

## READING PASSAGE 2

You should spend about 20 minutes on **Questions 14–26**, which are based on Reading Passage 2 below.

# THE FALKIRK WHEEL

## A unique engineering achievement

The Falkirk Wheel in Scotland is the world's first and only rotating boat lift. Opened in 2002, it is central to the ambitious £84.5m Millennium Link project to restore navigability across Scotland by reconnecting the historic waterways of the Forth & Clyde and Union Canals.

The major challenge of the project lay in the fact that the Forth & Clyde Canal is situated 35 metres below the level of the Union Canal. Historically, the two canals had been joined near the town of Falkirk by a sequence of 11 locks – enclosed sections of canal in which the water level could be raised or lowered – that stepped down across a distance of 1.5 km. This had been dismantled in 1933, thereby breaking the link. When the project was launched in 1994, the British Waterways authority were keen to create a dramatic twenty-first-century landmark which would not only be a fitting commemoration of the Millennium, but also a lasting symbol of the economic regeneration of the region.

Numerous ideas were submitted for the project, including concepts ranging from rolling eggs to tilting tanks, from giant seesaws to overhead monorails. The eventual winner was a plan for the huge rotating steel boat lift which was to become The Falkirk Wheel. The unique shape of the structure is claimed to have been inspired by various sources, both manmade and natural, most notably a Celtic double-

headed axe, but also the vast turning propeller of a ship, the ribcage of a whale or the spine of a fish.

The various parts of The Falkirk Wheel were all constructed and assembled, like one giant toy building set, at Butterley Engineering's Steelworks in Derbyshire, some 400 km from Falkirk. A team there carefully assembled the 1,200 tonnes of steel, painstakingly fitting the pieces together to an accuracy of just 10 mm to ensure a perfect final fit. In the summer of 2001, the structure was then dismantled and transported on 35 lorries to Falkirk, before all being bolted back together again on the ground, and finally lifted into position in five large sections by crane. The Wheel would need to withstand immense and constantly changing stresses as it rotated, so to make the structure more robust, the steel sections were bolted rather than welded together. Over 45,000 bolt holes were matched with their bolts, and each bolt was hand-tightened.

The Wheel consists of two sets of opposing axe-shaped arms, attached about 25 metres apart to a fixed central spine. Two diametrically opposed water-filled 'gondolas', each with a capacity of 360,000 litres, are fitted between the ends of the arms. These gondolas always weigh the same, whether or not they are carrying boats. This is because, according to Archimedes' principle of displacement,



floating objects displace their own weight in water. So when a boat enters a gondola, the amount of water leaving the gondola weighs exactly the same as the boat. This keeps the Wheel balanced and so, despite its enormous mass, it rotates through 180° in five and a half minutes while using very little power. It takes just 1.5 kilowatt-hours (5.4 MJ) of energy to rotate the Wheel – roughly the same as boiling eight small domestic kettles of water.

Boats needing to be lifted up enter the canal basin at the level of the Forth & Clyde Canal and then enter the lower gondola of the Wheel. Two hydraulic steel gates are raised, so as to seal the gondola off from the water in the canal basin. The water between the gates is then pumped out. A hydraulic clamp, which prevents the arms of the Wheel moving while the gondola is docked, is removed, allowing the Wheel to turn. In the central machine room an array of ten hydraulic motors then begins to rotate the central axle. The axle connects to the outer arms of the

Wheel, which begin to rotate at a speed of 1/8 of a revolution per minute. As the wheel rotates, the gondolas are kept in the upright position by a simple gearing system. Two eight-metre-wide cogs orbit a fixed inner cog of the same width, connected by two smaller cogs travelling in the opposite direction to the outer cogs – so ensuring that the gondolas always remain level. When the gondola reaches the top, the boat passes straight onto the aqueduct situated 24 metres above the canal basin.

The remaining 11 metres of lift needed to reach the Union Canal is achieved by means of a pair of locks. The Wheel could not be constructed to elevate boats over the full 35-metre difference between the two canals, owing to the presence of the historically important Antonine Wall, which was built by the Romans in the second century AD. Boats travel under this wall via a tunnel, then through the locks, and finally on to the Union Canal.

Questions 14–19

Do the following statements agree with the information given in Reading Passage 2?

In boxes 14–19 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

- 14 The Falkirk Wheel has linked the Forth & Clyde Canal with the Union Canal for the first time in their history.
- 15 There was some opposition to the design of the Falkirk Wheel at first.
- 16 The Falkirk Wheel was initially put together at the location where its components were manufactured.
- 17 The Falkirk Wheel is the only boat lift in the world which has steel sections bolted together by hand.
- 18 The weight of the gondolas varies according to the size of boat being carried.
- 19 The construction of the Falkirk Wheel site took into account the presence of a nearby ancient monument.

## Questions 20–26

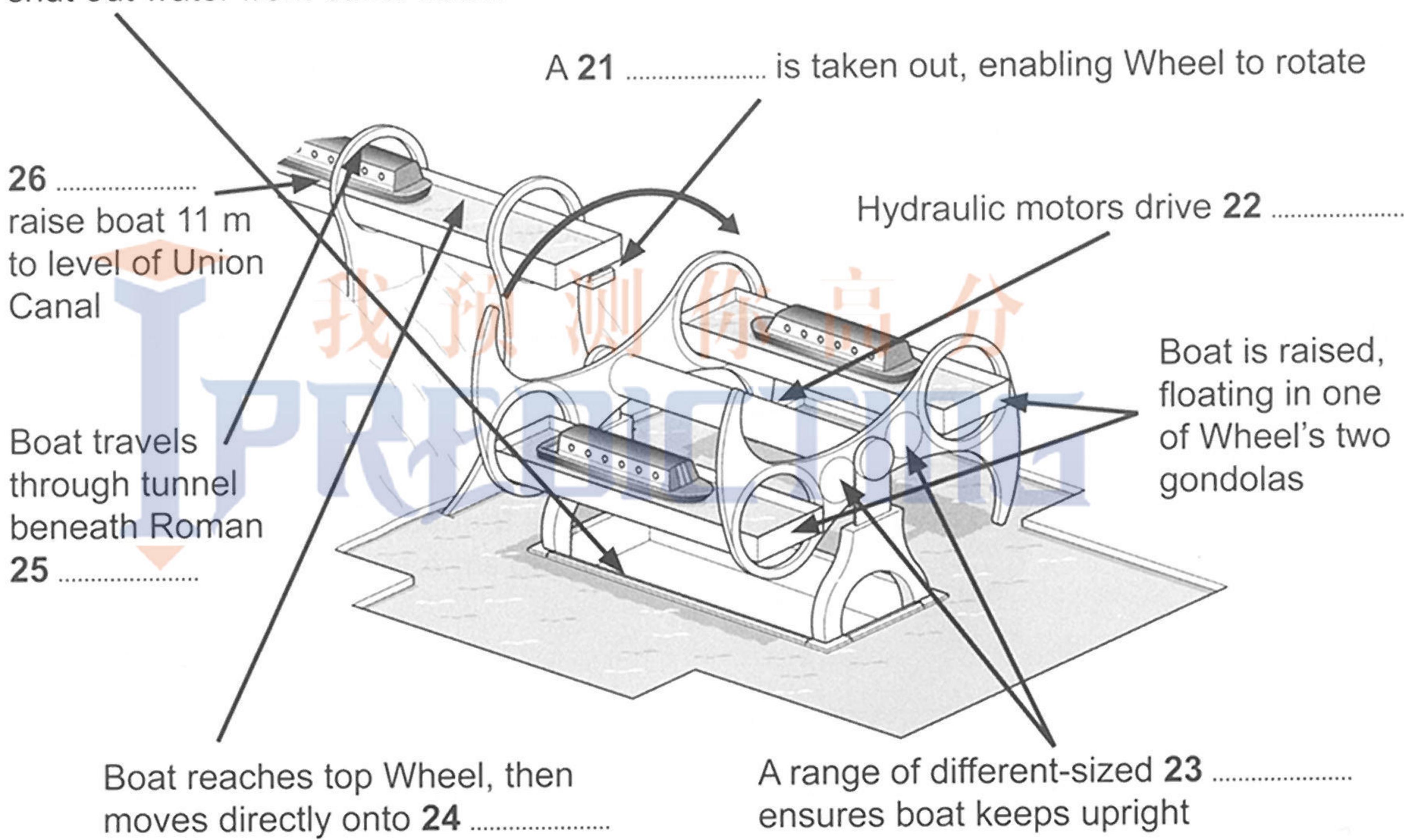
Label the diagram below.

Choose **ONE WORD** from the passage for each answer.

Write your answers in boxes 20–26 on your answer sheet.

### How a boat is lifted on the Falkirk Wheel

A pair of 20 ..... are lifted in order to shut out water from canal basin



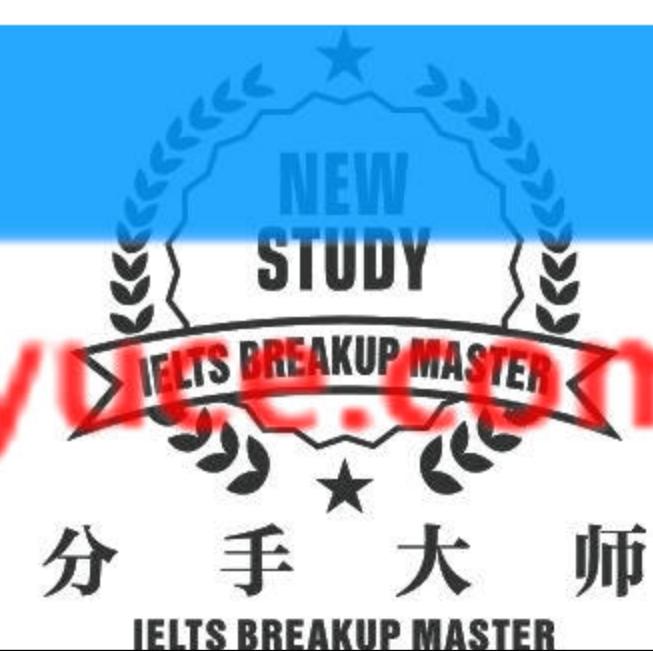
## READING PASSAGE 3

You should spend about 20 minutes on **Questions 27–40**, which are based on Reading Passage 3 below.

### Reducing the Effects of Climate Change

*Mark Rowe reports on the increasingly ambitious geo-engineering projects being explored by scientists*

- A Such is our dependence on fossil fuels, and such is the volume of carbon dioxide already released into the atmosphere, that many experts agree that significant global warming is now inevitable. They believe that the best we can do is keep it at a reasonable level, and at present the only serious option for doing this is cutting back on our carbon emissions. But while a few countries are making major strides in this regard, the majority are having great difficulty even stemming the rate of increase, let alone reversing it. Consequently, an increasing number of scientists are beginning to explore the alternative of geo-engineering – a term which generally refers to the intentional large-scale manipulation of the environment. According to its proponents, geo-engineering is the equivalent of a backup generator: if Plan A – reducing our dependency on fossil fuels – fails, we require a Plan B, employing grand schemes to slow down or reverse the process of global warming.
- B Geo-engineering has been shown to work, at least on a small localised scale. For decades, May Day parades in Moscow have taken place under clear blue skies, aircraft having deposited dry ice, silver iodide and cement powder to disperse clouds. Many of the schemes now suggested look to do the opposite, and reduce the amount of sunlight reaching the planet. The most eye-catching idea of all is suggested by Professor Roger Angel of the University of Arizona. His scheme would employ up to 16 trillion minute spacecraft, each weighing about one gram, to form a transparent, sunlight-refracting sunshade in an orbit 1.5 million km above the Earth. This could, argues Angel, reduce the amount of light reaching the Earth by two per cent.
- C The majority of geo-engineering projects so far carried out – which include planting forests in deserts and depositing iron in the ocean to stimulate the growth of algae – have focused on achieving a general cooling of the Earth. But some look specifically at reversing the melting at the poles, particularly the Arctic. The reasoning is that if you replenish the ice sheets and frozen waters of the high latitudes, more light will be reflected back into space, so reducing the warming of the oceans and atmosphere.
- D The concept of releasing aerosol sprays into the stratosphere above the Arctic has been proposed by several scientists. This would involve using sulphur or hydrogen sulphide aerosols so that sulphur dioxide would form clouds, which would, in turn, lead to a global dimming. The idea is modelled on historic volcanic explosions, such as that of Mount Pinatubo in the Philippines in 1991, which led to a short-term cooling of global temperatures by 0.5 °C. Scientists have also scrutinised whether it's possible to preserve the ice sheets of Greenland with reinforced high-tension cables, preventing icebergs from moving into the sea. Meanwhile in the Russian Arctic, geo-engineering plans include the planting of millions of birch trees. Whereas the region's native evergreen pines shade the snow and absorb radiation, birches would shed their



leaves in winter, thus enabling radiation to be reflected by the snow. Re-routing Russian rivers to increase cold water flow to ice-forming areas could also be used to slow down warming, say some climate scientists.

- E** But will such schemes ever be implemented? Generally speaking, those who are most cautious about geo-engineering are the scientists involved in the research. Angel says that his plan is ‘no substitute for developing renewable energy: the only permanent solution’. And Dr Phil Rasch of the US-based Pacific Northwest National Laboratory is equally guarded about the role of geo-engineering: ‘I think all of us agree that if we were to end geo-engineering on a given day, then the planet would return to its pre-engineered condition very rapidly, and probably within ten to twenty years. That’s certainly something to worry about.’
- F** The US National Center for Atmospheric Research has already suggested that the proposal to inject sulphur into the atmosphere might affect rainfall patterns across the tropics and the Southern Ocean. ‘Geo-engineering plans to inject stratospheric aerosols or to seed clouds would act to cool the planet, and act to increase the extent of sea ice,’ says Rasch. ‘But all the models suggest some impact on the distribution of precipitation.’
- G** ‘A further risk with geo-engineering projects is that you can “overshoot”,’ says Dr Dan Lunt, from the University of Bristol’s School of Geophysical Sciences, who has studied the likely impacts of the sunshade and aerosol schemes on the climate. ‘You may bring global temperatures back to pre-industrial levels, but the risk is that the poles will still be warmer than they should be and the tropics will be cooler than before industrialisation.’ To avoid such a scenario, Lunt says Angel’s project would have to operate at half strength; all of which reinforces his view that the best option is to avoid the need for geo-engineering altogether.
- H** The main reason why geo-engineering is supported by many in the scientific community is that most researchers have little faith in the ability of politicians to agree – and then bring in – the necessary carbon cuts. Even leading conservation organisations see the value of investigating the potential of geo-engineering. According to Dr Martin Sommerkorn, climate change advisor for the World Wildlife Fund’s International Arctic Programme, ‘Human-induced climate change has brought humanity to a position where we shouldn’t exclude thinking thoroughly about this topic and its possibilities.’

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Questions 27–29

Reading Passage 3 has eight paragraphs A–H.

Which paragraph contains the following information?

Write the correct letter, A–H, in boxes 27–29 on your answer sheet.

- 27 mention of a geo-engineering project based on an earlier natural phenomenon
- 28 an example of a successful use of geo-engineering
- 29 a common definition of geo-engineering



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Questions 30–36

Complete the table below.

Choose **ONE WORD** from the passage for each answer.

Write your answers in boxes 30–36 on your answer sheet.

## GEO-ENGINEERING PROJECTS

Procedure	Aim
put a large number of tiny spacecraft into orbit far above Earth	to create a 30 ..... that would reduce the amount of light reaching Earth
place 31 ..... in the sea	to encourage 32 ..... to form
release aerosol sprays into the stratosphere	to create 33 ..... that would reduce the amount of light reaching Earth
fix strong 34 ..... to Greenland ice sheets	to prevent icebergs moving into the sea
plant trees in Russian Arctic that would lose their leaves in winter	to allow the 35 ..... to reflect radiation
change the direction of 36 .....	to bring more cold water into ice-forming areas

Questions 37–40

Look at the following statements (Questions 37–40) and the list of scientists below.

Match each statement with the correct scientist, A–D.

Write the correct letter, A–D, in boxes 37–40 on your answer sheet.

- 37 The effects of geo-engineering may not be long-lasting.
- 38 Geo-engineering is a topic worth exploring.
- 39 It may be necessary to limit the effectiveness of geo-engineering projects.
- 40 Research into non-fossil-based fuels cannot be replaced by geo-engineering.

List of Scientists

- A Roger Angel
- B Phil Rasch
- C Dan Lunt
- D Martin Sommerkorn

**WRITING****WRITING TASK 1**

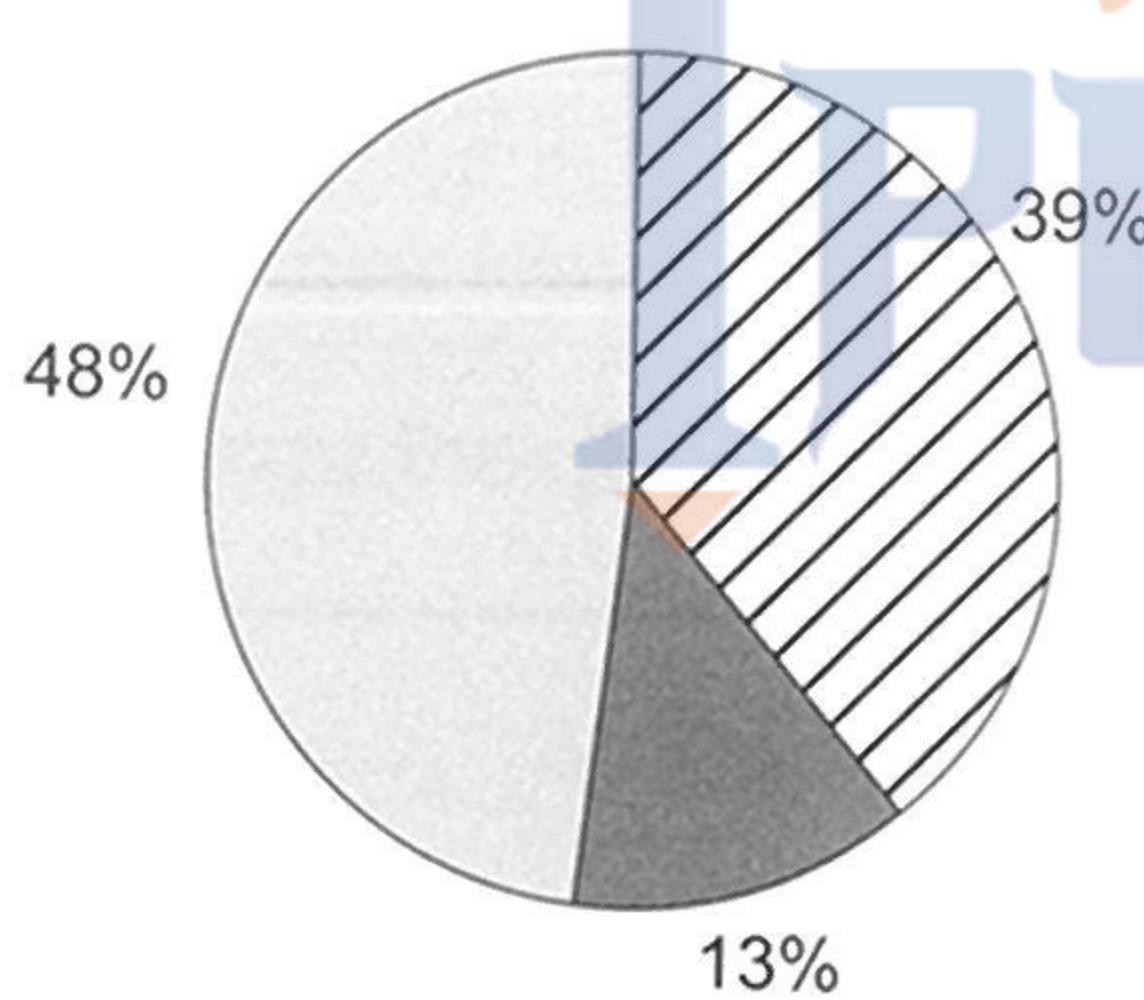
You should spend about 20 minutes on this task.

*The charts below show the percentage of water used for different purposes in six areas of the world.*

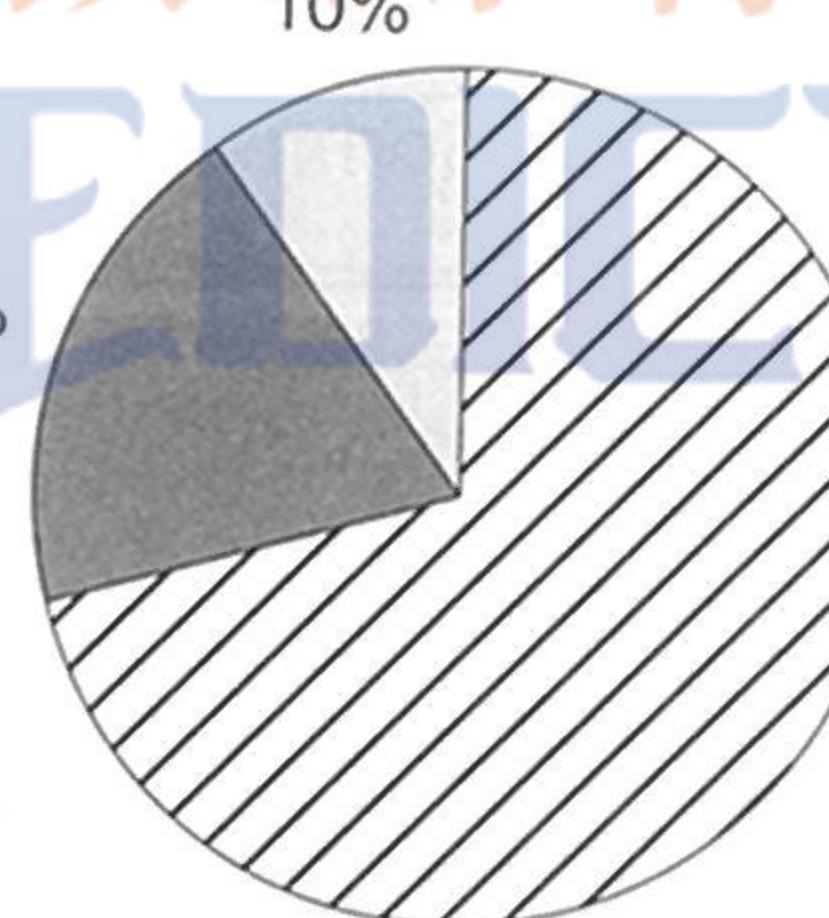
*Summarise the information by selecting and reporting the main features, and make comparisons where relevant.*

Write at least 150 words.

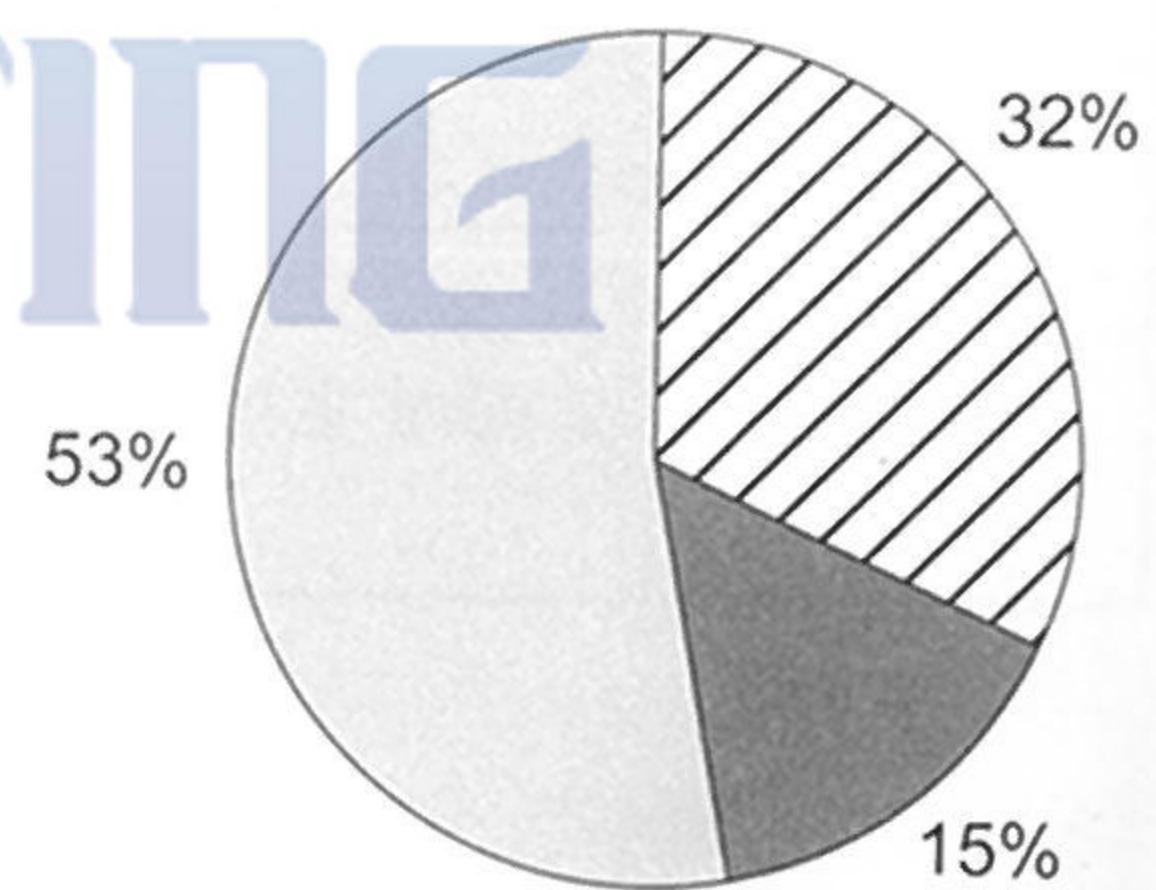
### Percentage of water used for different purposes in six areas of the world



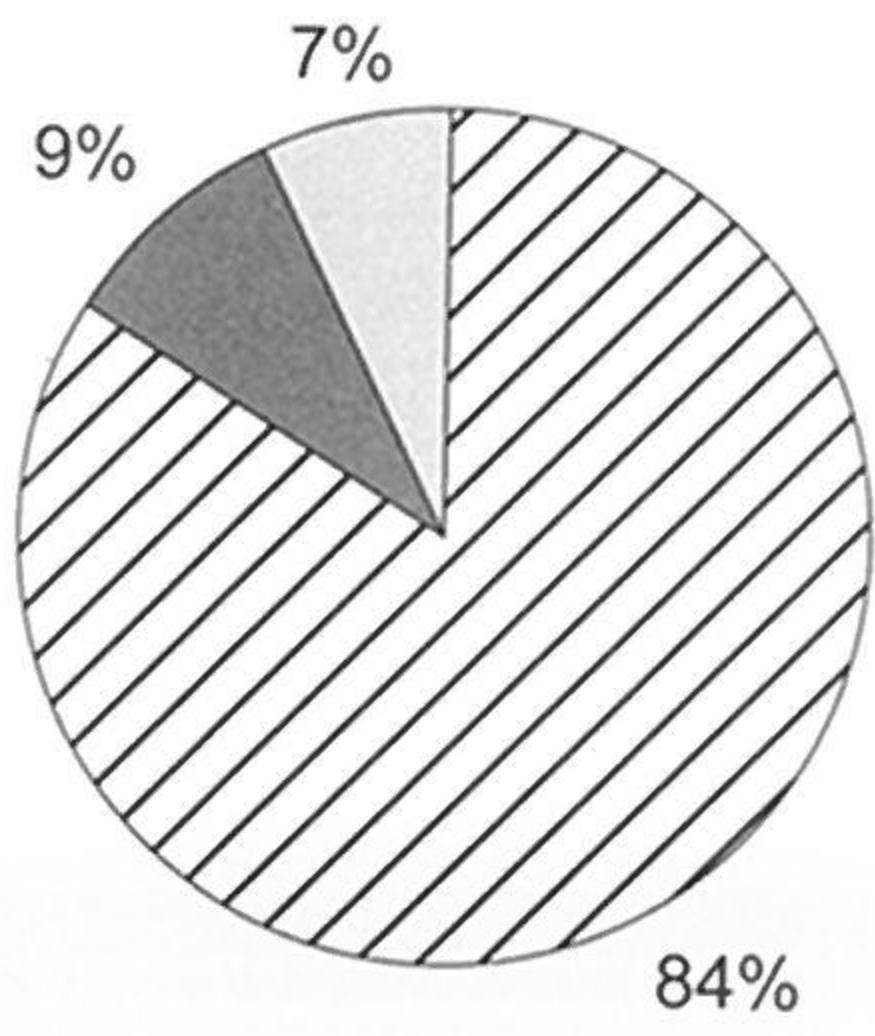
NORTH AMERICA



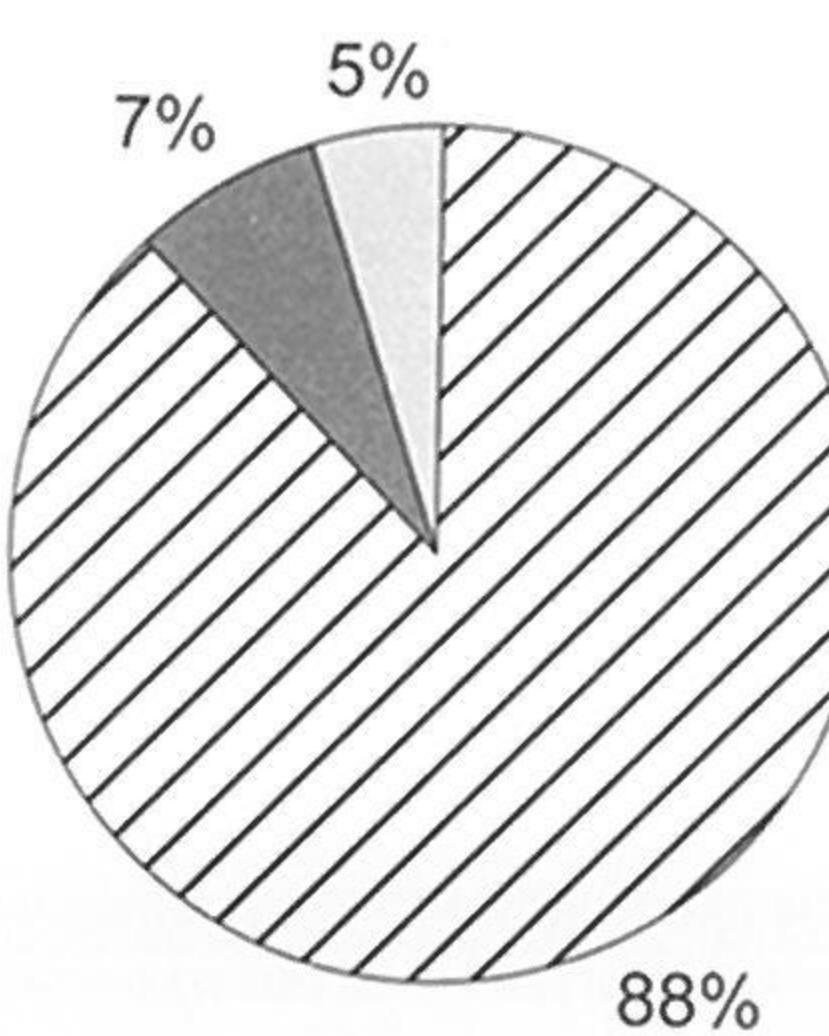
SOUTH AMERICA



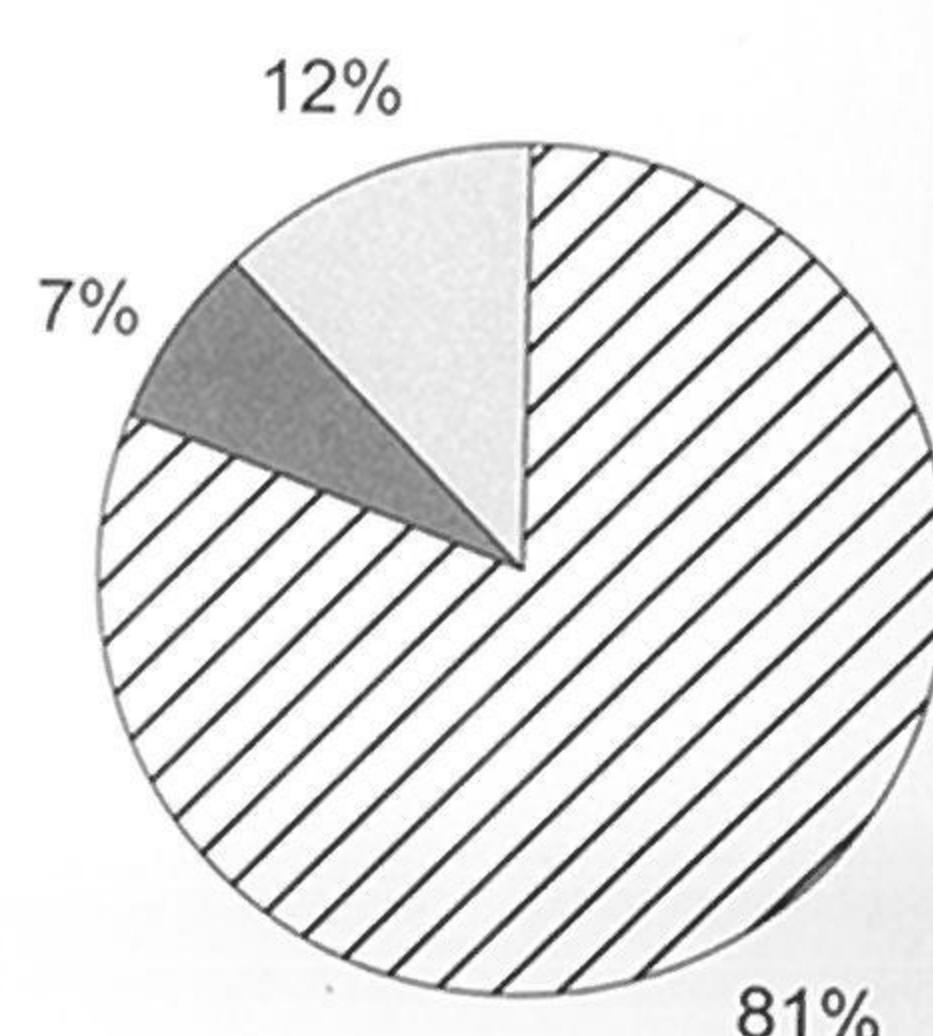
EUROPE



AFRICA



CENTRAL ASIA



SOUTH EAST ASIA

Industrial use      Agricultural use      Domestic use

## WRITING TASK 2

You should spend about 40 minutes on this task.

Write about the following topic:

***Governments should spend money on railways rather than roads.***

***To what extent do you agree or disagree with this statement?***

Give reasons for your answer and include any relevant examples from your own knowledge or experience.

Write at least 250 words.



## SPEAKING

### PART 1

The examiner asks the candidate about him/herself, his/her home, work or studies and other familiar topics.

#### EXAMPLE

##### Food and cooking

- What sorts of food do you like eating most? [Why?]
- Who normally does the cooking in your home? [Why/Why not?]
- Do you watch cookery programmes on TV? [Why/Why not?]
- In general, do you prefer eating out or eating at home? [Why?]

### PART 2

Describe a house/apartment that someone you know lives in.

You should say:

whose house/apartment this is  
where the house/apartment is  
what it looks like inside  
and explain what you like or dislike  
about this person's house/apartment.

You will have to talk about the topic for one to two minutes.

You have one minute to think about what you are going to say.

You can make some notes to help you if you wish.

### PART 3

#### *Discussion topics:*

##### Different types of home

###### *Example questions:*

What kinds of home are most popular in your country? Why is this?

What do you think are the advantages of living in a house rather than an apartment?

Do you think that everyone would like to live in a larger home? Why is that?

##### Finding a place to live

###### *Example questions:*

How easy is it to find a place to live in your country?

Do you think it's better to rent or to buy a place to live in? Why?

Do you agree that there is a right age for young adults to stop living with their parents?

Why is that?

# Test 2

## LISTENING

### SECTION 1 Questions 1–10

Complete the notes below.

Write **ONE WORD AND/OR A NUMBER** for each answer.

#### Enquiry about joining Youth Council

Example

Name: Roger..... Brown

Age: 18



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PREDICTING

Currently staying in a 1 ..... during the week

Postal address: 2 17, ..... Street, Stamford, Lincs

Postcode: 3 .....

Occupation: student and part-time job as a 4 .....

Studying 5 ..... (major subject) and history (minor subject)

Hobbies: does a lot of 6 ..... , and is interested in the

7 .....

On Youth Council, wants to work with young people who are  
8 .....

Will come to talk to the Elections Officer next Monday at  
9 ..... pm

Mobile number: 10 .....



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SECTION 2      *Questions 11–20*

### New staff at theatre

*Questions 11 and 12*

*Choose **TWO** letters, A–E.*

Which **TWO** changes have been made so far during the refurbishment of the theatre?

- A Some rooms now have a different use.
- B A different type of seating has been installed.
- C An elevator has been installed.
- D The outside of the building has been repaired.
- E Extra seats have been added.

*Questions 13 and 14*

*Choose **TWO** letters, A–E.*

Which **TWO** facilities does the theatre currently offer to the public?

- A rooms for hire
- B backstage tours
- C hire of costumes
- D a bookshop
- E a café

*Questions 15 and 16*

*Choose **TWO** letters, A–E.*

Which **TWO** workshops does the theatre currently offer?

- A sound
- B acting
- C making puppets
- D make-up
- E lighting



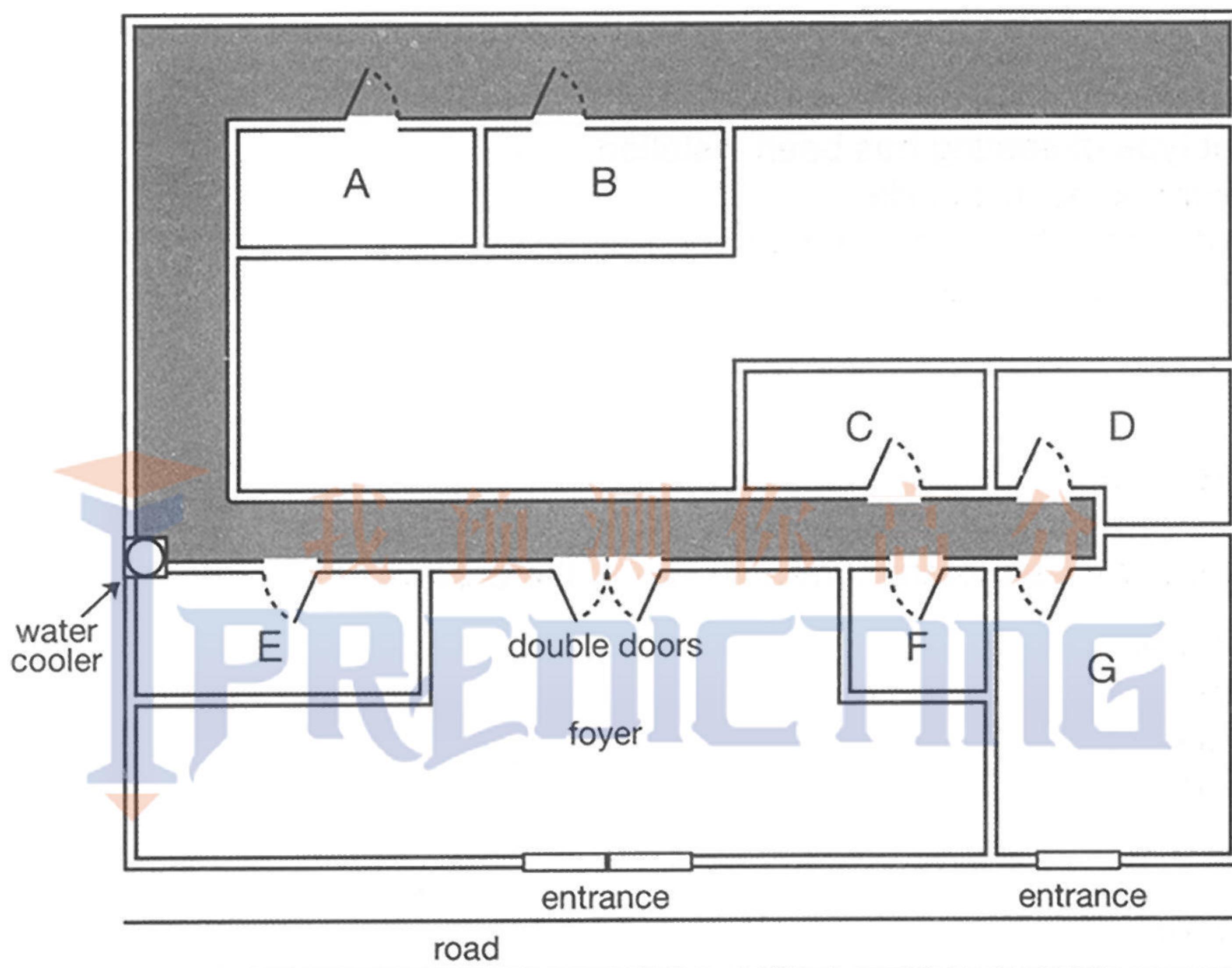
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Questions 17–20

Label the plan below.

Write the correct letter, A–G, next to Questions 17–20.

**Ground floor plan of theatre**



- 17 box office .....  
18 theatre manager's office .....  
19 lighting box .....  
20 artistic director's office .....

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**SECTION 3 Questions 21–30****Questions 21–26**

Choose the correct letter, **A**, **B** or **C**.

**Rocky Bay field trip**

**21** What do the students agree should be included in their aims?

- A** factors affecting where organisms live
- B** the need to preserve endangered species
- C** techniques for classifying different organisms

**22** What equipment did they forget to take on the Field Trip?

- A** string
- B** a compass
- C** a ruler

**23** In Helen's procedure section, Colin suggests a change in

- A** the order in which information is given.
- B** the way the information is divided up.
- C** the amount of information provided.

**24** What do they say about the method they used to measure wave speed?

- A** It provided accurate results.
- B** It was simple to carry out.
- C** It required special equipment.

**25** What mistake did Helen make when first drawing the map?

- A** She chose the wrong scale.
- B** She stood in the wrong place.
- C** She did it at the wrong time.

**26** What do they decide to do next with their map?

- A** scan it onto a computer
- B** check it using photographs
- C** add information from the internet

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Questions 27 and 28

Choose **TWO** letters, **A–E**.

Which **TWO** problems affecting organisms in the splash zone are mentioned?

- A** lack of water
- B** strong winds
- C** lack of food
- D** high temperatures
- E** large waves

Questions 29 and 30

Choose **TWO** letters, **A–E**.

Which **TWO** reasons for possible error will they include in their report?

- A** inaccurate records of the habitat of organisms
- B** influence on behaviour of organisms by observer
- C** incorrect identification of some organisms
- D** making generalisations from a small sample
- E** missing some organisms when counting

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**SECTION 4 Questions 31–40**

Complete the notes below.

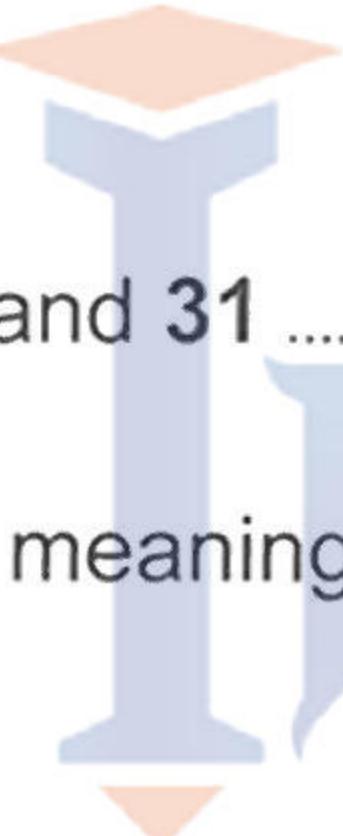
Write **ONE WORD ONLY** for each answer.

## DESIGNING A PUBLIC BUILDING: THE TAYLOR CONCERT HALL

### Introduction

The designer of a public building may need to consider the building's

- function
- physical and 31 ..... context
- symbolic meaning



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PREDICTING

### Location and concept of the Concert Hall

On the site of a disused 32 .....

Beside a 33 .....

The design is based on the concept of a mystery

**Building design**

It's approached by a 34 ..... for pedestrians

The building is the shape of a 35 .....

One exterior wall acts as a large 36 .....

In the auditorium:

- the floor is built on huge pads made of 37 .....
- the walls are made of local wood and are 38 ..... in shape
- ceiling panels and 39 ..... on walls allow adjustment of acoustics

**Evaluation**

Some critics say the 40 ..... style of the building is inappropriate