はじめに

◆本書の目的や特徴について

本書は、これまで世界で活躍してきた偉人たちのエピソードを紹介しながら、学生の皆さんが、英語のテキストを楽しんで理解することができるよう執筆したものです。大学生の皆さん、とくに、工学部の学生の皆さんが、工学関連分野における偉人たちに関する英文を通し、英語の総合的な運用能力を高めていくことを目的として、各エピソードの偉人たちの発明に関する説明部分には、工学的な要素を含めました。古代から現代にわたる歴史上有名な発明家に関するエピソードは、どれも興味をもって読んでいただけるものと思います。

◆各ユニットの構成について

本書は、15 のユニットから構成されており、1 つのユニットは次のような構成になっています。Pre-Reading では、各ユニットで紹介される偉人やその偉人が発明したものに関する背景知識を尋ねる質問をもとに、英語でやりとりしながら本文を読む動機を高めるように作られています。Reading text では、偉人やその偉人が発明したものについてのエピソードが、500 語程度の比較的平易な英語で書かれています。通常の英語テキストには、難しいと思われる語句に訳注などが付けられていますが、本書では大学生の皆さんが自ら考えリサーチする力を身に付けることも目標のひとつとし、敢えて訳注などは付けませんでした。Vocabulary は、英文テキスト中に出てきた重要語句の意味理解を確認する問題です。Understanding 1&2 は、それぞれ英文テキストの内容を確認する問題になっています。Understanding 1 は、概要をつかむための選択肢問題となっており Understanding 2 は、詳細な内容を捉えるための真偽問題として作成されています。

Dictation では、英文テキストで取り上げた偉人や発明に関するプラスアルファの情報を英語で聞いて空所を埋めるディクテーション問題になっています。Think About It は、英文テキストで取り上げた発明について工学的な部分のみを取り出した英語での要約になっています。英語での解説をまずは理解し、それをイラストで描写し自分なりの英語でイラストを表現してみるという応用問題となっています。巻末には、各ユニットで扱ったトピックについて英語でディスカッションできるような Further ‘Think About It’ Questions を用意しています。さらに活動が必要な場合、ご使用していただければと思います。

◆さいごに

本書をきっかけにして、英語に対する興味をもっていただき、英語力をさらに向上させる一助に本書がなることを執筆者一同、心より願っています。

2020 年 2 月　執筆者一同

Contents

はじめに III

Unit 1 Archimedes (c.287-c.212B.C.) 7

Unit 2 Leonardo da Vinci (1452-1519) 13

Unit 3 James Watt (1736-1819) 19

Unit 4 George Stephenson (1781-1848) 25

Unit 5 Isambard Kingdom Brunel (1806-1859) ... 31

Unit 6 Nikolaus Otto (1832-1891) 37

Unit 7 Gustave Eiffel (1832-1923) 43

Unit 8 Thomas Edison (1847-1931) 49

Unit 9 Nikola Tesla (1856-1943) 55

Unit 10 Henry Ford (1863-1947) 61

Unit 11 Guglielmo Marconi (1874-1937) 67

Unit 12 Alan Turing (1912-1954) 73

Unit 13 Stephanie Kwolek (1923-2014) 79

Unit 14 Steve Wozniak (1950-) 85

Unit 15 Tim Berners-Lee (1955-) 91

Further 'Think About It' Questions 97

Unit 1 Archimedes (c.287-c.212B.C.)

Archimedes

Pre-Reading

Answer the following questions with a partner:

1) Do you know the story of Archimedes and the golden crown?
2) Can you complete the following formula: Density = $\frac{\text{Mass}}{?}$
3) Which metal is denser, gold or silver?
4) If you had a piece of gold and a piece of silver the same weight, which piece would be bigger?
5) Which has the greater volume, a kilogram of rocks or a kilogram of feathers?

Reading text

02

The English word 'polymath' actually comes from two Greek words: '*poly*' and '*math*', which mean '*much*' and '*learn*'. In modern English, it means a person who has lots of knowledge of many different subjects. So, polymath is definitely a word that could be used to describe Archimedes. A mathematician, physicist, engineer, inventor and astronomer, this remarkable man lived in the city of Syracuse in modern Sicily from c.287 – c.212 BC.

Maybe you have heard the story about Archimedes lying in the bathtub one day thinking about a tricky problem. On suddenly realizing the solution, he is said to have jumped up and cried, 'Eureka!' (I have found it!). It is said that he was so excited that he ran through the streets naked!

What had Archimedes 'found', however? Well, have you ever wondered why very large ships don't just sink in the ocean? The answer is to be found in Archimedes' principle. This states that:

The buoyant force on a submerged object is equal to the weight of the fluid that is displaced by the object.

In other words, if you put an object in water, some of the water is displaced. Simultaneously, the force of buoyancy pushes up on the object; this alters its weight in the water. If the object weighs more than the amount of water, it will sink. If, however, the displaced water is equal to the weight of the object, it will float. The heavier an object is, the more water it needs to displace, which is why big boats have large, hollow hulls. The wide hulls displace more water, while being hollow keeps the weight down.

So, Archimedes' principle explains why large, heavy ships can float, but what problem was he trying to solve that day while lying in the bath? You may have heard the story of Archimedes and the golden crown. Hiero, the king of Syracuse, had asked a goldsmith to make him a new golden crown. The king was very pleased with the magnificent crown that the goldsmith produced, but soon he began to

hear rumours that he may have been tricked. It was said that the goldsmith had replaced some of the gold with an equal amount of silver. King Hiero decided to ask Archimedes if he could find some way of determining whether the crown was pure gold.

Archimedes knew that gold was denser than silver, so a piece of gold weighing the same amount as a piece of silver would be smaller. Therefore, a gold and silver crown would have a greater total volume than a pure gold crown. The problem was how to measure the volume of an irregular shaped object, which Archimedes figured out in his 'Eureka' moment.

He lowered a piece of pure gold, which was the same weight as the crown, into a pot filled with water and measured the amount of water that spilled out. He then did the same thing with the crown. The crown displaced more water than the piece of gold, proving that it had been mixed with silver. Hiero had his answer and the goldsmith was punished.

Archimedes was killed in c.212 during a battle for the city of Syracuse. As well as his work with water, he is remembered for many other inventions and theories, and was truly one of the world's great engineers.

MEMO

Vocabulary

The underlined word appears in the text. Choose the word below which best matches the underlined word.

1) Inventors often need to think long and hard to solve tricky problems.
   a) difficult b) impossible c) trivial

2) After a submarine dives, it is completely submerged in the water.
   a) under b) alone c) immersed

3) The hull of the Titanic struck an iceberg, causing it to sink.
   a) main body b) crew c) deck

4) Engineers sometimes have to determine the strength of various metals.
   a) change b) establish c) improve

5) Metals can be melted and then crafted into all kinds of irregular shapes.
   a) unbelievable b) standard c) variable

Understanding 1

Look at the reading passage and choose the correct expression.

1) As a polymath, Archimedes was interested in many different -------.
   a) people b) subjects c) places

2) When Archimedes figured out the -------, he was so excited that he forgot to get dressed.
   a) reason b) solution c) time

3) As water is moved by an object, something called buoyancy ------- acts against the submerged object.
   a) in opposition b) conversely c) simultaneously

4) Various people suggested that some gold in the crown had been r_____ by silver.

5) When Archimedes lowered the crown into water, it _____ a greater amount of water than it should have done.

Understanding 2

Look at the reading passage again and decide if the following statements are true or false. Be ready to explain your choice.

1) T / F If an object displaces water equal to its weight, it will float.

2) T / F Big boats have large, hollow hulls to make them lighter.

3) T / F King Hiero believed at once that the goldsmith had tricked him.

4) T / F Two lumps of gold and silver that are the same weight will be different sizes.

5) T / F Because the crown was not pure gold, it displaced more water than if it had been pure gold.

Dictation

03

Listen and fill in the blanks using the words below:

accurate	lower	dense	astronomer	peace
swapped	sink	believed	denser	astronaut
piece	scales	pure	low	accept

The famous Italian mathematician and 1. _____, Galileo Galilei, was interested in Archimedes' problem with the crown. Galileo 2. _____ that lowering a crown and a 3. _____ of gold into water would not be 4. _____ enough to determine that the crown was not 5. _____ gold. Instead, he believed that Archimedes would have used a set of 6. _____, with the crown on one side and a piece of gold on the other. In this test, the 7. _____ object with the smaller volume for the same weight would sink 8. _____ in the water. Therefore, the lump of pure gold would 9. _____ more than the crown, proving that the goldsmith had 10. _____ some gold for silver.

Think about it

Below is an explanation of how you could prove Archimedes' principle with a simple experiment. With a partner, or in a small group, make a diagram to illustrate the experiment. Be ready to explain your diagram in English!

Fill a beaker that has an overflow spout with water until the water comes out of the spout. When water stops flowing out of the spout, the water level in the beaker will now be level with the spout. Take an object, a stone or piece of wood, for example. Weigh the object on a hanging scale, and note the weight. Next, put an empty beaker on a standard scale, such as would be used for cooking, and place them both directly under the spout. Reset the standard scale to zero. Lower the object, still attached to the hanging scale, into the beaker of water so that the object is completely submerged. Displaced water will flow out of the spout into the empty beaker. When the flow stops, check the weight on the standard scale, and note it down. The weight of the object in the air minus the weight of the object in the water will be equal to the weight of the displaced water. This represents the buoyant force on the object, and proves Archimedes' principle.

Go to page 98 for a further activity.

Unit 2 Leonardo da Vinci (1452-1519)

Leonardo da Vinci

Pre-Reading

Answer the following questions with a partner:

1) Have you ever flown in an airplane? Where did you go?
2) What is the most famous painting you have ever seen?
3) How can human beings fly without the help of an engine?
4) Tell your partner what you know about Leonardo da Vinci.
5) If you could be an inventor, what would you like to create?