READING PRACTICE SETS

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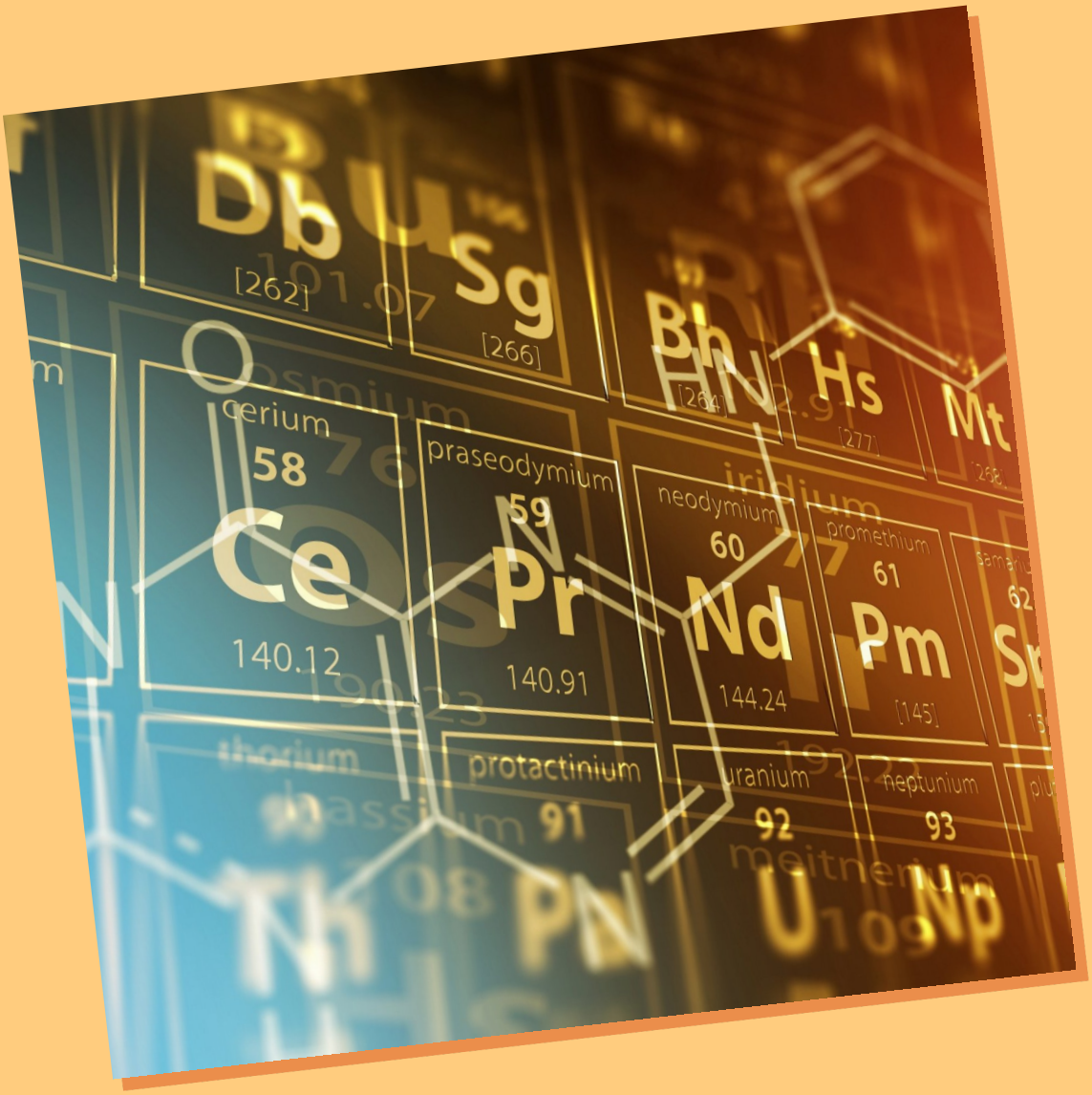
ELEMENTS OF LIFE



TOEFL iBT

READING PRACTICE SET

Directions: Read the passage and answer the questions. Give yourself 18 minutes to complete this practice set.

ELEMENTS OF LIFE

1 **[A]** The creation of life requires a set of chemical elements for making the components of cells. **[B]** Life on Earth uses about 25 of the 94 naturally occurring chemical elements, although just four of these elements – oxygen, carbon, hydrogen, and nitrogen – constitute about 96 percent of the mass of living organisms. **[C]** Thus, a first requirement for life might be the presence of most or all of the elements used by life. **[D]**

2 Interestingly, this requirement can probably be met by almost any world. During the formation of the universe some 13.8 billion years ago in the so-called Big Bang, only the lightest elements were formed – hydrogen and helium, along with trace amounts of lithium, beryllium, and boron. The last three elements can also be formed in the most catastrophic, energetic events in the universe in a process known as spallation. Scientists have determined that the rest of the elements found in nature were created in nuclear reactions in stars and in huge stellar explosions known as supernovae. These are known as heavy elements because they are heavier than hydrogen and helium. Although all of these heavy elements are quite rare compared to hydrogen and helium, they are found just about everywhere.

3 As heavy elements are continually being produced by stars and released into space by stellar deaths, their amount compared to hydrogen and helium gradually rises with time. Heavy elements make up approximately 2 percent of the chemical content (by mass) of our solar system, the other 98 percent being hydrogen and helium. In some very old star systems, which formed before many heavy elements were produced, the heavy-element share may be less than 0.1 percent. Nevertheless, every star system studied has at least some amount of all the elements used by life. Moreover, when planetesimals – small, solid objects formed in the early solar system that may coalesce to become planets – condense within a forming star system, they are inevitably made from heavy elements because the more common hydrogen and helium remain gaseous. Thus, planetesimals everywhere should contain the elements needed for life, which means that objects built from planetesimals – planets, moons, asteroids, and comets – also contain these elements. The nature of solar-system formation explains why Earth contains all the elements needed for life, and we expect these elements to be present on other worlds throughout our solar system, galaxy, and universe.

4 Note that this argument does not change even if we allow for life very different from life on Earth. Life on Earth is carbon-based, and most astrobiologists believe that life elsewhere is likely to be carbon-based as well. However, we cannot absolutely rule out the possibility of life with another chemical basis, such as silicon or nitrogen. The set of elements (or their relative proportions) used by life based on some other element might be different to a certain extent from that used by carbon-based life on the planet Earth. Nevertheless, the elements are still products of stars and would still be present in planetesimals everywhere. No matter what kinds of life we are looking for, we are likely to discover the necessary elements on almost every planet, moon, asteroid, and comet in the universe.

5 A somewhat stricter requirement is the presence of the aforementioned elements in molecules that can be used as ready-made building blocks for life, just as early Earth probably had amino acids and other complex organic molecules. Earth's organic molecules probably came from some combination of three sources: chemical reactions in the atmosphere, chemical reactions near deep-sea vents in the oceans, and molecules carried to Earth by asteroids and comets. The first two sources can occur only on worlds with atmospheres or oceans, respectively. However, the third source should have brought similar molecules to nearly all worlds in our solar system.

6 Studies of meteorites and comets suggest that organic molecules are widespread among both asteroids and comets. Because each body in the solar system was repeatedly struck by asteroids and comets during the period known as the Late Heavy Bombardment, about 4 billion years ago, each body should have received at least some organic molecules. However, these molecules tend to be destroyed by solar radiation on surfaces unprotected by atmospheres. Moreover, while these molecules might stay intact beneath the surface, they probably cannot react with each other unless some kind of liquid or gas is available to move them about. Therefore, if we limit our search to worlds on which organic molecules are likely to be involved in chemical reactions, we can probably rule out any world that lacks both an atmosphere and a surface or subsurface liquid medium, such as water.

1. According to paragraphs 1 and 2, which of the following do living cells contain?

   (A) All chemical elements in the universe except lithium
   (B) About 25 different chemical elements
   (C) About 96 percent of all known elements
   (D) At least 94 naturally occurring elements

2. Why does the author provide the information that heavy elements are continually being manufactured by stars and released into space by stellar deaths?

   (A) To explain how it is that the elements required for life can be found everywhere
   (B) To provide evidence that our solar system is relatively young
   (C) To argue that some solar systems are more likely to support life than others
   (D) To explain why heavy elements have greater mass than hydrogen and helium

3. According to paragraph 3, which of the following may be a difference between very old star systems and newer star systems?

   (A) Older star systems are likely to have fewer planets, moons, asteroids, and comets than newer star systems.
   (B) Newer star systems probably contain more hydrogen and helium than older star systems.
   (C) Newer star systems probably contain more heavy elements than older star systems.
   (D) The process of solar-system formation may have been fundamentally different in older star systems than in newer star systems.

4. The word inevitably in the passage is closest in meaning to

   (A) typically
   (B) unsurprisingly
   (C) necessarily
   (D) naturally

5. Which of the sentences below best expresses the essential information in the underlined sentence in paragraph 3? Incorrect choices change the meaning in important ways or leave out essential information.

   (A) Planetesimals may remain in star systems when hydrogen and helium combine with less common heavier elements.
   (B) Planetesimals are composed of heavy elements because hydrogen and helium stay in the form of gases.
   (C) Planetesimals are small, solid objects that condense within a forming star system and may become planets.
   (D) When planetesimals coalesce to form planets, they inevitably contain gaseous as well as heavy elements.

6. According to paragraph 4, which of the following is true about possible life on other planets?

   (A) It cannot be based on silicon or nitrogen.
   (B) It could not survive on Earth.
   (C) It probably would not be made of elements produced by stars.
   (D) It is likely to have carbon as its chemical basis.

7. According to paragraph 5, all of the following are true of the organic molecules on early Earth EXCEPT:

   (A) Some of them were probably brought to Earth by asteroids or comets.
   (B) Some of them probably formed as a result of chemical reactions in the atmosphere.
   (C) They were probably different from the organic molecules present on other planets in the solar system.
   (D) Some of them probably originated near deep-sea vents in the oceans.

8. According to paragraph 6, why is life unlikely to be found on any planet that lacks both an atmosphere and a surface or subsurface liquid medium?

   (A) Organic molecules must be protected from solar radiation by a surface layer of liquid.
   (B) Planets that lack both of these features are probably too small to have been hit by many asteroids or comets carrying organic matter.
   (C) Organic molecules need a liquid or gaseous environment to bring them together so that they can interact.
   (D) An atmosphere is needed to protect organic molecules from being destroyed by asteroids and comets.

9. Look at the four squares **[A-D]** that indicate where the following sentence could be added to the passage.

   In order to answer the question whether life could exist on other planets, we must first look at the necessary preconditions for life.

   Where would the sentence best fit?

10. **Directions:** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. **This question is worth 2 points.**

    The chemical elements that make up cells are likely to be available on just about any planet.

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Answer Choices

   (A) As many as 25 chemical elements are necessary for life, depending on the complexity of the organism.
   (B) Life is likely to be found in the oldest star systems, where heavy elements have been continually produced since those systems were formed.
   (C) Life is most likely to exist on those celestial bodies that were not heavily bombarded with asteroids and comets during the formation of the solar system.
   (D) The most common elements used by life – oxygen, carbon, hydrogen, and nitrogen – are also some of the most widely distributed elements in the universe.
   (E) Planets, moons, asteroids, and comets are all composed of heavy elements, which means that they contain the basis for any life form, whether carbon-based or otherwise.
   (F) Organic molecules are widely available, but chemical reactions among these molecules probably require either an atmosphere or a liquid medium.