	106	stoichiometry
481	street-fight	106	subduction
480	convention	106	towel
480	neuron	105	arctic
480	rare	105	biosphere
480	re-capture	105	cement
480	taste	105	daylight
480	t-shirt	105	deficit
479	institute	105	emphasis
479	sale-room	105	germinate
479	stretch	105	harbor
478	co-act	105	impress
			interpretation-
476	gather	105	computation
476	hide	105	lend
476	journal	105	monomial
476	overlap	105	operon
476	sub-sub-		
476	committee	105	roller-coaster

474	plasma	105	sailor
473	infect	105	soma
472	condition	105	span
472	forward	105	turbo-charger
472	presence	105	dove
472	snake	105	upside
471	labor	105	zoo
470	pain	104	adjective
470	principal	104	appoint
469	consider	104	corrode
469	worm	104	counsel
468	hyperbola	104	entrance
468	reject	104	grind
467	occupy	104	incinerate
467	upward	104	irrigate
466	coin	104	lithium
466	frog	104	ox-bow
466	wife	104	pm
465	cake	104	prophase
465	sink	104	request
465	wealth	104	rhythm
463	letter-collection	104	ridge
462	clock	104	sacred
462	frame	104	shrimp
462	peter	104	whip
461	tire	103	aloud
460	arithmetic	103	burrow

460	broad-bean	103	injure
460	elevate	103	jellyfish
460	kidney	103	likelihood
459	dust	103	mines
459	genome	103	niche
459	greenhouse	103	squid
459	judge	103	tennis
459	library	103	zygote
458	evaporate	102	appliance
458	seek	102	caption
457	housing	102	cast
456	beauty	102	dew
456	department	102	glow
456	photograph	102	grape
455	ancestor	102	herpes
454	scene	102	hut
453	complicate	102	inhalable
453	kilometer	102	meat-hook
453	medicine	102	osmosis
452	chief	102	placemat
451	artery	102	schedule
451	compass	102	shed
451	fish-finger	102	trachea
451	marine	102	tundra
451	playing-field	101	anus
451	reside	101	asthma
450	smell	101	courage

449	encourage	101	fascinate
449	float	101	grace
449	kilogram	101	grocery
449	underline	101	larval
448	painting	101	leak
447	enjoy	101	rock-drill
447	rank	101	slit
446	horse	100	arch
446	mitochondria	100	architecture
442	amphibian	100	chase
441	street-corner	100	cloud
440	march	100	consult
440	ozone	100	glove
440	plain	100	breed
439	lunch	100	halogen
439	none	100	insurance
439	ovary	100	obese
438	phylum	100	oval
438	trap	100	recursion
437	replicate	100	short-list
435	externality	100	somehow
435	latitude	100	spade
434	brief	100	squeak
434	sediment	100	summation
433	null	100	rail
432	famous	100	volt

Mid Frequency Word List

The Mid Frequency Word List has 5,006 lemmas ordered in respect of frequency. The list represents lemmas that appeared between 99 and 10 times within the corpus. For a complete list of mid-frequent words with derivational and inflectional forms, check www.myvirs.com/dictionary.

Table 17. Mid Frequency Word List.

Freq.	Word	Freq.	Word
99	adenine	27	stepping-stone
99	alphabet	27	streamline
99	bobcat	27	subarctic
99	deplete	27	tie-breaker
99	designer	27	toast-rack
99	dilute	27	translucent
99	discontinuity	27	transplant
99	enforce	27	tulip
99	counts	27	twig
99	goat	27	ventral
99	indirectly	27	wedding
99	isomer	27	wingspan
99	kiss	26	anticyclone
99	oven	26	autism
99	puppy	26	bobby
99	roman	26	boll
99	bark	26	boring
99	snake	26	burden

99	sorry	26	caffeine
99	subsequent	26	cannonball
99	suppress	26	carousel
99	bomb	26	cervix
99	trough	26	chin-up
98	anaphase	26	chromosphere
98	automobile	26	clade
98	beg	26	cocoon
98	chandler	26	concise
98	cookie	26	condemn
98	creek	26	cooperate
98	currency	26	cornea
98	dolphin	26	deceive
98	download	26	de-couple
98	knife	26	detritivore
98	magnificence	26	drummer
98	marrow	26	earlobe
98	microscopic	26	earnest
98	monomer	26	echo
98	nevertheless	26	fang
98	notion	26	faraday
98	penguin	26	flowchart
98	penis	26	gabbro
98	pronounce	26	ginkgo
98	protest	26	gnomon
98	re-incorporate	26	handlebar
98	subunit	26	harness

97	aggression	26	hearth
97	bald	26	hydrostatic
97	bike	26	iceberg
97	bitter	26	intimacy
97	disprove	26	intolerance
97	downhill	26	isotonic
97	electronegativity	26	ivy
97	ford	26	keystone
97	inventory	26	knight
97	knee-trembler	26	locust
97	lawn-mower	26	m
97	neat	26	mantis
97	nebula	26	meantime
97	nectar	26	micronutrient
97	pre-conference	26	milkweed
97	residual	26	neon-sign
97	score-draw	26	ovum
97	squirrel	26	peel
97	steroid	26	perch
97	straightforward	26	phlogiston
97	stratification	26	picture-gallery
97	unite	26	pipeline
97	vegetate	26	plank
97	vs	26	pox
97	widespread	26	preposition
96	anemia	26	presently
96	barely	26	provoke

96	cardinal	26	pseudopod
96	confess	26	purse-string
96	dissociate	26	quit
96	equinox	26	re-box
96	heal	26	regroup
96	inorganic	26	roam
96	kit-bag	26	roger
96	mad-house	26	scold
96	menstruate	26	scorn
96	mini-league	26	sea-monster
96	node	26	sextant
96	persist	26	shelf-grip
96	pest	26	shellfish
96	purchase	26	shuffle
96	servant	26	singer-songwriter
96	subset	26	sleeping-pill
96	thermostat	26	steel-casting
96	trillion	26	synthase
95	bilateral	26	tomb
95	broadcast	26	tonsil
95	cascade	26	tryptophan
95	cucumber	26	univariate
95	embryonic	26	venom
95	guanine	26	victor
95	latter	26	vivid
95	longitudinal	26	von
95	murder	26	winged

95	nominate	26	writ
95	qualify	25	anaconda
95	stair-well	25	antecedent
95	sundial	25	brood
94	bank	25	bugle
94	brittle	25	burst
94	buoyant	25	calcite
94	dermis	25	campground
94	dodder	25	casual
94	cabinet	25	charity
94	homozygote	25	circumscribe
94	inject	25	command
94	intermolecular	25	contractor
94	intrude	25	counter-warning
94	invasion	25	curb
94	maple	25	deploy
94	metaphase	25	dial
94	pharynx	25	duce
94	polypeptide	25	dumbbell
94	pretend	25	epiglottis
94	propel	25	flare
94	sea-port	25	folktale
94	shortage	25	frond
94	therapy	25	gigantic
94	toe	25	beast
93	complexion	25	heritable
93	cure	25	impair

93	elder	25	impermeable
93	erase	25	incubate
93	exhale	25	indigestible
93	jurisdiction	25	iodide
93	moth	25	jane
93	parking-token	25	ladybugs
93	prairie	25	ligand
93	implement	25	linguistic
93	reinforce	25	louis
93	spam	25	madness
93	stigma	25	map
93	thymine	25	metaphor
93	wipe	25	microscopy
92	administer	25	nonviolent
92	bang	25	northward
92	crash	25	nurture
92	dart	25	pineapple
92	electrochemistry	25	placebo
92	excerpt	25	platypus
92	frank	25	plead
92	glad	25	polyploidy
92	granite	25	proliferate
92	mall	25	pseudo-variable
92	nonfiction	25	refrigerant
92	nonmetals	25	remediation
92	peaceful	25	repulsive
92	petition	25	resort

92	pit-bull	25	round-wound
92	recreate	25	rude
92	sand-castle	25	sausage
92	sewage	25	septa
92	wherever	25	shave
91	attach	25	situate
91	backyard	25	slam
91	duct	25	spicule
91	expand	25	subsequently
91	inland	25	subway
91	invade	25	tame
91	meanwhile	25	ten-millionth
91	molarity	25	thigh
91	nonsense	25	triceratops
91	oocyte	25	tyrosine
91	parliament	25	unconscious
91	playground	25	video-recorder
91	process	25	viewpoint
91	radar	25	state
91	sharp	24	accent
91	simultaneous	24	acne
91	steer	24	alkane
91	tense	24	astrology
91	veil	24	auditorium
91	ventricle	24	auditory
90	ally	24	aurora
90	bud	24	barbarian

90	caste	24	butane
90	cytosine	24	caecilian
90	dare	24	carter
90	fin	24	centrifuge
90	forbid	24	cerevisiae
90	lactic	24	champion
90	limestone	24	coarse
90	peach	24	contend
90	pine-tree	24	coop
90	primitive	24	corps
90	radioisotope	24	crisscross
90	spine	24	decree
89	atrium	24	denature
89	batch	24	diction
89	carton	24	dignity
89	hepatitis	24	distress
89	pleasant	24	dizzy
89	pride	24	doc
89	prototype	24	drosophila
89	roar	24	dusk
89	rom	24	enthusiasm
89	salmon	24	gametogenesis
89	scent	24	ganglion
89	side-glance	24	gate
89	stadium	24	gibbon
89	token-reflexive	24	globule
89	virtue	24	guardian

88	antonym	24	gypsum
88	booklet	24	ham
88	celestial	24	headline
88	coincide	24	imperial
88	fabric	24	inconclusive
88	mesoderm	24	infiltrate
88	odor	24	kitten
88	sound	24	lady
88	tablet	24	lice
88	talent	24	lifelong
88	unify	24	luminescence
87	activate	24	lysogenic
87	administrate	24	macroscopic
87	camouflage	24	mess-tin
87	cholera	24	miniature
87	clever	24	miserable
87	cursor	24	monsoon
87	detector	24	multinomial
87	devise	24	nanometer
87	disjoint	24	newt
87	dormancy	24	nineteen-year-old
87	exhaust	24	ovarian
87	faint	24	photo-album
87	fate	24	pixel
87	fierce	24	porch
87	fluctuate	24	prenatal
87	free-associate	24	rainstorm

87	giraffe	24	ranch
87	integrand	24	rap
87	investigate	24	recombination
87	lichen	24	relocate
87	proto-oncogene	24	reprint
87	sex	24	restate
87	tentacle	24	restrain
87	terrify	24	safeguard
87	tonight	24	saltwater
87	underwater	24	self-revelation
87	vital	24	semi-luxury
86	astrolabe	24	slab
86	brave	24	snowball
86	circle	24	spatially
86	dean	24	stance
86	dull	24	staple
86	gorilla	24	startle
86	handle	24	stein
86	horn	24	stink
86	hot	24	suction
86	lancelet	24	supersaturated
86	markup	24	sur
86	participation	24	tar
86	pearl	24	transgress
86	pro-catholic	24	vacancy
86	sketch	24	viscous
86	sound-pulse	24	wart

86	spit	23	accessory
86	super-glue	23	anemometer
85	ambiguity	23	arterial
85	barrel-organ	23	arthritis
85	bump	23	bailey
85	carpet-bagger	23	beaver
85	coupon	23	bioluminescence
85	flat	23	bipedal
85	late	23	board
85	loaf	23	boxing-match
85	package	23	breakwater
85	parent	23	buddy
85	phagocyte	23	chill
85	rot	23	clack
85	summer	23	combat
84	boycott	23	comp
84	breakdown	23	conquest
84	cash-register	23	counteract
84	crisis	23	cumbersome
84	delicate	23	dance
84	exhibit	23	decipher
84	merchant	23	decode
84	obligation	23	deoxygenate
84	paddle	23	der
84	starfish	23	detergent
84	stratosphere	23	diff
84	subphylum	23	divorce

84	weave	23	dual
83	airway	23	ethylene
83	beach	23	exon
83	beef	23	eye
83	coastline	23	fireplace
83	comma	23	flourish
83	conifer	23	foul
83	crayon	23	gault
83	cyanobacteria	23	glance
83	estrogen	23	gunpowder
83	gear	23	headlight
83	huff	23	hedgehog
83	immunodeficiency	23	helmet-plate
83	incredible	23	herbaceous
83	joseph	23	high-flyer
83	leap	23	hydride
83	lifestyle	23	intricate
83	pace	23	jug
83	sixteenth	23	lane-end
83	taxi	23	lengthen
83	vinegar	23	lethal
82	banana-skin	23	leucoplast
82	crocodile	23	levy
82	dipper	23	lumen
82	duplicate	23	measles
82	extraneous	23	merge
82	grandparent	23	midrange

82	mid-seventeenth-century	23	mono-poly
82	pin	23	mop
82	prison-ship	23	non-eligible
82	sculpt	23	nonnegative
82	sense-perception	23	nucleolus
82	stock	23	nucleon
82	van	23	nursing-home
81	anti-inflammatory	23	od
81	arid	23	orthocenter
81	ballot	23	osteoclast
81	blueberry	23	pail
81	cheap-thrill	23	pandemic
81	concurrent	23	pants
81	convict	23	parrot
81	deliberate	23	pheromone
81	dialogue	23	phoenix
81	eager	23	photographed
81	fetal	23	purine
81	impeach	23	quarrel
81	incentive	23	raft
81	motor	23	re
81	musician	23	re-capitalize
81	navigate	23	recombine
81	ovulate	23	rhizoid
81	retail	23	ripen
81	suffix	23	rook
80	assort	23	sapiens

80	chemosynthesis	23	scrotum
80	cope	23	simplex
80	cyclone	23	skunk
80	grasp	23	smallpox
80	indoor	23	snap-shot
80	inflammation	23	snowfall
80	laying	23	sofa
80	mileage	23	spermatid
80	navy	23	splash
80	pale	23	spleen
80	powder	23	stoichiometric
80	remark	23	subtle
80	rug	23	super-ministry
80	sailing-ship	23	syncline
80	scroll	23	systole
80	seawater	23	kettle
80	seaweed	23	textile
80	spirit	23	toll-booth
80	stomata	23	touchdown
80	sunspot	23	tranquil
80	supercontinent	23	vocal
80	thorough	23	waitress
80	veto	23	ward
79	ample	23	warehouse
79	chimpanzee	23	waterborne
79	compromise	23	wen
79	email	23	whereby

79	fallopian	23	wildflower
79	gal	23	yell
79	grasshopper	23	zooplankton
79	id	22	adjourn
79	knees-up	22	aerospace
79	lattice	22	agenda
79	monoxide	22	agonize
79	offshore	22	alchemy
79	platelet	22	apartheid
79	polyhedron	22	apical
79	prisoner-of-war	22	atop
79	prominence	22	autocracy
79	rebel	22	backup
79	romance	22	barbecue
79	sixteen-year-old	22	barter
79	skip	22	baryon
79	spot	22	boat
79	step-sibling	22	buoy
79	taproot	22	celery
79	tray	22	cervical
79	versa	22	chimney
78	ascend	22	cocaine
78	builder	22	confer
78	church	22	crank
78	coronary	22	desktop
78	dent	22	dissect
78	disrupt	22	dopamine

78	forecast	22	dub
78	guitar	22	ductile
78	humor	22	elf
78	non-economist	22	embrace
78	numberty	22	eubacteria
78	ought	22	farce
78	paraphrase	22	fluency
78	patch	22	fluoride
78	pig-tail	22	frameshift
78	plankton	22	frontier
78	print	22	goodbye
78	rake-off	22	grant
78	relativity	22	hammer
78	renew	22	herb
78	sail	22	hermaphrodite
78	substantial	22	hind
78	top	22	horsepower
78	twin	22	hove
78	upright	22	hub
78	wildlife	22	iguana
77	dorsal	22	instituted
77	dye	22	intrigue
77	fibrous	22	jot
77	fulcrum	22	keen
77	holy	22	lane
77	landslide	22	legume
77	ninth	22	lobby

77	pigeon	22	heel
77	professor	22	magnetometer
77	repulsion	22	mayflower
77	scrape	22	mini-tripod
77	secretion	22	moan
77	skull	22	naval
77	sour	22	nephew
77	stalk	22	neutrino
77	stir	22	nighttime
77	sympathy	22	non-detection
77	terror	22	non-naturalist
77	thyroid	22	oath
77	titrate	22	opportunistic
77	toe-rag	22	orchid
77	tony	22	outstanding
77	top-seller	22	override
77	whichever	22	pawn
76	beverage	22	peacock
76	capsize	22	precaution
76	cheer	22	precedence
76	contest	22	prion
76	cultivate	22	processor
76	hippocampus	22	propane
76	inspire	22	quasi-monopoly
76	iodine	22	que
76	land-drain	22	reagent
76	midnight	22	rectum

76	mike	22	remedy
76	pepper	22	re-provision
76	petrol-station	22	resin
76	pumpkin	22	rhombi
76	rifle-pit	22	rip
76	roof	22	roadway
76	rule-follower	22	rose-grower
76	scan	22	rumor
76	scratch	22	scarf
76	semen	22	sermon
76	shock	22	service-provider
76	straightedge	22	shy
76	personality	22	slew
76	trigonal	22	solenoid
76	underneath	22	spreadsheet
75	antennae	22	spruce
75	bio-technology	22	stratigraphy
75	burger	22	summon
75	camp	22	sunglasses
75	chronology	22	superstition
75	discipline	22	syllogism
75	duck	22	terrace
75	feces	22	thermophile
75	fog	22	threes
75	grandma	22	tory
75	gravel	22	trickle
75	harsh	22	trisomy

75	hero	22	tusk
75	hyperbole	22	uracil
75	monosaccharide	22	vole
75	mucous	22	warranty
75	outbreak	22	whoever
75	pilot	21	albeit
75	plaque	21	alveolus
75	profile	21	app
75	proto	21	augment
75	saliva	21	await
75	shrub	21	baboon
75	skim	21	bac
75	tapeworm	21	bacon
75	tolerance	21	bar
74	breeding-ground	21	barge
74	bullet	21	beloved
74	carcinogen	21	benthic
74	craft-worker	21	bioethanol
74	evolve	21	brit
74	interpolate	21	butch
74	meridian	21	buzzer
74	mistletoe	21	byzantine
74	mosquitoes	21	cadmium
74	mouthpart	21	campus
74	myth	21	catastrophe
74	opossum	21	chain
74	peak	21	chaperone

74	predation	21	chilly
74	prevail	21	cobalt
74	session	21	corpse
74	ticket-collector	21	crusade
74	tumble-dryer	21	cumulonimbus
73	annoy	21	disappearance
73	anybody	21	disintegrate
73	apartment	21	disregard
73	bathroom	21	encase
73	bless	21	endospore
73	bracelet	21	entomology
73	dicot	21	fashion
73	dissipate	21	fine
73	doubt	21	fingertip
73	drip	21	flock
73	eject	21	fluff
73	elongate	21	footage
73	execute	21	forestry
73	exit	21	garden
73	innate	21	gasp
73	mosquito	21	gloss
73	over-charge	21	grandchildren
73	prose-writing	21	grove
73	resign	21	grumble
73	ring	21	hallway
73	sea-boot	21	hatchling
73	shoulder	21	hydrothermal

73	submarine	21	hygiene
73	suspicion	21	insecticide
73	toad	21	intact
73	turbo-diesel	21	irregularly
72	alexander	21	kilocalories
72	alley	21	lap-top
72	ape	21	laureate
72	attorney	21	license
72	barometer	21	lonesome
72	bronchi	21	lumber
72	coated	21	mac
72	cytosol	21	magnetosphere
72	dot	21	mal
72	dough	21	menopause
72	glory	21	meteoroids
72	hagfish	21	methadone
72	heron	21	mislead
72	pa	21	monk
72	pardon	21	monocline
72	possession	21	monocots
72	pyruvate	21	multimodal
72	scalene	21	non-intimate
72	self-criticism	21	obstruct
72	shoot	21	osteocyte
72	shortcut	21	over-emphasize
72	step	21	palmitate
72	sulfate	21	pancake

72	upset	21	par
72	vertebra	21	parallax
71	adverb	21	perpetual
71	anemone	21	posture
71	blanket	21	pot
71	char	21	poultry
71	conceive	21	preside
71	credit	21	proboscis
			pseudo-
71	delta	21	homophone
71	downstream	21	puma
71	engulf	21	puritan
71	fancy	21	pyroclastic
71	land-grant	21	quantile
71	mini-lecture	21	radium
71	occupation	21	rearrangement
71	project	21	re-cap
71	sucker	21	rickets
71	sue	21	ridicule
71	swirl	21	rotten
71	pointer	21	rubric
70	fungus	21	saccharide
70	arteriole	21	saguaro
70	catch	21	screenshot
70	cease	21	scud-c
70	centipede	21	sebum
70	cephalochordate	21	seer

70	chlamydia	21	seismologist
70	collar	21	shed
70	curtain	21	snow-flake
70	dim	21	spearman
70	eccentricity	21	spectrometer
70	hail	21	splendid
70	harry	21	spoil-sport
70	heterogeneous	21	steak
70	hypha	21	street-gang
70	import	21	stun
70	intercourse	21	summit
70	makeup	21	sunburn
70	nourish	21	superfund
70	oral	21	superposition
70	petition-drawer	21	sympatric
70	porta-cabin	21	taper
70	ray-ban	21	dodge
70	silver-grey	21	transmembrane
70	tent-peg	21	tree-stump
70	thrive	21	tubeworms
69	asleep	21	tween
69	crude	21	tyranny
69	diffract	21	upcoming
69	eared	21	uplift
69	endosymbiosis	21	varsity
69	headache	21	vase
69	hierarchy	21	violin

69	hillside	21	witch
69	milligram	20	abyss
69	mite	20	affirm
69	monomials	20	antioxidant
69	ours	20	blaze
69	plasmid	20	bouquet
69	priest	20	bowel
69	pronoun	20	braid
69	re-compile	20	chime
69	sleet	20	chimp
69	spell	20	chop
69	tremble	20	cinder
69	valve	20	coagulation
68	age	20	cockroach
68	amine	20	collage
68	artistry	20	compulsory
68	bleed	20	consonance
68	cafeteria	20	corridor
68	clump	20	crystallize
68	coli	20	cycad
68	colloid	20	cytochrome
68	conform	20	defy
68	cork-stopper	20	diethyl
68	cupcake	20	dimethyl
68	debris-flow	20	ding
68	dendrite	20	disconnect
68	employer	20	discrepancy

68	endure	20	downside
68	extrema	20	epoch
68	fallacy	20	expire
68	gel	20	extremophile
68	glide	20	fame
68	inter	20	famine
68	jog	20	filmmaker
68	nonetheless	20	fir
68	oscillate	20	firefight
68	philosopher-scientist	20	fling
68	phytoplankton	20	forehead
68	pi	20	fugitive
68	possess	20	fur
68	pray	20	g-cramp
68	primate	20	germline
68	ration	20	gesture
68	redwood	20	gooseberry
68	scare	20	hill
68	shoe-horn	20	homeroom
68	siphon	20	hunter-fisher
68	sixty-year-old	20	icon
68	streak	20	impartial
68	synapse	20	impatience
68	template	20	interrogate
68	urethra	20	iris
68	wander	20	kit
67	anticipate	20	knob

67	autoimmune	20	lamblia
67	carl	20	leeward
67	centriole	20	legitimate
67	diarrhea	20	levee
67	document	20	lightbulb
67	elapse	20	marshmallow
67	enforced	20	meat-eater
67	fade	20	myopia
67	fatality	20	nicotine
67	gadget	20	nipple
67	heritage	20	nose-bleed
67	honey	20	nymph
67	hunger-strike	20	oversee
67	hydrate	20	pennyroyal
67	kelvin	20	pharmacogenomics
67	lysosome	20	phenyl
67	mediate	20	pilgrim
67	nonlinear	20	plaster
67	octopi	20	playoff
67	olive	20	podcast
67	omission	20	policeman
67	pedigree	20	popsicle
67	permanence	20	preface
67	plow	20	profound
67	rainbow	20	prolong
67	re-qualify	20	propriety
67	sanitary	20	pry

67	sheet-anchor	20	puff
67	soak	20	ragweed
67	stare	20	raptor
67	strait-jacket	20	relocation
67	swim	20	rep
67	tab	20	rescue
67	upstream	20	reverence
66	adhere	20	ribose
66	advocate	20	ringworm
66	aqueous	20	salmonella
66	cosecant	20	sandpaper
66	dug	20	school
66	epididymis	20	semicircular
66	furthermore	20	semipermeable
66	gauge	20	shove
66	hardy	20	side-aisle
66	hydrochloride	20	sidebar
66	incorporate	20	socket
66	increment	20	sous-chef
66	locomotion	20	spectator
66	millipede	20	spinach
66	picnic	20	sprawl
66	plateau	20	spy
66	pot-boiler	20	steam
66	pouch	20	steamboat
66	assure	20	straight
66	undo	20	stride

66	weaken	20	stroma
66	woodland	20	strontium
65	abroad	20	tablecloth
65	alert	20	thaw
65	antenna	20	toddle
65	anther	20	trajectory
65	aquarium	20	trampoline
65	blame	20	transmutation
65	chunk	20	tyrannosaurus
65	claw	20	vertebrata
65	collaborate	20	vest
65	crack-up	20	workplace
65	dialect	20	mule
65	drain	19	acquire
65	drill	19	agitate
65	duck-pond	19	air
65	electrolysis	19	antheridia
65	gonorrhea	19	antimatter
65	gross	19	aspire
65	intake	19	assimilate
65	interphase	19	assonance
65	lignin	19	aureus
65	ma	19	barbed
65	non-communist	19	benny
65	populate	19	brad
65	purification	19	bye
65	quarter	19	carboniferous

65	raindrop	19	carnation
65	re-coil	19	carnival
65	shelve	19	catfish
65	somebody	19	cemetery
65	stern	19	ceramic
65	transduce	19	chairman
64	aldehyde	19	chorus
64	ammunition	19	clown
64	arachnid	19	clutch
64	bolt-rig	19	congregate
64	bungee	19	conspire
64	capita	19	craton
64	cardioid	19	crisp
64	corpus	19	dc
64	crane	19	decelerate
64	crazy	19	demo
64	devastate	19	depot
64	dispersal	19	dimer
64	extrapolate	19	dishwasher
64	folk	19	dock
64	forcing	19	donut
64	framework	19	embryology
64	gastropod	19	enterprise
64	gym	19	eradicate
64	incorrectly	19	ere
64	interchange	19	eucalypt
64	nephron	19	eyelid

64 neurotransmitter	19 fore
64 paint	19 frigid
64 pneumonia	19 gemstone
64 praise	19 gloom
64 rewriting	19 groin
64 rose-hip	19 harass
64 sand-martin	19 hyperopia
64 scavenger	19 hypertension
64 swamp	19 inappropriate
64 tem	19 incapable
64 tiger	19 inlet
64 triglyceride	19 javelin
64 wholesale	19 joey
63 aid	19 kiddie
63 alligator	19 leg
63 basalt	19 leucine
63 candle	19 ligation
63 captivate	19 macromolecule
63 conquer	19 masturbate
63 crawl	19 maxillae
63 dancer	19 mayonnaise
63 database	19 mint
63 dispose	19 mockingbird
63 distort	19 moonlight
63 donor	19 multiplier
63 effuse	19 nanoscale
63 fluke	19 neural

63	fluoresce	19	nitrogenous
63	fundraise	19	oil-burner
63	giardia	19	onset
63	grave	19	orgasm
63	holder	19	palm
63	landfill	19	panther
63	offense	19	parachute
63	ping	19	pare
63	plume	19	paycheck
63	profit	19	p-bass
63	self-evaluation	19	pentane
63	self-reward	19	periosteum
63	shop-fitting	19	pertain
63	solstice	19	photosystem
63	spare	19	piracy
63	zebra	19	plague
62	adrenal	19	platinum
62	bighorn	19	poppy-seed
62	canvas	19	preconception
62	carpet	19	prod
62	chromatin	19	pyrimidine
62	cluster	19	query
62	crystalline	19	ram
62	deciduous	19	reconsider
62	epidemic	19	redraw
62	epithelia	19	regret
62	explode	19	rehearsal

62	frost	19	reset
62	garbage	19	resume
62	leveled	19	ritual
62	neglect	19	sailboat
62	non-manual	19	self-congratulation
62	outlet	19	shirt-dress
62	prospect	19	reel
62	python	19	side-foot
62	retina	19	slosh
62	schematic	19	soy
62	scrub	19	spaghetti
62	seep	19	spectral
62	stationary	19	sprint
62	surge	19	stereo-type
62	telophase	19	stromatolite
62	thylakoid	19	subdivision
62	timeline	19	submerge
62	tom	19	synapsis
61	anymore	19	tanker
61	autosome	19	tempore
61	bile	19	testify
61	ceil	19	tetanus
61	chronic	19	toothbrush
61	commit	19	tuba
61	conjunction	19	tuber
61	corollary	19	underside
61	delight	19	uphold

61	deserve	19	vague
61	discard	18	accrue
61	dose	18	adage
61	estuary	18	adverse
61	falcon	18	airborne
61	fortune	18	anole
61	fountain	18	asbestos
61	gonad	18	ascent
61	hibernate	18	assassinate
61	incandescent	18	autonomy
61	input	18	auxin
61	involuntary	18	basal
61	junior	18	binge
61	land-grab	18	bliss
61	larynx	18	blot
61	leech	18	bombard
61	myosin	18	brainstorming
61	non-alcoholic	18	browse
61	opponent	18	bum
61	peristalsis	18	caboose
61	popcorn	18	campers
61	quartz	18	canine
61	sierra	18	carne
61	silicon	18	caucus
61	spray	18	censor
61	subscript	18	chaos
61	sunset	18	chirp

61	surgery	18	codominant
61	transpire	18	console
61	wastewater	18	cougar
60	abrasion	18	counterpart
60	advertise	18	critter
60	atherosclerosis	18	crop
60	autumn	18	croton
60	boldface	18	curie
60	bottle	18	cute
60	brainstorm	18	detriment
60	comic	18	discomfort
60	concert	18	duckweed
60	damp	18	dune-buggy
60	degrade	18	dwarf
60	dessert	18	dystrophy
60	dictate	18	endothelium
60	dragon	18	epistasis
60	elbow	18	esterify
60	endanger	18	exosphere
60	graphite	18	faraway
60	leukocyte	18	finger nail
60	octet	18	fist
60	pave	18	floodplain
60	pharyngeal	18	glycoprotein
60	pop-up	18	godwit
60	position	18	graviton
60	province	18	grizzly

60	racial	18	grouse
60	re-circulate	18	helmet
60	reform	18	hexane
59	bivalve	18	hostile
59	bookstore	18	hotdog
59	bulge	18	hum
59	collagen	18	idiom
59	crane-boulder	18	ignite
59	desert	18	ineffective
59	discount	18	insignificant
59	flag	18	isocline
59	hydrophobic	18	isometric
59	joule	18	jail
59	lactose	18	katydid
59	mask	18	latex
59	mayor	18	lazy-bed
59	mound	18	leukemia
59	mycelia	18	loudspeaker
59	nonzero	18	lynx
59	omnivore	18	lyric
59	over-exploit	18	mangrove
59	permeability	18	mast
59	prayer-stool	18	merit
59	precession	18	meteoroid
59	resonance	18	micrograph
59	seesaw	18	motor-glider
59	shoreline	18	murphy

59	spoil	18	nanometers
59	supernova	18	nee
59	tag	18	nickname
59	thorax	18	non-linearity
58	advent	18	non-linguist
58	airline	18	nonparametric
58	alloy	18	northeastern
58	back	18	northwestern
58	biofilm	18	numeral
58	boost	18	object
58	buyer	18	ordain
58	ceremony	18	ordinance
58	deed	18	overturn
58	delete	18	pat
58	endocytosis	18	patty
58	enumerate	18	penumbra
58	funnel	18	peridotite
58	hare	18	pier-head
58	hay	18	pin-curl
58	hemophilia	18	piston
58	inspect	18	platter
58	ketone	18	portal
58	lac	18	prodigy
58	luster	18	radio
58	memorial	18	reabsorb
58	meristem	18	redistribution
58	moon-daisy	18	redo

58	oogenesis	18	rex
58	plantation	18	rile
58	punctuate	18	ruby
58	ruin	18	rusty
58	sprout	18	sand-eel
58	sublimation	18	scare-story
58	synonym	18	sea-gull
58	theme-pub	18	self-restraint
58	toppings	18	semi-joke
58	update	18	sergeant
57	antiderivative	18	setup
57	artifact	18	shell
57	biogeochemical	18	shock-absorber
57	blizzard	18	sovereign
57	climax	18	spew
57	dancing-teacher	18	step-granddaughter
57	daytime	18	stony-iron
57	despair	18	stool
57	dogma	18	studio
57	dream	18	sturdy
57	duodenum	18	substantially
57	freight	18	suite
57	fulfill	18	sun-bathe
57	crown	18	sunken
57	hesitate	18	surgeon
57	inflate	18	syntax
57	melanin	18	transcend

57	mesosphere	18	traverse
57	misconception	18	triplet
57	nonmetal	18	triumph
57	oar	18	twitch
57	ongoing	18	und
57	pistil	18	vanadium
57	privilege	18	virgin
57	red	18	wright
57	slide	17	absurd
57	slug	17	actinide
57	vacuum	17	align
57	vulture	17	aniline
56	appeal	17	ankle-strap
56	buildup	17	annuity
56	centromere	17	antiparticle
56	chitin	17	armband
56	contradict	17	armor
56	detach	17	asymmetry
56	entitle	17	audacity
56	exploit	17	aura
56	flagellate	17	azimuth
56	fluorine	17	banish
56	fuse	17	bark
56	horror	17	bay
56	hula-hoop	17	bed
56	intraplate	17	blowup
56	methyl	17	bock

56	micro	17	bolt
56	microtubule	17	boreal
56	optimistic	17	buckwheat
56	overseas	17	bun
56	photo-op	17	bushy
56	pianist	17	catastrophic
56	presume	17	cephalothorax
56	sally	17	charity-school
56	scholar	17	chromium
56	scorpion	17	chronometer
56	self-peptide	17	concession
56	staircase	17	convene
56	subatomic	17	counter-accusation
56	subordinate	17	crackle
55	afterward	17	crumple
55	amazon	17	crunch-point
55	astronomer-priest	17	cur
55	caldera	17	decoy
55	centroid	17	dichotomy
55	compensate	17	dielectric
55	cuticle	17	disguise
55	cystic	17	dishonest
55	ectoderm	17	diurnal
55	inwards	17	emulsion
55	kinase	17	epic
55	lepton	17	facultative
55	mosaic	17	firewood

55	muffin	17	freeway
55	mutates	17	fume
55	mx	17	garter
55	nowhere	17	geo
55	poke	17	glial
55	polyatomic	17	google
55	preamble	17	growl
55	role-reversal	17	hamper
55	script-writer	17	hand-cuff
55	semester	17	impose
55	ski	17	impure
55	spark	17	injustice
55	supermarket	17	insufficient
55	thermodynamics	17	interdependence
55	wagon	17	interdependent
55	zoom	17	interviewer
54	almond	17	itch
54	amoeba	17	jealous
54	anytime	17	keystroke
54	archive	17	lithification
54	arrange	17	lurk
54	barrel	17	lutein
54	bother	17	melanocyte
54	capacitance	17	meningitis
54	cigarette	17	metropolitan
54	clam	17	micrometer
54	dedicate	17	mnemonic

54	ectotherm	17	modem
54	exclaim	17	mum
54	fibrosis	17	mycobacteria
54	flesh	17	nomadic
54	generous	17	golfer
54	goose	17	nutritious
54	info	17	outcrop
54	mammary	17	oyster-catcher
54	matt	17	patent-holder
54	mini-boom	17	pho
54	motorcycle	17	phone
54	mutant	17	photographic
54	naked	17	photosphere
54	optional	17	ply
54	plausible	17	polonium
54	plumb	17	polymorphism
54	polysaccharide	17	proclaim
54	quasi-partnership	17	propulsion
54	sprinkle	17	psi
54	starship	17	puffball
53	arena	17	quadruple
53	ash	17	quota
53	barrage	17	rabies
53	blog	17	ralph
53	carbonyl	17	rarefaction
53	carve	17	erect
53	cerebellum	17	regain

53	ciliate	17	reign
53	cotangent	17	repro
53	courtship	17	retard
53	coward	17	retrofit
53	decorated	17	reusable
53	diminish	17	revenge
53	finish	17	rhesus
53	hydronium	17	routinely
53	laptop	17	rumble
53	leftover	17	runaway
53	mercy	17	serine
53	okay	17	shepherd
53	p	17	sim
53	poster	17	sparkle
53	rake	17	spice
53	rape	17	sputnik
53	re-import	17	stakeholder
53	relay	17	stoma
53	rob	17	strap-end
53	self-contradiction	17	sugarcane
53	sign-post	17	supervisor
53	sooner	17	suzette
53	spring	17	swap
53	swear	17	swift
52	autobiography	17	taco
52	carnivorous	17	tampon
52	chick	17	teepee

52	clerk	17	theta
52	contingent	17	threonine
52	cosmic	17	tiffany
52	crescent	17	toolbox
52	downtown	17	transact
52	endoderm	17	truffle
52	firework	17	truss
52	ghost-fleet	17	typeset
52	glaze	17	utter
52	helicopter	17	vanish
52	horse-brass	17	visceral
52	inflection	17	weekday
52	midst	17	wheelchair
52	nematode	17	wildcat
52	nitrate	17	workman
52	outermost	16	acetyl
52	painter	16	ach
52	paleontologist	16	ache
52	peregrine	16	albino
52	polygenic	16	alkylate
52	reluctance	16	aneroid
52	self-examination	16	anglerfish
52	sewing-machine	16	apostrophe
52	sick	16	aviation
52	skating-rink	16	barren
52	systemic	16	battle
52	thrust	16	beanstalk

52	tunnel	16	blink
52	wildfire	16	bowman
52	workshop	16	campsite
51	aerosol	16	candida
51	alarm	16	cate
51	avocado	16	checklist
51	babysit	16	cigar
51	ban	16	climatology
51	blast	16	craven
51	blastocyst	16	crease
51	bookcase	16	cristae
51	causality	16	crouch
51	cheek	16	crystallization
51	disc	16	debrief
51	doorbell	16	dengue
51	enrich	16	despot
51	immense	16	diaper
51	insertion	16	dihedral
51	intervention	16	dissent
51	lobster	16	dodecagon
51	locale	16	dover
51	lottery	16	drake
51	modulate	16	edge
51	non-gay	16	electromotive
51	over-caution	16	elegant
51	pin-cushion	16	epilepsy
51	pluck	16	escalator

51	predatory	16	fabricate
51	prince	16	fireside
51	pup	16	forage
51	recombinant	16	forest
51	reward	16	forum
51	rival	16	furious
51	sensation	16	glassware
51	sled	16	gleam
51	spite	16	glimpse
51	sword	16	goalpost
51	tarantula	16	gratitude
51	cab	16	gravitropism
51	termite	16	groan
51	tetrahedron	16	halt
51	transistor	16	hamster
50	anterior	16	hand-clap
50	appendix	16	homeland
50	atria	16	horsetail
50	autotroph	16	hygrometer
50	bagel	16	incandescence
50	blueprint	16	incisor
50	bryophyte	16	infield
50	campfire	16	inn
50	carmen	16	intrinsic
50	cattail	16	invariably
50	concord	16	isoelectric
50	contact	16	jam

50	dehydrate	16	jeopardize
50	deoxyribonucleic	16	jungle
50	discourage	16	kudzu
50	driveway	16	lavender
50	evacuate	16	legislate
50	fridge	16	ling
50	graze	16	lore
50	halide	16	lowercase
50	hello	16	masteries
50	hinge	16	mend
50	hose	16	micro-kernel
50	inhibit	16	microvilli
50	medusa	16	migratory
50	molality	16	mockingbirds
50	morphology	16	mw
50	new	16	nap
50	obstacle	16	nick
50	breeder	16	orchestra
50	photosynthesize	16	outlaw
50	pie	16	ow
50	plantae	16	parabens
50	predominate	16	parcel
50	protostome	16	part
50	retreat	16	passageway
50	sake	16	peat
50	sidewalk	16	pedestrian
50	sonar	16	pinworm

50	spurt	16	polio
50	stratum	16	polynucleotide
50	substrate	16	pons
50	superior	16	preimages
50	thereby	16	proficiency
50	thereof	16	radish
50	timer	16	razor
50	trim	16	realtor
50	tuberculosis	16	recruit
50	victim	16	rehearse
50	second	16	offend
49	angel	16	repository
49	biodiesel	16	revive
49	brilliance	16	rhino
49	chambered	16	rhinoceros
49	charter	16	roentgen
49	child	16	secretariat
49	colleague	16	sequester
49	coplanar	16	shipwreck
49	counter-assertion	16	sinusoidal
49	curl	16	skateboarder
49	deflect	16	sleeve
49	deuterostome	16	slender
49	disappoint	16	small-businessman
49	drastic	16	snowstorm
49	drift	16	soar
49	flagpole	16	squish

49	hamburger	16	staphylococcus
49	hydro	16	suffrage
49	inter-glacial	16	superconductor
49	lighthouse	16	thot
49	livestock	16	topple
49	logo	16	upload
49	long-hop	16	venture
49	meadow	16	wainwright
49	monument	16	waiter
49	multiplicity	16	warfare
49	nomenclature	16	whirl
49	pinch	15	adorn
49	rash	15	affluence
49	sauce	15	allopatric
49	self-referral	15	amateur
49	self-serving	15	ambitious
49	skirt-length	15	apposite
49	smog	15	arbor
49	splice	15	arcade
49	sunrise	15	arrogance
49	tadpole	15	attenuation
49	thorium	15	axial
49	titan	15	bacteriophage
49	totter	15	bas-relief
49	tournament	15	beep
49	tropism	15	blastopore
49	vanilla	15	bot

49	volleyball	15	boxcar
48	acknowledge	15	bribe
48	bivariate	15	broccoli
48	cabbage	15	broth
48	canoe	15	bust-up
48	childbirth	15	canister
48	coevolution	15	carp
48	companion	15	cavern
48	consciousness	15	cecum
48	cub	15	chili
48	disinfect	15	cladogram
48	drown	15	concussion
48	eardrum	15	cosmetic
48	everglades	15	creak
48	evergreen	15	custody
48	exocytosis	15	deadline
48	fisherman	15	decentralize
48	glycogen	15	deem
48	heartbeat	15	deteriorate
48	humane	15	diphosphate
48	hydrolyze	15	donkey
48	infrastructure	15	duster
48	intertidal	15	egret
48	la	15	electrophoresis
48	lagoon	15	elodea
48	litter	15	eloquence
48	microphone	15	envy

48	partition	15	eutrophication
48	psych	15	evenings
48	sacrifice	15	eyepiece
48	scale	15	feldspar
48	softball	15	fieldwork
48	solemn	15	footwall
48	stupid	15	forceps
48	sucrose	15	foreshadow
48	sulfide	15	fuchsia
48	swarm	15	gatherer
48	tap-penalty	15	glimmer
48	telegraph	15	glomerulus
48	terrain	15	groom
47	bicep	15	habeas
47	bonus	15	canopy
47	brown	15	haw
47	checker	15	hell
47	clarity	15	housefly
47	comb	15	hydropower
47	degenerate	15	hypersecretion
47	diplomacy	15	hypertrophy
47	endometrium	15	inert
47	felsic	15	jasper
47	freshman	15	jay
47	gauss	15	jell
47	gizmo	15	joyful
47	ingest	15	kilo

47	inherent	15	landlord
47	joke	15	liable
47	kelp	15	lifecycle
47	nuclide	15	lowland
47	onion	15	lynch
47	overhead	15	mainland
47	potter	15	malleable
47	prom	15	matter
47	pubic	15	mesa
47	regime	15	mesodermal
47	retrieval	15	mesophyll
47	saddle-tank	15	mil
47	sandstone	15	mismatch
47	sew	15	neritic
47	silicate	15	nod
47	sneak	15	non-diabetic
47	teeter	15	obedience
47	temper	15	osteoarthritis
47	thermosphere	15	outreach
47	trilobite	15	over-compensate
47	veteran	15	overeat
47	vulnerable	15	papilloma
47	waterway	15	papillomavirus
46	aircraft	15	paralysis
46	badly	15	para-relation
46	barnacle	15	parlor
46	bathymetry	15	persevere

46	blood	15	perspire
46	bob-wig	15	phosphorylation
46	bristle	15	piecewise
46	carol	15	pillow-fight
46	charm	15	pluton
46	dealer	15	polygonal
46	dietary	15	portable
46	dung	15	proximate
46	eco-system	15	pulverize
46	elaborate	15	racecar
46	encountering	15	railway
46	esters	15	randy
46	flap	15	raven
46	glutamine	15	ravine
46	goody	15	realm
46	graduate	15	recede
46	hallucinate	15	reclaim
46	hectare	15	recur
46	index	15	reed-warbler
46	newborn	15	refill
46	ninety-year-old	15	refute
46	orangutan	15	re-house
46	pedal	15	rejoin
46	phage	15	repeal
46	pong	15	restoration
46	re-dedicate	15	sack
46	rock-climber	15	sanction

46	salvia	15	scarecrow
46	self-questioning	15	scout
46	skin	15	sebaceous
46	sneeze	15	sept
46	snow	15	sequoia
46	subphyla	15	shampoo
46	synapsid	15	shays
46	thymus	15	sherry
46	topsoil	15	silkworm
46	undertake	15	sloth
45	abdomen	15	stage
45	bail	15	standby
45	banner	15	standpoint
45	bet	15	starburst
45	biochemistry	15	stardust
45	botany	15	stingray
45	brazil	15	stopper
45	buffalo	15	daddy
45	catalog	15	super-sprinter
45	curvature	15	surfboard
45	dash-pot	15	surplus
45	deoxyribose	15	swamp-dweller
45	dimorphism	15	swan
45	exotic	15	ta
45	expel	15	tandem
45	facial	15	temp
45	fingerprint	15	thereafter

45	gif	15	toll
45	handbook	15	tope
45	hockey-stick	15	tuft
45	imprint	15	vend
45	indefinite	15	ventilate
45	jewel	15	wafer
45	juvenile	15	watchdog
45	lawn	14	abject
45	liverwort	14	admit
45	loosen	14	afflict
45	mail	14	ail
45	mason-architect	14	alkene
45	microchip	14	alleviate
45	monatomic	14	alps
45	perfume	14	amass
45	plentiful	14	annihilate
45	pocket	14	antimony
45	pop	14	aroma
45	porous	14	arsenic
45	rhyme	14	astound
45	salamander	14	avert
45	se	14	baton
45	self-correction	14	bauxite
45	sessile	14	beet
45	Sixths	14	bewilder
45	stamens	14	binoculars
45	tertiary	14	bioenergy

45	therian	14	blockade
45	Toast	14	bottlenose
45	Toilet	14	brane
45	Vine	14	burr
44	ashamed	14	busy
44	Atlas	14	byproduct
44	Biker	14	carcass
44	blindness	14	casino
44	buoyancy	14	centigram
44	cathedral	14	chemotherapy
44	chat-up	14	chrysalis
44	decagon	14	chuck
44	dressing	14	churn
44	Feast	14	cleanup
44	Fest	14	clubmoss
44	Grin	14	coelenteron
44	gymnast	14	colorblind
44	hill-fort	14	competence
44	inferior	14	conceal
44	influenza	14	congressman
44	irritate	14	consolidate
44	Italic	14	consul
44	lawmaker	14	copepod
44	legend	14	courtier
44	loyalist	14	crevice
44	mankind	14	dame
44	packet	14	dataset

44	pity	14	decent
44	placeholder	14	detritus
44	plasmodium	14	didelphis
44	play-reading	14	dirk
44	plum	14	discern
44	posterior	14	disjunction
44	prone	14	disposition
44	rear	14	disrespect
44	roast	14	dissatisfaction
44	salinity	14	enact
44	self-rating	14	endow
44	shaft	14	enlist
44	sic	14	eve
44	slipper	14	eyebrow
44	southwestern	14	farsighted
44	specimen	14	femur
44	spike	14	ferromagnetic
44	squirt	14	footstep
44	star	14	forelimb
44	starvation	14	fraud
44	subdivide	14	frown
44	supper	14	fudge
44	syphilis	14	gallop
44	tetrapod	14	gastrulation
44	miner	14	geocentric
44	villi	14	girlfriend
44	vowel	14	grad

43	algorithm	14	handgun
43	awake	14	handheld
43	breeze-block	14	hardwood
43	cane	14	hobby
43	cephalization	14	howl
43	cleavage	14	hydrofoil
43	clinic	14	indict
43	closure	14	inductor
43	coulomb	14	inflict
43	deuterium	14	intermittent
43	emphysema	14	intro
43	extraordinary	14	jagged
43	flux	14	jejunum
43	fuel-dump	14	jess
43	grateful	14	keyboard
43	homo	14	lantern
43	impedance	14	lar
43	integumentary	14	layout
43	jones	14	leaflet
43	lamprey	14	leash
43	master	14	lineup
43	nth	14	lingua
43	pear-tree	14	litmus
43	rad	14	loneliness
43	recharge	14	longshore
43	recommendation	14	lubricant
43	rock	14	lunchtime

43	scream	14	lush
43	seafood	14	malnutrition
43	silt	14	mam
43	sophistication	14	maneuver
43	haven	14	manganese
43	torque	14	medal-winner
43	watershed	14	memoir
43	whistle	14	methionine
43	wounded	14	mf
42	alley-way	14	microbiology
42	alright	14	mini-conglomerate
42	backpack	14	miscible
42	belly	14	mist
42	bout	14	misunderstanding
42	carpel	14	monohybrid
42	citric	14	moose
42	conquistador	14	moraine
42	dermal	14	mush
42	diode	14	nautical
42	emigrate	14	neocortex
42	exaggerate	14	neutrophil
42	flick	14	nonsmoker
42	flush	14	nuisance
42	fuzz	14	oak
42	herein	14	ocher
42	hertz	14	oligarchy
42	histamine	14	orchard

42	hitchhike	14	outrage
42	ice	14	overflow
42	intuitive	14	overnight
42	maritime	14	oxbow
42	night-fighter	14	paperclip
42	ok	14	paraben
42	outfit	14	parenchymal
42	over-celebrate	14	payload
42	paste-up	14	pervade
42	plastid	14	pinpoint
42	positron	14	planter
42	rate	14	playful
42	rover	14	playlist
42	screen	14	plaza
42	section	14	pleiotropic
42	semicircle	14	post-acquisition
42	shield	14	premature
42	striate	14	prewriting
42	ted	14	prosecute
42	withstand	14	pylorus
42	wow	14	rattle
41	acetic	14	re-acquaint
41	afterwards	14	rechargeable
41	alliteration	14	redefine
41	allure	14	refrain
41	ambassador	14	relaxation
41	anecdote	14	repatriate

41	aorta	14	replant
41	appetite	14	rhyolite
41	applet	14	rubbish
41	beagle	14	rubisco
41	bison	14	runway
41	bluebird	14	saint
41	butter-blob	14	sclerosis
41	climatic	14	scour
41	congestion	14	seaside
41	dihybrid	14	selfish
41	dining	14	showerhead
41	dragonfly	14	shriek
41	epiphyte	14	shrine
41	forgive	14	shrivel
41	fructose	14	skyscraper
41	fry	14	snack
41	gilt-bronze	14	snatch
41	greet	14	staff
41	gum	14	stagger
41	haul	14	stoop
41	hector	14	stray
41	highland	14	subinterval
41	hornwort	14	systolic
41	hydrosphere	14	tapestry
41	judge	14	tesla
41	keratin	14	testcross
41	magic	14	theodolite

41	mussel	14	thumbtack
41	neo-liberal	14	toluene
41	noisy	14	tread
41	non-conservative	14	triton
41	non-entity	14	turgor
41	paramecia	14	turnip
41	planetary	14	usurp
41	pre-announcement	14	venous
41	pupil-teacher	14	vicinity
41	quartic	14	wherein
41	sensible	14	yarn
41	shiver	13	aftershock
41	silica	13	aloe
41	smash	13	amid
41	sow	13	amide
41	spermatogenesis	13	anima
41	sponsor	13	apprehend
41	toothpick	13	apron
41	vain	13	aquaculture
41	viscosity	13	arcsine
41	worship	13	asparagine
41	wreck	13	assertive
40	adenosine	13	auction
40	albert	13	awe
40	ampere	13	barley
40	aromatic	13	barrack
40	awkward	13	battlefield

40	barn	13	beard
40	chimney-sweeper	13	behold
40	code	13	berlin
40	coercion	13	biomedical
40	costa	13	blackboard
40	cottage	13	blacksmith
40	cottontail	13	blonde
40	cretaceous	13	boxplot
40	cylindrical	13	breach
40	decibel	13	breadth
40	default	13	bruise
40	deforest	13	buffer
40	depart	13	bully
40	doorknob	13	bully-boy
40	fare	13	campylobacter
40	fasten	13	carapace
40	gardener	13	cheddar-type
40	gastroenteritis	13	chickenpox
40	gluon	13	chlorofluorocarbon
40	hydrophilic	13	clubhouse
40	icosahedral	13	coelomate
40	indo	13	commend
40	mother-goddess	13	commensal
40	ng	13	compassionate
40	nitric	13	contraception
40	non-juror	13	cookbook
40	offset	13	crankshaft

40	over-expose	13	cricket
40	palm-tree	13	cricket-writer
40	pepperoni	13	crumble
40	pose	13	curvilinear
40	prejudice	13	cyclin
40	provision	13	cypress
40	radula	13	deflate
40	reputation	13	deity
40	rodent	13	deport
40	shame	13	deter
40	snowy	13	dinitrogen
40	stamen	13	directories
40	stiff	13	elude
40	tedious	13	eternity
40	slot	13	evade
39	aboard	13	excision
39	abort	13	forge
39	abstain	13	formaldehyde
39	alongside	13	frack
39	astonish	13	fragrance
39	awful	13	gastritis
39	batter	13	gelatin
39	boson	13	gibberellin
39	broaden	13	gibbous
39	bronchiole	13	ginger
39	carriage	13	goalie
39	chalk	13	gob

39	confront	13	gossip
39	deprive	13	gyre
39	dinoflagellate	13	hailstone
39	electronegative	13	handy
39	fashioning	13	heir
39	fig	13	helm
39	furnace	13	heterocyclic
39	grab	13	husky
39	greed	13	immerse
39	hawthorn	13	indies
39	insure	13	indivisible
39	ken	13	interbreed
39	laser	13	interconnector
39	life-guard	13	intermembrane
39	macro-cannon	13	internationally
39	market	13	intimidate
39	missile	13	isotherm
39	modest	13	jade
39	necklace	13	jewel-case
39	nocturnal	13	lactate
39	ordinal	13	leach
39	prop	13	luggage
39	re-constitute	13	lysine
39	re-formulate	13	lysis
39	renal	13	man
39	replenish	13	mare's-tail
39	repressor	13	misunderstand

39	self-excuse	13	moat
39	someday	13	modal
39	spawn	13	monastery
39	tabular	13	monoecious
39	thirst	13	motif
39	thorn	13	nationwide
39	voltaic	13	nematocysts
39	waterproof	13	nines
39	windmill	13	ninths
38	anomaly	13	non-homosexual
38	attic	13	nostril
38	behalf		
38	bible	13	objectivity
38	boron	13	occlude
38	brook	13	ocelli
38	can	13	orthogonal
38	chessboard	13	outnumber
38	cytotoxic	13	overwhelm
38	dandelion	13	pacemaker
38	deaf	13	pansy
38	desperate	13	pant
38	diastole	13	pear
38	enslave	13	pedometer
38	extrude	13	pelvic
38	frustrate	13	photocopy
38	graham	13	piccolo
38	gut	13	pillar

38	hydroxyl	13	pimple
38	imprison	13	pine
38	inefficient	13	polyadenylation
38	inevitably	13	pony-tail
38	interconnect	13	pope
38	investigator	13	porcupine
38	iron-filing	13	prank
38	keyword	13	prison
38	merry-go-round	13	prolactin
38	microbe	13	proline
38	mutagen	13	prong
38	nm	13	protrude
38	non-client	13	proverb
38	nova	13	pulp
38	nut-tree	13	pumice
38	omega	13	radicand
38	participant-role	13	reap
38	polite	13	recap
38	precedent	13	recite
38	prescribe	13	redundancy
38	protocol	13	reintroduce
38	radon	13	retention
38	re-awaken	13	rev
38	equip	13	roasting-pan
38	rig	13	rosemary
38	rigor	13	salol
38	sanctuary	13	sandal

38	semi-profession	13	sawmill
38	shoe-polish	13	servitude
38	statue	13	slim
38	sterile	13	sol
38	sunflower	13	sot
38	superscript	13	stalactite
38	tender	13	stockholder
38	thief	13	strenuous
38	trapdoor	13	subside
38	withdraw	13	suburb
37	acme	13	sun
37	affinity	13	surrender
37	angle	13	syllable
37	anorexia	13	tarnish
37	arouse	13	tendrils
37	bathtub	13	testicle
37	blind	13	testimony
37	caliphate	13	threadlike
37	camel-train	13	ting
37	capitol	13	token
37	caramel	13	trey
37	catabolic	13	triploid
37	cheetah	13	trivia
37	chelicerae	13	tuck
37	closet	13	vestigial
37	comedies	13	villus
37	commissioner	13	vulva

37	compel	13	wobble
37	compost	13	yahoo
37	confirm	13	zenith
37	corona	12	abide
37	corrupt	12	abominable
37	countryside	12	accredit
37	curse	12	accustomed
37	cuttlefish	12	acoustic
37	depreciate	12	aeronautics
37	divinity	12	aesthetics
37	dump	12	affirmation
37	electrostatic	12	afghan
37	eon	12	aftermath
37	ethyl	12	altocumulus
37	flaw	12	ambulance
37	funeral	12	amorphous
37	gall	12	anthem
37	gizzard	12	antidiuretic
37	indeterminate	12	antinode
37	inevitable	12	antitrust
37	interquartile	12	appalled
37	interspecific	12	applause
37	kangaroo	12	arch
37	lifespan	12	awesome
37	livelihood	12	azurite
37	mc	12	bachelor
37	milestone	12	bacillus

37	musher	12	badger
37	mycorrhiza	12	ballpoint
37	nobility	12	bankruptcy
37	obligate	12	beech
37	photoelectric	12	billboard
37	scuba	12	bioengineer
37	seldom	12	blond
37	sheath	12	bob
37	siren	12	body
37	slate	12	bologna
37	solitary	12	bract
37	stud	12	bulldoze
37	subgroup	12	burdock
37	subscription	12	bypass
37	tendon	12	cade
37	terry	12	calf
37	theirs	12	casework
37	signature	12	caudal
37	upwell	12	centiliter
37	wrinkle	12	cesium
37	zip	12	cheesecloth
36	abrupt	12	chia
36	allege	12	chink
36	baron	12	chromatography
36	blur	12	clash
36	brace	12	clove
36	caution	12	coma

36	certify	12	comer
36	chemoautotroph	12	commence
36	cling	12	congenital
36	coke	12	courthouse
36	dairy	12	courtyard
36	dictator	12	cowbird
36	disaccharide	12	cramp
36	distract	12	creole
36	episode	12	cripple
36	faucet	12	dangle
36	flea	12	denitrification
36	flywheel	12	denounce
36	forensic	12	dire
36	garage	12	disapproval
36	gigawatt	12	dispute
36	grief	12	distil
36	hadron	12	dodo
36	honeybee	12	drumlin
36	inadequate	12	earthshine
36	intron	12	electro
36	invalid	12	empower
36	juggle	12	encircle
36	late-developer	12	endosymbiont
36	buck	12	energize
36	mimic	12	evoke
36	peroxide	12	eyeball
36	pledge	12	fan

36	polish	12	farewell
36	preach	12	fetch
36	rainwater	12	fibrin
36	ramp	12	fire-extinguisher
36	repay	12	florid
36	sewer	12	frantic
36	steppe	12	furry
36	tempt	12	galactose
36	upstairs	12	gee
36	walkway	12	gent
35	asp	12	glob
35	auto	12	gummy
35	beer-shop	12	hale
35	beryllium	12	halophiles
35	bimodal	12	handwriting
35	bow	12	hazel
35	bromine	12	heartburn
35	cashew	12	heliocentric
35	citrus	12	heterosexual
35	cohere	12	hexapod
35	cross-addiction	12	holler
35	cruise	12	holly
35	domino	12	horrible
35	ejaculate	12	horsefly
35	flora	12	hos
35	foster	12	humpback
35	gentry	12	hyena

35	grandson	12	hysteria
35	groove	12	incur
35	haste	12	indigenous
35	helical	12	inmate
35	hen	12	intercontinental
35	hypotonic	12	irony
35	instinct	12	isobar
35	insult	12	jazz
35	invest	12	ligase
35	irreversible	12	lithospheric
35	jersey	12	littoral
35	landmark	12	lungfish
35	leather	12	lymphoma
35	macroevolution	12	macadamia
35	muon	12	manure
35	nanotechnology	12	mas
35	negotiate	12	matinee
35	oceanographer	12	medal
35	pebble	12	mega-store
35	pictograph	12	metro
35	pivot	12	microprocessor
35	plywood	12	minicomputer
35	pool	12	misery
35	portray	12	monocot
35	preliminary	12	morocco
35	progesterone	12	motility
35	propaganda	12	mural

35	quaternary	12	musculoskeletal
35	rattlesnake	12	muse
35	scoot	12	myofibrils
35	shear	12	nail
35	sheng	12	nelson
35	southeastern	12	niece
35	subheading	12	nitrite
35	susceptible	12	non-elite
35	tetrahedral	12	onshore
35	tip	12	opiate
35	trademark	12	orogeny
35	tub	12	orthodoxy
35	tum	12	oscula
35	widow	12	overly
34	acetate	12	oxidative
34	anticline	12	pancreatic
34	antiviral	12	paralyze
34	arctic-alpine	12	parthenogenesis
34	aspirin	12	pasture
34	asthenosphere	12	peek
34	avenue	12	perish
34	bargain-hunter	12	peroxisomes
34	bench	12	piggy-bank
34	benthos	12	pinocytosis
34	bilaterally	12	playwright
34	bi	12	plummet
34	bite	12	pol

34	borrow	12	populist
34	buzz-word	12	possum
34	calibrate	12	pow
34	capture	12	powerhouse
34	cheat	12	pseudo-intellectual
34	circumcenter	12	pyroxene
34	cyst	12	quadriceps
34	cytokine	12	rediscover
34	dawn	12	redress
34	emperor	12	rem
34	felony	12	reshape
34	grate	12	retrograde
34	halite	12	rheumatoid
34	heptagon	12	rho
34	humble	12	rinse
34	insist	12	rotor
34	inversion	12	rpm
34	lobbyist	12	rudder
34	mafic	12	scorch
34	microclimate	12	screwdriver
34	motile	12	seashore
34	nekton	12	second-rower
34	optimal	12	self-adhesive
34	osteoporosis	12	self-deception
34	password	12	sever
34	peninsula	12	sill
34	photography	12	sinkhole

34	primer	12	smelting
34	protozoan	12	smokestack
34	puddle	12	sophomore
34	radiometric	12	sox
34	rally	12	span
34	ranger	12	sparse
34	revere	12	speck
34	riddle	12	starling
34	root	12	straddle
34	scrap	12	stumble
34	sea-fairy	12	subjective
34	shop-assistant	12	supercapacitors
34	submersible	12	super-ferry
34	submission	12	superheated
34	sub-routine	12	supernatural
34	tablespoon	12	tactic
34	tee-time	12	tailor
34	tragedy	12	tat
34	uphill	12	tempera
34	viable	12	tenure
34	xylem	12	thalamus
33	annex	12	lag
33	band	12	tome
33	barium	12	torture
33	bathing-suit	12	tot
33	bedrock	12	tower
33	bloody	12	treason

33	bronchitis	12	trout
33	bulletin	12	trypsin
33	cam	12	tuatara
33	chin	12	tubulin
33	chore	12	updraft
33	commission	12	uppermost
33	compliment	12	vault
33	dale	12	volatile
33	dialysis	12	waffle
33	dismiss	12	weep
33	dog-rose	12	whilst
33	donna	12	wholly
33	drawback	12	wilt
33	drier	12	workout
33	echelon	12	yep
33	echolocation	11	acquaintance
33	enforcement	11	acquiesce
33	enriched	11	ad
33	extracellular	11	airship
33	gen	11	airtight
33	gourd	11	allegory
33	guinea	11	allot
33	inexpensive	11	allover
33	jerk	11	alto
33	lytic	11	ammeter
33	mandible	11	anneal
33	md	11	anthracite

33	medieval	11	anthrax
33	mudslide	11	anthropology
33	osteoblast	11	antislavery
33	overweight	11	aphid
33	oyster	11	arable
33	peculiar	11	archer
33	photoautotrophs	11	arctangent
33	pierce	11	artwork
33	plunge	11	asphalt
33	pork	11	aspirate
33	preservation	11	autobiographical
33	prince-bishop	11	baggage
33	remnant	11	bantu
33	ripe	11	baobab
33	script	11	bicyclist
33	shingles	11	biodegrade
33	single-decker	11	birch
33	sis	11	black
33	spare-rib	11	bleak
33	spermatocyte	11	blouse
33	sphincter	11	blub
33	storm	11	bombardment
33	subintervals	11	bon
33	sundae	11	book
33	teaspoon	11	boom
33	tribute	11	bronchus
33	tuna	11	bubonic

33	zodiac	11	bunk
32	anchorage	11	cava
32	anticodon	11	centrosome
32	aqueduct	11	chant
32	argon	11	chap
32	baseline	11	charcoal
32	beard-shaving	11	cheerleader
32	bicarbonate	11	cheesecake
32	biogeography	11	chlorate
32	brush	11	choir
32	byte	11	clockwork
32	carta	11	cloy
32	clog	11	coalesce
32	clone	11	cod
32	commensalism	11	colligative
32	connotation	11	columnist
32	costume	11	commune
32	craft	11	compo
32	cranium	11	contempt
32	disapprove	11	corrugated
32	edible	11	counterforce
32	euro	11	creepy-crawly
32	exoplanet	11	darling
32	facto	11	daunting
32	finch	11	del
32	foliate	11	dichromate
32	hydraulic	11	dieter

32	imbalance	11	dihydrogen
32	indefinitely	11	din
32	inspiration	11	dunk
32	interstate	11	dynasty
32	jenny	11	echinoid
32	latency	11	elk
32	ligament	11	emulsify
32	lowers	11	endemic
32	loyal	11	epidemiology
32	lunch	11	epiphyseal
32	mammoth	11	equity
32	mount	11	eyedropper
32	mv	11	falsify
32	ne	11	fauna
32	near-certainty	11	filibuster
32	nominee	11	fissure
32	non-durable	11	fortify
32	nonspecific	11	fours
32	onward	11	freckle
32	oppress	11	freeman
32	packaged	11	fringe
32	paintbrush	11	galvanic
32	parade	11	gamble
32	photic	11	genuine
32	prostate	11	gestation
32	rag-doll	11	gilbert
32	recount	11	glycol

32	oxygenated	11	gneiss
32	rim	11	goat-antelope
32	semiconductor	11	goo
32	shorthand	11	gospel
32	sigh	11	grill
32	slash	11	headquarter
32	southward	11	healthcare
32	space-occupant	11	hematite
32	spectacle	11	high-brow
32	spiny	11	hiss
32	squat	11	hoe
32	string	11	hostage
32	strive	11	hover
32	subclass	11	hydra
32	subject	11	icosahedron
32	supergiant	11	impost
32	synovial	11	impoverish
32	thrill	11	inconsistency
32	timber	11	infraclass
32	tinker	11	jpeg
32	toothpaste	11	keck
32	triphosphate	11	kin
32	unprecedented	11	knit
32	waist	11	laxative
32	wales	11	ledge
32	waterfall	11	leftmost
32	yogurt	11	les

31 alkaline
31 amber
31 apothem
31 blister
31 brute
31 cochlea
31 confound
31 couch
31 den
31 differentiate
31 dosage
31 doughnut
31 farmland
31 fatigue
31 fiery
31 hardware
31 hookworm
31 horseshoe
31 imitate
31 innocence
31 interneuron
31 intracellular
31 krill
31 laughter-line
31 lawsuit
31 lime
31 macronutrients

11 lest
11 liar
11 lioness
11 litigant
11 lux
11 mea
11 meditation
11 mega-flop
11 meiotic
11 melanoma
11 meniscus
11 metamorphose
11 microbial
11 miracle-worker
11 misinterpret
11 missense
11 monocyte
11 multi-millionaire
11 mumps
11 murmur
11 myriad
11 nanoscience
11 napkin
11 nausea
11 near-drowning
11 nearsightedness
11 nitrous

31	meander	11	noncoding
31	messy	11	non-delinquent
31	molly	11	noontime
31	octahedron	11	oat
31	oligochaete	11	octant
31	ossification	11	oddly
31	ostrich	11	oneself
31	over-ambition	11	orphan
31	photographer	11	outlying
31	premium	11	overfish
31	reliance	11	palace
31	ribonucleic	11	palette
31	rupture	11	panama
		11	paradox
31	savannah	11	paternal
31	scallop	11	peasant-proletarian
31	scarlet	11	pelican
31	sedentary	11	phot
31	self-portrait	11	pickle
31	semi-consonant	11	pike
31	sepal	11	pinna
31	shale	11	poach
31	shopper	11	ponder
31	skeptical	11	pool-liner
31	skydive	11	pounce
31	slug-pellet	11	precinct
31	snack-bar	11	propagate

31	southerner	11	protactinium
31	spaceship	11	protease
31	speculate	11	pulsar
31	sporangia	11	puncture
31	subsidy	11	pupal
31	substituent	11	pupil
31	subtropical	11	raffle
31	sway	11	rage
31	syrup	11	re-bait
31	cue	11	recoil
31	tor	11	refuel
31	unification	11	regrow
31	ureter	11	rejoice
31	vomit	11	salter
31	wick	11	scyphozoan
30	abridge	11	semi-finalist
30	abscisic	11	shack
30	acetone	11	she-ass
30	aphorism	11	sheer
30	apologize	11	shrug
30	ashore	11	shun
30	assert	11	siege-tower
30	authentic	11	skit
30	bargain	11	snapshot
30	breakthrough	11	spear
30	breeze	11	spec
30	bulimia	11	squint

30	camel	11	statewide
30	cloaca	11	statute
30	clownfish	11	storyteller
30	crick	11	stunt
30	deference	11	suckle
30	dislike	11	suicide
30	disobey	11	surf
30	ditch	11	tallgrass
30	doctorate	11	taxpayer
30	dolly	11	teammate
30	downstairs	11	teddy
30	dread	11	telomere
30	fragment	11	terra
30	gaze	11	theft
30	geodesy	11	threshold
30	ghost	11	thunder
30	grease	11	timescale
30	idle	11	tremor
30	insoluble	11	trimester
30	installation	11	trimethylamine
30	interface	11	trophy
30	joe	11	undersea
30	kick	11	unroll
30	magenta	11	vigil
30	menarche	11	viper
30	mortal	11	wallet
30	mpg	11	warship

30	mythology	11	weird
30	nanotube	11	wont
30	nonnative	11	workspace
30	nylon	11	yeah
30	outlook	11	youngster
30	overpopulation	11	zigzag
30	overthrow	10	head-count
30	parliamentary	10	filing-cabinet
30	patio	10	aching
30	penicillin	10	addict
30	pudding	10	adobe
30	pure	10	affix
30	putter	10	afloat
30	rime	10	ammonite
30	robin	10	amnesty
30	rural	10	animalcule
30	savanna	10	antagonize
30	semi-automatic	10	antipodal
30	shovel	10	anvil
30	slump	10	apiece
30	spy-hole	10	articulate
30	squash	10	ascertain
30	stratus	10	balboa
30	tackle	10	bask
30	thou	10	bat
29	amylase	10	bellow
29	anabolic	10	benzoate

29	apprentice	10	betray
29	archegonia	10	birthrate
29	bamboo	10	bizarre
29	bodily	10	blunt
29	brine	10	bod
29	burial	10	booby-trap
29	chipmunk	10	brisk
29	circadian	10	bust
29	cirrus	10	cafe
29	coconut	10	cant
29	codominance	10	caravel
29	communism	10	caress
29	condom	10	caricature
29	consensus	10	carina
29	cotyledon	10	cedar
29	discontinuous	10	certiorari
29	dowry	10	chairperson
29	embarrass	10	chuckle
29	encompass	10	chug
29	eyesight	10	col
29	fake	10	coolant
29	fractal	10	coordinate
29	fragile	10	cop
29	gem	10	corkscrew
29	glycine	10	cove
29	hood	10	daffodil
29	hoof	10	daydream

29	humus	10	derail
29	hydrozoa	10	detoxify
29	intervene	10	diner
29	java	10	dinucleotide
29	junk	10	draft
29	lump-sum	10	droop
29	manatee	10	drumstick
29	manifest	10	dwindle
29	marathon	10	echidna
29	maze	10	electroplate
29	muddy	10	ell
29	nasal	10	encephalitis
29	om	10	endosperm
29	peat-bog	10	entree
29	photo-finish	10	eudicot
29	pound	10	euglena
29	pupa	10	ex-boyfriend
29	pyruvic	10	exterminate
29	quad	10	eyeglass
29	radically	10	eyespot
29	re-board	10	fellow-commoner
29	resent	10	fend
29	ripple	10	finder
29	roly-poly	10	firefly
29	sarcomere	10	firsthand
29	scramble	10	flit
29	silly	10	foal

29	slag-heap	10	foreshocks
29	soybean	10	gale
29	sunscreen	10	gecko
29	triathlete	10	gigabyte
29	urea	10	giggle
29	warrior	10	gin
28	acorn	10	girdle
28	alkali	10	glare
28	audio-visual	10	glorify
28	balcony	10	goldenrod
28	ballpark	10	grapple
28	bioterrorism	10	grobe
28	bleach	10	grout
28	blossom	10	gulp
28	boast	10	guzzle
28	brew	10	haircut
28	brochure	10	handkerchief
28	carload	10	hash
28	choke	10	heroin
28	chromo	10	hippo
28	claim	10	hometown
28	compilation	10	hoot
28	concentric	10	hurdle
28	contagious	10	hush
28	cumulus	10	hydrologic
28	cupboard	10	impel
28	dine	10	indifference

28	disposed	10	infinitesimally
28	distillate	10	insurrection
28	dwell	10	interfaith
28	echo-sounder	10	intergovernmental
28	enroll	10	jimson
28	film	10	laurel
28	flagellum	10	layer
28	flashback	10	leathery
28	foam	10	lettering
28	font	10	lyse
28	genius	10	machine-gunner
28	hers	10	mandate
28	hinder	10	marital
28	isle	10	meta-deduction
28	judiciary	10	midday
28	karyotype	10	millennia
28	lap	10	mock-up
28	laundry	10	mosque-cap
28	loci	10	multinucleated
28	locus	10	multitude
28	macrophage	10	nightly
28	medulla	10	nightmare
28	methanol	10	nondisjunction
28	microfilament	10	obsess
28	myelin	10	oftentimes
28	non-consultant	10	olivine
28	noninfectious	10	orb

28	ogive	10	oxoacid
28	passion	10	oxy
28	pasta	10	pact
28	pepsin	10	parathyroid
28	peptidoglycan	10	pee
28	percolate	10	pentachloride
28	permafrost	10	pep-talk
28	pharmacist	10	percussion
28	pre-ispose	10	perplex
28	prescription	10	persecute
28	pyrite	10	pf
28	ram-raid	10	photochemical
28	rearranging	10	piglet
28	rebound	10	pilus
28	rebuild	10	placer
28	reckon	10	planetarium
28	rhetoric	10	playa
28	roadrunner	10	plop
28	saprotroph	10	polo
28	scar	10	pone
28	self-install	10	portfolio
28	self-justification	10	posterity
28	seminiferous	10	preexist
28	sincere	10	prehistoric
28	snap	10	primula
28	sonnet	10	problematic
28	sovereignty	10	profess

28	stopwatch	10	quantize
28	subfamily	10	quilter
28	tern	10	raspberry
28	tic	10	reabsorption
28	cyclist	10	re-bore
28	tug	10	recalculate
28	tumble	10	recycler
28	librarian	10	redshift
28	uptake	10	ref
28	vane	10	re-format
28	vigor	10	regent
28	warrant	10	rendition
27	anal	10	replica
27	antacid	10	revival
27	antique	10	rick
27	appellate	10	rill
27	banquet	10	rite
27	barber-surgeon	10	roadside
27	broom	10	salicylic
27	champagne	10	salt-cellar
27	cinnamon	10	scavenge
27	crinoid	10	scrabble
27	demon	10	seabird
27	desalinate	10	sea-green
27	disgust	10	seahorse
27	doorway	10	seashell
27	endeavor	10	seduce

27	enlighten	10	self-citation
27	esteem	10	sesame
27	expertise	10	sidekick
27	flee	10	sidereal
27	fond	10	single
27	gang-boss	10	skipping-rope
27	glycerol	10	slogan
27	gnu	10	sludge
27	goldfish	10	smear
27	herd	10	snapdragon
27	hive	10	snowshoe
27	hoover	10	socioeconomic
27	hug	10	sorrow
27	hypertonic	10	spaceflight
27	indistinguishable	10	spar
27	innermost	10	spirogyra
27	instability	10	spook
27	intraspecific	10	spouse
27	ism	10	squad
27	iteration	10	staghorn
27	kneel	10	stalagmite
27	lettuce	10	stealth
27	lightweight	10	stegosaurus
27	lollipop	10	stereotype
27	luteum	10	stitch
27	maglev	10	strangeness
27	manually	10	strap

27	maternal	10	subscribe
27	mem	10	tack
27	microevolution	10	tarp
27	mister	10	throne
27	nematocyst	10	thunderhead
27	nervosa	10	tidy
27	nonagon	10	timothy
27	non-stranger	10	tokay
27	nowadays	10	tow-truck
27	overtime	10	tungsten
27	patent	10	typewriter
27	patriot	10	typhoon
27	phototropism	10	underlie
27	pile	10	varicella
27	prickly	10	velvet
27	prosper	10	vernal
27	raisin	10	vow
27	refinery	10	wane
27	renaissance	10	watermelon
27	salesman	10	weary
27	sap	10	webpage
27	seamount	10	wed
27	seismometer	10	whereof
27	semi-opaque	10	whiskey
27	sideways	10	worksheet
27	sip	10	worthwhile
27	skirt	10	no-go

27 snowflake

27 stanza

10 pollen-tube

10 silk-screen

Low Frequency Word List

The Low Frequency Word List, shown in Table 18, has 8,080 lemmas. Words in this list had between nine occurrences and a single occurrences in the corpus. For a complete list of low-frequent words with all derivational and inflectional forms, check www.myvirs.com/dictionary.

Table 18. Low Frequency Word List.

Freq.	Word	Freq.	Word
9	aberration	2	capo
9	acer	2	carbolic
9	acronym	2	caretaker
9	adjustable	2	carnelian
9	adore	2	carny
9	agrarian	2	carob
9	ambience	2	carpe
9	amethyst	2	carrageenan
9	ankle	2	carrousel
9	antifreeze	2	case
9	apathy	2	castigate
9	apex	2	castor
9	apportion	2	catchword
9	auto	2	cationic
9	autumnal	2	caustic

9	avian	2	centerpiece
9	axel	2	centerpieces
9	ballast	2	cep
9	banjo	2	cessation
9	barb	2	cession
9	beam	2	chai
9	beckon	2	chalet-bungalow
9	bedside	2	chamberlain
9	beery	2	chares
9	bel	2	chariot
9	benign	2	chasm
9	berg	2	chastity
9	beryl	2	checkout
9	billiard-table	2	cheekbone
9	biogas	2	chemo
9	bioremediation	2	chestnut
9	biosynthesis	2	chevalier
9	birthright	2	chiasma
9	biscuit	2	chickpea
9	blight	2	chieftain
9	blimp	2	chine
9	bloodroot	2	chis
9	bowerbird	2	chlorinate
9	brag	2	chopstick
9	broil	2	choro
9	bromeliad	2	churchyard
9	burgess	2	chute

9 burrito	2 cider
9 candid	2 ciliary
9 canker	2 circumpolar
9 canon	2 cirrhosis
9 cardio	2 cirrostratus
9 caribou	2 cisterna
9 casa	2 clayton
9 catamaran	2 clientele
9 catapult	2 cline
9 chameleon	2 clock
9 chat	2 clod
9 circus	2 clothespins
9 cisternae	2 clueless
9 clap	2 coach
9 clasp	2 coattails
9 cleave	2 cobb
9 cleft	2 cochineal
9 clench	2 cockatoo
9 clipper	2 coffeehouse
9 clutter	2 cogeneration
9 cocoa	2 cognitive
9 colitis	2 collarbone
9 combinatory	2 collate
9 commotion	2 colleen
9 concur	2 collenchyma
9 congested	2 collisional
9 corner	2 cologne

9	cosmos	2	colorectal
9	counterargument	2	colugo
9	crayfish	2	columbaria
9	cremate	2	combo
9	crook	2	comfy
9	cropland	2	commonsense
9	culver	2	compart
9	dander	2	comport
9	deli	2	concha
9	delve	2	conciliate
9	depositor	2	concoct
9	deputy	2	concourse
9	desolate	2	confetti
9	dimple	2	confluence
9	dioecious	2	congeal
9	diploblast	2	consanguinity
9	disdain	2	cookout
9	disorder	2	copious
9	displease	2	copulation
9	disseminate	2	coquina
9	dungeon	2	cordon
9	dysplasia	2	corer
9	earplugs	2	cornucopian
9	earring	2	corral
9	emancipate	2	corsage
9	embark	2	corticosteroid
9	entail	2	cottonwood

9	etymology	2	counterclaim
9	excise	2	countrywide
9	facet	2	covet
9	faction	2	cowgirl
9	fad	2	cowries
9	feminine	2	crab
9	fimbria	2	cranial
9	fizz	2	cranky
9	flank	2	crass
9	fletcher	2	craw
9	flint	2	credo
9	flutter	2	creosote
9	foodborne	2	crib
9	foothill	2	crinkle
9	foreground	2	crock
9	foreman	2	crossover
9	foxglove	2	crosspiece
9	fraternal	2	crosswalk
9	gallium	2	crossway
9	garlic	2	crummy
9	garment	2	crystallography
9	gateway	2	cuddle
9	genesis	2	cumber
9	gerund	2	curfew
9	glitter	2	curry
9	glucagon	2	cutler
9	glycolipid	2	cyan

9	gown	2	cyanobacterial
9	grana	2	cybercrime
9	granular	2	daft
9	grip	2	dag
9	gush	2	dainty
9	gutter	2	daises
9	hack	2	dally
9	hairpin	2	darn
9	heed	2	dater
9	helicase	2	debar
9	helicobacter	2	debut
9	hemichordate	2	deciliters
9	hem lymph	2	decry
9	hemorrhage	2	deft
9	hermit	2	degeneracy
9	hitch	2	dele
9	hog	2	delineate
9	holothurian	2	delinquency
9	honeycomb	2	delude
9	hospitable	2	deluxe
9	humiliate	2	demagnetized
9	hump	2	demarcation
9	hurl	2	dementia
9	hyphen	2	demist
9	hypochlorite	2	demote
9	immiscible	2	dendrochronology
9	impart	2	depersonalize

9	inalienable	2	depose
9	inaugural	2	deprotonate
9	indexed	2	dermatitis
9	inflamed	2	desaturase
9	infrequent	2	devalue
9	inoculate	2	dexterity
9	jackal	2	diadem
9	jackrabbit	2	diffidence
9	jimmy	2	difluoride
9	lactobacillus	2	dinghy
9	ladybird	2	diocese
9	lag	2	diphtheria
9	lamb	2	dirigible
9	landmass	2	disarray
9	laterite	2	disavow
9	lease	2	disclaim
9	lengthwise	2	discoloration
9	letter	2	disconsolate
9	lodge	2	disempower
9	loosestrife	2	disenfranchisement
9	lovelock	2	disgruntled
9	lupus	2	disillusion
9	lustrate	2	disinherit
9	lye	2	dispatch
9	malacostraca	2	dissemble
9	maltose	2	dissident
9	manly	2	disused

9	mead	2	ditty
9	melanogaster	2	divination
9	melon	2	divulge
9	methanogen	2	dizygotic
9	microbiologist	2	dodecahedron
9	midline	2	dodge
9	mighty	2	doggedly
9	millisecond	2	dogwood
9	mod	2	don
9	mononucleosis	2	doomster
9	mortar	2	dopey
9	mothball	2	dosimeter
9	moxie	2	doughty
9	mustard	2	douse
9	mysid	2	downgrade
9	clipping	2	downpour
9	neurologist	2	downright
9	nom	2	downslope
9	no-man	2	dram
9	noncommercial	2	drawstring
9	non-conformist	2	dray
9	nonspontaneous	2	driftwood
9	notch	2	drowse
9	oatmeal	2	duchess
9	overtake	2	duh
9	padre	2	dunce
9	panda	2	duo

9	paperback	2	dupe
9	passport	2	dysmenorrhea
9	pastime	2	earthwork
9	patron	2	ectopic
9	peck	2	edema
9	pertinent	2	effluent
9	phenylketonuria	2	egg
9	pic	2	eggbeater
9	pickup	2	eighties
9	picky	2	electrodynamic
9	plagiarism	2	electroweak
9	plea	2	elixir
9	podia	2	elm
9	pointless	2	embankment
9	post	2	embassy
9	preinitiation	2	embattled
9	preservative	2	embolus
9	prophage	2	empress
9	psalm	2	encapsulate
9	purge	2	encasement
9	quarterback	2	enclave
9	raid	2	endgame
9	ravage	2	endosomes
9	reassure	2	engravings
9	re-commence	2	enigma
9	contra	2	enliven
9	recrystallization	2	enteric

9	refinement	2	enterococci
9	refrigeration	2	entourage
9	regurgitate	2	entrails
9	resurrect	2	envious
9	retroviruses	2	envisage
9	reunion	2	epicardium
9	rewrote	2	epipelagic
9	rightward	2	Equimolar
9	riparian	2	ergo
9	rotifer	2	esophageal
9	roundabout	2	ethnobotany
9	samosas	2	evict
9	sanger	2	ewe
9	sarcoma	2	exalt
9	scoliosis	2	expletive
9	secede	2	extracurricular
9	secondly	2	exuberance
9	seltzer	2	exude
9	septic	2	eyewash
9	shanghai	2	eyewear
9	shatter	2	fab
9	shoe-lace	2	facsimile
9	shortcoming	2	fairground
9	shroud	2	fallout
9	silvery	2	fanatic
9	slang	2	fanfare
9	slideshow	2	fart

9	sling	2	fastidious
9	slither	2	fellow-countryman
9	soil	2	fellowship
9	soothe	2	fen
9	south-easterly	2	ferret
9	spa	2	fetter
9	spiracle	2	feu
9	splinter-group	2	feudal
9	springtail	2	fiasco
9	stake-out	2	fibula
9	stature	2	fiddle
9	stone-mason	2	field
9	stroll	2	fil
9	stub	2	filmmaking
9	stuffy	2	firestone
9	subcommittee	2	firth
9	sublime	2	flab
9	subsoil	2	flagella
9	substantiate	2	flannel
9	suburban	2	flappy
9	superego-precursor	2	fledgling
9	superman	2	flinch
9	surpass	2	flocculants
9	switch grass	2	flor
9	symbiont	2	flotsam
9	synchrony	2	flulike
9	taiga	2	flurry

9	tailor	2	foghorn
9	taker	2	folate
9	talisman	2	foodstuff
9	tamarin	2	footfall
9	tangle	2	footie
9	terawatt	2	footpath
9	thyroxine	2	footsore
9	tilly	2	forb
9	transfect	2	forcibly
9	tribune	2	foreboding
9	trophoblast	2	forefront
9	trot	2	foregoing
9	trypanosome	2	foregut
9	tumorigenesis	2	forerunner
9	turbulence	2	forgoes
9	twinkle	2	fortnight
9	walnut	2	forward
9	wiggle	2	fovea
9	wisp	2	foyer
9	wit	2	frisky
8	aboriginal	2	fritillary
8	absolve	2	fritz
8	acclaim	2	frizzy
8	acquit	2	frostbite
8	adenovirus	2	fugue
8	allocate	2	fullerene
8	ament	2	fumigate

8	anode	2	funfair
8	antheridium	2	furrow
8	antihistamine	2	fusillade
8	apparel	2	gab
8	arccosine	2	gadabout
8	ark	2	gadolinium
8	armature	2	gads
8	arraign	2	galactic
8	arsenate	2	galena
8	aseptic	2	garland
8	assent	2	garner
8	atrophy	2	garth
8	autoclave	2	gawk
8	avail	2	gawp
8	avid	2	geocaching
8	awhile	2	geochemical
8	bandwagon	2	geoengineering
8	barbeque	2	geomancy
8	bathysphere	2	gerbil
8	bayonet	2	gesticulation
8	bead	2	getaway
8	beeswax	2	getter
8	befriend	2	ghetto
8	bicameral	2	ghetto-blaster
8	bikini-top	2	giddy
8	biomolecules	2	gingko
8	bionic	2	givens

8	bituminous	2	gladiolus
8	blackbird	2	glean
8	blanc	2	glim
8	blower	2	glint
8	bluenose	2	globin
8	bluish	2	glossopteris
8	blush	2	glug
8	bonfire	2	gluten
8	boo	2	glycan
8	boor	2	glyceraldehyde
8	borealis	2	glycogenesis
8	bottleneck	2	glyph
8	braille	2	goblet
8	burke	2	goof
8	bustle	2	gore
8	cairngorm	2	gouache
8	cambium	2	graffiti
8	cantor	2	granary
8	caravan	2	granulocytic
8	carillon	2	grassroots
8	carpool	2	gravis
8	cartography	2	gravy
8	cartridge	2	greenbelt
8	cartwright	2	griddle
8	cashier	2	grille
8	cello	2	grist
8	cellphone	2	grot

8	chatter	2	grotto
8	checkup	2	groundhog
8	chemiosmosis	2	groundskeeper
8	chondrocytes	2	gruffly
8	cilium	2	guacamole
8	cleanse	2	guesswork
8	clergyman	2	guidebook
8	clip	2	guile
8	clostridium	2	hade
8	cloture	2	hafiz
8	cock	2	hailstorm
8	codswallop	2	hairspray
8	coelacanth	2	handiwork
8	colossal	2	handyman
8	confocal	2	hardworking
8	congratulate	2	harpacticoid
8	contemplate	2	harpy
8	convict	2	hawkmoth
8	cornerstone	2	haymow
8	covenant	2	hazmat
8	coworker	2	headlamp
8	crimson	2	headstone
8	crossword	2	headway
8	cunning	2	heartbroken
8	cutaway	2	hedgerow
8	dazzle	2	hemp
8	dell	2	henceforth

8	demise	2	heptane
8	detain	2	hereafter
8	devoid	2	heresy
8	discontent	2	hereunto
8	distrust	2	heterochromatin
8	dorm	2	heyday
8	drear	2	hibiscus
8	duke	2	hick
8	dumb	2	hickory
8	dwarfism	2	hidalgo
8	ellipsoid	2	highroad
8	eminence	2	hipped
8	emirates	2	hoard
8	empanada	2	homegrown
8	endorse	2	hon
8	engagement	2	honeymoon
8	eosinophil	2	honeysuckle
8	errand	2	hoodoo
8	excuse	2	hopper
8	exile	2	hornlike
8	exotoxin	2	hornworm
8	expo	2	horsehair
8	fabulous	2	horticulture
8	figurine	2	hothouse
8	firearm	2	hotline
8	francium	2	hotpot
8	freefall	2	housekeeper

8	geode	2	housewife
8	geosphere	2	hoy
8	gerrymander	2	humanoid
8	goliath	2	hummus
8	gooey	2	husbandry
8	gothic	2	hymenoptera
8	greenstone	2	hypercholesterolemia
8	gumball	2	hypersaline
8	hardcover	2	hyperspace
8	haunt	2	hypocotyl
8	heartworm	2	hypocrisy
8	hefty	2	hyponatremia
8	hem	2	hypostatic
8	hereby	2	icebox
8	herpesvirus	2	ichthyosaurs
8	het	2	ick
8	histidine	2	icky
8	hoc	2	iguanodon
8	holdfast	2	illicit
8	homer	2	imbed
8	homograph	2	immunoglobulin
8	homology	2	impudence
8	honk	2	inattentiveness
8	huddle	2	inaudible
8	hummer	2	incense
8	hurtle	2	inception
8	hypersensitivity	2	incompetent

8	iframe	2	inconceivable
8	incompletely	2	indiscriminately
8	inconvenient	2	indistinct
8	indigo	2	indulge
8	infamous	2	inefficiently
8	influx	2	inequitable
8	infrasound	2	inescapably
8	inoperative	2	infallible
8	intel	2	infanticide
8	intermittency	2	infarction
8	intertwine	2	inflexibility
8	intramural	2	ingle
8	iridium	2	ingot
8	juniper	2	inkling
8	kersey	2	inlay
8	labia	2	inning
8	labium	2	insane
8	ladybug	2	insecticidal
8	lame	2	insensible
8	lance-corporal	2	insignia
8	lazily	2	integrase
8	lieutenant	2	intercity
8	lima	2	interconvertible
8	linger	2	interlace
8	linotype	2	interleukin
8	lipase	2	interlink
8	loft	2	interlock

8	loop	2	intermarry
8	lump	2	intermix
8	macronutrient	2	interrelationship
8	malachite	2	intersperse
8	malnourished	2	interviewee
8	marigold	2	intonation
8	marijuana	2	intoxicate
8	marketplace	2	intramembranous
8	masculine	2	intrepid
8	bid	2	inventive
8	meltwater	2	irreducible
8	merchandise	2	isopropyl
8	merry	2	isothermal
8	mesquite	2	jab
8	midway	2	jargon
8	mill	2	jeez
8	millennium	2	jimmies
8	milo	2	jostle
8	modus	2	joystick
8	monogamous	2	jukebox
8	monotype	2	junctional
8	mood	2	jus
8	morula	2	kabbalah
8	mote	2	kaon
8	mudflow	2	kart
8	munch	2	ked
8	nautilus	2	keepers

8	neck	2	kern
8	negligible	2	kestrel
8	neurobiology	2	ketchup
8	nodule	2	ketoacidosis
8	noodle	2	khaki
8	notorious	2	kilowatt-hour
8	nudge	2	kimberlite
8	octave	2	kindred
8	overboard	2	kip
8	overdose	2	kismet
8	overexploitation	2	kneecap
8	overgrowth	2	komatiite
8	overhang	2	labyrinth
8	overheat	2	lacewing
8	overwhelming	2	lad
8	oxford	2	ladle
8	palpitate	2	lamppost
8	pam	2	lanai
8	parakeet	2	lash
8	parch	2	lashing
8	parish	2	lass
8	past	2	lasso
8	peasant	2	lather
8	pedant	2	latte
8	pelvis	2	laud
8	pend	2	lavish
8	perennial	2	lawman

8	periscope	2	lawrencium
8	piece	2	lecithin
8	pipette	2	leopard
8	pistol	2	lepidopteran
8	planula	2	lieu
8	pneumatic	2	lifeguard
8	pollen	2	lifesaver
8	pollster	2	ligate
8	polyethylene	2	lignified
8	postal	2	liken
8	prosthetic	2	lilac
8	pseudopodia	2	limnetic
8	puffy	2	limp
8	pushpin	2	limpet
8	pyloric	2	linoleic
8	qc	2	liquor
8	radiocarbon	2	lire
8	rainier	2	listings
8	raja	2	livery
8	rand	2	lix
8	reactivate	2	llama
8	re-badge	2	lockjaw
8	reckless	2	loggerhead
8	reconcile	2	loll
8	recyclable	2	longboard
8	red-herring	2	longboards
8	redness	2	longhand

8	reformer	2	loony
8	refreeze	2	loti
8	refresh	2	lousy
8	remodeling	2	lovable
8	reptilian	2	lude
8	repulse	2	lunchbox
8	rifle	2	luncheon
8	roadster	2	lycophytes
8	robust	2	machos
8	rooftop	2	macro
8	rum	2	macro-structure
8	sag	2	magneto
8	saucer	2	mainline
8	savage	2	makeshift
8	scurry	2	malign
8	seam	2	malnourishment
8	secondhand	2	malodorous
8	self-denial	2	mamba
8	servlet	2	mange-tout
8	shilling	2	mangle
8	shudder	2	mangos
8	silicosis	2	mania
8	sinkholes	2	manpower
8	skein	2	marasmus
8	slap	2	maries
8	slay	2	marinate
8	snare	2	marshy

8	snout	2	martial
8	snowmelt	2	martini
8	soggy	2	mash
8	solo	2	masonry
8	spermatophyte	2	masterpiece
8	splinter	2	matriarchal
8	spur	2	maw
8	stale	2	mcc
8	stall	2	meatless
8	stillness	2	medial
8	stirrup	2	medic
8	stonewort	2	megakaryocyte
8	strew	2	megalomania
8	sub-sect	2	megaspore
8	subspecies	2	melaleuca
8	suitcase	2	meltdown
8	sulfides	2	mendelevium
8	summand	2	mentation
8	sunfish	2	meshwork
8	superimpose	2	mesophilic
8	supersede	2	mesospheric
8	surf	2	methylamine
8	swordfish	2	micks
8	symporter	2	microelectronics
8	synopsis	2	microfossil
8	taffy	2	microscale
8	tariff	2	midbrain

8 teamwork	2 midlands
8 tease	2 midsize
8 telecommunication	2 midwinter
8 tetraploid	2 militant
8 thanksgiving	2 mime
8 theatre-goer	2 mindset
8 therein	2 minibus
8 treadmill	2 minivan
8 trematode	2 minx
8 trio	2 mire
8 tryout	2 miscalculate
8 tubby	2 miscalculation
8 twos	2 mischief
8 two-seater	2 misinformation
8 unto	2 mislabeling
8 upgrade	2 misleadingly
8 urn	2 mitted
8 utensil	2 mockup
8 verdict	2 mockups
8 vide	2 moiety
8 virtuous	2 mommy
8 virulence	2 monazite
8 voltmeter	2 money-grabber
8 voracity	2 monitory
8 warbler	2 monocarpic
8 weightlifter	2 monoclines
8 whoop	2 monoclinic

8	willow	2	monograph
8	worsen	2	monolingual
8	zoology	2	monopolize
8	zucchini	2	monorail
7	abode	2	monotheism
7	almanac	2	monozygotic
7	ambush	2	moonquakes
7	amen	2	morn
7	andesite	2	morphine
7	anesthesia	2	morphism
7	anguish	2	mort
7	anhydrous	2	mortuary
7	anopheles	2	mossy
7	anthology	2	motherhood
7	antiretroviral	2	mourner
7	antler	2	mousetrap
7	anyhow	2	mucosa
7	apatite	2	muffle
7	appease	2	mug
7	aptly	2	multicultural
7	aqua	2	multiethnic
7	ascetic	2	muscipula
7	assault	2	muscovite
7	assets	2	mutter
7	astrophysics	2	myoblast
7	avarice	2	myocyte
7	bacilli	2	nadir

7	backdrop	2	nag
7	ballgame	2	nanotech
7	barefoot	2	nape
7	barnyard	2	napoleon
7	barricade	2	nary
7	basaltic	2	nascent
7	batholith	2	nastic
7	beforehand	2	nautili
7	bench-altar	2	nave
7	benedict	2	navigable
7	beware	2	nays
7	bioaccumulation	2	neb
7	biotite	2	needlework
7	bitten	2	neoliberal
7	bleep	2	nervine
7	blip	2	neuroanatomy
7	bloat	2	neurofibromatosis
7	boar	2	neuroscientist
7	bode	2	newbie
7	bombardier	2	newfoundland
7	bowler	2	niacin
7	boyhood	2	nick
7	brainstem	2	nightshade
7	breccia	2	nitrogen-fixer
7	bride	2	nobleman
7	bromide	2	nociceptor
7	brotherly	2	noel

7	budget	2	non-cichlid
7	butt	2	nonfat
7	buttress	2	nonfictions
7	cache	2	nonfunctional
7	calorimeter	2	nonhomogeneous
7	candidiasis	2	nonmaterial
7	caregiver	2	nonpareil
7	carrack	2	nonpartisan
7	carrion	2	nonreligious
7	casket	2	nonresident
7	casserole	2	nonsmoking
7	catheter	2	norovirus
7	cavalry	2	north-easterner
7	cede	2	notepad
7	centrum	2	novelty
7	chad	2	nucleobase
7	charlotte	2	nucleoplasm
7	checkerboard	2	nucleoprotein
7	checkmate	2	numbness
7	chinook	2	nun
7	chiton	2	oblast
7	chorine	2	oblate
7	cicada	2	obliterate
7	circumnavigate	2	obstinate
7	cistern	2	oddball
7	clamor	2	offish
7	clarification	2	offshoot

7	clink	2	oft
7	clothe	2	okra
7	coccus	2	oleic
7	cog	2	oligotrophic
7	coil	2	omicron
7	commonplace	2	oncolytic
7	compliance	2	oncoming
7	comply	2	onetime
7	conduce	2	onomatopoeia
7	conjure	2	oospores
7	contiguous	2	orient
7	coot	2	origami
7	coronavirus	2	orthographic
7	cosmopolitan	2	out-class
7	counter	2	outcroppings
7	countertop	2	outcry
7	croak	2	outlandish
7	crustal	2	outmoded
7	cuboid	2	outpatient
7	culprit	2	outputted
7	cyanobacterium	2	outright
7	dana	2	outrun
7	debunk	2	outskirts
7	decaffeinate	2	outweigh
7	Dee	2	overconsumption
7	defibrillation	2	overdraft
7	denim	2	over-dramatize

7	derrick	2	overdrawn
7	despise	2	overgrazing
7	detract	2	overhanging
7	devious	2	overharvesting
7	devour	2	overland
7	didgeridoo	2	overpower
7	dimerism	2	overran
7	diorite	2	oversimplify
7	dipeptide	2	overstate
7	disassemble	2	overwhelmingly
7	dismantle	2	painstakingly
7	disparage	2	paintball
7	disparate	2	paisley
7	dispense	2	paleness
7	disproportionately	2	paleo
7	distal	2	paleogeography
7	dominion	2	pallid
7	doorstop	2	pallidum
7	dovetail	2	pampa
7	downturn	2	pang
7	drench	2	pangolin
7	drowsy	2	pantothenic
7	drunk	2	paper
7	duckling	2	papery
7	dust	2	papillomaviruses
7	dystrophin	2	papyrus
7	earl	2	paracrine

7	elicit	2	paranoid
7	emblem	2	parenthood
7	enchanted	2	parity
7	encyst	2	parody
7	endomembrane	2	partisan
7	endonuclease	2	passbook
7	engage	2	paste
7	ensue	2	pasteurization
7	epinephrine	2	pastor
7	epiphysis	2	pastureland
7	eugenics	2	pate
7	ex-boxer	2	patella
7	exocrine	2	patellar
7	extinguish	2	patronage
7	extraterrestrial	2	payroll
7	eyelash	2	peacetime
7	fairway	2	pecan
7	fathom	2	pedagogy
7	feline	2	pensive
7	fermions	2	pentene
7	ferocious	2	peppermint
7	fibrinogen	2	peptidoglycans
7	filthy	2	periodontal
7	firebreak	2	perm
7	fixture	2	permanganate
7	flask	2	permeate
7	floodwater	2	perp

7	flop	2	pesky
7	flute	2	pester
7	footwear	2	petunia
7	forearm	2	pewter
7	foresight	2	phantom
7	foreword	2	pharmacology
7	frail	2	phasmid
7	freak	2	phobia
7	frigate	2	phonograph
7	frugal	2	phosphine
7	gaggle	2	phosphodiester
7	gasify	2	phosphoglycerate
7	gearshift	2	phospholipase
7	glace	2	photogenic
7	glaciate	2	photo-montage
7	glamorous	2	photoreceptor
7	glee	2	photosynthesizes
7	gnaw	2	phototropic
7	gonadotropin	2	physique
7	gorgeous	2	pickers
7	grandchild	2	picturesque
7	ground	2	piedmont
7	groundwork	2	piety
7	gumdrop	2	pi-meson
7	hallmark	2	pinball
7	handsome	2	pinky
7	harem	2	pinner

7	hart	2	pinscher
7	header	2	pipedream
7	heap	2	pirouette
7	herd	2	pizzeria
7	hindgut	2	plantain
7	homeowner	2	plate
7	homerun	2	playtime
7	hominid	2	plena
7	hone	2	pliers
7	hydrant	2	ploidy
7	hydrofluoric	2	pluripotent
7	indentation	2	poise
7	inelastic	2	poleward
7	injunction	2	polychlorinated
7	interim	2	polycyclic
7	internment	2	polyglot
7	internode	2	ponderous
7	intoxicating	2	poop
7	intravenous	2	poop-scoop
7	invaluable	2	popper
7	jasmine	2	poppycock
7	jellybean	2	porphyrin
7	jour	2	porphyritic
7	karate	2	porpoise
7	kilocalorie	2	portent
7	kinetochore	2	postgraduate
7	kiwi	2	postponing

7	knot	2	postscript
7	lactase	2	posttest
7	lacy	2	powerboat
7	landowner	2	power line
7	lea	2	praiseworthy
7	lecturer	2	prance
7	lesion	2	prearranged
7	lib	2	preconceived
7	liquefy	2	predicament
7	lizzie	2	prehypertension
7	lure	2	premier
7	macronucleus	2	premolar
7	maggot	2	preposterous
7	mainframe	2	presage
7	majesty	2	presenter
7	malignant	2	presentment
7	malleability	2	preserver
7	margarine	2	pretest
7	marshal	2	priesthood
7	mascot	2	primrose
7	masquerade	2	proactive
7	mastodon	2	proffer
7	megawatt	2	pro-forma
7	mellitus	2	progeny
7	mica	2	prosaic
7	microcontinents	2	proteome
7	milkshake	2	prothrombin

7	misconduct	2	proviso
7	misidentify	2	pseudogene
7	mitten	2	pseudonym
7	moa	2	puck
7	monetary	2	puffin
7	mustache	2	pula
7	myofibril	2	pullet
7	mystic	2	pulmonic
7	nanomaterials	2	pulsate
7	nanosecond	2	punter
7	nearness	2	purr
7	neuromuscular	2	putida
7	neurotoxin	2	putrefy
7	nitty-gritty	2	pyridine
7	non-accountant	2	quadrat
7	nonflowering	2	quartet
7	nonmetallic	2	quiver
7	nonprofit	2	racetrack
7	novella	2	rachis
7	nucleoid	2	radicle
7	nugget	2	radiosonde
7	nursery-rhyme	2	radix
7	ogle	2	raggedy
7	olfactory	2	raintree
7	ballet	2	rani
7	orator	2	ravel
7	orienteering	2	reacquaint

7	ostia	2	reattaches
7	ottoman	2	re-booking
7	outage	2	reborn
7	outcompete	2	recalculation
7	outgrow	2	recalibrate
7	ovate	2	recheck
7	overshoot	2	recidivism
7	overshot	2	reclassification
7	oversight	2	recollection
7	oxytocin	2	redeem
7	pallet	2	redevelopment
7	panic	2	redirection
7	parable	2	redoubt
7	pathological	2	reedy
7	pearly	2	referendum
7	pectoral	2	reflux
7	pelagic	2	refold
7	pentose	2	reforestation
7	perihelion	2	reformulation
7	permeate	2	refrigerates
7	pert	2	refurbish
7	phi	2	refurbishment
7	phlegm	2	regimen
7	photoautotroph	2	regolith
7	pidgin	2	regrowth
7	pier	2	reimburse
7	pincers	2	rein

7	pineal	2	rejuvenate
7	pinhole	2	relaunch
7	pinkish	2	relive
7	pinwheel	2	rend
7	pion	2	reorientation
7	pistachio	2	repass
7	pith	2	repentant
7	plagioclase	2	replay
7	plaintiff	2	replotted
7	plication	2	reprehensible
7	plight	2	repressive
7	podium	2	reprisal
7	polyester	2	reproducibility
7	ponce	2	repugnant
7	postpone	2	requisite
7	prerequisite	2	resize
7	proofread	2	restock
7	propanol	2	restructure
7	protagonist	2	restructuring
7	protoplanetary	2	ret
7	pseudomonas	2	retest
7	pumpnickel	2	reticular
7	punch	2	retort
7	pupae	2	retouch
7	racquet	2	retrial
7	reactance	2	reverie
7	readability	2	revitalize

7	reinvest	2	revoke
7	relent	2	reweigh
7	restorative	2	reweighed
7	rethink	2	rewind
7	reunite	2	reword
7	rhizome	2	rhododendron
7	riot	2	ribonucleoprotein
7	riverside	2	rickety
7	rivet	2	ridgeline
7	roan	2	roadbed
7	ropy	2	rocket
7	rustle	2	roebuck
7	saddle	2	rog
7	saltation	2	rollerblades
7	sanctuary	2	ropelike
7	sandbar	2	rosin
7	scab	2	rostrum
7	scalp	2	router
7	schmaltz	2	roving
7	scholastic	2	rubbly
7	schoolchildren	2	rubicund
7	scotia	2	rubidium
7	seaman	2	rucksack
7	self-interruption	2	rudimentary
7	seminal	2	rugged
7	sentence	2	rump
7	serpent	2	safari

7	short-working	2	safranin
7	sieve	2	salami
7	sift	2	saleswoman
7	silk	2	salicylate
7	sliver	2	salmonellosis
7	smack	2	saloon
7	solicit	2	salve
7	sparrow	2	sandblast
7	spear	2	sandboarding
7	spermicide	2	sapling
7	sporangium	2	saprophytic
7	spotlight	2	sash-window
7	sprite	2	sassed
7	stamina	2	satin
7	stereo	2	sawing
7	stew	2	sax
7	stilt	2	scald
7	stockpile	2	scant
7	stomp	2	scanty
7	stout	2	schoolteacher
7	strep	2	scone
7	subjugation	2	scorecard
7	subsidence	2	scoundrel
7	summa	2	scribal
7	sunblock	2	scrumptious
7	supercharger	2	scrunch
7	superlative	2	scrutinize

7	surveillance	2	sea-kayak
7	swoon	2	searing
7	sycamore	2	seascape
7	tact	2	sedan
7	tangible	2	selenium
7	teem	2	semifluid
7	tendinitis	2	sentence-grammarian
7	thermos	2	sepia
7	thoracic	2	sequitur
7	thumbnail	2	serrated
7	tonnage	2	shamanic
7	torsion	2	shantytown
7	transcontinental	2	shanty-town
7	translocate	2	shape-changer
7	transposon	2	shard
7	treacherous	2	sharecropper
7	tricycle	2	shew
7	turf	2	shippers
7	turgid	2	shockwave
7	typhimurium	2	shoplift
7	unanimous	2	shorebirds
7	uncoil	2	shortfall
7	unmanned	2	shrill
7	unravel	2	shuffleboard
7	vampire	2	shush
7	vie	2	sideboard
7	void	2	sig

7	walrus	2	signpost
7	ware	2	silliness
7	wean	2	silty
7	weasel	2	silversmith
7	wheeze	2	simmer
7	whew	2	singe
7	whoosh	2	sinister
7	whore	2	sinus
7	withhold	2	sisterhood
7	workforce	2	sixes
7	wrestle	2	sixties
7	zappy	2	sizable
7	zoster	2	sketchbook
6	abdicate	2	sky
6	abound	2	skylight
6	afterlife	2	skyrocket
6	afterschool	2	slacken
6	agave	2	slat
6	airbag	2	slather
6	aldosterone	2	slaveholder
6	aloft	2	sledge-hammer
6	alt	2	slippage
6	amiodarone	2	slot
6	amylose	2	slurry
6	ancillary	2	smarten
6	angus	2	smooshed
6	anteater	2	smudge

6	antiseptic	2	smut
6	apoptosis	2	snapper
6	apprentice	2	snickerdoodle
6	ardent	2	snore
6	aristocrat	2	snort
6	armadillo	2	snowdrift
6	armpit	2	snuck
6	arrest	2	snuggle
6	artic	2	somersault
6	articular	2	songbird
6	artifice	2	sonic
6	artillery	2	sooners
6	ascribe	2	soya
6	assess	2	spacelab
6	atrioventricular	2	spacesuit
6	australopithecines	2	spaniel
6	avatar	2	specie
6	aver	2	specious
6	awn	2	spectrophotometer
6	babble	2	sphagnum
6	backboard	2	spindly
6	ballad-writer	2	spinet
6	bandage	2	spire
6	barrettes	2	spongiform
6	baseman	2	sportswriter
6	basil	2	spotter
6	basophil	2	spyglass

6	bassoon	2	staccato
6	benevolent	2	staminate
6	bin	2	staphylococci
6	bioethics	2	stasis
6	biohazard	2	statesman
6	biophysics	2	stele
6	biweekly	2	stellar
6	blowfly	2	stench
6	blue-stocking	2	stewardship
6	bollard	2	stinkbugs
6	bonnie	2	stipe
6	booker	2	stonework
6	bough	2	stoppage
6	bread	2	storehouse
6	buckle	2	stork
6	bunny	2	stovetop
6	burdensome	2	straightway
6	buss	2	stranglehold
6	butanol	2	streetlamp
6	cadastral	2	stricture
6	cajole	2	strife
6	caller	2	strikeouts
6	calliope	2	strum
6	cates	2	stubby
6	charade	2	stylet
6	cherish	2	subcontinent
6	chiasmata	2	subdued

6	chromite	2	subfield
6	churros	2	subjugate
6	cinema	2	subkingdom
6	cinnabar	2	sublittoral
6	clammy	2	submicroscopic
6	clonal	2	submissive
6	cockpit	2	subordination
6	coexist	2	subsist
6	commemorate	2	subtest
6	companionate	2	subtitle
6	con	2	succumb
6	conflagration	2	sudoriferous
6	conscript	2	summands
6	consortium	2	sundown
6	coppice	2	sundry
6	cormorant	2	suntan
6	cortisol	2	sunwards
6	cotransport	2	supercomputer
6	countercurrent	2	superconducting
6	counterfeit	2	superfamily
6	courtroom	2	superficial
6	cowboy	2	superfine
6	crevasses	2	superhighway
6	crunch	2	superimposable
6	culvert	2	superset
6	cushion	2	supersize
6	cyanide	2	supertanker

6	dal	2	sweltering
6	dartboard	2	swimwear
6	dashboard	2	switchback
6	decease	2	switchboard
6	defecate	2	swiveled
6	dehydrogenate	2	swoosh
6	delirium	2	symphylans
6	deplore	2	synth
6	derby	2	tabloid
6	desmosome	2	taboo
6	devolve	2	tac
6	diablo	2	tacit
6	diploma	2	tail-ender
6	dis-associate	2	takeoff
6	discipline	2	talc
6	discord	2	talon
6	disgrace	2	tangerine
6	dismal	2	tangy
6	doghouse	2	tannic
6	doze	2	tarsal
6	draught	2	tartar
6	dredge	2	tassel
6	dresser	2	teakwood
6	driveshaft	2	teal
6	drone	2	techno
6	drumheads	2	tee
6	drywall	2	telltale

6	dummy	2	telomerase
6	dun	2	tepee
6	dynamo	2	tepid
6	earphone	2	terrapin
6	electroluminescence	2	tetramer
6	electrometallurgy	2	tetroxide
6	emolument	2	theocracy
6	end-effector	2	theology
6	endochondral	2	thereupon
6	endotoxin	2	thermocline
6	engrave	2	thrasher
6	entice	2	threadbare
6	entrepreneurial	2	thrombocytes
6	episodic	2	thromboxane
6	epithet	2	thrush
6	ermine	2	thug
6	espionage	2	thundercloud
6	ethologist	2	thyrotropin
6	eusocial	2	tidbit
6	fable	2	tinge
6	fair	2	tiptoe
6	fanny	2	tit
6	fawn	2	titrant
6	fibrillation	2	toadstool
6	fingerlike	2	tock
6	fireball	2	toehold
6	flamingo	2	toil

6 florist	2 tomography
6 flytrap	2 tonic
6 folic	2 Tono plast
6 foresee	2 tooting
6 fortitude	2 tootsie
6 fringelike	2 topmost
6 gangrene	2 topoisomerase
6 gazelle	2 touchstone
6 gluconeogenesis	2 tourmaline
6 glue	2 toxoplasmosis
6 gobstopper	2 trachomatis
6 goldsmith	2 tramp
6 gong	2 transposition
6 grit	2 trawl
6 groomsmen	2 trepidation
6 guanosine	2 triad
6 guppy	2 trice
6 hairline	2 trichomonas
6 hairstreak	2 trident
6 handmade	2 triose
6 harmony	2 tripod-cauldron
6 hassle	2 trochanter
6 hawkweed	2 troglodyte
6 haze	2 trop
6 heath	2 tropomyosin
6 hematoma	2 troponin
6 hemi	2 troublemaker

6	hemophiliacs	2	trousers
6	hijack	2	trove
6	hobbyist	2	trudge
6	hodge-podge	2	tumult
6	holt	2	turbocharged
6	homeodomain	2	turbocharger
6	homicide	2	turmoil
6	honeyeater	2	turnover
6	hotplate	2	turnstone
6	housecat	2	tweak
6	hull	2	type-setter
6	hyper	2	unbend
6	hyperventilation	2	undocking
6	hypodermis	2	undue
6	icebreaker	2	uninhabitable
6	icecap	2	uniporter
6	ide	2	unison
6	immunology	2	unlit
6	impervious	2	untrammelled
6	income-beneficiary	2	up
6	incriminating	2	uppercase
6	incumbent	2	upslope
6	inflexible	2	uptight
6	infuse	2	urologic
6	ingenious	2	utero
6	inhospitable	2	valance
6	insipidus	2	valor

6	invagination	2	vancomycin
6	irresponsible	2	vanguard
6	irrupt	2	vanity
6	ivory	2	varnish
6	jalapeno	2	varve
6	jig-saw	2	vasodilation
6	jumble	2	vassal
6	keratinocytes	2	vaulter
6	kerosene	2	vax
6	kiloliters	2	velociraptor
6	kilowatt	2	vendor
6	knuckle	2	venetian
6	kth	2	vermillion
6	kw	2	vesta
6	lapse-rate	2	vicious
6	lax	2	videotape
6	leatherback	2	virally
6	lecture	2	vitreous
6	legionella	2	vizier
6	levitate	2	vulgaris
6	licorice	2	wabbit
6	lifelike	2	waddle
6	limerick	2	wag
6	linen	2	wain
6	lm	2	wally
6	load	2	wannabe
6	loam	2	wardrobe

6 lob	2 wary
6 lodging-house	2 waterfowl
6 loess	2 wattage
6 logger	2 waxwing
6 lounge	2 wayside
6 luminous	2 welch
6 luteal	2 weld
6 mag	2 welt
6 mainstream	2 wert
6 malfunction	2 whatsoever
6 mama	2 whet
6 manhood	2 whir
6 mantra	2 whup
6 mapmaker	2 willy
6 marcel	2 wimp
6 mayfly	2 wink
6 mediation	2 wintergreen
6 meg	2 wintertime
6 meninges	2 wistful
6 mercenary	2 withal
6 mesh-length	2 witty
6 meta-procedure	2 wiz
6 methicillin	2 wolfram
6 microgram	2 woodshop
6 midterms	2 woodsman
6 mink	2 woodwork
6 mitigate	2 workflow

6	mitogen	2	workroom
6	monologue	2	worktime
6	moo	2	wort
6	moray	2	wrack
6	motherboard	2	wrath
6	mozzarella	2	wren
6	muffled	2	wrought
6	multidisciplinary	2	wry
6	mustang	2	yap
6	mutagenesis	2	yardstick
6	muzzle	2	yearbook
6	myopathy	2	yen
6	nestle	2	yoke
6	newsletter	2	yo-yo
6	nicotinamide	2	zebrafish
6	noisemaker	2	zest
6	nonelectrolytes	2	zygotic
6	nonstandard	2	three-pointer
6	nope	1	abalone
6	numb	1	abash
6	oats	1	Abbas
6	obscene	1	abbey
6	obscure	1	abbots
6	obsolete	1	abduction
6	ochers	1	abettor
6	oi	1	abeyance
6	ouch	1	abnegation

6	outgoing	1	absentminded
6	overheating	1	acclimated
6	overrule	1	acclimatize
6	oviparous	1	accomplice
6	ox	1	acker
6	paleontology	1	acoelomates
6	palladium	1	acrobatic
6	palsy	1	acromegaly
6	panel	1	acropolis
6	panhandle	1	actus
6	papa	1	acumen
6	parasympathetic	1	adduct
6	parietal	1	adenoviruses
6	parsley	1	adjudicate
6	parvovirus	1	adjunct
6	pastel	1	advert
6	patchy	1	afferent
6	patriarch	1	affray
6	peat-digger	1	afield
6	pension	1	afire
6	pent	1	aflame
6	peso	1	afoot
6	petri	1	aftershave
6	pharaoh	1	afterworld
6	phosphor	1	agape
6	phytochemicals	1	agate
6	pigeonhole	1	ager

6	pinewood	1	agglutination
6	plasm	1	aggrieved
6	polydactyly	1	agoraphobia
6	polygamous	1	agroforestry
6	polymerize	1	aileron
6	posh	1	airboats
6	posse	1	airlift
6	postage	1	airman
6	postcard	1	alameda
6	pot	1	alcove
6	precollege	1	alderman
6	predecessor	1	aldolase
6	predicate	1	algebra lab
6	presidio	1	allotrope
6	principia	1	almagest
6	procession	1	amateurish
6	prometaphase	1	ambidextrous
6	prophecy	1	ameliorate
6	prostitute	1	aminobutyric
6	provost	1	amour
6	pucker	1	amperages
6	pus-cell	1	ampersand
6	quail	1	amphipathic
6	quanta	1	ampicillin
6	quench	1	amrita
6	quill	1	anagoge
6	readership	1	anchovy

6	recompose	1	andante
6	reenter	1	andiron
6	refreshing	1	aneurysm
6	refrigerate	1	angiotensin
6	regency	1	anglo
6	regionally	1	anhydrase
6	regress	1	anise
6	renovate	1	antennal
6	renowned	1	anterograde
6	retrovirus	1	anthropocentric
6	rhinitis	1	anticlinal
6	ribulose	1	anticlockwise
6	ridgetop	1	antielectron
6	rollercoaster	1	antigovernment
6	rookie	1	antileptons
6	rosette	1	antimacassar
6	ross	1	anti-malarial
6	royally	1	antiparallel
6	salesperson	1	antireligious
6	salsa	1	antisocialist
6	salvation	1	antiwar
6	sarcasm	1	antral
6	schooner	1	apartness
6	sclera	1	aphelion
6	screenplay	1	apicomplexans
6	scribble	1	apocalypse
6	semantic	1	apocopate

6	semicolon	1	apocrypha
6	semiconservative	1	apodosis
6	shin-bone	1	aponeurosis
6	shop	1	appassionato
6	sider	1	applauses
6	siltstone	1	applesauce
6	skid	1	approbation
6	slick	1	appurtenance
6	slop	1	apropos
6	slur	1	aquanaut
6	snicker	1	arabesque
6	sob	1	arachidonic
6	spirochete	1	arachnophobia
6	spirometer	1	arbuscular
6	spool	1	archeology
6	squall	1	archway
6	squeal	1	arear
6	squiggly	1	areligious
6	sterol	1	areolae
6	stipulate	1	argentine
6	stringent	1	argosy
6	subconscious	1	armistice
6	subcutaneous	1	arnicas
6	subdue	1	arson
6	subtopic	1	artful
6	succinct	1	arty
6	succulent	1	ascidians

6	sunlit	1	ascot
6	superhero	1	ashtray
6	superpower	1	asocial
6	superstitious	1	aspen
6	surrey	1	aspers
6	swoop	1	assay
6	tabby	1	astride
6	tabletop	1	astringent
6	takeover	1	asunder
6	tang	1	asylum
6	tape	1	atelier
6	telluride	1	attacker
6	tentative	1	attar
6	thermochemistry	1	atwitter
6	thermoregulation	1	atypical
6	throb	1	auricle
6	thump	1	auspicious
6	tomb-robber	1	austere
6	tortilla	1	austral
6	tote	1	automat
6	tout	1	autopilot
6	tram	1	autoradiography
6	trauma	1	autotomy
6	tropopause	1	autoworkers
6	trumpet	1	averse
6	turbo	1	babe
6	turquoise	1	backbreaking

6	twilight	1	backlash
6	two-footer	1	badminton
6	unction	1	badness
6	undecagon	1	bae
6	upheaval	1	bag
6	vesicular	1	bagpiper
6	vet	1	bah
6	virology	1	bailiff
6	wallpaper	1	baleen
6	waver	1	ball
6	wheelbarrow	1	ballad
6	wildebeest	1	ballroom
6	witchcraft	1	balm
6	wither	1	balsa
6	woodchuck	1	banco
6	yank	1	bandanna
5	accrete	1	bandy
5	adamant	1	banister
5	alas	1	bannister
5	alkaloid	1	banter
5	alkyne	1	barbary
5	allude	1	bargeman
5	alma	1	barrette
5	almighty	1	bartender
5	amalgamate	1	baseload
5	amylopectin	1	baserunner
5	androgen	1	bash

5	animism	1	bashfulness
5	annotate	1	basidiomycetes
5	anoint	1	basilica
5	aperture	1	basilisk
5	applaud	1	baste
5	archers	1	bastion
5	archipelago	1	bathe
5	aristocratic	1	bathrobe
5	arrack	1	batik
5	arrowhead	1	batman
5	artesian	1	battleground
5	ascorbic	1	baud
5	astatine	1	beachfront
5	auger	1	beachgoers
5	avalanche	1	bearer
5	axillary	1	beaux
5	backstroke	1	becket
5	bacteriology	1	bedcover
5	balloon	1	bedspread
5	barbell	1	bedsprings
5	bard	1	beekeeping
5	beady	1	beeves
5	bedbug	1	beggar
5	beige	1	begirt
5	belch	1	begrimed
5	benefactor	1	begrudge
5	betty	1	belatedly

5	bilingual	1	belladonna
5	biotin	1	bellhop
5	birthstone	1	belli
5	bisphosphate	1	bellicose
5	blacken	1	bellman
5	blockbuster	1	bellybutton
5	bluegrass	1	belter
5	bookmark	1	bemoan
5	bookshelf	1	benzocaine
5	boon	1	beriberi
5	borehole	1	berm
5	botulism	1	berth
5	bra	1	beset
5	bran	1	betroth
5	branes	1	bettering
5	bridle	1	betterment
5	briefcase	1	betting-slip
5	brink	1	bettor
5	budge	1	bewitch
5	bullfrog	1	bifida
5	bullmastiff	1	biflagellate
5	burp	1	biggish
5	bushel	1	bigotry
5	butler	1	bigwig
5	cactuses	1	bilge
5	cag	1	billow
5	canary	1	billowy

5	card	1	bimetallic
5	carotenoid	1	bimolecular
5	carpal	1	bing
5	carryon	1	bio
5	carving	1	biocontrol
5	caseload	1	bioinorganic
5	cassowary	1	biomaterial
5	casualty	1	biomolecule
5	cataract	1	biopsy
5	cater	1	biopsychology
5	celeste	1	biosensor
5	chancellor	1	biotech
5	chemotrophic	1	bipolar
5	childbearing	1	birthplace
5	chlorite	1	bisphenol
5	choreograph	1	bistro
5	cirque	1	bitesize
5	clamp	1	bivalent
5	clan	1	biz
5	clitellum	1	blackbody
5	cloak	1	blackout
5	clockmaker	1	blacksmithing
5	clothesline	1	blah
5	clothespin	1	blameworthy
5	cloudless	1	blastocoel
5	cloze	1	blat
5	coaching-inn	1	blatant

5	coerce	1	blear
5	cognac	1	bleat
5	collie	1	bleh
5	columnar	1	bloc
5	commodify	1	block-buster
5	condominium	1	blockhead
5	constipate	1	blockhouse
5	consummate	1	blogosphere
5	convulsion	1	bloodstain
5	corn	1	bloodstained
5	cornet	1	blotchy
5	councilor	1	blowtorch
5	counterintuitive	1	blueness
5	cram	1	bluesman
5	crave	1	bluestem
5	creed	1	blunder
5	creel	1	blustery
5	cringe	1	boatload
5	crossroads	1	boatman
5	crumb	1	bodega
5	crus	1	boggy
5	crutch	1	bogie
5	cryosphere	1	bogle
5	cusp	1	bohemia
5	cysteine	1	bohemian
5	damn	1	boking
5	dandy	1	bola

5	daybreak	1	bondman
5	deamination	1	bookmaking
5	deerfly	1	boomtowns
5	defiance	1	bootleg
5	demolish	1	boozy
5	deodorant	1	borate
5	deregulate	1	bottomless
5	dermatologist	1	bourbon
5	detention	1	boutique
5	detour	1	bovine
5	diligence	1	bowhead
5	dimly	1	bowie
5	dislocate	1	bowlegged
5	dispel	1	bowstring
5	dissuade	1	bozo
5	doodle	1	brachiopod
5	doom	1	bracket
5	doom-monger	1	brainless
5	downdraft	1	brainy
5	drapery	1	brash
5	drizzle	1	brassica
5	drum	1	brassier
5	dude	1	brassiere
5	dumpling	1	brassy
5	dysentery	1	brawl
5	edict	1	breakneck
5	eggplant	1	bream

5	eggshell	1	breaststroke
5	elucidate	1	breathtaking
5	embroider	1	brew-pub
5	embryoblast	1	briarwood
5	emulate	1	brigandage
5	enamel	1	brimstone
5	endo	1	brinish
5	engross	1	bris
5	enthusiast	1	britches
5	err	1	brittleness
5	erratic	1	broadband
5	erythropoietin	1	broadcaster
5	etch	1	broadleaf
5	ethology	1	broadleaved
5	etiquette	1	broadside
5	exemplify	1	broch
5	exempt	1	brokerage
5	exogenesis	1	bromate
5	exquisite	1	brownout
5	extirpate	1	brushfire
5	extrasolar	1	bub
5	exult	1	buckminsterfullerene
5	factsheet	1	buckram
5	fallow	1	bulldog
5	falter	1	bulletproof
5	fam	1	bullhead
5	fantail	1	bullion

5	fecal	1	bullock
5	fervent	1	bulwark
5	fiddlehead	1	bumble
5	filmy	1	bungle
5	firehouse	1	bunkum
5	fireman	1	bure
5	firmament	1	burg
5	flue	1	burnet
5	follicular	1	burnup
5	foothold	1	burton
5	footnote	1	bushiness
5	foraminifera	1	butterflyfish
5	foreclose	1	butterscotch
5	foremost	1	buttock
5	forfeit	1	butyl
5	formidable	1	butyric
5	fowl	1	buzzword
5	fret	1	bylaw
5	fro	1	bystander
5	fury	1	cabby
5	gam	1	cabinetmaker
5	garrison	1	cadaver
5	geld	1	caddisflies
5	geoscience	1	calcareous
5	glottis	1	calendula
5	glutton	1	caliber
5	gobble	1	caliper

5	goodwife	1	calumny
5	goshawk	1	calve
5	gossamer	1	calypso
5	gouge	1	camaraderie
5	graft	1	camcorder
5	granny	1	cameraman
5	granola	1	camshaft
5	griffin	1	candlelight
5	grim	1	candlewick
5	grime	1	candor
5	grub	1	canfield
5	grunt	1	cannibalism
5	guts	1	cannula
5	gyroscope	1	canonize
5	hadean	1	canopy
5	halibut	1	cantata
5	halo	1	canteen
5	hamlet	1	cap
5	handicap	1	capitation
5	hank	1	capote
5	hawk	1	capricious
5	heel	1	captor
5	hen-coop	1	capuchin
5	hereof	1	carat
5	hideout	1	carbonize
5	high-flier	1	carburetors
5	hindsight	1	cardiomyopathy

5	hippopotamus	1	cardiopulmonary
5	hire	1	carmaker
5	hoarse	1	carmine
5	hoary	1	carney
5	homecoming	1	carotid
5	hotshot	1	carper
5	hound	1	carrel
5	humankind	1	carry out
5	humongous	1	cartage
5	hydrocyanic	1	carte
5	hyperthermophiles	1	cartel
5	hypo	1	cartwheel
5	hypocritical	1	cassia
5	icicle	1	castanet
5	idol	1	castaway
5	imminent	1	catalase
5	impassable	1	catcall
5	incomprehensible	1	catenary
5	inconvenience	1	catharsis
5	incurable	1	caudex
5	inefficiency	1	caudillo
5	infringe	1	cauliflower
5	inosine	1	caulk
5	insecure	1	causeway
5	interject	1	cavalryman
5	intern	1	caveman
5	interplay	1	cavort

5	invalidate	1	cay
5	invincible	1	censure
5	inviolable	1	centennial
5	invoke	1	centermost
5	irrelevant	1	centigrade
5	isopropanol	1	cero
5	jingle	1	cerumen
5	jolt	1	cesspit
5	jumbo	1	cetera
5	kaleidoscope	1	chaetae
5	karst	1	chalcopyrite
5	kea	1	chard
5	keel	1	charismatic
5	kennel	1	charlatan
5	kicker	1	cheapskate
5	kindergarten	1	checkmark
5	labrum	1	cheeseburger
5	lapse	1	chemoreception
5	lariat	1	chemosensory
5	lars	1	chessman
5	latch	1	chest
5	lattes	1	chic
5	legacy	1	chickadee
5	leisure	1	chidden
5	lentil	1	chide
5	leopard-skin	1	childbirths
5	lf	1	chillum

5	lick	1	chimera
5	lilt	1	chirr
5	lineage	1	chit
5	linoleic	1	chitter
5	lipoprotein	1	chivalry
5	literate	1	chlorinated
5	logy	1	chlorobenzene
5	loiter	1	chloroform
5	loo	1	choicest
5	looser	1	cholecalciferol
5	lop	1	cholecystokinin
5	lope	1	choline
5	lough	1	chortle
5	lysozymes	1	chow
5	mage	1	choy
5	mandarin	1	christen
5	manic-depressive	1	chromolithograph
5	manometer	1	chromos
5	marina	1	chubby
5	marmoset	1	churl
5	master-craftsman	1	chymotrypsin
5	mastiff	1	cig
5	mayo	1	cinch
5	mealworm	1	circa
5	meaty	1	circumfix
5	megabyte	1	cirri
5	meh	1	cissy

5	melody	1	citadel
5	mentor	1	citrate
5	merciful	1	ciudad
5	meringue	1	claimant
5	mesoglea	1	clangorous
5	metallurgical	1	clapboard
5	micronucleus	1	clapper-board
5	midair	1	clarinet
5	midge	1	classwork
5	midsummer	1	clayey-silt
5	mildew	1	clemency
5	mina	1	cleric
5	mini-buffet	1	clerical
5	miracle	1	clerked
5	miscarriage	1	clitella
5	miscellaneous	1	clop
5	mistrust	1	club
5	mitral	1	cluck
5	mitt	1	coagulate
5	monophosphate	1	coastland
5	mosque	1	coble
5	mot	1	cobweb
5	mourn	1	cockade
5	mousse	1	cockle
5	moviegoers	1	cockscomb
5	mudskipper	1	cocksure
5	munity	1	coco

5	negro	1	coeducational
5	nibble	1	cofferdams
5	nip	1	cohabitation
5	nit	1	coleslaw
5	nitrile	1	colic
5	non-descriptor	1	coliseum
5	nonelectrolyte	1	colorimetry
5	nonexistent	1	comedian
5	nonpoint	1	comeliness
5	nori	1	comity
5	nose-dive	1	commonwealth
5	noteworthy	1	compatriot
5	oasis	1	compote
5	odometer	1	conch
5	oligosaccharide	1	concubine
5	ooze	1	condescending
5	operculum	1	condiment
5	opium	1	condor
5	ornament	1	coneflowers
5	osprey	1	confection
5	outspoken	1	conge
5	ova	1	congenial
5	overdue	1	conniption
5	overexposure	1	consort
5	overhear	1	contraband
5	overlay	1	contravention
5	overlying	1	convocation

5	overpass	1	convoy
5	oversized	1	cookware
5	overthrew	1	coombs
5	ovoid	1	coon
5	pad	1	cootie
5	pageant	1	copilot
5	pall	1	copperhead
5	palmitic	1	coprolites
5	palp	1	cordial
5	pamphlet	1	cordova
5	pane	1	corgis
5	pantheon	1	corm
5	pantry	1	corn-cob
5	paperweight	1	cornice
5	paradise	1	corny
5	parry	1	coronet
5	partway	1	corset
5	patrol	1	corvette
5	patrolman	1	councilman
5	peccary	1	countdown
5	pedestal	1	counterplots
5	pelota	1	counterpoint
5	pendent	1	counterstain
5	perturbation	1	countess
5	pessimist	1	countywide
5	petiole	1	couscous
5	photoautotrophic	1	covey

5	photoelectrons	1	cowbell
5	photolysis	1	cow-byre
5	photoperiod	1	cowl
5	pili	1	crackdown
5	pillar-box	1	craftsmanship
5	pinyon	1	craic
5	pitfall	1	crampon
5	platy	1	cranberry
5	polymerization	1	crane
5	poplar	1	cranny
5	poppy	1	crate
5	post-modifier	1	cravings
5	prestige	1	crema
5	priestly	1	crepe
5	probe	1	crevasse
5	prostaglandin	1	crier
5	proximal	1	crimp
5	psychosis	1	croft
5	psychrometric	1	croon
5	pubis	1	crossbreed
5	pulse	1	cross-compiler
5	pun	1	crosscut
5	puppetry	1	crosshatch
5	putty	1	crosstown
5	pyrotechnic	1	croup
5	quartzite	1	cruces
5	quicksand	1	crud

5	quorum	1	cruse
5	rabbi	1	crusty
5	racquetball	1	crypt
5	radiolarian	1	cryptologic
5	raincoat	1	cryptosporidium
5	ramification	1	crystallographer
5	ratfish	1	crystallographic
5	rec	1	cuff
5	reconnect	1	cufflink
5	reek	1	cuisine
5	rehab	1	cum
5	rehabilitator	1	cummings
5	reindeer	1	cupola
5	re-model	1	cupric
5	repatriation	1	cuprous
5	rephrase	1	curdle
5	rescale	1	curium
5	restart	1	curt
5	retake	1	curtail
5	retroviral	1	curtsy
5	rhea	1	cutaneous
5	rheumatic	1	cutthroat
5	rib	1	cyanocobalamin
5	ribonucleoproteins	1	cycloalkane
5	rightmost	1	cyclohexane
5	romaine	1	cypridium
5	rood	1	cytogenetic

5	roost	1	cytotechnologist
5	rotary	1	czar
5	rubrum	1	dabble
5	rugby	1	dachshund
5	rut	1	dactyl
5	saclike	1	dada
5	sari	1	daguerreotype
5	sate	1	dampen
5	sawed	1	damselfish
5	saxophone	1	dang
5	scalpel	1	danio
5	schist	1	daredevil
5	schizophrenia	1	dastardly
5	scintillate	1	databank
5	scramjet	1	datasheet
5	scum	1	dative
5	seabed	1	dauphine
5	seagrass	1	dawg
5	seamstress	1	daycare
5	secular	1	deaden
5	seethe	1	deaminase
5	self-inductance	1	deathwatch
5	senescence	1	debase
5	serge	1	decaf
5	serotonin	1	decalcified
5	sesamoid	1	decameter
5	setae	1	decanal

5	sf	1	deckhand
5	shank	1	deconstruct
5	shareholder	1	decrepit
5	sheet	1	defrost
5	shimmer	1	defunct
5	shoebox	1	dehumanize
5	shoelace	1	deicer
5	shoemaker	1	deindustrialization
5	shotput	1	delectable
5	silverfish	1	delist
5	sitcom	1	deluge
5	skyway	1	deme
5	slate-quarry	1	demeaning
5	slaughter	1	demeanor
5	sluggish	1	demilitarized
5	slumber	1	demoniac
5	smartphone	1	demoralize
5	sniff	1	demotion
5	snorkeling	1	demur
5	snowmobile	1	demystify
5	snowpack	1	dene
5	snuff	1	denning
5	soot	1	denture
5	southernmost	1	deoxyadenosine
5	spigot	1	deoxynucleic
5	stagnant	1	depo
5	starchy	1	depopulation

5	stark	1	deprave
5	starlight	1	deprecate
5	statin	1	depredation
5	station	1	dervish
5	steamship	1	dese
5	sternum	1	desecrate
5	stethoscope	1	desensitizes
5	stolon	1	desiccated
5	stoplight	1	desiderata
5	streetlight	1	desperado
5	streptococcal	1	destitute
5	stroke	1	deterrent
5	subpoena	1	detonate
5	subscriber	1	devilish
5	subservient	1	devolution
5	substitutive	1	devout
5	suffocate	1	dewdrop
5	sultan	1	diabolism
5	summertime	1	diacritical
5	sunbathe	1	diarist
5	superintendent	1	dickens
5	supervision	1	dickey
5	supple	1	didactic
5	synergy	1	diglyceride
5	takeout	1	dilapidated
5	talkies	1	dilly
5	tanner	1	dimeter

5	tarsier	1	diminution
5	tart	1	dingle
5	televised	1	dink
5	ternary	1	dinnertime
5	tetrad	1	dint
5	thermochemical	1	diorama
5	thermonuclear	1	diose
5	thesaurus	1	dioxygen
5	tibia	1	diphenhydramine
5	timepiece	1	diphenyl
5	toenail	1	diphenylamine
5	tokes	1	dipsomaniac
5	toolbar	1	disaffected
5	toolkit	1	disaggregate
5	topaz	1	disallow
5	torment	1	disco
5	toxoplasma	1	discolor
5	tradeoff	1	discolored
5	trample	1	discreet
5	transpose	1	disfigure
5	triathlon	1	disheveled
5	tufa	1	dishonoring
5	tularemia	1	dishpans
5	tur	1	dishware
5	turboprop	1	dishwater
5	turnout	1	disillusionment
5	twitter	1	disinterested

5	undergraduate	1	dismay
5	undermine	1	disoriented
5	uniramous	1	disown
5	upbeat	1	disrepair
5	upstate	1	disservice
5	uterine	1	dissimulation
5	vacate	1	dissonance
5	valine	1	disuses
5	vegan	1	dive-bomb
5	veliger	1	doable
5	verge	1	dobsonflies
5	versatile	1	docile
5	vinyl	1	docket
5	viviparous	1	dolomite
5	wad	1	dolphinkind
5	waggle	1	domelike
5	warhead	1	domineer
5	wartime	1	doming
5	welsh	1	doo
5	wetsuit	1	doo-dah
5	windowsill	1	doomsday
5	xerophyte	1	doorstep
5	yolk	1	dormouse
5	zig-zag	1	dost
5	zooxanthellae	1	downcast
5	park-keeper	1	downloadable
5	re-fuel	1	downplay

5	semi-fast	1	downregulate
5	pouch-seat	1	downtime
5	re-assure	1	dozers
5	non-golfer	1	drafty
4	abbreviate	1	drat
4	abhor	1	drayman
4	ablaze	1	dree
4	adept	1	dressmaker
4	aerodynamic	1	driftnet
4	afterbirth	1	dropdown
4	agrochemical	1	dropout
4	airflow	1	drudgery
4	amiss	1	druid
4	amphioxus	1	drumbeat
4	amphoteric	1	drumhead
4	anagram	1	duchy
4	anoxic	1	ducking-stool
4	ante	1	dumas
4	antibacterial	1	duodenal
4	antic	1	dup
4	antidepressant	1	duplex
4	antipathy	1	dustman
4	aortic	1	dyestuff
4	aplastic	1	dysprosium
4	apocrine	1	earmark
4	apricot	1	earmuffs
4	apt	1	earwig

4	archaic	1	easel
4	areoles	1	easygoing
4	arginine	1	ebony
4	armchair	1	eddy
4	arsenide	1	efface
4	artisan	1	efferent
4	assail	1	effervescent
4	aster	1	egad
4	attire	1	egghead
4	autograph	1	egotism
4	auxiliary	1	einsteinium
4	axil	1	eke
4	backtrack	1	elastin
4	baggy	1	electrocution
4	bam	1	electroscopes
4	baptize	1	electrovalent
4	barbules	1	elfin
4	bathwater	1	elide
4	bawl	1	eligibility
4	beanbag	1	emaciating
4	beck	1	embalmmment
4	bedclothes	1	ember
4	bedtime	1	embezzle
4	belie	1	emblazon
4	bibliography	1	embodiment
4	biff	1	emboss
4	biloba	1	embryogenesis

4	biomimicry	1	emend
4	biopolymer	1	emir
4	birdlike	1	emo
4	birdwatch	1	encampment
4	bitumen	1	encephalopathy
4	blackwood	1	enchilada
4	bland	1	endogenous
4	blare	1	endoribonuclease
4	bolster	1	enema
4	bomb	1	enfant
4	bomber	1	engorge
4	bonanza	1	enkindle
4	booby	1	enneagon
4	bossy	1	enol
4	bothersome	1	enshrine
4	bounty	1	ensign
4	brainstormed	1	entomb
4	breastfeeding	1	entrap
4	broach	1	entreaty
4	bromothymol	1	entryway
4	brother	1	enucleated
4	brotherhood	1	enwrap
4	brunt	1	epicuticle
4	bryozoan	1	equine
4	bumblebee	1	equisetum
4	bunting	1	ergonomic
4	burly	1	espouse

4	burro	1	esterase
4	caesarian	1	estradiol
4	calamity	1	ethnolinguistic
4	calico	1	euthanasia
4	calif	1	euthanized
4	calyx	1	eutherian
4	canola	1	eutrophic
4	cappuccino	1	eventful
4	carbide	1	everlasting
4	carcinoma	1	evermore
4	cart	1	everyman
4	catastrophically	1	evocative
4	caveat	1	exasperate
4	caver	1	excavate
4	cellophane	1	excrement
4	cellulosic	1	excruciatingly
4	cerium	1	exergonic
4	chalkboard	1	exfoliate
4	champ	1	exhort
4	chapman	1	exhume
4	chip	1	exonerations
4	chisel	1	exopolysaccharides
4	chlorophyte	1	exorbitant
4	chromate	1	exorcist
4	chrysanthemum	1	expiate
4	cirrocumulus	1	explant
4	civet	1	extant

4	clatter	1	extort
4	clementine	1	extradition
4	clipboard	1	extravaganza
4	clumsiness	1	extrinsic
4	clumsy	1	eyeless
4	clunk	1	eyestalks
4	coax	1	eyewall
4	coevolved	1	facers
4	cofactor	1	factoid
4	cofounder	1	fag
4	commiserate	1	falafel
4	compartmentalize	1	falsehood
4	compendium	1	famished
4	concede	1	fangled
4	confiscate	1	farad
4	conn	1	farmyard
4	consolation	1	fascioliasis
4	contrail	1	fascism
4	contrive	1	fastball
4	convoluted	1	fatherhood
4	copolymer	1	fatlike
4	cordless	1	fatso
4	core	1	faunal
4	cork	1	fax
4	corndogs	1	fecundity
4	cornstarch	1	feedstock
4	coroner	1	felling

4	corpora	1	fellow-conspirator
4	corpuscle	1	felts
4	corroborate	1	femora
4	corundum	1	fennec
4	couplet	1	fermi
4	court	1	ferric
4	coven	1	fervor
4	cower	1	fess
4	cowpox	1	fiat
4	cowrie	1	fib
4	cox	1	fickle
4	coxa	1	fid
4	cozy	1	fidelity
4	cradle	1	fidget
4	crap	1	fiendish
4	croc	1	fife
4	cryogenic	1	filigree
4	curbside	1	finesse
4	curry-powder	1	finicky
4	cuss	1	firebrats
4	cutoff	1	fireproof
4	cutout	1	fishbowl
4	dampers	1	fistula
4	damselfly	1	fizzle
4	daze	1	flagship
4	deadweight	1	flagstaff
4	dearth	1	flail

4	debilitating	1	flair
4	debit	1	flakey
4	deb-type	1	flaky
4	debug	1	flamboyant
4	deduct	1	flashbulb
4	deerskin	1	flashcard
4	demonize	1	flatbreads
4	demy	1	flatus
4	destabilize	1	flection
4	detest	1	flimsy
4	diamondback	1	flipbooks
4	dichloride	1	flirt
4	diem	1	floorboard
4	digress	1	floret
4	dike	1	flowerbed
4	dingy	1	flowerlike
4	diprotic	1	flume
4	disassociate	1	flyaway
4	discredit	1	flybys
4	dispersant	1	flyover
4	dissimilar	1	fodder
4	disulfide	1	folioing
4	dock	1	folly
4	dome	1	foolhardy
4	dour	1	footrest
4	dowel	1	forebrain
4	drab	1	foreknow

4	drainpipe	1	foreplay
4	drape	1	forestland
4	dribble	1	forlorn
4	drool	1	forsake
4	drugstore	1	forthwith
4	duckbilled	1	fortissimo
4	duff	1	fourscore
4	duly	1	frag
4	duper	1	franchise
4	earthbound	1	freeborn
4	eave	1	friar
4	ebb	1	frothy
4	ecstasy	1	frustule
4	eerie	1	fug
4	eff	1	fulgurite
4	elate	1	furlong
4	electron-antineutrino	1	furtively
4	elephantiasis	1	fuss
4	embargo	1	futility
4	embellish	1	gag
4	encroach	1	gaiety
4	ensnare	1	gait
4	entangle	1	galactosidase
4	envision	1	galilee
4	epimysium	1	galleon
4	erectus	1	gallstone
4	erythema	1	garb

4	erythematous	1	gasket
4	erythrocyte	1	gasmask
4	ese	1	gastro
4	esker	1	gastrula
4	espresso	1	gaudy
4	eulogy	1	gazette
4	evert	1	gazillion
4	examiner	1	gees
4	excursion	1	genet
4	exonuclease	1	genocide
4	expressway	1	genu
4	extravagant	1	geochronology
4	eyehole	1	gests
4	facies	1	getup
4	fanner	1	gharials
4	fascicle	1	ghastly
4	fay	1	ghrelin
4	feeble	1	gibberish
4	feral	1	gilded
4	fibroblast	1	girt
4	fie	1	girts
4	filial	1	giveaway
4	flatiron	1	glia
4	flatter	1	gloaming
4	fleece	1	glucometer
4	fleet	1	glum
4	floral	1	glycosylases

4	flounder	1	glycosylation
4	flyway	1	gnash
4	folklore	1	goatherd
4	foo	1	gobbledygook
4	foolproof	1	godlike
4	forefinger	1	gonococcal
4	forthcoming	1	gooier
4	fortress	1	gook
4	fray	1	gorgonian
4	frenzy	1	gory
4	fumble	1	goth
4	fuselage	1	gowned
4	fussy	1	grail
4	gabby	1	grandkids
4	gable	1	grandparenthood
4	gaily	1	grandpop
4	gar	1	granger
4	gash	1	granitic
4	gastrin	1	graven
4	gastrovascular	1	gravestone
4	gazebo	1	greenspace
4	gearbox	1	greenwash
4	geostationary	1	gregarious
4	giganotosaurus	1	gridiron
4	glen	1	grouch
4	glisten	1	groundspeed
4	glutaraldehyde	1	grueling

4	gnarled	1	grumpy
4	gnat	1	guan
4	goosebumps	1	guanaco
4	gopher	1	guar
4	gosling	1	gubernatorial
4	grackles	1	guild
4	gramps	1	gulley
4	granodiorite	1	gulling
4	granum	1	gumbo
4	grimace	1	gummer
4	grocer	1	gunboat
4	groundbreaking	1	gunfire
4	gully	1	gunky
4	gurgle	1	gunsmith
4	gust	1	gurnard
4	gyrate	1	gusto
4	haboob	1	gusty
4	hairdryer	1	habitude
4	hairstyle	1	haemochromatosis
4	canton	1	haft
4	handler	1	hammerhead
4	handout	1	handicraft
4	handshake	1	handspring
4	hap	1	hanger
4	haptophytes	1	haphazardly
4	harlot	1	haram
4	harp	1	hardboard

4	head-ach	1	hardcopy
4	headland	1	harpoon
4	headwind	1	harrow
4	heck	1	hassock
4	heriot	1	haywire
4	histone	1	headband
4	histoplasmosis	1	headdress
4	hobble	1	headfirst
4	holm	1	headgear
4	hop	1	headlock
4	hornblende	1	headset
4	horseback	1	heartfelt
4	hostess	1	heartland
4	houseplant	1	heartsick
4	hue	1	heathen
4	hunchback	1	heave
4	hurray	1	hebetate
4	hustle	1	hectic
4	hydrangea	1	hedge
4	hydrolase	1	hegemony
4	hymn	1	heifer
4	hype	1	helioseismology
4	imperative	1	helpdesk
4	inadvertently	1	helter
4	indestructible	1	helves
4	inescapable	1	hematuria
4	infest	1	hemic

4	infrequently	1	hemlock
4	inmost	1	hemolytic
4	inset	1	hemoproteins
4	insidious	1	henpecked
4	insomnia	1	heptathlon
4	interferon	1	herculean
4	intergenic	1	hereinafter
4	intermediary	1	herewith
4	interrelated	1	herpetic
4	interstitial	1	herpetologists
4	inundate	1	heterodimeric
4	ionosphere	1	heterodox
4	ire	1	hiatus
4	iron	1	hiccup
4	irregularity	1	hickey
4	isomerism	1	hideaway
4	itinerary	1	hieroglyphic
4	jaundice	1	hillslopes
4	jo	1	hilt
4	jut	1	hippie
4	kay	1	hipping
4	kerchief	1	histoire
4	keyhole	1	histology
4	kinematic	1	hob
4	knead	1	hobo
4	kwashiorkor	1	holistic
4	lactones	1	holmium

4	laminar	1	hologram
4	lanceolate	1	homage
4	lanugo	1	homebody
4	lawnmower	1	homeopathic
4	ledger	1	homepage
4	leftward	1	homesickness
4	legionnaire	1	homestretch
4	lesbian	1	homoscedasticity
4	levitation	1	homosexuality
4	lieutenant-colonel	1	honeydew
4	lightheadedness	1	honeypot
4	linings	1	hoodie
4	lip	1	hoody
4	liquefaction	1	hoppy
4	litany	1	hora
4	livable	1	hornet
4	loom	1	horseman
4	loon	1	horseplay
4	lorry	1	hospice
4	luminosity	1	hotcakes
4	lust	1	houseboat
4	lutetium	1	hovercraft
4	madeleine	1	hoverfly
4	magician	1	hubris
4	magna	1	humph
4	magpie	1	hunk
4	maiden	1	hutch

4	maidenhair	1	hyaline
4	malate	1	hydrazine
4	malice	1	hydrofluorocarbon
4	maltase	1	hydrophytes
4	mandamus	1	hydrops
4	mane	1	hydroscopic
4	manuscript	1	hydrous
4	margarita	1	hyoid
4	maroon	1	hypercritical
4	marshland	1	hypergiant
4	marvel	1	hyperthermia
4	master-lacquer	1	hypnotize
4	masticate	1	hypopharynx
4	maverick	1	hypothermia
4	mealtime	1	hypothyroidism
4	memorialize	1	hypoxic
4	menace	1	ibn
4	mic	1	ichthyosaur
4	mick	1	idyllic
4	micronuclei	1	illegible
4	micropipette	1	immunosuppression
4	midgut	1	impending
4	migraine	1	imperator
4	minh	1	impetigo
4	minuscule	1	impetuous
4	mirage	1	impetus
4	mischievous	1	impinge

4	miscibility	1	impious
4	misdemeanor	1	importunity
4	misfortune	1	improvise
4	misread	1	impulsive
4	molybdenum	1	inadvertent
4	money-lender	1	inapplicable
4	monotheistic	1	inappropriately
4	monotonically	1	inattentive
4	morbid	1	incant
4	morph	1	incapacitate
4	morrow	1	incendiary
4	morsel	1	incessant
4	mottle	1	incision
4	mucilage	1	incisive
4	mudstone	1	incognita
4	mullein	1	incognito
4	multilingual	1	incoherently
4	myocardial	1	incompetence
4	myoglobin	1	incomprehensibly
4	naphthalene	1	inconsiderate
4	nasty	1	incontinence
4	navel	1	inconveniently
4	needy	1	incursion
4	nelly	1	incus
4	neurotransmission	1	indecisive
4	newcomer	1	indefatigable
4	nimbostratus	1	indelible

4	nitro-organic	1	indignant
4	no	1	indispensable
4	nomad	1	indisputably
4	nonconsecutive	1	indistinctly
4	nonequivalent	1	indoctrinate
4	nonstop	1	ineligible
4	nontoxic	1	inequity
4	northland	1	inestimable
4	nosepiece	1	inexperienced
4	nota	1	inexpertly
4	notify	1	inextricable
4	notwithstanding	1	infallibility
4	nozzle	1	infamy
4	np	1	infantile
4	obsidian	1	infantry
4	occipital	1	infill
4	ocular	1	infinities
4	odyssey	1	infinitive
4	offence	1	infirm
4	ominous	1	inflamm
4	oomycetes	1	inflamer
4	opera	1	infuriate
4	opt-out	1	inhuman
4	or	1	inhumanity
4	orca	1	inions
4	organogenesis	1	inkjet
4	ort	1	inky

4	osmium	1	innings
4	ossifies	1	inordinately
4	osteogenesis	1	insensitive
4	oust	1	insensitivity
4	outstretched	1	inseparable
4	over-abstraction	1	insincere
4	overgrown	1	insinuate
4	overkill	1	insolation
4	overshadow	1	instate
4	overt	1	instep
4	oxoacids	1	instill
4	padlock	1	insubstantial
4	palisade	1	insula
4	palooka	1	insular
4	pan	1	insurgency
4	panicked	1	intangible
4	pap	1	interconnectedness
4	papillae	1	interconnecting
4	paraffin	1	interconnection
4	pariah	1	interconversion
4	parmesan	1	interdisciplinary
4	parsec	1	intergenerational
4	parson	1	interglacial
4	pasty	1	interminable
4	peacekeeping	1	intermission
4	pending	1	intermural
4	perforation	1	internee

4	perfringens	1	internship
4	periwinkle	1	interpose
4	pertinacity	1	interposition
4	pestle	1	interrelate
4	petit	1	interrelatedness
4	phoebe	1	inters
4	phosphatidylinositol	1	interstellar
4	phototroph	1	interwoven
4	phototrophs	1	intoxication
4	piezoelectric	1	intoxications
4	pinecones	1	intramolecular
4	pipe	1	introspective
4	pique	1	inveterate
4	plesiosaur	1	inviabile
4	plough	1	invincibility
4	plump	1	invulnerable
4	pneumocystis	1	irate
4	poi	1	iridescent
4	polypoid	1	ironclad
4	polytheistic	1	ironsides
4	ponens	1	irradiated
4	porcelain	1	irrationally
4	porter	1	irrelevance
4	prawn	1	irreparable
4	predate	1	irreplaceable
4	premenstrual	1	irresolution
4	prentice	1	irrespective

4	preprophase	1	irreversibly
4	preschool	1	isocyanates
4	prickle	1	isogloss
4	pristine	1	isomerase
4	propanone	1	isomerases
4	propene	1	isoprene
4	protonated	1	isotretinoin
4	prowess	1	jackhammer
4	prudence	1	jackpot
4	pseudogenes	1	jadeite
4	psoriasis	1	jangle
4	ptarmigan	1	jap
4	pterosaur	1	jar
4	pygidium	1	jects
4	pylon	1	jeer
4	pyruvates	1	jellylike
4	quack	1	jezebel
4	quadrant	1	jigsaw
4	quadrillion	1	jilt
4	quintillion	1	jive
4	quo	1	jock
4	racket	1	jubilant
4	racy	1	judicious
4	radioed	1	junkyard
4	railing	1	junkyards
4	rainbowfish	1	juris
4	reassuringly	1	jurist

4	recta	1	kabbalists
4	redistribute	1	kai
4	reed	1	kanga
4	reel	1	kapok
4	refresher	1	karyotyping
4	refund	1	kelps
4	reincarnation	1	kemp
4	reinforcement	1	keratinized
4	relist	1	keratitis
4	remedial	1	keta
4	remiges	1	keypad
4	reminiscent	1	kiddo
4	renewal	1	kilopascals
4	mortgage	1	kimchi
4	repack	1	kina
4	repress	1	kinematical
4	reprise	1	kinesthetic
4	reproducible	1	kingly
4	reproductively	1	kingship
4	resale	1	kinkajou
4	resorption	1	kinship
4	resound	1	kirk
4	restatement	1	knick-knack
4	resupply	1	knitter
4	retainer	1	knoblike
4	retractable	1	kombu
4	rhizobium	1	kookaburra

4	ria	1	kowtow
4	ribcage	1	krater
4	ribozyme	1	krypton
4	rice-paddy	1	kung
4	ricin	1	kuru
4	rocket-launcher	1	kwh
4	rooky	1	labile
4	rosy	1	laburnum
4	rote	1	lacerate
4	rouse	1	lacunae
4	rout	1	lair
4	rube	1	laissez
4	ruddy	1	lakeside
4	ruff	1	lamella
4	saber	1	lamellae
4	sacrificial	1	lameness
4	sagebrush	1	lament
4	saltpeter	1	lamine
4	salvage	1	lampshade
4	sandcastle	1	landholding
4	sarcoplasm	1	landmine
4	sauerkraut	1	landward
4	savant	1	lanthanide
4	sawyer	1	lapis
4	scandal-sheet	1	largemouth
4	scat	1	largo
4	sciatic	1	lark

4	screech	1	laryngitis
4	scrubland	1	lasagna
4	seaboard	1	latrine
4	seafarer	1	laundromat
4	seagull	1	lavishness
4	sea-loch	1	lazuli
4	secluded	1	lazybones
4	sedan-chair	1	leaden
4	self-reproach	1	leastways
4	semiarid	1	lection
4	semifinalists	1	lector
4	sentiment	1	leggy
4	sentimental	1	legible
4	sentinel	1	legion
4	serene	1	legit
4	serum	1	leigh
4	serviceman	1	lemur
4	sheikh	1	leniency
4	shelly	1	lenticular
4	shred	1	leotard
4	shrew	1	leptin
4	sienna	1	letterbox
4	sigmoid	1	ley
4	signal	1	liaison
4	sims	1	lifeline
4	sire	1	lifesaving
4	skink	1	liftoff

4	smother	1	lime
4	snarl	1	limeade
4	snowbird	1	limey
4	snowboard	1	limo
4	snowfield	1	limulus
4	snug	1	lint
4	sojourner	1	lithograph
4	solace	1	livings
4	someplace	1	loathing
4	sourcebook	1	lodgings
4	souvenir	1	logograph
4	specular	1	loner
4	speedometer	1	longstanding
4	spencer	1	loofah
4	sphinx	1	lookup
4	spinneret	1	loot
4	splay	1	loth
4	splint	1	lotto
4	spokesperson	1	lotus-eater
4	sprain	1	lowdown
4	springtime	1	luciferase
4	squat-urn	1	lugworm
4	stag	1	luminescent
4	stairway	1	lune
4	stake	1	lupine
4	stearate	1	lute
4	steed	1	lyre-bird

4	steeple-chaser	1	lyses
4	sterling	1	lysosomal
4	stifle	1	macaque
4	still	1	machinist
4	stoke	1	mackerel
4	stonewall	1	mackintosh
4	storeroom	1	macromolecular
4	stratovolcano	1	macular
4	stricken	1	mad
4	strongman	1	madam
4	stubborn	1	madeira
4	stump	1	madras
4	sublimate	1	maharaja
4	submenu	1	mahatma
4	subsistence	1	mailer
4	subsystem	1	mailroom
4	subtilis	1	mainstay
4	subtopics	1	majordomo
4	suffuse	1	malar
4	sullen	1	maleness
4	superb	1	malformed
4	supermassive	1	malicious
4	superorder	1	mallard
4	superpose	1	man-hater
4	surrogate	1	manicotti
4	sushi	1	manifold
4	swish	1	manila

4	symposium	1	manmade
4	synodic	1	mannose
4	syringe	1	mansion
4	tailbone	1	mantelpiece
4	takings	1	manzanita
4	tarsus	1	mare
4	tattoo	1	marinade
4	taunt	1	marinara
4	tawny	1	markka
4	connector	1	marlin
4	teaberry	1	marten
4	tele	1	masse
4	teosinte	1	mastermind
4	tephra	1	mastitis
4	tetra	1	matchbox
4	thresh	1	maternally
4	thud	1	maternity
4	tickle	1	maxi
4	timid	1	meager
4	tis	1	measly
4	toby	1	meatloaf
4	torpid	1	mecca
4	torrent	1	meddle
4	torso	1	mediastinum
4	township	1	medusas
4	transient	1	megalomaniac
4	tricuspid	1	megastore

4	triiodide	1	mellow
4	trill	1	memento
4	trinity	1	memo
4	tritium	1	memorabilia
4	troll	1	menagerie
4	trolley	1	menthe
4	trowel	1	mercier
4	trundle	1	meritocratic
4	trypanosomiasis	1	mesentery
4	tsetse	1	mesh
4	tweed	1	mesmerize
4	twirl	1	mesopelagic
4	unforeseen	1	mesotrophic
4	unveil	1	mess
4	uprising	1	mestizo
4	uproot	1	metazoan
4	uteri	1	metheg
4	vaginalis	1	methylated
4	valentine	1	methylbenzene
4	vasoconstriction	1	metropolis
4	veg	1	mew
4	vena	1	miasma
4	vestry	1	mickey
4	viroid	1	micro
4	vis	1	microalgae
4	vitiligo	1	microarrays
4	vitro	1	microblog

4	waft	1	microcirculation
4	wail	1	microcontroller
4	wherewithal	1	microfarad
4	whirlpool	1	microliters
4	whitewater	1	micrometeorite
4	whorl	1	micron
4	widget	1	microspore
4	widower	1	microvillus
4	windbreak	1	midfield
4	woe	1	miens
4	womb	1	millet
4	woodrat	1	milliard
4	workload	1	millpond
4	wot	1	millstone
4	wraith	1	mimosa
4	yea	1	minable
4	yoga	1	minaret
4	zooid	1	minefield
4	zoospores	1	mingle
4	cargo-ship	1	ministerial
4	anti-fungal	1	minnow
3	abate	1	minuteman
3	acclivity	1	misalignment
3	acrylate	1	misapply
3	acrylic	1	misattributed
3	adjoin	1	misbehave
3	aforementioned	1	miscalled

3	afresh	1	miscellany
3	aggravate	1	misdoings
3	agribusiness	1	misfolded
3	airboat	1	mish-mash
3	airbus	1	misinform
3	albedo	1	mismanagement
3	allay	1	misname
3	aloof	1	misnomer
3	alveolar	1	mispronounces
3	amalgam	1	misquotation
3	amble	1	mistreat
3	amidst	1	misty
3	amphibole	1	moil
3	amphipods	1	molasses
3	amputation	1	moll
3	amyotrophic	1	molluscan
3	anabaena	1	monas
3	anathema	1	mongo
3	anisolet	1	mongoose
3	anon	1	mongrel
3	antifederalists	1	monoatomic
3	antigenic	1	monocotyledon
3	antimicrobial	1	monoculture
3	antiproton	1	monogenean
3	antiquark	1	monogeneans
3	antisense	1	monohybrids
3	apolipoprotein	1	monomeric

3	apparition	1	mononucleotide
3	appendicular	1	monophyletic
3	archosaur	1	monopolist
3	aristocracy	1	monotonous
3	arties	1	monstrous
3	ascomycete	1	moody
3	asterisk	1	moonrise
3	astern	1	moonscape
3	astray	1	moonset
3	astrobiology	1	moor
3	astrodome	1	moot
3	asylum-seeker	1	mora
3	auburn	1	morphogenesis
3	aunty	1	mortify
3	aurum	1	mortis
3	autoimmunity	1	motorway
3	autolysis	1	mournful
3	automaker	1	moustache
3	aversion	1	mouthpiece
3	awry	1	mouthwash
3	axiom	1	mouton
3	bactericide	1	muck
3	bacteriologist	1	muckraker
3	baffle	1	mucoid
3	bafflement	1	muezzin
3	bale	1	mukluk
3	bandit	1	mulattoes

3	banknote	1	mulch
3	banyan	1	mull
3	baptism	1	multidimensional
3	basolateral	1	multifaceted
3	bates	1	multilayer
3	bathypelagic	1	multimillion
3	batt	1	multiplayer
3	bayside	1	multiplex
3	beastly	1	multiscale
3	beget	1	multistate
3	benzoic	1	multitask
3	besiege	1	multitasking
3	bestow	1	multivalent
3	bf	1	mumble
3	bibliotheca	1	mummy
3	bicuspid	1	murky
3	bicuspid	1	musket
3	bifocal	1	muss
3	bingo	1	muster
3	biphenyls	1	mutable
3	bird	1	myasthenia
3	birdhouse	1	mycology
3	birdseed	1	mycotoxin
3	birth	1	myelinated
3	bisexual	1	myofilament
3	bismuth	1	myotonic
3	blackberry	1	myrtle

3	blackjack	1	naively
3	blackmail	1	namesake
3	blanche	1	nannie
3	blastula	1	nanotechnologists
3	blindfold	1	naphthoquinone
3	bloodshed	1	narcotic
3	boa	1	nark
3	boatlift	1	natal
3	bois	1	natively
3	bolivar	1	natty
3	bollock	1	naughty
3	bonsai	1	nauseous
3	booty	1	nemesis
3	borax	1	neodymium
3	boredom	1	neo-fascist
3	bottommost	1	neoliberalism
3	botulinum	1	neomycin
3	boulevard	1	neoprene
3	brachiate	1	nep
3	brainteaser	1	net
3	bravo	1	netball
3	breakaway	1	netlike
3	breech	1	neuronal
3	brevis	1	neurophysiology
3	bridegroom	1	neurosurgeon
3	brim	1	neuter
3	bro		

3	brocade	1	neve
3	broker	1	newscast
3	brusque	1	newsroom
3	buckskin	1	newsworthy
3	buckthorn	1	nexus
3	buff	1	nifty
3	bug	1	nightingale
3	bulbous	1	nightjar
3	burgh	1	nimble
3	bursa	1	nimbus
3	businessperson	1	nimby
3	buttercup	1	nineties
3	cadence	1	ninetieth
3	caiman	1	nine-to-five
3	calligraphy	1	niobium
3	campgrounds	1	nitrobenzene
3	campo	1	nitrocellulose
3	candela	1	nock
3	canvass	1	nonadjacent
3	carabineer	1	nonbonding
3	caramelizes	1	nonce
3	carbo	1	non-deviant
3	cardinalfish	1	nonessential
3	careen	1	nonfarm
3	cargo	1	nonflammable
3	carotene	1	nonionic
3	carwash	1	nonmagnetic

3	cash	1	nonmilitary
3	cassava	1	nonobvious
3	cassette	1	nonorganic
3	celiac	1	nonpresidential
3	celibate	1	nonprofits
3	centaur	1	nonreactive
3	centime	1	nonrenewal
3	centralize	1	nonresponse
3	cerebrospinal	1	nonscientist
3	cetacean	1	nonsensical
3	chance	1	nonspecialized
3	checkbook	1	nontaxable
3	chemoreceptor	1	nontechnical
3	chloric	1	nonvirulent
3	chomp	1	nonvisible
3	chylomicron	1	nonwhite
3	chylomicrons	1	nook
3	circumvent	1	northbound
3	cisco	1	northernmost
3	clamber	1	notepaper
3	clang	1	notoriety
3	clank	1	noxious
3	clavicle		
3	clearinghouse	1	nub
3	cleat	1	nucleobases
3	clinometer	1	nucleoli
3	coal	1	nucleoside

3	coca	1	nude
3	co-chair	1	numbersome
3	cochlear	1	numeri
3	cocktail	1	nunnery
3	coenzyme	1	oared
3	coffin	1	obfuscate
3	cog-wheel	1	oblivious
3	columbine	1	obnoxious
3	comeback	1	obstreperous
3	come-hither	1	oceangoing
3	condole	1	oceanology
3	conduit	1	ocotillo
3	constable	1	octane
3	coo	1	odious
3	copier	1	oilrig
3	coriander	1	oilseed
3	cortical	1	ollie
3	cote	1	omelet
3	countenance	1	omniscient
3	counterweight	1	onboard
3	coup	1	onlooker
3	courier	1	on-looker
3	coursework	1	ono
3	covert	1	onslaught
3	crawdad	1	opal
3	cream	1	ophthalmologist
3	cress	1	opulence

3	croissant	1	orc
3	crossbow	1	ordeal
3	crowbar	1	oregano
3	culminate	1	oriole
3	cup	1	orthopsychiatry
3	curator	1	orthorhombic
3	curio	1	osseous
3	custard	1	ostentation
3	cuttlebone	1	ostium
3	cyclase	1	oud
3	cymbal	1	ouds
3	cytomegalovirus	1	ouns
3	dab	1	out-bluff
3	das	1	outboard
3	dateline	1	outbound
3	deb	1	outcast
3	decapods	1	outdated
3	defame	1	outdid
3	defile	1	outdrew
3	delocalized	1	outflow
3	depolarize	1	outjump
3	depopulate	1	outlast
3	depute	1	outlies
3	derision	1	outpace
3	desegregate	1	outperform
3	diaphysis	1	outpouring
3	diatribe	1	oved

3	difficile	1	overactive
3	dilatation	1	overarching
3	dinnerware	1	overcast
3	disclaimer	1	overcharge
3	disclose	1	overcoat
3	discontinue	1	overcompensate
3	discourse	1	overconfident
3	dislodge	1	overeaten
3	dismember	1	overeater
3	disorganized	1	overeats
3	disqualification	1	over-embalm
3	dix	1	overexposed
3	dog	1	overgraze
3	dole	1	overgrazed
3	dope	1	overhunt
3	doss	1	overhyped
3	dote	1	overlain
3	downfall	1	overmastered
3	downwind	1	overpopulate
3	downy	1	overproduce
3	dragster	1	overrated
3	duet	1	overreliance
3	dysfunction	1	overridden
3	earthlight	1	overseen
3	eavesdrop	1	oversimplification
3	eccrine	1	oversize
3	ecotourism	1	overspent

3	eczema	1	overstretch
3	EEK	1	overtop
3	effrontery	1	overture
3	eft	1	overwork
3	electroencephalogram	1	overworked
3	elope	1	oviduct
3	emanate	1	oviparity
3	emerald	1	oxalate
3	emery	1	oxalic
3	endnote	1	oxidant
3	ennoble	1	oxidase
3	ensemble	1	oxidoreductase
3	entrench	1	oxyacid
3	entrust	1	pacifist
3	epicycle	1	paddleball
3	equivocate	1	page
3	erne	1	painstaking
3	escalate	1	pajama
3	escort	1	palatial
3	escribe	1	palaver
3	esophagitis	1	paleomagnetism
3	estrus	1	palimpsest
3	ethylamine	1	palmate
3	eugenol	1	palpably
3	euphoria	1	pamper
3	evince	1	panacea
3	evoke	1	panicky

3	exacerbate	1	pantaloons
3	expatriate	1	paperboard
3	expound	1	paperwork
3	expulsion	1	papillary
3	extensor	1	papulation
3	extenuate	1	paramilitary
3	eyewitness	1	paramount
3	facade	1	paranoia
3	fakir	1	parapet
3	fanwort	1	paraphernalia
3	farads	1	paraplegia
3	farmhouse	1	paraplegics
3	fascia	1	paratrooper
3	ferrous	1	parenchyma
3	fetid	1	parkland
3	fetish	1	parley
3	fide	1	parrotfish
3	fieldtrip	1	parsimony
3	finger	1	parsons
3	fink	1	participle
3	fireweed	1	partings
3	fiscal	1	partridge
3	fivefold	1	pasha
3	flaunt	1	passerby
3	flax	1	passible
3	fleck	1	pastoralist
3	fledge	1	patchwork

3	floodway	1	pathfinder
3	fluorite	1	patria
3	foe	1	patsy
3	formalin	1	patter
3	formyl	1	pavilion
3	forte	1	peafowl
3	fourfold	1	peaty
3	frankfurter	1	pectin
3	freehand	1	pectoralis
3	frivolity	1	peddle
3	frogfish	1	pediatrics
3	gage	1	peduncle
3	gallant	1	pegmatite
3	gallbladder	1	pen
3	gallows	1	penance
3	gametocyte	1	pendant
3	gantry	1	penknife
3	gaping	1	penmanship
3	gargoyle	1	pentoxide
3	garibaldi	1	peptidyl
3	gat	1	percale
3	gator	1	perf
3	geek	1	perforin
3	geophysicist	1	perfunctorily
3	geosynchronous	1	peritonitis
3	geotropism	1	perpend
3	gibbet	1	pertussis

3	girth	1	peruse
3	glockenspiel	1	perverse
3	glycerin	1	petabytes
3	gnome	1	petitioner
3	goad	1	pettiness
3	goon	1	phal
3	gorge	1	pharmacopoeia
3	gourmet	1	phenol
3	graben	1	philatelic
3	gran	1	philologist
3	grandeur	1	phony
3	graylag	1	phosphide
3	greenwood	1	phosphoenolpyruvate
3	greyhound	1	phosphoinositide
3	greyish	1	phosphorescence
3	grotesque	1	phosphorescent
3	gruesome	1	photodegrade
3	guesstimate	1	phytochemical
3	gular	1	pia
3	gun	1	piezo
3	halfpipe	1	piezoelectricity
3	handball	1	pigtail
3	handprint	1	pilothouse
3	hangman	1	pinion
3	hark	1	pink
3	harper	1	pinnacle
3	haughty	1	piper

3	haunch	1	piranha
3	headphone	1	piss-up
3	headwater	1	piteous
3	hearken	1	pix
3	heather	1	plait
3	hectometer	1	planarian
3	hematocrit	1	plantings
3	hendecagon	1	plantlet
3	hetero	1	plasmodia
3	hew	1	plasterboard
3	hex	1	playhouse
3	hexafluoride	1	playmate
3	hexose	1	plebeian
3	hic	1	plethora
3	hilltop	1	pliable
3	hoax	1	plover
3	hobbit	1	plunger
3	hoist	1	pocketbook
3	homeward	1	pogo
3	hominem	1	poignant
3	homocercal	1	poinsettia
3	horde	1	polaroid
3	horoscope	1	poliomyelitis
3	horrendous	1	polity
3	horst	1	polliwogs
3	hourglass	1	polyacrylamide
3	housebreaker	1	polycystic

3 hugger	1 polyether
3 hulk	1 polymorphic
3 hullo	1 polyposis
3 husk	1 polypropylene
3 hydrocephalus	1 polyspermy
3 hydroid	1 polyvinyl
3 hydroxylase	1 pompom
3 hyperactive	1 ponderosa
3 hyperlink	1 poodle
3 hypochondriac	1 poolroom
3 hyrax	1 poon
3 ibis	1 pope-burning
3 ident	1 popup
3 immaculate	1 porphyry
3 immunotherapy	1 porta
3 implore	1 portage
3 impound	1 portly
3 inadequately	1 portraitures
3 inanimate	1 postcolonial
3 incarnation	1 postman
3 incest	1 postmortem
3 incompressible	1 postorbital
3 incorrigible	1 postpartum
3 indebted	1 postsecondary
3 indenture	1 postsynaptic
3 indigent	1 postwar
3 indium	1 potency

3	indomitable	1	potentate
3	inexplicable	1	potentiometer
3	inflatable	1	potholder
3	inflow	1	pothole
3	innervate	1	potion
3	innumerable	1	potpourri
3	inquisitive	1	pout
3	intercalate	1	praseodymium
3	intercellular	1	precancerous
3	interconvert	1	precipitously
3	intercostal	1	preclude
3	interlocking	1	precocious
3	interplanetary	1	precolonial
3	intravenously	1	predefined
3	involuntarily	1	preeminent
3	irradiance	1	preen
3	irradiate	1	preimplantation
3	irradiation	1	premarital
3	isoleucine	1	premed
3	isopod	1	premenopausal
3	isthmus	1	premiere
3	jaguar	1	prepetition
3	jeep	1	preponderance
3	jetliner	1	prepress
3	jimsonweed	1	preschooler
3	jumpsuit	1	prescience
3	jute	1	presentative

3	kale	1	presentiment
3	kidnap	1	preset
3	killdeer	1	preteen
3	kiloliter	1	pretrial
3	kitty	1	pretzel
3	knobby	1	pricey
3	komodo	1	prick
3	kylie	1	primeval
3	lace	1	primo
3	lacrosse	1	procrastinator
3	lam	1	prodigal
3	lambda	1	profanity
3	landfall	1	profligate
3	lard	1	prognostic
3	leafcutter	1	pro-imperialist
3	leafhopper	1	promo
3	leek	1	promontory
3	lei	1	promulgate
3	leprosy	1	pronghorns
3	lev	1	proofreads
3	leveling	1	propionate
3	lifeform	1	propitious
3	lifeless	1	propter
3	lighten	1	propylene
3	lignite	1	proselytize
3	linden	1	prosy
3	lionfish	1	prothorax

3	lipopolysaccharide	1	provirus
3	lipstick	1	proxy
3	listeria	1	psychotherapist
3	lithographic	1	psyllid
3	lithography	1	pubertal
3	loan	1	pudgy
3	lodestone	1	pug
3	loge	1	pummeled
3	longevity	1	punchline
3	longwave	1	punitive
3	lopsided	1	purplish
3	lotion	1	pushdown
3	lull	1	putrescent
3	lulu	1	putrescine
3	lumberjack	1	puzzlement
3	macaroni	1	pyelonephritis
3	madly	1	pyogenes
3	madman	1	pyridoxine
3	magistrate	1	pyriformis
3	magnolia	1	pyro
3	mailbox	1	qi
3	mamma	1	quadrangle
3	mango	1	quadrillions
3	manic	1	quadrillionth
3	mannequin	1	quagmire
3	maracas	1	quasar
3	marginalize	1	quash

3	marmot	1	queer
3	marque	1	quell
3	mart	1	quiche
3	massacre	1	quintillions
3	massage	1	quintillionth
3	materialistic	1	quizzical
3	matte	1	quoll
3	mattress	1	qv
3	maximal	1	radiological
3	medina	1	radiology
3	melatonin	1	raff
3	meltdowns	1	rag
3	membranous	1	raingear
3	memorandum	1	raj
3	meow	1	rami
3	mercantile	1	rampart
3	metacarpal	1	ramshackle
3	metalworker	1	rancid
3	metameres	1	rangeland
3	mete	1	rangy
3	meth	1	ransom
3	microgravity	1	rant
3	microphotograph	1	ranunculus
3	microsatellite	1	rapist
3	microsatellites	1	rascal
3	midsection	1	rasp
3	midterm	1	raster

3	mineable	1	rave
3	miniscule	1	rawhide
3	mirror	1	rayon
3	miserably	1	readme
3	misrepresent	1	reallocate
3	mock	1	reallots
3	molarities	1	reappearance
3	monotonic	1	reapply
3	morbidity	1	reappoint
3	morel	1	reapportion
3	morphemic	1	rearms
3	mosasaur	1	reassign
3	motto	1	rebate
3	mug-shot	1	reboot
3	mullet	1	recaps
3	multicolored	1	recapture
3	multinational	1	re-christen
3	multistage	1	reclusive
3	multistep	1	recollect
3	mummified	1	recompense
3	mutagenic	1	reconfigure
3	mutilate	1	re-configure
3	nacre	1	reconnaissance
3	nanocrystals	1	reconnection
3	nanoparticles	1	reconstitute
3	nay	1	reconversion
3	neap	1	recrystallizing

3	nearshore	1	rectitude
3	neigh	1	rector
3	nemo	1	redbelly
3	nerd	1	redbreast
3	nettle	1	redcoat
3	newfound	1	redde
3	newness	1	redeliver
3	nobelium	1	redevelo
3	non-evangelical	1	redraft
3	non-existent	1	redux
3	nonflying	1	reelected
3	nongovernment	1	reenactment
3	nonhuman	1	reentry
3	nonpolluting	1	reexam
3	nonscientific	1	refi
3	nonvolatile	1	refillable
3	noose	1	refiner
3	nose	1	reformation
3	nous	1	refrozen
3	nurse	1	regale
3	nutration	1	regather
3	nutcracker	1	regiment
3	nutshell	1	registrant
3	oblong	1	registry
3	offender	1	rehash
3	officeholder	1	reheat
3	oleander	1	reinterpret

3	oligonucleotide	1	reinterpretation
3	ology	1	reintroduction
3	oncogenesis	1	reinvent
3	onstage	1	reinvestment
3	oops	1	re-kindle
3	opt	1	relabeled
3	organdy	1	relabeling
3	ornate	1	relapse
3	orthoclase	1	relaxant
3	osteoid	1	relight
3	osteon	1	reline
3	otherworldly	1	relish
3	outback	1	remand
3	outburst	1	remarriage
3	outfield	1	remiss
3	outing	1	remix
3	outpost	1	remodel
3	overage	1	rendezvous
3	overbearing	1	renin
3	overcrowd	1	renter
3	overcrowded	1	reparation
3	overjoyed	1	repayment
3	overproduction	1	repercussion
3	overrun	1	repertory
3	overwinter	1	repine
3	ovoviviparous	1	repo
3	owlet	1	reprogram

3	oxaloacetate	1	requited
3	oxygenase	1	rerun
3	painkiller	1	rese
3	pajamas	1	resold
3	papaya	1	restroom
3	parchment-seller	1	resupplies
3	parishioner	1	resurface
3	pastry	1	resuscitation
3	paunch	1	resynthesized
3	peaceable	1	rete
3	peacemaker	1	retinue
3	peal	1	retrace
3	pediatrician	1	retrospect
3	penalize	1	reuptake
3	pen-pal	1	revel
3	penumbral	1	reverberate
3	peptic	1	reverberation
3	peptidase	1	revile
3	perchlorate	1	revue
3	pericardium	1	rhapsody
3	peril	1	rhinestone
3	perpetrator	1	rhinoceroses
3	petrochemical	1	rhizobia
3	petty	1	rhodium
3	phalange	1	rhodopsin
3	pheasant	1	rhombohedra
3	photocopier	1	rhombohedral

3	photojournalist	1	ricing
3	photosystems	1	rickettsia
3	phototrophic	1	rig
3	picket	1	ringtones
3	piggyback	1	riverboat
3	pillow	1	riverhead
3	pillowcase	1	rly
3	pinecone	1	roach
3	pinnacle	1	roadblock
3	pinnately	1	roadmap
3	pinto	1	robe
3	pip-pip	1	roc
3	pit	1	rodeo
3	placid	1	roentgenogram
3	planetoid	1	rogue
3	plantlike	1	roil
3	plasmolysis	1	romp
3	plat	1	roomers
3	platonic	1	roomy
3	pleat	1	roro
3	plunder	1	rouge
3	pock	1	roulette
3	polka	1	rowboat
3	polystyrene	1	rowdy
3	polyunsaturated	1	ruefully
3	poo-poo	1	ruffle
3	porosity	1	ruination

3	port	1	rulebook
3	porthole	1	runaround
3	posit	1	ruthenium
3	post-audit	1	ruthlessly
3	postponement	1	sabal
3	potash	1	sachem
3	power-loom	1	sacral
3	precut	1	sadistic
3	predetermined	1	safflowers
3	prehensile	1	saffron
3	presynaptic	1	sago
3	pretense	1	salability
3	prima	1	salient
3	primase	1	saloonkeepers
3	primordial	1	samara
3	probiotic	1	sandaled
3	procure	1	sandbag
3	prodigious	1	sanddabs
3	prof	1	sanders
3	promethium	1	sandlot
3	proponent	1	sandstorm
3	prosimian	1	sans
3	prostrate	1	saponification
3	protocell	1	saprobic
3	prune	1	sassafras
3	pummel	1	saturnine
3	pungent	1	saucepan

3	puny	1	sawgrass
3	pupate	1	sawn
3	purse	1	scalawags
3	pygmy	1	scalloped
3	quasi-psychedelic	1	scam
3	quatrain	1	scandium
3	qui	1	scavenging
3	quicklime	1	schadenfreude
3	quicksilver	1	schemer
3	quiescence	1	schism
3	quine	1	schoolbook
3	quintessential	1	schoolfellow
3	quirk	1	schwa
3	ramjet	1	scoff
3	rea	1	scorpionfish
3	readout	1	scot
3	ream	1	scourge
3	reassurance	1	scowl
3	reattach	1	scram
3	rebirth	1	scrapbook
3	reclassify	1	scrapbooking
3	reconsideration	1	scrapie
3	recrystallize	1	scrapyard
3	rectal	1	scree
3	rectify	1	screenwriter
3	redirect	1	scrimmage
3	rediscovery	1	scrip

3	redshifted	1	scud
3	reductase	1	scull
3	reformulate	1	scullery
3	refreshment	1	scurvy
3	rei	1	scuttle
3	reinstate	1	scythe
3	reissue	1	seaborne
3	re-iterate	1	sealant
3	relic	1	sears
3	relinquish	1	seasick
3	remonstrate	1	seaward
3	remora	1	sedative
3	remorse	1	self-contemplation
3	rennin	1	self-efficacy
3	renounce	1	self-immolation
3	mob	1	selfishly
3	repaint	1	selfless
3	repopulate	1	semiannually
3	repression	1	semiconducting
3	reprieve	1	semifixed
3	reprocessing	1	semiliquid
3	reputable	1	semilunar
3	resilience	1	semiprofessional
3	resurgence	1	semisolid
3	retaliate	1	semitrailer
3	retic	1	semitransparent
3	retract	1	sentry

3	retribution	1	sepsis
3	retrotransposons	1	sequel
3	retry	1	serf
3	ribbit	1	serfdom
3	riboflavin	1	serial
3	ribonuclease	1	servant-maid
3	ribonucleotide	1	sextupled
3	rind	1	sg
3	riverbank	1	shabbiness
3	riverbed	1	shag
3	roadkill	1	shamefacedly
3	robes	1	shawl
3	rocklike	1	sheen
3	roe	1	sheepherding
3	roommate	1	sheetrock
3	rootlet	1	shenanigans
3	roster	1	shih
3	rotavirus	1	shipbuilder
3	roundtrip	1	shire
3	rubella	1	shirtwaist
3	rufous	1	shish
3	rune	1	shoat
3	rungs	1	shoddy
3	rye	1	shoe
3	salon	1	shopkeeper
3	salute	1	shorthorn
3	samosa	1	shotgun

3	sapphire	1	showdown
3	sarcolemma	1	showroom
3	satire	1	shrimplike
3	sawdust	1	shutdown
3	scaly	1	sib
3	scamper	1	sibilance
3	scape	1	side-chapel
3	sceptic	1	sideline
3	schistosomiasis	1	sideshow
3	schoolgirl	1	sidestroke
3	schoolwork	1	sidetrack
3	schoolyard	1	sidle
3	sclerenchyma	1	sightseeing
3	scrawny	1	signage
3	scrimp	1	signatory
3	sear	1	silage
3	searchlight	1	silverback
3	seaway	1	sinew
3	self-appraisal	1	sitar
3	self-delusion	1	sitter
3	sensuality	1	sixtieth
3	setback	1	sizzle
3	shad	1	skiff
3	sheriff	1	skimobile
3	shiitake	1	skincare
3	shipboard	1	skittle
3	shipyard	1	skulk

3	shrapnel	1	skullcap
3	sidestep	1	skyward
3	signer	1	slalom
3	silhouette	1	slander
3	silicone	1	slaveholding
3	silo	1	slaws
3	silverware	1	sleigh
3	simian	1	slingshot
3	sinewave	1	slog
3	singsong	1	slough
3	sinoatrial	1	slovenly
3	sinuses	1	sluice
3	sinusoid	1	slurp
3	situ	1	slushes
3	skirmish	1	slushy
3	slack	1	slyly
3	slaughterhouse	1	smatter
3	sleek	1	smirk
3	slouch	1	smolder
3	slue	1	smuggle
3	slum	1	snarl-up
3	sly	1	sneer
3	smock	1	snide
3	snowboarder	1	snip
3	snow-plough	1	snobbery
3	sober	1	snowman
3	sockeye	1	softeners

3	sod	1	sola
3	softwood	1	solder
3	soli	1	solicitude
3	solitude	1	soliloquy
3	somber	1	sombrero
3	songlike	1	someway
3	sop	1	sonny
3	sorghum	1	sorbet
3	soundproof	1	sordid
3	spacer	1	southerly
3	spangle	1	sou'wester
3	spasm	1	spacious
3	spectrogram	1	spank
3	spheroid	1	spasmodically
3	sphygmomanometer	1	spasticity
3	sportsmanship	1	spate
3	spud	1	spatula
3	squamous	1	spay
3	squirm	1	spearfishing
3	stab	1	spearmint
3	stall-holder	1	speckled
3	stammer	1	speedboat
3	standstill	1	spermatozoon
3	stash	1	sphalerite
3	steel	1	spidery
3	steno	1	spina
3	stepfather	1	splatter

3	stim	1	spliceosome
3	stitch-up	1	splintery
3	stocking-filler	1	splotch
3	stocking-top	1	spokeswoman
3	storeowner	1	sprig
3	strait	1	springboard
3	s-transferase	1	spunky
3	stratocumulus	1	spurn
3	streetcars	1	sputter
3	strobilation	1	sputum
3	subcompact	1	sPYmasters
3	subshell	1	squabble
3	substantive	1	squadron
3	subtly	1	squalid
3	subversive	1	squalor
3	succinate	1	squander
3	sulfite	1	squawk
3	sump	1	stagecoach
3	sumptuous	1	stairwell
3	sunbeam	1	stalemate
3	sunburst	1	stallion
3	sundew	1	stalwart
3	superball	1	standout
3	superbugs	1	staphylococcal
3	supereon	1	startup
3	superficially	1	statuary
3	superhuman	1	staunch

3	supernovae	1	stave
3	supplant	1	steamer
3	surcingle	1	stearic
3	swat	1	steelmaking
3	sweatshirt	1	steelworker
3	swerve	1	stellateing
3	swimsuit	1	stent
3	symphony	1	stepchildren
3	sync	1	stepwise
3	tad	1	stereoscopic
3	tagmata	1	stereotyping
3	tail-skid	1	steward
3	taint	1	stickler
3	talkie	1	stile
3	taut	1	stint
3	tautology	1	stockade
3	technetium	1	stockroom
3	telepathy	1	stoiles
3	tempeh	1	stolid
3	tenacious	1	stonebreaker
3	tenant	1	stonefish
3	tenet	1	stoneflies
3	tether	1	storied
3	tetherball	1	storyboard
3	tetrachloride	1	storyline
3	textbox	1	stovepipe
3	thaliana	1	stow

3	thallus	1	stowaway
3	thatch	1	strass
3	thermohaline	1	streptomycin
3	thicket	1	strongbox
3	three-putt	1	stronghold
3	throng	1	stupider
3	thru	1	sturgeon
3	thunderbolt	1	styli
3	thuringiensis	1	suave
3	tian	1	subbituminous
3	tice	1	subcompacts
3	tightrope	1	subcontinents
3	tillage	1	subcontract
3	timetable	1	subgenre
3	tine	1	subhead
3	tingle	1	maxims
3	tint	1	submetallic
3	tombstone	1	suborders
3	tong	1	sub-schema
3	torch	1	subscripted
3	toucan	1	subsection
3	tow	1	subservience
3	townspeople	1	subsonic
3	tradesman	1	substantia
3	trance	1	subsume
3	transfix	1	subtend
3	trek	1	subtests

3	trichinosis	1	subtlety
3	trifle	1	subvention
3	trilogy	1	suchlike
3	triode	1	suit
3	trioxide	1	suitor
3	trisphosphate	1	sumac
3	trombone	1	sunbelt
3	tsar	1	sunbird
3	tuition	1	sunder
3	turpentine	1	sunroof
3	tympanum	1	sunup
3	typhoid	1	superbug
3	typography	1	supercapacitor
3	uncontrollable	1	supercell
3	underscore	1	superclass
3	underway	1	supercool
3	underwood	1	superdeep
3	unwieldy	1	ego
3	upholstery	1	superjumbo
3	upland	1	supernatant
3	usher	1	supersaturation
3	vantage	1	supersonic
3	vat	1	supinate
3	velocipede	1	surly
3	velum	1	surmise
3	vent	1	surreptitiously
3	ventriloquist	1	suture

3	venue	1	suzerainty
3	verbatim	1	swab
3	veronica	1	swallowtail
3	vert	1	swami
3	viceroi	1	swatch
3	vid	1	swath
3	villain	1	sweepstake
3	vindicate	1	swindler
3	vintage	1	switchman
3	viridian	1	swordsman
3	visa	1	syllabus
3	vise	1	syncopated
3	vocation	1	syndicate
3	volley	1	tacky
3	vulcanization	1	tactile
3	wade	1	tai
3	waistband	1	tailfin
3	wan	1	taillights
3	wat	1	tallow
3	waterwheel	1	tam
3	weakling	1	tambura
3	weal	1	tammy
3	weatherman	1	tamp
3	whack	1	tamper
3	whim	1	tantalize
3	whine	1	tantrum
3	whipworm	1	tapa

3	whit	1	tapioca
3	whittle	1	tarmac
3	whiz	1	tarn
3	whopping	1	tavern
3	willie	1	taws
3	windblown	1	taxman
3	windfarm	1	teacup
3	windpipe	1	teapot
3	wizened	1	teat
3	wondrous	1	telemedicine
3	woodpecker	1	teleology
3	workday	1	tenement
3	wretch	1	tenfold
3	yam	1	tenor
3	yearling	1	tenuous
3	yum	1	terrarium
3	zap	1	terrier
3	zoroastrian	1	tesseract
3	fruit-bat	1	tetragonal
3	thank-offering	1	thalidomide
3	railway-wagon	1	thallium
2	abacus	1	thecae
2	abase	1	thein
2	ablation	1	thiamin
2	abrogate	1	thiamine
2	abut	1	thickset
2	accede	1	thimble

2	accolade	1	thistle
2	accordion	1	thither
2	accursed	1	thong
2	acetaminophen	1	thorp
2	acetoacetic	1	threefold
2	acrid	1	thrift
2	acrostic	1	thromboplastin
2	actinium	1	thrombosis
2	admonish	1	thwart
2	adrenocorticotropic	1	thyroxin
2	advection	1	thymself
2	aeruginosa	1	tier
2	aforesaid	1	tiff
2	aft	1	tiller
2	agaric	1	timberland
2	agronomic	1	timeliness
2	airfield	1	tinea
2	airmail	1	tined
2	airspace	1	tingly
2	airspeed	1	tinkle
2	airwaves	1	tipis
2	akin	1	tithe
2	albatross	1	titian
2	albumin	1	tocopherol
2	aliphatic	1	tog
2	allegation	1	toggle
2	allosteric	1	toile

2	alphonso	1	tonto
2	amoxicillin	1	topo
2	amphitheater	1	tori
2	anarchy	1	torpedo
2	android	1	tort
2	anew	1	totipotent
2	angiogenesis	1	tourniquet
2	antibaryons	1	towboats
2	anticonvulsant	1	towhees
2	antimalarial	1	trabecular
2	antiporter	1	transglutaminase
2	anyplace	1	transhumance
2	apache	1	transliterate
2	aphasic	1	trashcan
2	aplasia	1	travers
2	apocryphal	1	treble
2	apostle	1	tree-creeper
2	apperception	1	treetop
2	appraise	1	trespass
2	aptitude	1	triangulate
2	aquamarine	1	tribespeople
2	archaebacterial	1	tricarboxylic
2	archbishop	1	trichloroethylene
2	archery	1	triclinic
2	areal	1	tricolored
2	areole	1	triiodothyronine
2	argentum	1	trike

2	aria	1	tringle
2	arteriosclerosis	1	trinitrotoluene
2	artichoke	1	trinket
2	articulation	1	trinucleotide
2	ascariasis	1	triplex
2	astrocyte	1	triplicate
2	astute	1	triploblastic
2	atlatl	1	tripod
2	atman	1	triticale
2	atoll	1	trivet
2	atrocious	1	trochee
2	attest	1	troubleshoot
2	audit	1	trouble-shooter
2	audition	1	truce
2	auld	1	trump
2	auspices	1	tuberosity
2	autocrat	1	tumbleweeds
2	autocratic	1	tunic
2	autoinfection	1	turbidity
2	autopsy	1	turbo-alternator
2	avow	1	turbofan
2	awash	1	turducken
2	azalea	1	tut
2	baccalaureate	1	twain
2	backcountry	1	tweet
2	backfire	1	twill
2	backflow	1	twine

2	backseat	1	unbridled
2	backside	1	underdog
2	backstage	1	undergrad
2	bacteriorhodopsin	1	underprivileged
2	bailor	1	underwear
2	baleful	1	undying
2	balk	1	unheralded
2	ballerina	1	unicorn
2	ballistic	1	unilateral
2	balsam	1	unis
2	bandana	1	unkempt
2	bane	1	unpalatable
2	bantam	1	unpasteurized
2	banzai	1	unperturbed
2	barbershop	1	unruly
2	barleycorn	1	unstrung
2	barney	1	unsung
2	baroque	1	upbraid
2	barrio	1	upbringing
2	baseboard	1	upkeep
2	basketful	1	upperclassmen
2	bastille	1	upriver
2	bathyal	1	uproar
2	bawdy	1	upscale
2	bazaar	1	upturn
2	beadle	1	urate
2	beany	1	uric

2	bedlam	1	utmost
2	beehive	1	utopian
2	befit	1	valent
2	belfry	1	vanillin
2	belittle	1	vanquish
2	belle	1	varlet
2	beluga	1	vasculature
2	bequeath	1	vaudeville
2	berkelium	1	veer
2	betel	1	vehemence
2	betoken	1	venae
2	bib	1	venality
2	bicker	1	veneration
2	biconcave	1	vengeance
2	bicultural	1	vengeful
2	bier	1	verbiage
2	bine	1	vernacular
2	bioscience	1	vestibular
2	biotechnologists	1	vex
2	bipyramid	1	vey
2	birdie	1	viand
2	birdlife	1	vicissitude
2	birdsong	1	victual
2	bireme	1	villa
2	birthdate	1	vineyard
2	bitterroot	1	visage
2	bittersweet	1	vison

2	biuret	1	vita
2	blackhead	1	vitriol
2	blackish	1	vodka
2	blaspheme	1	voluminous
2	blasphemy	1	wallow
2	blithe	1	wand
2	bloodedness	1	warden
2	bloodhound	1	warlike
2	bloodletting	1	warp
2	bloodthirsty	1	washi
2	blotch	1	wassail
2	blowdown	1	watchman
2	blowhole	1	watercolor
2	blowout	1	watercourse
2	bluestone	1	waterfront
2	bluffs	1	waterhole
2	boardinghouse	1	waterpower
2	boardwalk	1	weathercock
2	bobsled	1	webmaster
2	bobtail	1	weevil
2	bodybuilder	1	wellhead
2	bog	1	wend
2	boggle	1	wharf
2	bolus	1	whimsical
2	bona	1	whippersnapper
2	bondholder	1	whirlwind
2	bong	1	whirr

2	bongo	1	whitefly
2	bonk	1	whiteout
2	boob	1	whitetip
2	bookkeeping	1	whizzbang
2	bookseller	1	whoa
2	bookshelves	1	whomever
2	borer	1	wiener
2	bosom	1	wigwam
2	bourgeois	1	wildland
2	bourgeoisie	1	wile
2	bouzouki	1	wily
2	boxy	1	wince
2	brahma	1	windfall
2	brainer	1	windowpane
2	brat	1	windscreen-wiper
2	brawn	1	windshield
2	bray	1	windsurfer
2	breadbasket	1	windup
2	breastbone	1	wireframe
2	brickyard	1	wishbone
2	bridge	1	wizard
2	brig	1	woo
2	brindle	1	woodcut
2	brio	1	woodwind
2	bristlecone	1	wordplay
2	bristletails	1	workbench
2	bronzy	1	workhorse

2	broomrape	1	workmanship
2	bubo	1	workshare
2	bucker	1	worktop
2	bulbourethral	1	workweek
2	bunkhouse	1	world-beater
2	burgeoning	1	wreath
2	burgundy	1	wrench
2	bursa	1	wristwatch
2	businesspeople	1	writhe
2	butadiene	1	xenon
2	buttermilk	1	xylophone
2	bygone	1	xylose
2	byway	1	yak
2	cacao	1	yawn
2	cackle	1	yea
2	caeca	1	yearn
2	caecum	1	yellowhammer
2	calabash	1	yew
2	calcified	1	yip
2	calicle	1	yon
2	californium	1	yonder
2	callas	1	yuck
2	callosum	1	yurt
2	callus	1	zag
2	candlestick	1	zenial
2	canebrake	1	zeppelin
2	canid	1	zines

2 cantaloupe

2 capitulate

1 zoonosis

1 super-ego

K-12 Academic Word List

The Academic Word List, displayed in Table 19, has 461 lemmas and is divided into two sub-lists of higher and lower frequency words. With regard to the developing of academic and STEM-related words, I took a semantic perspective toward word inclusion in the lists (Flowerdew, 2004). In developing the academic list, words that are common among three content areas out of the four (math, science, social studies, and language arts) are included on the list.

Table 19. K-12 Academic Word List.

Higher Freq.	Lower Freq.
area	converse
chapter	convince
data	exclude
factor	exclusive
vary	finite
function	infinite
volume	mutual
proportion	community
ratio	register
coordinate	valid
evaluate	revolution
formula	credit
formulate	revise
negate	context
negative	reside

rational	resident
positive	drama
similar	release
similarity	series
similarly	hypothesis
equivalent	occupy
dimension	instruct
dimensional	instruction
method	exhibit
methodology	network
identify	perspective
identifying	insert
identity	participate
analyze	feature
analysis	underlie
sequence	schedule
display	approach
prime	professional
select	instance
selection	format
survey	successor
strategy	successive
team	shift
mental	unique
mentally	theme
range	concentrate
outcome	labor

substitute	contrast
substitution	adjust
label	react
concept	reaction
symbol	hypothesize
symbolic	periodic
predict	cycle
prediction	infer
correspond	inference
corresponding	evident
involve	adapt
involving	adaption
approximate	evolution
approximation	evolutionary
approximately	globe
random	global
randomly	core
convert	projection
conversion	giant
converting	potential
item	dominate
compute	dominant
computation	impact
computer	phase
computing	expose
mode	exposure
section	stable

justify	unstable
justification	internal
challenge	displace
distribute	displacement
distribution	detect
distributive	device
parallel	contribute
error	contribution
appropriate	transmit
source	transmission
locate	component
location	undergo
create	tense
creation	phenomenon
project	phenomena
grade	neutral
grader	append
rotate	consequent
image	apparent
link	suspend
design	suspension
construct	integrate
construction	integration
statistics	modify
statistical	mechanism
conclude	enormous
conclusion	distinct

odd	regulate
input	derive
define	adjustment
definition	rigid
undefined	dispose
indicate	disposal
constant	collapse
plus	trigger
transform	parameter
transformation	virtual
output	issue
region	incline
investigate	prior
investigation	dynamic
occur	highlight
goal	passive
interval	manipulate
purchase	decade
adult	acquire
process	acquisition
compound	accumulate
respond	margin
response	recover
complement	modifier
complementary	draft
chart	tension
domain	quote

previous	quotation
target	tradition
remove	traditional
period	assignment
illustrate	fragment
illustration	imagery
supplement	standardize
supplementary	thesis
annual	version
objective	aspect
spreadsheet	civil
theory	perception
theoretical	intelligence
theorize	legal
maximize	illegal
maximum	confer
summary	conference
final	convene
job	convention
require	attitude
affect	automate
bias	automatic
unbiased	abandon
tape	submit
radical	submission
technology	military
capacity	mature

available	panel
eliminate	minor
elimination	foundation
assume	unify
principal	ignorance
logic	ignorant
logical	assist
trace	assistant
sphere	monitor
interpret	media
interpretation	mediate
topic	medical
simulate	policy
invest	retain
investment	sustain
option	sufficient
expand	welfare
fee	vision
sector	violate
income	via
principle	utilize
trend	status
accurate	qualitative
accuracy	notion
route	norm
compatible	motive
generate	inspect

generation	insight
precise	integral
precision	integrity
terminate	deduce
minimum	decline
focus	crucial
reverse	allocate
proceed	analogy
procedure	arbitrary
commission	assemble
research	bond
element	brief
layer	bulk
consume	capable
category	fluctuate
portion	hierarchy
code	debate
technique	compile
index	compensate
vehicle	deviate
consist	diminish
site	offset
resource	ongoing
physical	invoke
partner	paradigm
energy	subsidy
initial	revenue

isolate	restrict
specific	temporary
journal	enhance
visual	ethic
visualize	ethnic
overlap	exceed
normal	explicit
complex	implicit
task	exploit
demonstrate	exploitation
medium	extract
equip	facilitate
identical	devote
alter	federal
alternate	ministry
voluntary	prospect
volunteer	protocol
transport	pursue
transportation	orient
conduct	restore
assign	restrain
obtain	practitioner
fund	pose
fundamental	nuclear
maintain	inhibit
documentary	inhibition
	denote

K-12 STEM-related Word Lists

The STEM-related word lists, shown in Tables 20 and 21, are composed of two sub-lists of Math (184 lemmas) and Science (228 lemmas). With respect to the STEM-related list, words that are domain specific are included on the list; in other words, all words appearing only in one content area (math or science) but not in others are included in the STEM-related word list. In addition, each sub-list is divided into two sections of higher and lower frequency words.

Table 20. K-12 STEM-related words: Math.

Higher Freq.	Lower Freq.
equate	arithmetic
equation	cumulative
graph	lateral
graphic	tank
fraction	associative
fractional	assess
triangle	assessment
triangular	adjacent
percent	finite
percentage	infinite
decimal	infinitely
factorization	diagram
math	altitude
mathematical	angle
mathematician	arc
meter	arithmetic sequence

centimeter
kilometer
metric
millimeter
estimate
estimation
rectangle
rectangular
subtract
subtraction
integer
variable
variation
sum
algebra
algebraic
height
cube
cubic
perimeter
denominator
exponent
exponential
plot
prism
linear
nonlinear
score

array
asymptote
average
balance
base
binomial
bisect
cardinal number
central angle
certainty
circle
circumcenter
coefficient
collinear
combination
compass
congruent
conjecture
converse
corner
opposites
operation
ordinate
permutation
pictograph
pie graph
place value
polyhedron

geometry	postulate
geometric	probability
tile	protractor
congruous	quadrant
congruence	quantity
polygon	quarter
vertex	radian
quotient	remainder
median	resultant
intercept	rhombus
axis	root
diameter	scalar
segment	scale
cylinder	secant
polynomial	semicircle
parallelogram	sine
notate	slope
inequalities	solution
pyramid	square
numerator	tessellation
radius	trinomial
circumference	vector
marble	x-axis
divisor	x-intercept
divisible	y-axis
vertical	y-intercept
ounce	decagon
symmetry	degree

quadratic	determinant
rotate	diagonal
rotation	dilation
rotational	dime
cone	direct variation
inverse	discriminant
trapezoid	dividend
reciprocal	dodecahedron
quadrilateral	ellipse
perpendicular	equals
sketch	event
discount	factorial
spinner	figure
grid	frequency
horizontal	histogram
acute	inequality
obtuse	matrix
parenthesis	mode
hypotenuse	monomial
commutative	scatterplot

Table 21. K-12 STEM-related words: Science.

Higher Freq.	Lower Freq.
cell	balloon
organism	sperm
atom	beaker
atomic	equator
chemistry	sodium
chemical	mercury
chemicals	seismic
volcano	beach
volcanic	magnitude
carbon	algae
molecule	aluminum
oxygen	respire
atmosphere	respiration
planet	organic
environment	polar
environmental	hemisphere
fossil	reptile
dense	radioactive
density	groundwater
solar	helium
sediment	wavelength
sedimentary	thermometer
species	lithosphere
electron	drift
acid	spectrum
acidic	marine

gene	contour
genetic	metamorphic
gravity	vascular
gravitational	lever
continent	rocket
continental	era
tissue	ozone
muscle	buoy
erode	buoyant
erosion	hurricane
physical	elevate
climate	elevation
ecosystem	embryo
bacterium	jar
bacteria	mirror
trait	injure
hydrogen	injury
ion	metamorphosis
ionic	biotic
chromosome	abiotic
dioxide	producer
nucleus	consumer
fuel	herbivore
laboratory	carnivore
lab	omnivore
fluid	scavenger
radiate	decomposer
radiation	food web

galaxy	energy pyramid
crust	niche
protein	limiting factor
tectonic	carrying capacity
allele	biome
magnet	estuary
magnetic	wetland
electromagnetic	eukaryote
magma	prokaryote
plastic	equilibrium
zone	osmosis
erupt	diffusion
eruption	endocytosis
friction	exocytosis
nerve	organ system
nervous	phenotype
lens	genotype
nitrogen	dominant allele
telescope	recessive allele
pollute	evolution
pollution	natural selection
deposit	adaptation
deposition	artificial selection
geology	delta
geologic	astrophysics
acceleration	biochemistry
accelerate	biology
offspring	botany

precipitate	Bunsen burner
nutrient	burette
nutrition	funnel
glacier	genetics
orbit	geophysics
mammal	glassware
velocity	graduated cylinder
proton	herpetology
dissolve	ichthyology
mantle	immunology
absorb	magnetism
photosynthesis	mass
crystal	matter
fungus	measure
fungi	meteorologist
lava	meteorology
astronomy	microbiologist
astronomer	microbiology
microscope	mineral
vapor	mineralogy
vaporize	ornithology
neutron	quantum
membrane	scale
thermal	science
humid	scientist
humidity	seismology
igneous	temperature
tropic	test tube

tropical	theory
nuclear	zoology
kinetic	experiment
latitude	extrapolation

Essential Word List (EWL) for K-12 ELLs

The Essential Word List is composed of three sub-lists, presented in Tables 22, 23, and 24: K1 (first 1,000 most frequent words), K2 (second 1,000 most frequent words), and academic words. Each sub-list has two levels of higher and lower frequency words.

Table 22. Essential Word List: K1.

Freq.	Word	Freq.	Word
775747	the	2489	separate
378097	be	2486	basic
361295	of	2481	division
297511	a	2480	random
247446	and	2478	degree
243373	to	2478	rational
185046	in	2475	carry
118803	way	2467	sometime
107940	you	2466	vocabulary
105481	that	2465	require
73894	have	2463	social-service
63724	this	2462	inside

63014	use	2462	odd-job
62504	they	2461	sing-along
61359	or	2457	conclude
59402	we	2447	mid-late
56463	by	2447	wind
55294	as	2445	liquid
55130	on	2445	stamping-ground
50510	can	2443	cover
49647	with	2431	protect
47797	what	2429	tennis-court
45749	from	2421	history
44462	home	2417	design
41166	at	2412	secretary-general
41010	how	2410	re-form
35937	he	2407	vertical
35336	not	2405	ball
33120	will	2395	bird
32618	one	2394	quadratic
31693	if	2387	bacterium
30657	each	2385	across
29789	example	2384	teach
28771	equate	2382	horizon
27267	find	2373	reach
26131	make	2360	enter
25125	when	2359	inverse
24169	point	2352	polynomial
23958	which	2350	discuss

22929	other	2349	individual
22798	more	2342	text
22668	do	2340	muscle
22455	about	2336	introduction
22401	all	2332	specific
20163	so	2331	technology
18698	these	2322	purple-blue
18504	there	2316	mark
18461	many	2313	major
18412	differ	2313	room-key
18356	write	2312	bond
18231	nobody	2304	record
18185	time	2298	little
17947	water	2294	rotate
17807	value	2293	two-pound
17728	form	2287	sure
17561	line	2286	independence
17458	figure	2285	pay
17171	than	2276	presidency
17041	cell	2272	video
16934	would	2269	white
16855	function	2265	woman
16464	answer	2263	consist
16396	but	2261	axis
16323	may	2260	outgoing
16069	solve	2252	tell
15915	energy	2250	interval

15882	also	2244	easy
15855	into	2239	pseudo-operation
15664	first	2237	friend
15631	graph	2236	enough
15553	see	2236	exact
15519	like	2234	characterize
15402	problem	2230	something
15091	it	2227	west
15085	out	2226	war
15082	below	2221	temple-complex
14445	some	2209	balance
14414	up	2205	today
14344	give	2204	over-correct
13714	follow	2197	indicate
13713	between	2197	lonely-heart
13626	angle	2196	metal
13444	same	2192	letter
13311	area	2185	self-interest
12884	need	2185	variety
12829	people	2180	sex-role
12772	work	2179	environment
12660	numbers	2178	chromosome
12377	state	2175	symbol
12258	table	2174	intercept
11751	take	2165	out-flow
11737	system	2165	sense-organ
11557	get	2163	evolution

11538	change	2162	cross
11347	add	2154	vote
11186	look	2153	decide
11183	plant	2150	feel
11122	because	2149	life-choice
11020	help	2148	build
10970	year	2148	motion-picture
10913	most	2139	pass
10829	left	2138	warm
10778	quarter	2133	share
10609	both	2127	light-curve
10568	data	2127	until
10439	call	2122	building
10299	where	2122	soil
10151	she	2122	station-building
9899	show	2117	release
9885	explain	2116	three-month
9874	why	2115	re-appear
9872	lesson	2110	micro-electric
9613	such	2103	green
9590	through	2102	behave
9515	right	2096	self-control
9487	move	2093	evidence
9487	new	2088	member
9354	relate	2085	approximate
9354	order	2076	drive
9297	image	2076	lose

9277	only	2072	big-wig
9258	view	2071	sea-wind
9238	part	2069	magnet
9214	super-power	2067	lifter
9153	no	2065	over-balance
8935	simple	2063	sell
8839	term	2049	am
8720	could	2048	primary
8705	now	2031	hydrogen
8647	word	2029	atmosphere
8622	include	2028	gravity
8572	good	2027	heart
8537	unit	2027	position
8418	open	2018	transport
8387	earth	2008	normal
8357	live	2003	dense
8273	set	2001	super-store
8270	any	1999	ice
8208	self-review	1997	integer
8175	over	1996	fact
8143	read	1991	egg
8125	represent	1990	receive
8051	factor	1985	plate
7927	describe	1978	hear
7829	day	1976	membrane
7821	force	1973	proportion
7758	square	1958	eye

7660	determine	1955	round
7655	two-step	1951	river
7645	place	1950	run
7602	per	1940	chart
7533	group	1940	exist
7520	after	1931	card
7493	direct	1931	flower
7428	know	1929	perform
7394	great	1928	discover
7388	grow	1928	reflect
7367	cause	1927	meaningful
7366	much	1925	quick
7330	chapter	1921	hard
7318	length	1917	vertex
7311	who	1915	source-text
7296	probable	1912	pie-chart
7272	divide	1912	row
7247	high	1908	south-westerly
7170	test	1907	meter
7129	body	1906	never
7019	result	1906	rise
6984	life	1895	suppose
6965	must	1893	plate-layer
6948	equal	1892	self-seed
6943	let	1883	spend
6912	triangle	1876	fossil
6894	side	1875	physical

6836	org	1873	particular
6835	draw	1869	t-short
6785	common	1868	middle
6752	still-large	1865	meet
6735	very	1864	planet
6716	food	1861	believe
6685	another	1857	tissue
6657	learn	1853	weather
6634	world	1851	widen
6618	real	1849	algebra
6450	law	1845	collect
6429	here	1845	house-hold
6413	express	1845	six-year-old
6375	down	1840	bar
6375	multiply	1837	substitute
6370	atom	1828	life-history
6362	small-animal	1823	instead
6308	process	1822	meaning
6249	compare	1822	think
6227	student	1819	lot
6129	object	1818	decrease
6126	importance	1815	translate
6103	long	1810	face
6093	measure	1810	micro-climate
6085	sub-process	1810	micro-fossil
6081	distance	1798	parent
6073	just	1796	count

6060	formula	1795	present
6049	product	1792	multiplication
5920	name	1791	author
5859	above	1781	deviate
5795	identified	1778	female
5790	amount	1777	previous
5757	population	1775	re-write
5738	should	1767	non-local
5686	human	1764	extend
5650	temperature	1763	care
5647	scientific	1763	game
5635	contain	1763	room
5630	light	1763	block
5629	even	1762	pre-condition
5624	total	1762	short-fall
5623	rate	1761	mix
5598	theory	1760	play
5592	complete	1758	near
5572	next	1752	nerve
5553	standard	1751	non-national
5536	practice	1750	focus
5528	increase	1747	clear
5513	occur	1747	geometry
5454	personalize	1745	repeat
5440	define	1740	bring
5428	since	1724	health
5388	means	1724	necessitate

5384	thing	1723	research
5353	found	1719	prose-character
5303	end	1718	seem
5300	become	1708	though
5291	gas	1708	waste
5280	re-found	1705	die
5230	surface	1705	non-male
5218	start	1704	segment
5197	fraction	1695	against
5189	role-model	1689	young
5188	base	1680	re-buy
5186	chemical	1676	culture
5167	mean	1673	potential
5076	during	1672	bone
5072	center	1672	organize
5039	hour	1670	walk
5037	go	1666	obtain
5023	render	1665	prove
5018	explore	1663	politic
5005	circle	1655	full
4982	less	1654	spread
4981	token	1651	statistic
4948	blood	1650	stop
4947	type	1650	strong
			octave-
4930	begin	1647	combination
4923	direction	1646	correspond

4911	around	1646	significance
4907	therefore	1645	machine
4891	small-scale	1642	run-up
4883	organic	1641	near-synonym
4877	want	1640	absolute
4876	domain	1639	east
4849	social-science	1637	expect
4838	self-concept	1625	sense-unit
4825	gene	1624	outside
4811	cost	1623	label
4772	act	1623	radius
4767	produce	1622	re-connect
4760	mass-murderer	1621	top-to-bottom
4745	non-event	1616	over-fill
4742	slope	1615	definition
4733	foot	1615	over-exercise
4692	electron	1615	strategic
4683	sub-section	1613	convert
4665	sub-rule	1604	skin
4663	summarize	1599	advance
4650	however	1597	black
4647	check	1594	locate
4605	government	1594	step-mother
4605	watch	1593	multiple-unit
4585	similar	1593	stage
4567	before	1592	boy
4548	create	1590	although

4538	understand	1587	among
4536	click	1584	concentrate
4511	happen	1577	treat
4504	molecule	1572	cut
4503	low	1571	send
4498	man	1568	semi-double
4450	together	1562	tide-mark
4438	ratio	1559	quantify
4431	well	1557	criticize
4423	re-heat	1556	biology
4418	hydro-carbon	1556	brain
4402	element	1549	grade
4357	calculate	1543	elect
4332	pair	1542	evolve
4315	inequality	1542	side-chain
4314	back	1539	essence
4314	tie-back	1538	night
4270	true	1537	purpose
4255	sub-sample	1536	solar
4252	ask	1535	insect
4250	re-calculate	1534	generate
4249	apply	1533	digest
4242	far	1533	equivalence
4238	volume	1531	median
4230	speed	1530	already
4220	scale	1530	bill
4218	idea	1527	language

4207	mile	1525	dioxide
4207	public	1521	turn
4181	trust-me	1520	pollute
4157	land	1519	oil-spill
4157	often	1518	due
4151	list	1516	mineral
4140	type-case	1514	cold-store
4115	semi-negative	1513	construct
4111	structure	1509	nucleus
4091	sin	1509	slave-girl
4081	wrist	1506	two-leg
4067	subject	1502	location
4053	compound	1496	tool
4050	re-consider	1487	safe
4049	three-inch	1486	rest
4045	box	1484	dimension
4034	root	1484	say
4028	resource	1483	cup
4027	cos	1482	replace
4024	twin-car	1478	efficiency
4020	material	1475	stem
4008	species	1474	ever
4007	subject-matter	1474	pdf
4004	level	1471	score
3989	rock	1468	polar
3963	sun-worshipper	1467	trade
3950	able	1467	serve

3941	possible-world	1463	coefficient
3936	original	1460	perpendicular
3920	always	1452	thousand
3913	page	1447	skill
3910	class	1441	survey
3882	distribution	1440	talk
3869	keep	1437	removable
3831	every	1434	bear
3823	without	1432	dog
3815	study	1426	component
3801	co-worker	1420	contrast
3798	red	1418	display
3783	charge	1413	earthquake
3780	those	1408	ago
3777	choose	1392	accord
3770	human-being	1388	ray
3739	ocean	1388	return
3706	thought- experiment	1384	deep
3702	close	1384	outline
3690	early	1379	resist
3685	positive	1378	asymptote
3683	half	1376	virus
3668	property-owner	1374	thus
3660	under	1372	socialism
3659	analyze	1371	succeed
3656	develop	1370	fit
3648	involve	1364	recall

3633	height	1361	party
3628	while	1358	tone-poem
3616	few	1357	nature
3611	eat	1354	available
3577	plot	1354	leave
3559	particle	1352	tax
3558	space	1351	thought-content
3548	re-unit	1350	typical
3520	reason	1344	column
3488	exponent	1340	entire
3484	provide	1339	team
3477	off	1338	super-company
3474	continue	1337	front
3457	ordinate	1333	death
3453	try	1333	finality
3436	picture	1333	shall
3434	respond	1330	pseudo-objective
3431	notice	1330	raise
3422	allow	1330	respiration
3394	re-charge	1329	citizen
3388	decimate	1328	stay
3377	activity	1325	match
3363	guide	1324	engineer
3353	again	1322	vary
3350	plan	1320	win
3311	put	1318	generalize
3302	limit	1313	lake

3283	refer	1310	parabola
3253	diagram	1309	continent
3245	zero	1308	review-article
3243	lead	1308	super-computer
3226	parallel	1307	retro-fit
3197	foundation	1305	throughout
3177	sound	1304	branch
3174	effect	1304	polygon
3171	last	1304	toward
3162	plane	1301	photo-pass
3138	average	1300	fungus
3132	press	1293	fly
3111	mini-city	1291	self-reflection
3110	member-country	1290	notable
3104	affect	1289	derive
3094	linear	1288	topic-shift
3088	note	1287	large
3078	too	1285	almost
3071	correct	1285	item
3071	property	1285	trouser-front
3069	pattern	1282	source
3065	size-class	1281	run-past
3045	depend	1281	tall
3044	tale	1277	rain
3041	usual	1276	dissolve
3037	song-cycle	1276	link
3036	color	1275	account

3030	story	1274	associate
3012	leaf	1269	mammal
3010	support	1266	short-change
3005	acid	1264	agree
2994	small	1264	wood
2989	frequency	1261	photo
2983	break	1261	yes
2982	select	1255	sexuality
2977	within	1248	matrix
2976	natural	1243	electromagnet
2968	house	1241	combine
2967	still-room	1240	log
2965	sub-region	1240	recognition
2964	main	1238	course
2963	protein	1236	extreme
2956	best-seller	1235	tail
2949	remember	1233	saw-mill
2924	control	1229	wall
2916	oppose	1228	fire
2915	connect	1228	wide
2908	take-away	1226	non-essential
2906	least	1224	accelerate
2902	money-winner	1224	prevent
2897	math	1218	rule
2890	disease	1218	supply
2885	electricity	1216	appropriate
2883	book	1216	pump

2878	actual	1215	soil-nutrient
2875	predict	1212	cancer
2871	come	1212	visit
2871	sit-com	1208	over-extend
2853	manage	1207	converge
2848	several	1207	tangency
2836	north	1205	ease
2826	tree	1203	re-discover
2824	whole	1202	industrial
2823	top	1202	short-circuit
2823	travel	1202	wiki
2822	remain	1201	adult
2815	congruence	1193	tri-gram
2811	constant	1192	spring
2809	commons	1188	non-identity
2807	observe	1188	re-build
2788	rectangle	1188	semi-final
2786	substance	1188	symmetry
2765	once	1187	change
2756	two-piece	1183	numerator
2751	field	1178	mechanic
2749	denominate	1178	sugar
2738	detail	1177	pine-cone
2733	map	1176	ion
2714	certain	1176	pull
2710	free	1176	yellow
2707	sentence	1174	re-assume

2698	special	1173	bag
2698	child	1173	trait
2695	age	1170	volcano
2691	solidify	1166	town
2666	vector	1164	decay
2663	student-teacher	1162	interpret
2660	current	1161	congress
2649	hold	1159	drop
2644	old	1157	sunlight
2639	paper	1155	religion
2634	million	1155	stand
2633	families	1153	three-iron
2629	either	1151	miss
2626	work-situation	1147	sea-salt
2620	whether	1146	net
2586	song	1146	rather
2574	fill	1145	experience
2564	oxygen	1144	lie
2563	for	1143	digit
2558	week	1138	difficulty
2550	reduce	1138	hair
2547	moon	1136	weigh
2542	minute	1134	composite
2526	cannot	1133	shade
2525	fish	1126	billion
2524	weight	1126	error
2522	subtract	1125	semi-colony

2510 kind

2499 head

2489 separate

1119 apart

1117 trouser-press

1116 ride

1115 tube

Table 23. Essential Word List (EWL): K2.

Freq.	Word	Freq.	Word
1111	issue	590	sheet
1108	hearing-aid	589	crystal
1107	slow-match	589	sample
1105	favor	589	sleep
1104	king	588	modify
1103	love	588	transit
1100	long-hair	587	nitrogen
1099	floor	587	re-group
1097	non-native	586	mass
1096	sea-floor	585	covalent
1095	transfer	585	international
1094	classified	585	p-orbital
1091	dark	584	string
1090	iniquity	583	confide
1088	train	583	depth
1081	maintain	583	tit-bit
1080	amendment	583	university
1080	damage	582	brighten
1079	modern	581	biodiverse
1079	upon	581	literature
1078	yet	578	mid-year
1073	report	578	re-absorb
1072	guidance	578	scatter
1069	courtesy	577	alga

1066	false	577	drug
1065	totem-pole	577	push-up
1063	fair	577	vascular
1062	suggest	576	media
1060	re-combine	576	parameter
1060	reproduction	576	step-sister
1058	storage	575	intense
1057	sub-project	575	mitosis
1050	pseudo-device	575	portion
1050	re-examine	575	smart-drug
1047	lung	574	investigate
1045	whose	574	stick
1043	swimming-pool	573	felt
1042	straight-jacket	573	regard
1039	chance	573	sixth-former
1039	semi-regular	572	space-arc
1037	sky	571	beyond
1036	cool	571	reciprocal
1030	non-decision	571	paint
1029	fruit	571	passage
1027	business	571	slow
1024	sine	570	brother
1024	trigonometry	569	arrow
1023	rain-forest	568	conduct
1022	communicate	568	wrong
1022	hi	567	balloon
1022	respect	567	melt

1022	trunk-road	567	smooth
1021	goal	566	circumference
1020	establish	565	capital
1020	influence	565	trace
1020	rewrite	564	own
1019	circulate	563	solute
1018	salt-burn	562	morning
1018	spirit	559	coming
1017	mode	556	adjacent
1016	speak	556	precipitate
1015	non-writer	555	income
1012	over-dry	555	metric
1012	radiance	555	pack
1009	visual	554	cancel
1007	reproduce	553	prep
1006	perfect	553	sport
1001	parenthesis	553	tile
998	short	552	newton
995	yard	552	truth-claim
992	hit	551	compete
992	step-father	551	spoon-feed
991	diameter	550	mirror
991	extra	550	pick
990	vision	550	print
988	glass	550	zone
986	settle	549	bake
981	contribute	549	grass

981	expand	549	radio-wave
981	introduce	548	detect
980	ship	548	revise
980	kill	547	price
978	island	546	size
978	themselves	545	valley
975	attract	544	empty
975	organization	544	lock
974	attend	544	pre-arthropod
973	fat	544	village
973	pyramid	543	ten-year-old
971	integral	542	district
969	unique	542	himself
968	century	542	manufacture
966	core	542	restrict
966	eukaryote	542	ribosomal
966	thunder-cloud	541	fundamental
966	wire	541	obvious
963	centimeter	541	wing
963	petro-dollar	540	land-bridge
962	date	540	sub-shell
962	interest	539	fault
961	opinion	539	rolling-pin
959	summer	539	wash
959	harm	538	radioactive
957	hormone	537	re-arrangement
957	literacy	536	movie

957	velocity	535	carbohydrate
954	ten-foot	534	flight
952	park	534	listen
952	re-fuel	533	agriculture
951	exercise	532	stomach
951	fast	531	violate
951	site	530	fear
950	benefit	529	grid
950	gold	528	compose
949	earn	527	rich
949	winter	526	cook
947	someone	525	street-woman
947	universe	524	para-military
946	save	524	band
945	cosine	522	attempt
943	message	522	plastic
942	habitat	522	sea-grass
940	twice	522	simulate
936	snow-bank	521	effort
934	binomial	521	ended
933	interact	520	inner
931	principle	520	rope
931	trial	518	hunt
929	fertility	517	mentally
928	tend	516	oxidation
927	eventuality	516	realize
927	go-fast	516	wild

927	path	515	justify
926	fix	515	soft-drink
925	except	514	oxide
924	magnitude	514	san
921	voice	513	proctor
920	challenge	511	altitude
918	consumption	511	copper
917	surround	510	index
916	hole	510	tooth
914	cube	509	clue
912	immune	509	newspaper
908	inter-connection	509	oh
908	proof	507	nine-year-old
907	loss	506	inquire
905	photosynthesis	506	km
905	six-hit	506	sudden
904	tiny	505	bed
903	self-description	505	contact
900	dominance	505	senate
900	isolate	504	sort
899	office	503	copy
897	vessel	502	anniversary
895	six-cylinder	502	two-shoe
893	prism	502	promote
892	intersect	501	decompose
890	big	501	factory
890	mountain-top	501	logarithm

889	recent	501	secondary
888	proton	501	supreme
887	arrive	501	threat
886	interior	500	embryo
885	technique	500	prior
883	histogram	500	seat
883	prokaryote	500	silver
882	built-in	500	synthesis
882	sub-program	500	hat
882	ton	499	army
881	plug	498	operate
880	bind	498	reveal
879	dead	498	search-party
879	shape	497	cord
878	wear	497	isosceles
875	pan	497	satellite
873	improve	497	worth
873	door	496	contract
872	nation-state	496	expend
870	minimum	495	burn
867	danger	495	lack-of-pulse
866	sphere	495	photo-story
865	setting	494	assess
863	publish	494	bus-ticket
862	riding-crop	494	houses
862	sand	494	sodium
861	trumpet-player	493	radian

856	advantage	492	aspect
	counter-	492	surprise
856	argument	490	colonial
856	rough	490	non-customer
855	especial	490	transcribe
854	enzyme	489	parasite
853	bad	489	staging-post
853	theme	488	cytoplasm
852	arm	488	pump-prime
852	glucose	487	wrap
852	revolt	485	neutron
851	future	484	glacier
851	quadrilateral	483	crime
849	invert	483	persuade
849	window	483	pollen
848	rose-garden	482	address
847	partner	482	carrying-on
846	heavy	482	medium
844	behind	482	purple
844	trouble-spot	482	reverse-punch
841	edge	481	chloroplast
840	seven-year-old	481	street-fight
839	instance	480	convention
838	risk	480	neuron
837	accept	480	rare
837	customer	480	re-capture
837	dimensional	480	taste
837	touch		

835	empire	480	t-shirt
835	slave	479	institute
834	pathogen	479	sale-room
830	boundaries	479	stretch
830	erode	478	co-act
830	tying	476	gather
829	input-output	476	hide
828	trip	476	journal
827	internal	476	overlap
			sub-sub-
827	polka-dot	476	committee
827	race	474	plasma
827	signal	473	infect
826	hill	472	condition
825	fish-farm	472	forward
825	freeze	472	presence
825	sand-hill	472	snake
824	coin-op	471	labor
824	gallon	470	pain
823	subtraction	470	principal
819	shadow	469	consider
818	infinite	469	worm
818	power	468	hyperbola
818	station	468	reject
817	battery	467	occupy
816	conserve	467	upward
815	education	466	coin

814	host	466	frog
814	intersection	466	wife
814	poor	465	cake
813	adapt	465	sink
809	thin	465	wealth
804	bisect	463	letter-collection
804	steam-engine	462	clock
802	outer	462	frame
801	molecular	462	peter
800	tradition	461	tire
797	join	460	arithmetic
797	super-market	460	broad-bean
796	allele	460	elevate
796	jpg	460	kidney
795	sales-force	459	dust
795	semi-desert	459	genome
793	poet	459	greenhouse
793	representative	459	judge
791	ear	459	library
791	hypotenuse	458	evaporate
790	mind-reader	458	seek
790	orbit	457	housing
789	art	456	beauty
789	spy-fly	456	department
788	ancient	456	photograph
788	deliver	455	ancestor
788	prepare	454	scene

786	avoid	453	complicate
784	coal-tip	453	kilometer
784	offer	453	medicine
781	license	452	chief
780	diverse	451	artery
780	perimeter	451	compass
780	throw	451	fish-finger
780	invest	451	marine
779	mountain	451	playing-field
779	style	451	reside
777	leader	450	smell
775	clean	449	encourage
775	plus-point	449	float
774	ellipse	449	kilogram
774	tide	449	underline
773	distinguish	448	painting
773	sperm	447	enjoy
772	diagonal	447	rank
772	extinct	446	horse
772	music	446	mitochondria
772	soon	442	amphibian
770	still-birth	441	street-corner
769	demand	440	march
769	reproductive	440	ozone
768	amino-acid	440	plain
767	unlike	439	lunch
767	vertebrate	439	none

766	ready	439	ovary
766	topic	438	phylum
765	everything	438	trap
764	anything	437	replicate
764	red-brown	435	externality
761	strike	435	latitude
760	ax	434	brief
760	output	434	sediment
759	option	433	null
759	sea-flat	432	famous
758	geology	431	eclipse
758	season	430	pollinate
757	gland	429	kinetic
757	numeric	429	prize-giving
755	else	428	beside
754	distinct	428	excite
752	kingdom	428	fresh
752	minute-book	428	gain
751	paragraph	428	tens
750	classification	427	border
750	ion-exchange	427	pizza
750	midpoint	426	geography
750	southern	425	huge
748	re-arrange	423	beat
748	renewable	423	modeled
745	thick	423	recycle
744	election	423	american

744	god	422	definite
740	meiosis	421	astronomy
739	supplement	421	expose
734	colonize	421	quartile
734	ticket	420	everyday
733	eliminate	420	haploid
731	familiar	419	preimage
730	defend	418	aquatic
730	guess	418	catch
727	official	418	puberty
726	mole	418	re-assign
725	marble	417	coffee
725	sea-coast	416	fall
724	sketch-pad	415	night-club
724	union	415	sub-sector
723	dilate	414	diamond
723	mouth	414	diet
722	fuel	413	amplitude
721	re-gain	413	decline
720	cm	412	desire
719	board	412	please
719	nation	412	shore
719	over-control	412	smile
719	physician	412	tropics
717	consume	411	archaea
717	self	411	soft
716	erupt	410	mercury

712	babies	409	homeostasis
712	formation	407	flowed
708	destroy	406	fiber
708	emit	405	feat
707	distribute	404	biochemist
707	neighbor	404	endpoint
707	northern	404	title
707	radio-phone	403	breathing-space
703	endings	403	immediacy
701	sunshine	403	justice
701	tan	403	succession
698	boil	403	whenever
697	snow-wreath	402	cry
696	foreign	402	lipid
696	sex-war	401	bread-winner
695	re-attach	401	stream-water
694	attack	400	non-document
694	breathe	400	soldier
693	step-son	399	thermal
692	web	399	voluntary
691	pick-up	398	corn
690	proper	398	expanse
689	fluid	398	football
689	popular	398	pet
689	quality	398	route
689	ring	397	medical
688	reactant	397	micro-instruction

686	efficient	396	butterfly
686	friction	395	commute
685	non-consumer	394	cream
685	push	394	motor-vehicle
685	screen	393	hydrocarbon
683	strength	392	deposit
682	puppet	392	induction
681	overall	392	magma
680	whisker	392	mantle
679	lay	392	network
678	tenant-farmer	392	push-bike
677	gamete	392	teacher-researcher
676	bounded	391	semi-conductor
676	everyone	391	wet
673	flip	390	sir
673	hope	389	chordate
673	rapid	389	grain
673	speaker	389	migration
673	thunder-storm	389	photo-cd
672	partial	389	tidal
672	quotient	388	secure
671	buy	387	argue
670	representation	387	non-executive
670	toilet-roll	385	exterior
669	copyright	385	toxin
669	permutation	384	fence
668	mega-deal	384	slide

667	belong	383	immigrant
666	fold	383	repair
666	microscope	383	steel-worker
666	progress	382	debate
666	speech	382	drink
666	upper	382	fund
662	inherit	382	perspective
661	pre-adaptation	382	swim
661	substitution	381	museum
660	prefer	380	sensor
659	quite	380	terminal
656	bottle	380	wavelength
655	milk-yield	379	alter
654	checkpoint	379	sec
653	weak	379	stock-take
652	honey-guide	378	conic
649	nothing	378	decade
648	fail	378	mar
648	slight	378	nest
648	vehicle	378	ounce
646	offspring	378	stone-thrower
646	purchase	377	confuse
646	toffee-apple	377	elephant
646	toss	377	gray
645	exchange	377	strand
645	investigation	376	propose
645	perhaps	376	vitamin

643	background	375	deck
643	compute	375	thank
643	stand-alone	374	alcohol
642	environ	374	pie
642	yield	374	postulate
641	profit	373	beneath
640	onto	373	loose-liver
636	diffuse	373	workbook
635	procedural	372	enclose
635	self-interaction	372	photo-copy
634	eating-disorder	372	poison
634	regression	372	re-mark
634	wheel	372	review
632	sit	371	authority
632	wonder	371	comprehend
631	concern	371	lab
630	moment	371	load
629	experiment	371	mistake
629	possibility	370	split
628	precise	369	capability
627	animate	369	solubility
627	equilibrate	369	whatever
627	neither	368	target
627	trapezoid	367	ensure
626	news-stand	367	prize
626	predator	366	alike
624	galaxy	366	anyone

623	orange	366	dinosaur
622	diverge	366	disagree
622	majority	366	multicellular
622	non-ionic	365	allergen
621	nearly-silence	365	secrete
619	organelle	364	configure
617	benchmark	364	giant
616	transmit	364	skeletal
615	integrate	363	unless
614	correlate	362	calcium
613	pure-bred	362	sight
612	poster- opportunity	361	bicycle
612	undergo	361	govern
611	complement	361	para-legal
611	mature	360	commerce
611	reptile	360	flood
609	daughter	360	narrow
609	discrete	358	fun
609	wait	358	mention
608	flash-bulb	358	sit-up
608	policy	358	stimulant
608	sponge	358	utilize
608	step-daughter	357	audience
607	identical	357	rely
607	satisfy	355	nucleotide
606	instrument	354	bacterial
605	college	354	button

605	crust	354	exposed
605	intestinal	354	rose-pink
603	ideal	353	appearance
603	serious	353	capillary
603	smoke	353	council
601	tip	353	revisit
600	wish	352	memory-jogger
599	prey	351	currant
597	tom-cat	351	voltage
596	candy	350	fell
596	daily	350	shop
596	quadrant	350	triple
594	telescope	350	verb
593	over-determine	350	warn
593	vapor	350	I
591	candidate	349	cotton-spinner
590	biome	349	happy
590	pencil	349	lava

Table 24. Essential Word List (EWL): Academic words.

Higher Freq.	Lower Freq.
area	undefined
chapter	indicate
data	constant
factor	plus
vary	transform

function	transformation
volume	output
proportion	region
ratio	investigate
coordinate	investigation
evaluate	occur
formula	goal
formulate	interval
negate	purchase
negative	adult
rational	process
positive	compound
similar	respond
similarity	response
similarly	complement
equivalent	complementary
dimension	chart
dimensional	domain
method	previous
methodology	target
identify	remove
identifying	period
identity	illustrate
analyze	illustration
analysis	supplement
sequence	supplementary
display	annual

prime	objective
select	spreadsheet
selection	theory
survey	theoretical
strategy	theorize
team	maximize
mental	maximum
mentally	summary
range	final
outcome	job
substitute	require
substitution	affect
label	bias
concept	unbiased
symbol	tape
symbolic	radical
predict	technology
prediction	capacity
correspond	available
corresponding	eliminate
involve	elimination
involving	assume
approximate	principal
approximation	logic
approximately	logical
random	trace
randomly	sphere

convert	interpret
conversion	interpretation
converting	topic
item	simulate
compute	invest
computation	investment
computer	option
computing	expand
mode	fee
section	sector
justify	income
justification	principle
challenge	trend
distribute	accurate
distribution	accuracy
distributive	route
parallel	compatible
error	generate
appropriate	generation
source	precise
locate	precision
location	terminate
create	minimum
creation	focus
project	reverse
grade	proceed
grader	procedure

rotate	commission
image	research
link	element
design	layer
construct	consume
construction	category
statistics	portion
statistical	code
conclude	technique
conclusion	index
odd	vehicle
input	consist
define	site
definition	resource

Word list validation

To validate the word lists, I decided to compare their text coverage of TUSK and SMACK against three major word lists: New General Service List (NGSL) (Brown, 2017), Coxhead's AWL (2000), and Gardner and Davies's AVL (2013) (see Chapter 2 for a detailed description of these studies). These word lists were chosen because they are the most recent and reliable general and academic word lists that have been used commonly over the last decade. According to the instruction of AntWordProfiler, I compiled the words of NGSL, AWL, and AVL into baseword files, a plain text format document that can be uploaded into the software through the provided option in the setting. I uploaded 1000 word families in each baseword file. I also uploaded a total of 20 baseword files including 19,327 word families. Table 24 presents an overview of the total number of lemmas in each word list and the text coverage that they provide.

Table 25. Text coverage of each word list in this study.

Word list type	Total lemma	Total token	Text coverage
High Freq.	3,606	9,808,239	92.78%
Mid Freq.	5,006	176,317	1.66%
Low Freq.	8,080	25,670	0.24%
Academic words	461	430,143	4.06%
STEM	412	130,690	1.23%
Total Corpus	17,565	10,571,059	100.00%

In order to have a clear profile of the word lists and to make a validated index, I compared the word lists (HF, MF, LF, STEM-related, and academic list) against the three base lines mentioned above in four genres or K-12 content areas of math, science, social studies, and language arts. Table 25 shows that the three frequency word lists provide a higher text coverage than that of NGSL.

Table 26. Text coverage of three frequency lists against NGSL in four K-12 content areas.

Corpus genre	Math	Science	Social studies	Lang Arts
Gap (HF – NGSL)	8.30	7.21	5.58	2.07
Gap (MF – NGSL)	5.51	4.23	4.81	1.10
Gap (LF – NGSL)	3.01	2.28	1.91	1.00

Figures are in percentages.

As shown in Table 26, the smallest gap superiority is for Language Arts, demonstrating its rich context with respect to high frequency words in general English. However, in math and science we see larger gaps. All three frequency lists outperformed NGSL in the four K-12 content areas. This higher text coverage could be related to the fact that the three frequency lists are directly derived from K-12 textbooks while NGSL is based on a corpus of general English. This higher text coverage shown in Table 26 confirms the validity of the three frequency lists in this study. To validate the academic and STEM-related word lists, I also compared their text coverage of the K-12 corpora against AWL and AVL (Coxhead, 2000; Gardner & Davies, 2013). Results of the comparisons obtained from AntWordProfiler are presented in Table 27.

Table 27. Text coverage of my Academic and STEM-related word Lists against AWL and AVL in four K-12 content areas.

Corpus genre	Math	Science	Social S	Lang A.
Gap (Academic word list – AWL, AVL)	1.45	3.20	2.98	4.23
Gap (STEM-related – AWL, AVL)	1.62	3.73	1.91	3.55

Figures are in percentages.

The gap in four content areas is always larger than 1%, thereby demonstrating the validity of the academic and STEM-related word lists of the present study. Nation (2016) claims that larger gaps show weaker text coverage. Both Tables 26 and 27 show that our word lists have smaller gaps. A further finding from these comparisons substantiates the value of adjusted frequency word lists in making word lists with a relatively high text coverage.

Finally, Figures 6 and 7 demonstrate Zipf's (1949) law that a small portion of text token covers a considerable part of the corpus. In accordance with Zipf's notion of lemma offering more bank for the buck, in this research, high frequency and academic words account for approximately 23% of the 17,565 lemmas; however, these two categories have a text coverage of 96.84%, meaning that, learning only these two classes of words will likely provide ELLs with sufficient word knowledge (Nation, 2013) to obtain a successful reading comprehension.

Figure 6. Text coverage vs lemma percentage of academic and high frequency words for the entire corpus.

Figure 7. Academic vocabulary vs STEM vocabulary in TUSC and SMACK by percent.

The rate of STEM words is lower than academic words in both TUSC and SMACK (see Chapter 2 for a typology of vocabulary in this study). However, this might be because I used the AntConc software, and a selective process is still needed to make the final decision about the STEM words and this might change the balance. Figure 6 compares STEM words in TUSC (a general corpus) and SMACK (a specialized corpus) showing the importance of academic words in specialized corpora.

Essential word list (EWL) considerations

So far, I developed new academic and essential word lists. Figure 8 displays what I found with regard to K-12 EWL which is re-answering RQ #1 with the K-12 data of this dissertation. As maybe be seen in Figure 8, a good portion of text coverage in both TUSC and SMACK comes from the first thousand most common words. It also shows that basic academic words (only 200 of the first most common lemmas) cover more than 7 percent of the textbooks represented by SMACK. Overall, Figure 8 substantiates the significance of K-12 EWL with respect to text coverage.

Figure 8. EWL by K1, K2, and Basic Academic Words in TUSC and SMACK by percent

CHAPTER V

The mobile app and website: Vocabulary in Reading Study – VIRS

Introduction

We live in a society with an ever growing technological tools and we are becoming more dependent to its applications and uses. Therefore, it is now a high priority in K-12 schools to apply technology to teach content areas and English as a second language, as well. Cristen (2009) writes that with the emphasis that Common Core Standards put on technology in K-12 education, the use of technology in classrooms is essential if teachers hope to have a positive impact on students' learning and prepare them for the real life situation.

Future research recommended by the National Reading Panel (2017) was the incorporation of computer and mobile apps in reading instruction. Therefore, a key outgrowth of this project is the development of a mobile app—Vocabulary in Reading Study (VIRS), available on the APP Store, Android, and Google Play—and a website (www.myvirs.com). In this respect, I answer the third research question in this chapter, whose focus is on developing VIRS as a mobile app for teaching reading and vocabulary to ELLs.

I have been working with three computer teams in College of Computer Science at FIU from January 2017 to May 2018 to develop VIRS. So far, we have developed three versions of the app and Version 4 is currently under construction. In the first version, we set the foundation of the website and color-coded reading method. In Versions 2 and 3, we

added School Dictionary, iTranslate, Vocabulary Tests, and Profile. In Version 4, we hope to add Essential Word List and improve text analysis.

With the use of the website and the app, teachers are able to analyze any type of text which may be sifted through OCR technology to create a vocabulary profiler. The app synthesizes the academic vocabulary found in K-12 textbooks and features an enhanced reading method that expedites the L2 reading process using a color-coded system.

The app uses six categories for sifting the words: high, mid, and low frequency words, STEM-related and academic words, plus a category for names and off-lists. Therefore, teachers can use VIRS in choosing the appropriate reading texts to work on in their classes.

Figure 9. The home page of the app – VIRS.

In addition, teachers can sign in by creating a user name and password. This way, all teachers can have their own profile to save their data for future use. The option from which

teachers can benefit is the readability measurement function which analyzes the text. VIRS has the following features:

1. It produces enhanced texts through a color-coded system.
2. It gives a detailed analysis of texts that will help K-12 teachers develop course materials, and
3. It helps teachers to take a picture of a text through OCR technology and then sifts it through a vocabulary profiler,

The current version of VIRS also has six vocabulary tests for all proficiency levels from beginner to advanced. Each test has 100 questions that randomly scramble each time the user starts a test. Two out of the six tests are Nation's Vocabulary Size Test (Nation, 2001) that I divide them into two versions of A and B. Other main functionalities of VIRS include:

1. VIRS analyzes texts quickly in four different input modes.
2. It raising students' awareness to different word categories such as academic and STEM-related words through a different color.
3. It gives a result table for vocabulary tests and recommends on what to do next,
4. It has a pop-up dictionary that hopefully makes the reading for ELLs easier and quicker, and
5. VIRS has an online translation tools that saves users' time.

Overview of tools

VIRS has four tools for analyzing texts, improving reading, and conducting corpus linguistic research. These tools are a) Analyze your text, b) School dictionary, c) vocabulary tests, and d) iTranslate. *Analyze your text* is designed to be used by teachers for material development, the other tools may be used by ELLs in classroom or while doing self-study. Below, I will explain each tool in order.

Analyze your text

This tool allows teachers and ELLs to upload texts and then the app turns it into enhanced text. There are four modes for uploading texts: type the text (max 30,000), word document files (max 5 MB), PDF files (max 25 MB), and image files (max 25 MB).

Figure 10. Color-coded system for reading comprehension

By pressing the Enhanced Text option, VIRS analyzes the text and presents in a different page in a color-coded enhanced format. Each word has a different color such that ELLs will hopefully be more engaged in reading processes.

An important feature of enhanced texts is their link to a pop up dictionary such that the meaning of the word pops up by clicking or touching the word. This way ELLs do not need to search every word in a dictionary that helps save time and energy. Also on this page is a detailed statistics of the uploaded text, including the number of academic and STEM-related words as well as high frequency vocabulary.

School dictionary

I used the K-12 corpora, TUSC and SMACK, to compile a new school dictionary which may make it easier for students to learn new vocabularies while reading their textbooks through VIRS. This is a frequency-based dictionary which categorizes words into five categories of lemmas which are in harmony with the color-coded system in the enhanced text option. The five categories include high (3,750 lemmas), medium (5,030 lemmas) and low frequency vocabularies (8,089 lemmas), academic words (423 lemmas), and a section for STEM-related words (238 lemmas) as well. In total, our school dictionary has 16,500 lemmas plus derivational and inflectional forms.

Figure 11. School dictionary.

Pilot vocabulary tests

There are six test categories in this tool through which ELLs can check their vocabulary knowledge. Tests are ordered in terms of difficulty from beginner to advanced level (Cambridge vocabulary tests, 2016). Also, there are two versions of Nation's (2013) Levels Test. Each test has a different number of questions that will be shuffled each time an ELL takes the test so that the chance of having repeated questions will be low. For each question, ELLs will have 60 seconds to answer. Test results will be presented in a table alongside some recommendations based on the ELL's score on the test.

Figure 12. Categories of pilot vocabulary test

iTranslate

The iTranslate tool is linked to Google translation (www.translate.google.com) and has the same function, as well. Its purpose is to save ELLs time and make the reading easier. This tool allows ELLs to switch to their native language while reading on VIRS help them scaffolding reading through translanguaging (Nation, 2016).

Figure 13. iTranslate home page.

Vocabulary in Reading Study Language

- Home
- Analyze Your Text
- School Dictionary
- Vocabulary Tests
- iTranslate**
- My Profile

iTranslate

Enter your text to translate here

Select target language ▾

Translate

Characters left to translate: 1000

Translation

CHAPTER VI

Teaching-learning implications of this dissertation and conclusion

Synopsis

For this dissertation, I created two corpora—The Teacher’s U.S. Corpus (TUSC) and the Science/Math Academic Corpus for Kids (SMACK); six word lists emerging from these corpora—high frequency, mid frequency, and low frequency words, as well as lists for academic words and STEM-related words, and an Essential Word List; and a mobile app which is synchronized with a website offering four main tools (text analysis, school dictionary, vocabulary tests, and iTranslate).

I created the two corpora, and then based on Cobb’s LexTutor, I developed a profile of textbooks for the States of Florida and California. The main findings of this dissertation are as follows:

1. I developed a new typology of vocabulary knowledge including K-12 STEM-related words (Chapter 2).
2. I developed a new model for developing vocabulary knowledge based on mental process (Chapter 2).
3. The text coverage of academic vocabulary in Florida and California K-12 textbooks is 4.12%, which is way lower than recommended 10% used in college texts (Chapter 4).
4. Based on proportions of academic vocabulary, Social Studies seemingly uses the most difficult language, while Language Arts employs the easiest (Chapter 4).

5. I created the largest K-12 STEM-related and academic corpus to date, SMACK, with more than 8 million words (Chapter 4).
6. All five word lists are more valid than the NGSL, AWL, and AVL (Chapter 5).
7. High frequency words cover 91.81% of K-12 textbooks; meaning, that ELLs can survive in school with only 3,750 lemmas (Chapter 5).
8. The high frequency words with about 3,750 lemmas include both the essential and survival words that ELLs need to survive in school (Nation, 2016) (Chapter 5).
9. For having a better comprehension in K-12 content areas, focusing on domain-specific words, both academic and STEM-related word lists, can likely improve ELLs' text coverage (Chapters 3 and 5).
10. I developed a new K-12 dictionary that is specifically designed for ELLs (Chapter 6).

Implications for teaching English as a second language in U.S.-based schools

Course design

Setting realistic language learning goals is an important part of designing a course. There is a rich line of research on text coverage (Nation, 2006; Nation, 2013; Schmitt & Schmitt, 2014) that has suggested low, mid, and high frequency levels considered as learning goals for ELLs. Thus, the six word lists developed in this study, as well as the two corpora, may hopefully provide K-12 teachers and textbook writers with a guidelines about which words and how many are needed at different learning stages for ELLs. However, this needs further research to be confirmed statistically.

Nation (2013) claims that, in designing a course, high and mid frequency words are taken as receptive vocabulary knowledge learning goals for learners who want to use it for everyday purposes. In this study, however, the high and mid frequency words are more than 8,000 lemmas that ELLs need to survive through K-12. Nation (2016, p. 172) believes that textbook writers and course designers do not use word lists and vocabulary levels systematically. This is why he thinks that the influence of word lists in K-12 curriculum development is uncertain. Designing an effective course for ELLs in K-12 requires using an appropriate word list which is driven out of K-12 textbooks that meet the needs of ELLs.

Reading material development for ELLs

While ELLs read for the purpose of understanding messages, incidental vocabulary acquisition from meaning-focused input may happen. Appropriate materials can expedite this process (Hulstijn, 2001). In the selection process and preparation of such reading materials for ELLs, word lists can have a central role. The word lists in this study may provide teachers with a tool from which they can select the words that ELLs should develop first. For those ELLs in content areas who are beginners in academic English, the STEM-related and academic word lists of this study are resources that ELLs can start with as a precursor before learning AWL and AVL. Range and AntWordProfiler (Webb & Nation, 2008) are also other tools but with different functionality that teachers can use.

Readability measurement for ELLs

With using three text analysis programs (VocabProfiler on Cobb's Lextutor, AntWordProfiler, and Range – see Chapters 4 and 5 for the description of these programs),

there is an upward trend of research on the different types of vocabulary load of texts ELLs read. For example, VocabProfiler is a tool on LexTutor that analyzes a text with respect to frequency level and academic words as well. The program determines the frequency level of words and which and how many are off-list. In the next step, the program makes a judgement on the difficulty level or vocabulary load based on the proportion of text tokens at the low frequency or off-list levels.

Such programs and other research carried out on vocabulary load depends on well-researched word lists. List makers fortunately share their lists freely through publications or websites and this may improve the quality of readability measurement tools.

Developing K-12 vocabulary tests

An area affected the most by the use of word lists is vocabulary tests. In developing the vocabulary size tests (Nation & Beglar, 2007; Coxhead, Nation & Sirm, 2014) BNC and COCA have been used. Schmitt, Schmitt and Clapham (2001) and McLean and Kramer (2015) also used AWL for the vocabulary test development. With respect to levels tests (McLean, Kramer & Beglar, 2015), BNC and COCA word lists were also used.

The difference between size and levels tests has always been misunderstood by language teachers. While vocabulary levels tests measure ELLs' vocabulary knowledge of a particular level, size tests focus on the ELLs' total word knowledge. For designing a language course, Nation (2016) believes that levels tests are more beneficial because they measure the actual words that ELLs need to know. The original levels tests are mainly based on Thorndike and Lorge's (1944) list, which is pretty old. There are now better and updated lists that could be used for developing new levels tests. In this regard, three of the

word lists I developed through this study focus on three frequency levels that could be used for developing the K-12 levels test. Meanwhile, an appropriate vocabulary test has to use a sample of the words that represents the whole language. Dictionaries were the main source for such samples, but Nation (2013) claims that this sampling method results in a sampling error. He believes that word lists provide the best word samples because they are corpus-driven. As a result, the word lists of the present study may provide teachers and researchers with reliable samples for vocabulary test development. Furthermore, teachers may substitute the items of depth of vocabulary knowledge test (Read, 2000) with the items of the word lists to measure depth dimensions of word knowledge.

Classroom activities that focus on word lists in teaching vocabulary to ELLs

In this section of teaching-learning implications of the word lists that I developed in this study, I present some classroom activities that might help both teachers and students focus on words from the K-12 word lists. Each activity comes with a brief description and implementation in class, followed by some suggestions for how to modify it according to the needs of ELLs. My focus is on how to use these vocabulary instruction activities with the lists that I developed in this dissertation; however, these activities may also be applicable to other lists and learning contexts.

Fruyer model

Fruyer, Frederick, and Klausmeier (1969) developed the Fruyer Model, which applies the graphic organizer technique to let students explore the deeper aspects of

meanings of the words in word lists. Through the tasks below, Frayer et al found that students are able to clarify their understanding of the target words:

- Identifying the examples and non-examples of the meaning, and
- Identifying the essential and non-essential characteristics of the word in a particular word list.

Implementation

As such, through the implementation of VIRS – and indeed the word lists coming out of TUSC and SMACK – students may be able to

- Identify the target words from a word list, for example, some basic words such as *tissue, cell, organism, atom* from the Science sub-list of the STEM-related word list.
- Distribute the model's graphic organizer among student (this is available online).
- Brainstorming for completing the areas of the graphic organizer using the words from the lists.
- Ask students to make their individual graphic organizers with other similar words.

Word sorts

A word sorts is a hands-on activity (Gillett, Temple, & Crawford, 2004) that seemingly improves ELLs' manipulating academic or STEM-related words into different groups of other words based on relationship or function. Teachers may use this activity to make comparisons between domain specific words to improve ELLs' word analogy.

Implementation

- Choose 10-20 words from a word list which are related to the discussed topic.
- Choose between open or closed sort and then model word sorting for students.
- In small groups, ask ELLs to sort words based on the domain or word list the word is belong to. Then show the word in the original list and ask them to discuss.

Triple-entry vocabulary journal

The triple-entry vocabulary journal is a version of dual-entry diary (Berthoff, 1981) that teachers may use to help students make connections between words across different word lists. By using this activity, teachers can also communicate with their ELLs through feedback on their entries. Meanwhile, this activity can be used as a personal record of word list learning.

Implementation

- Choose a number of words from a particular word list that appear frequently in a topic that is discussed in class.
- Provide a template for this activity with three columns titled sentence in text, word, and my thought.
- According to the chosen words from word lists, ask ELLs to complete the Triple-entry vocabulary journals
- Share ELLs' thoughts and then give feedback

Semantic feature analysis

A semantic feature analysis uses graphic organizers to improve ELLs' understanding of similarities and differences between academic and STEM-related words (Schmitt, 2000). Therefore, this activity will be effective for teaching synonyms or antonyms. Also, this activity will be a good choice for teaching similar or opposite concepts.

Implementation

- Identify the words from word lists that represent similarities or differences, for example, a comparison between physical and chemical changes.
- Prepare a graphic organizer with the words and display it on the board.
- Present the words to ELLs and then discuss the similarities and differences.

Identifying cognates

Because of the same Latin roots, there are many Spanish-English cognates in English academic words (Nation, 2013). Bushong (2010) identified several Spanish-English cognates on AWL. The same is also true about the word lists of this study. This activity will be especially helpful for Spanish-speaking ELLs by making them aware and teaching the cognate recognition strategies through using the word lists.

Implementation

- Introduce cognate to ELLs and explain that they can use their knowledge in Spanish to understand English texts.
- Work with students on a cognate pair from a word list.
- Ask students to use the words from the list in both languages.

General implications for teaching English as a second language

Word cards and flash cards

Vocabulary learning activities with word lists sometime is misunderstood with the idea of memorizing words from list of words which is out of context and is technically known as rote learning. However, learning words from word lists through doing activities such as word cards or flash cards has proven to be effective learning tools (Nation, 2013, 2016), if the right words chosen appropriately.

Nation (2013) suggests that using flash or word cards based on a well-designed word list is a kind of intentional vocabulary learning that will subsequently lead to learning the studied words. In Chapter 11 of his book, Nation (2013) reviews the research in support of using flash card apps. With respect to the findings of this study, the word lists may be used in developing flash cards for ELLs. In addition, developing the flash cards based on the STEM words from this study can help ELLs in ESP courses.

Learners' dictionary

An important tool in the app which is a direct outgrowth of the word lists is the K-12 dictionary. There is no doubt that a learners' dictionary has significant effect on

ELLs' overall proficiency (Nation, 2013). With respect to this study, the six word lists developed may be used to annotate properly the words in the four content areas. A further application of the word lists in developing a K-12 learners' dictionary is the construction of well-controlled definitions for the words because many words have different meanings some of which are irrelevant to the K-12 context and by the use of K-12-based word lists we can determine the most relevant meanings that ELLs need to first learn.

Designing graded readers

Graded readers are books written within a specific level of word frequency with the intention of improving ELLs' vocabulary and finally their reading comprehension (Nation, 2001). Graded readers have a specific vocabulary scheme for each proficiency level. However, there are not well-designed graded readers for ELLs in the K-12 context and the sub-lists I developed in this study will lead to the integration of K-12 word lists into different series of graded readers.

Limitations of this project

A number of limitations regarding this project are worth mentioning:

1. The main limitation of this study is the size of the corpus and number of books. The two corpora involves books from California and Florida. Due to time, budget, and other resource limitations, I couldn't collect textbooks from other states especially New York and Texas, which are two main educational centers textbook companies often look to. A further related issue is the size of the corpora (more than 10 million

in total) which is not a satisfactory size for making fair claims, as De Gardner and Davies (2013) believe that a way bigger corpus is needed to confirm the claims.

2. The second limitation of this study is the lack of grade by grade analysis of the four content areas with respect to vocabulary classification. This was mainly because of time limitation and it will be top on my research agenda for future research.
3. Because of the problems that I had in collecting the textbooks, the corpus is skewed toward middle and high school textbooks. This issue, however, will be solved by adding more K-5 science and social studies textbooks.

Directions for future research

For further research on corpus-driven and word list studies, there are various directions that I recommend:

1. Application of word lists based on frequency or so-called efficiency over time has never been fully researched. In other words, a frequency-based curriculum is needed in order to teach vocabulary in a need-based order. This line of research could also be extended to textbook development and syllabus design.
2. Corpus development for making a word list should be in accordance with the needs of the target audience and their language uses. Also, all corpora are only a rough representation of the actual needs of ELLs, especially in K-12 context, a research study is needed to focus on dispersion rather than frequency.
3. A readability index particularly designed for ELLs' texts is a needed research that has not been developed yet. This should be an interdisciplinary research with a team

of statisticians. This readability measurement will be of great help to course developers and classroom teachers in choosing the appropriate reading materials.

4. TUSC is a Florida general corpus with more than 3 million word and SMACK is an academic corpus which is skewed toward middle and high school. Both corpora represent textbooks from States of Florida and California. Future research can focus on developing word lists based on larger and more comprehensive corpora. This way, the claims made by word lists will be more generalizable to K-12 school system.
5. A validated vocabulary test based on the current word lists is needed. Such a test which will be based on analysis of K-12 textbooks will help designing a curriculum for ELLs that best matches their needs.
6. There has never created a spoken corpus for ELLs in K-12 context. Developing such a corpus for improving learners' fluency is needed. Developing well-designed reading materials accompanied with audio files will also be beneficial for improving ELLs' fluency.

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