READING

READING PASSAGE 1

*You should spend about 20 minutes on **Questions 1–13**, which are based on Reading Passage 1 below.*

William Henry Perkin

The man who invented synthetic dyes

William Henry Perkin was born on March 12, 1838, in London, England. As a boy, Perkin's curiosity prompted early interests in the arts, sciences, photography, and engineering. But it was a chance stumbling upon a run-down, yet functional, laboratory in his late grandfather's home that solidified the young man's enthusiasm for chemistry.

As a student at the City of London School, Perkin became immersed in the study of chemistry. His talent and devotion to the subject were perceived by his teacher, Thomas Hall, who encouraged him to attend a series of lectures given by the eminent scientist Michael Faraday at the Royal Institution. Those speeches fired the young chemist's enthusiasm further, and he later went on to attend the Royal College of Chemistry, which he succeeded in entering in 1853, at the age of 15.

At the time of Perkin's enrolment, the Royal College of Chemistry was headed by the noted German chemist August Wilhelm Hofmann. Perkin's scientific gifts soon caught Hofmann's attention and, within two years, he became Hofmann's youngest assistant. Not long after that, Perkin made the scientific breakthrough that would bring him both fame and fortune.

At the time, quinine was the only viable medical treatment for malaria. The drug is derived from the bark of the cinchona tree, native to South America, and by 1856 demand for the drug was surpassing the available supply. Thus, when Hofmann made some passing comments about the desirability of a synthetic substitute for quinine, it was unsurprising that his star pupil was moved to take up the challenge.

During his vacation in 1856, Perkin spent his time in the laboratory on the top floor of his family's house. He was attempting to manufacture quinine from aniline, an inexpensive and readily available coal tar waste product. Despite his best efforts, however, he did not end up with quinine. Instead, he produced a mysterious dark sludge. Luckily, Perkin's scientific training and nature prompted him to investigate the substance further. Incorporating potassium dichromate and alcohol into the aniline at various stages of the experimental process, he finally produced a deep purple solution. And, proving the truth of the famous scientist Louis Pasteur's words 'chance favours only the prepared mind', Perkin saw the potential of his unexpected find.

Historically, textile dyes were made from such natural sources as plants and animal excretions. Some of these, such as the glandular mucus of snails, were difficult to obtain and outrageously expensive. Indeed, the purple colour extracted from a snail was once so costly that in society at the time only the rich could afford it. Further, natural dyes tended to be muddy in hue and fade quickly. It was against this backdrop that Perkin's discovery was made.

Perkin quickly grasped that his purple solution could be used to colour fabric, thus making it the world's first synthetic dye. Realising the importance of this breakthrough, he lost no time in patenting it. But perhaps the most fascinating of all Perkin's reactions to his find was his nearly instant recognition that the new dye had commercial possibilities.

Perkin originally named his dye Tyrian Purple, but it later became commonly known as mauve (from the French for the plant used to make the colour violet). He asked advice of Scottish dye works owner Robert Pullar, who assured him that manufacturing the dye would be well worth it if the colour remained fast (i.e. would not fade) and the cost was relatively low. So, over the fierce objections of his mentor Hofmann, he left college to give birth to the modern chemical industry.

With the help of his father and brother, Perkin set up a factory not far from London. Utilising the cheap and plentiful coal tar that was an almost unlimited byproduct of London's gas street lighting, the dye works began producing the world's first synthetically dyed material in 1857. The company received a commercial boost from the Empress Eugénie of France, when she decided the new colour flattered her. Very soon, mauve was the necessary shade for all the fashionable ladies in that country. Not to be outdone, England's Queen Victoria also appeared in public wearing a mauve gown, thus making it all the rage in England as well. The dye was bold and fast, and the public clamoured for more. Perkin went back to the drawing board.

Although Perkin's fame was achieved and fortune assured by his first discovery, the chemist continued his research. Among other dyes he developed and introduced were aniline red (1859) and aniline black (1863) and, in the late 1860s, Perkin's green. It is important to note that Perkin's synthetic dye discoveries had outcomes far beyond the merely decorative. The dyes also became vital to medical research in many ways. For instance, they were used to stain previously invisible microbes and bacteria, allowing researchers to identify such bacilli as tuberculosis, cholera, and anthrax. Artificial dyes continue to play a crucial role today. And, in what would have been particularly pleasing to Perkin, their current use is in the search for a vaccine against malaria.

Questions 1–7

Do the following statements agree with the information given in Reading Passage 1?

In boxes 1–7 on your answer sheet, write

TRUE	*if the statement agrees with the information*
FALSE	*if the statement contradicts the information*
NOT GIVEN	*if there is no information on this*

1 Michael Faraday was the first person to recognise Perkin's ability as a student of chemistry.

2 Michael Faraday suggested Perkin should enrol in the Royal College of Chemistry.

3 Perkin employed August Wilhelm Hofmann as his assistant.

4 Perkin was still young when he made the discovery that made him rich and famous.

5 The trees from which quinine is derived grow only in South America.

6 Perkin hoped to manufacture a drug from a coal tar waste product.

7 Perkin was inspired by the discoveries of the famous scientist Louis Pasteur.

Questions 8–13

Answer the questions below.

Choose ***NO MORE THAN TWO WORDS*** *from the passage for each answer.*

Write your answers in boxes 8–13 on your answer sheet.

8 Before Perkin's discovery, with what group in society was the colour purple associated?

9 What potential did Perkin immediately understand that his new dye had?

10 What was the name finally used to refer to the first colour Perkin invented?

11 What was the name of the person Perkin consulted before setting up his own dye works?

12 In what country did Perkin's newly invented colour first become fashionable?

13 According to the passage, which disease is now being targeted by researchers using synthetic dyes?

READING PASSAGE 1

You should spend about 20 minutes on **Questions 1-13**, *which are based on Reading Passage 1 on pages 3 and 4.*

Questions 1 – 6

Reading Passage 1 has six paragraphs, **A-F**.

Choose the correct heading for each paragraph from the list of headings below.

Write the correct number, ***i-ix****, in boxes 1-6 on your answer sheet.*

List of Headings

i	The appearance and location of different seaweeds
ii	The nutritional value of seaweeds
iii	How seaweeds reproduce and grow
iv	How to make agar from seaweeds
v	The under-use of native seaweeds
vi	Seaweed species at risk of extinction
vii	Recipes for how to cook seaweeds
viii	The range of seaweed products
ix	Why seaweeds don't sink or dry out

1 Paragraph **A**

2 Paragraph **B**

3 Paragraph **C**

4 Paragraph **D**

5 Paragraph **E**

6 Paragraph **F**

Seaweeds of New Zealand

A Seaweed is a particularly wholesome food, which absorbs and concentrates traces of a wide variety of minerals necessary to the body's health. Many elements may occur in seaweed – aluminium, barium, calcium, chlorine, copper, iodine and iron, to name but a few – traces normally produced by erosion and carried to the seaweed beds by river and sea currents. Seaweeds are also rich in vitamins; indeed, Inuits obtain a high proportion of their bodily requirements of vitamin C from the seaweeds they eat. The health benefits of seaweed have long been recognised. For instance, there is a remarkably low incidence of goitre among the Japanese, and also among New Zealand's indigenous Maori people, who have always eaten seaweeds, and this may well be attributed to the high iodine content of this food. Research into historical Maori eating customs shows that jellies were made using seaweeds, nuts, fuchsia and tutu berries, cape gooseberries, and many other fruits both native to New Zealand and sown there from seeds brought by settlers and explorers. As with any plant life, some seaweeds are more palatable than others, but in a survival situation, most seaweeds could be chewed to provide a certain sustenance.

B New Zealand lays claim to approximately 700 species of seaweed, some of which have no representation outside that country. Of several species grown worldwide, New Zealand also has a particularly large share. For example, it is estimated that New Zealand has some 30 species of *Gigartina*, a close relative of carrageen or Irish moss. These are often referred to as the New Zealand carrageens. The substance called agar which can be extracted from these species gives them great commercial application in the production of seameal, from which seameal custard (a food product) is made, and in the canning, paint and leather industries. Agar is also used in the manufacture of cough mixtures, cosmetics, confectionery and toothpastes. In fact, during World War II, New Zealand *Gigartina* were sent to Australia to be used in toothpaste.

C New Zealand has many of the commercially profitable red seaweeds, several species of which are a source of agar (*Pterocladia, Gelidium, Chondrus, Gigartina*). Despite this, these seaweeds were not much utilised until several decades ago. Although distribution of the *Gigartina* is confined to certain areas according to species, it is only on the east coast of the North Island that its occurrence is rare. And even then, the east coast, and the area around Hokianga, have a considerable supply of the two species of *Pterocladia* from which agar is also made. New Zealand used to import the Northern Hemisphere Irish moss (*Chondrus crispus*) from England and ready-made agar from Japan.

Turn over ▶

D Seaweeds are divided into three classes determined by colour – red, brown and green – and each tends to live in a specific position. However, except for the unmistakable sea lettuce (*Ulva*), few are totally one colour; and especially when dry, some species can change colour significantly – a brown one may turn quite black, or a red one appear black, brown, pink or purple. Identification is nevertheless facilitated by the fact that the factors which determine where a seaweed will grow are quite precise, and they tend therefore to occur in very well-defined zones. Although there are exceptions, the green seaweeds are mainly shallow-water algae; the browns belong to the medium depths; and the reds are plants of the deeper water, furthest from the shore. Those shallow-water species able to resist long periods of exposure to sun and air are usually found on the upper shore, while those less able to withstand such exposure occur nearer to, or below, the low-water mark. Radiation from the sun, the temperature level, and the length of time immersed also play a part in the zoning of seaweeds. Flat rock surfaces near mid-level tides are the most usual habitat of sea-bombs, Venus' necklace, and most brown seaweeds. This is also the home of the purple laver or Maori *karengo*, which looks rather like a reddish-purple lettuce. Deep-water rocks on open coasts, exposed only at very low tide, are usually the site of bull-kelp, strapweeds and similar tough specimens. Kelp, or bladder kelp, has stems that rise to the surface from massive bases or 'holdfasts', the leafy branches and long ribbons of leaves surging with the swells beyond the line of shallow coastal breakers or covering vast areas of calmer coastal water.

E Propagation of seaweeds occurs by seed-like spores, or by fertilisation of egg cells. None have roots in the usual sense; few have leaves; and none have flowers, fruits or seeds. The plants absorb their nourishment through their leafy fronds when they are surrounded by water; the holdfast of seaweeds is purely an attaching organ, not an absorbing one.

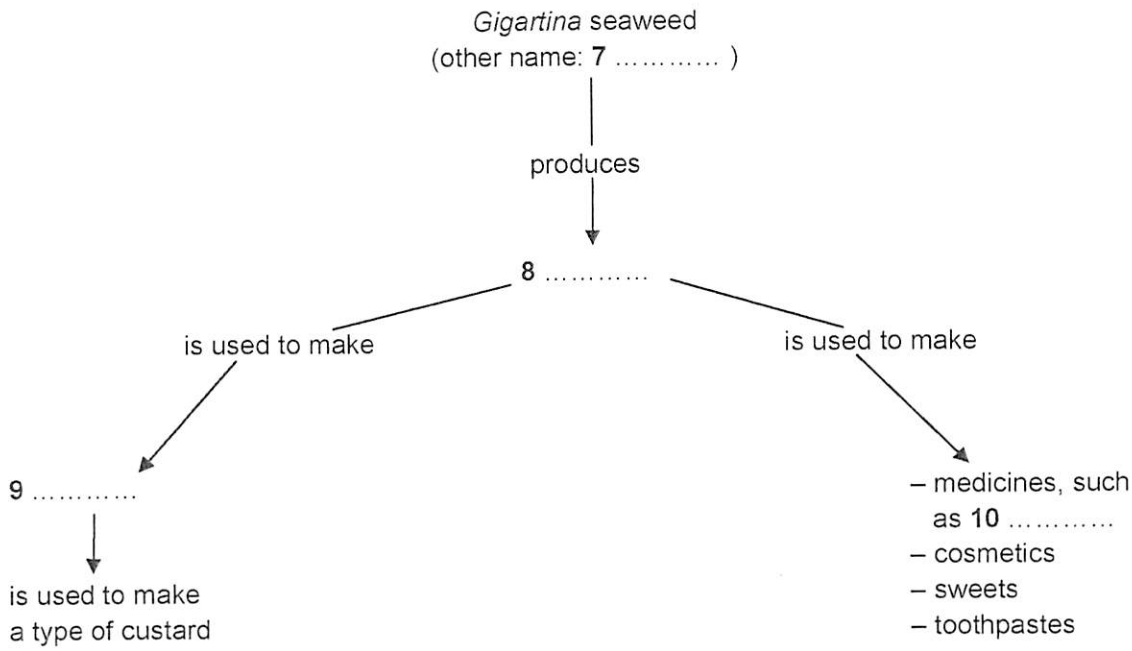
F Some of the large seaweeds stay on the surface of the water by means of air-filled floats; others, such as bull-kelp, have large cells filled with air. Some which spend a good part of their time exposed to the air, often reduce dehydration either by having swollen stems that contain water, or they may (like Venus' necklace) have swollen nodules, or they may have a distinctive shape like a sea-bomb. Others, like the sea cactus, are filled with a slimy fluid or have a coating of mucilage on the surface. In some of the larger kelps, this coating is not only to keep the plant moist, but also to protect it from the violent action of waves.

Questions 7 – 10

Complete the flow-chart below.

Choose **NO MORE THAN THREE WORDS** *from the passage for each answer.*

Write your answers in boxes 7-10 on your answer sheet.



Questions 11 – 13

Classify the following characteristics as belonging to

- *A* *brown seaweed*
- *B* *green seaweed*
- *C* *red seaweed*

Write the correct letter, **A**, **B** *or* **C**, *in boxes 11-13 on your answer sheet.*

11 can survive the heat and dryness at the high-water mark

12 grow far out in the open sea

13 share their site with *karengo* seaweed

Turn over ▶