Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: SYNERGY

H

Higher Tier Paper 1 Life and Environmental Sciences

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a protractor
- a scientific calculator
- the periodic table (enclosed)
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

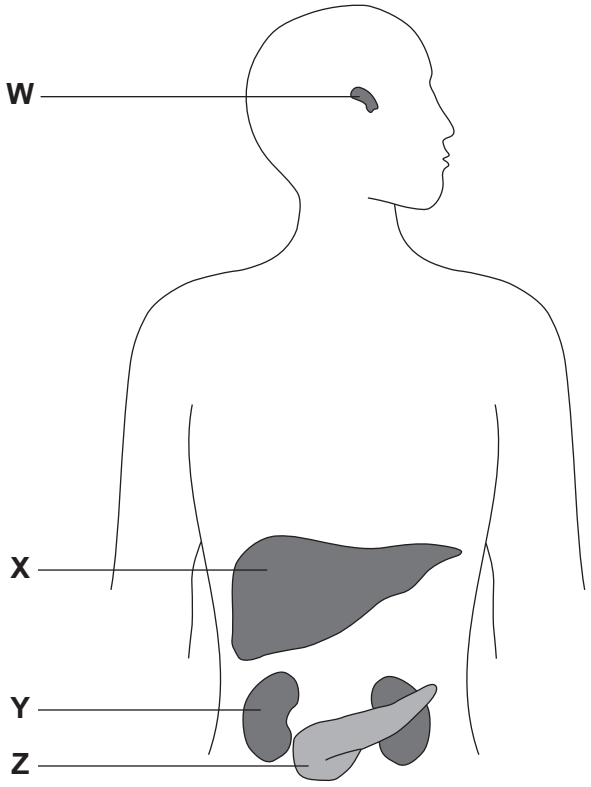
Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Do not write outside the box

0 1 The endocrine system releases hormones into the blood.

Figure 1 shows some endocrine glands and some target organs.

Figure 1



0 1 . 1 Which structure is the pituitary gland?

[1 mark]

Tick (✓) **one** box.

W ☐ **X** ☐ **Y** ☐ **Z** ☐

Do not write outside the box

0 1 . 2 Which is the main **target** organ of the hormone insulin?

[1 mark]

Tick (✓) **one** box.

Kidney ☐ Liver ☐ Pancreas ☐

0 1 . 3 The endocrine system sends hormones to target organs.

The nervous system sends impulses to target organs.

How does the speed of movement of hormones compare with the speed of transmission of impulses?

[1 mark]

Tick (✓) **one** box.

Hormones travel more slowly than impulses. ☐

Hormones travel at the same speed as impulses. ☐

Hormones travel more quickly than impulses. ☐

0 1 . 4 The pituitary gland releases hormones, which results in widespread effects on the body.

Explain why the pituitary gland is sometimes called the 'master gland'.

[2 marks]

_____

_____

_____

_____

Question 1 continues on the next page

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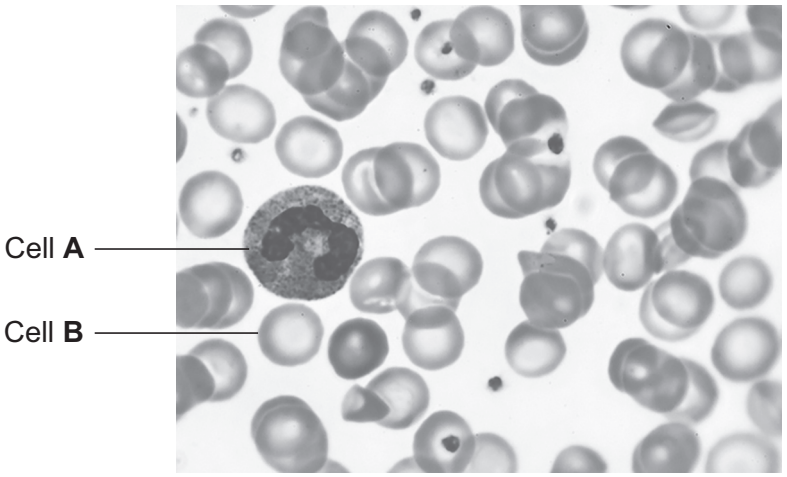
Figure 2 shows human blood viewed through a light microscope.

Figure 2



0 1 . 5 Name cell **A** and cell **B**.

[2 marks]

A _____

B _____

Do not write outside the box

0 1 . 6 The image of a cell has a diameter of 3.5 millimetres.

The magnification of the image is ×500.

Calculate the diameter of the real cell.

Give your answer in micrometres.

Use the equation:

$$\text{magnification} = \frac{\text{diameter of image}}{\text{diameter of real cell}}$$

1 millimetre = 1000 micrometres

[4 marks]

Diameter of the real cell = _____ micrometres

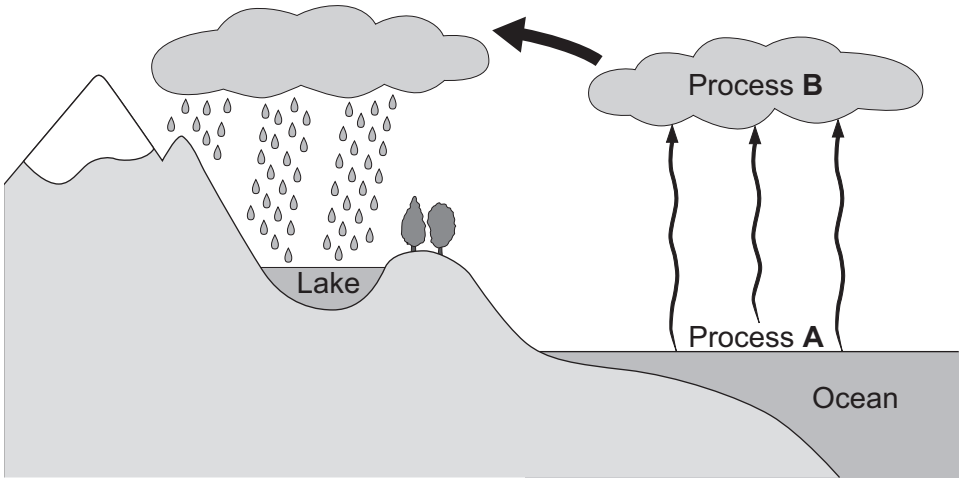
11

Turn over for the next question

Do not write outside the box

0 2 **Figure 3** shows some of the processes in the water cycle.

Figure 3



0 2 . 1 Name process **A** and process **B**.

[2 marks]

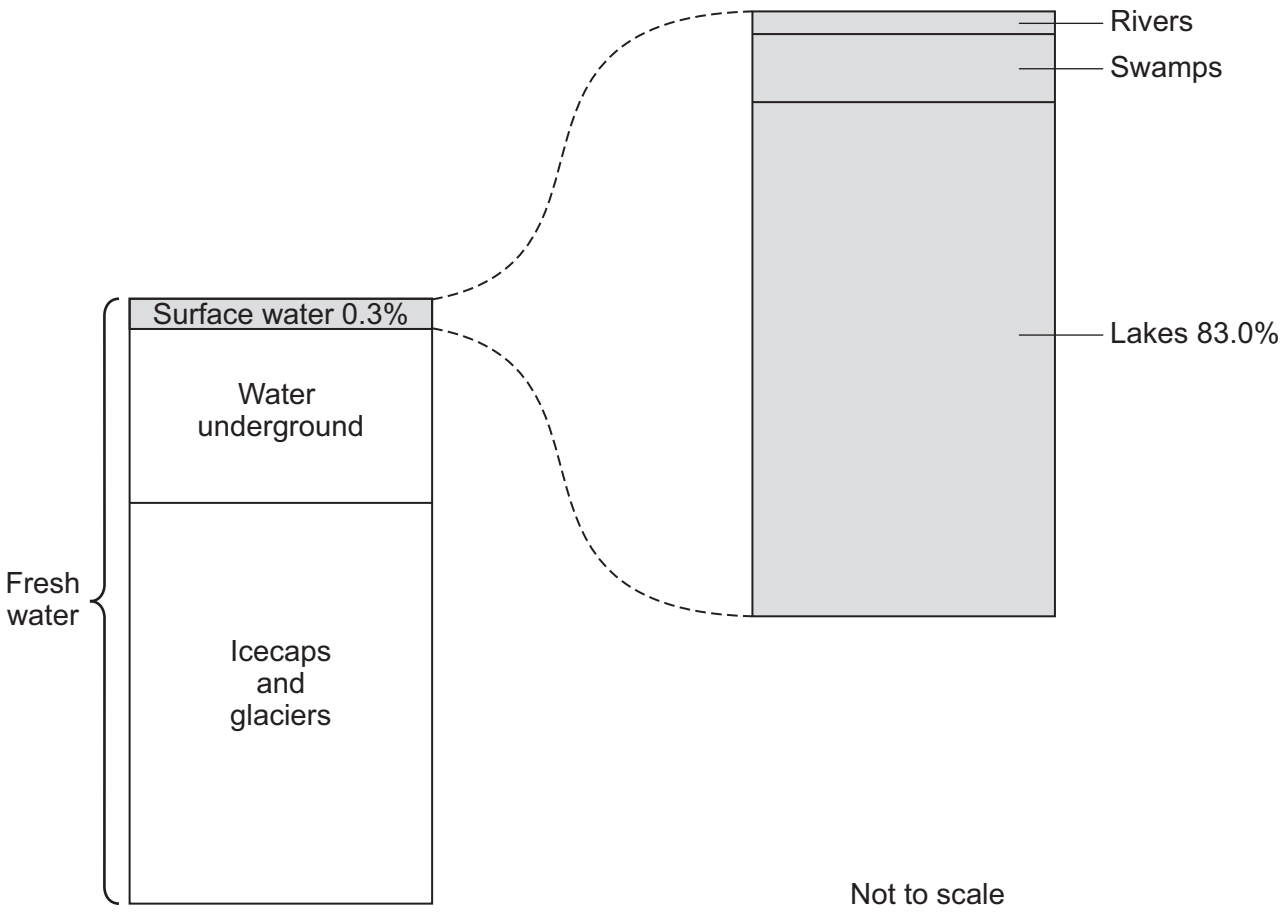
A _____

B _____

Do not write outside the box

0 2 . 2 **Figure 4** shows the locations of fresh water on Earth.

Figure 4



Calculate the amount of fresh water in lakes as a percentage of the total amount of fresh water.

[2 marks]

Percentage = _____ %

Question 2 continues on the next page

Do not write outside the box

0 2 . 3 Give **two** ways humans pollute the water in lakes.

Do **not** refer to litter, plastic pollution or rubbish.

[2 marks]

1 _____

_____

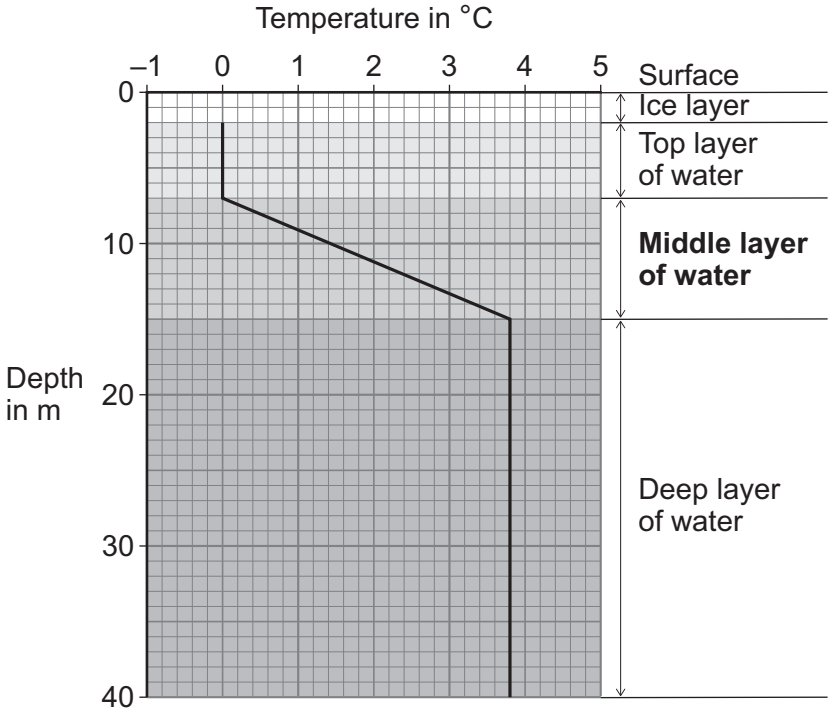
2 _____

_____

The surface of a lake can freeze if the water at the surface of the lake cools to 0 °C.

Figure 5 shows the temperature of the water at increasing depth in a lake in winter.

Figure 5



Do not write outside the box

0 2 . 4 Suggest why organisms in the lake can survive in winter.

Use **Figure 5**.

[1 mark]

0 2 . 5 The middle layer of water is from 7 metres below the surface to 15 metres below the surface.

The temperature at a depth of 7 metres below the surface is 0 °C.

Determine the change in temperature per metre in the middle layer of water.

Use the equation:

$$\text{change in temperature per metre} = \frac{\text{change in temperature}}{\text{change in depth}}$$

[3 marks]

Change in temperature = _____ °C/m

Question 2 continues on the next page

Do not write outside the box

0 2 . 6 Write down the equation which links density (ρ), mass (m) and volume (V).

[1 mark]

_____

0 2 . 7 The density of ice is 920 kg/m^3.

Calculate the volume of 2.3 kg of ice.

[3 marks]

_____

_____

_____

_____

_____

Volume = _____ m^3

Do not write outside the box

0 2 . 8 Describe a method to measure the mass and volume of a liquid.

[4 marks]

18

Turn over for the next question

Do not write outside the box

0 3 This question is about hormones and reproduction.

0 3 . 1 Hormones are used in some methods of contraception.

Give **two** types of contraception that use hormones.

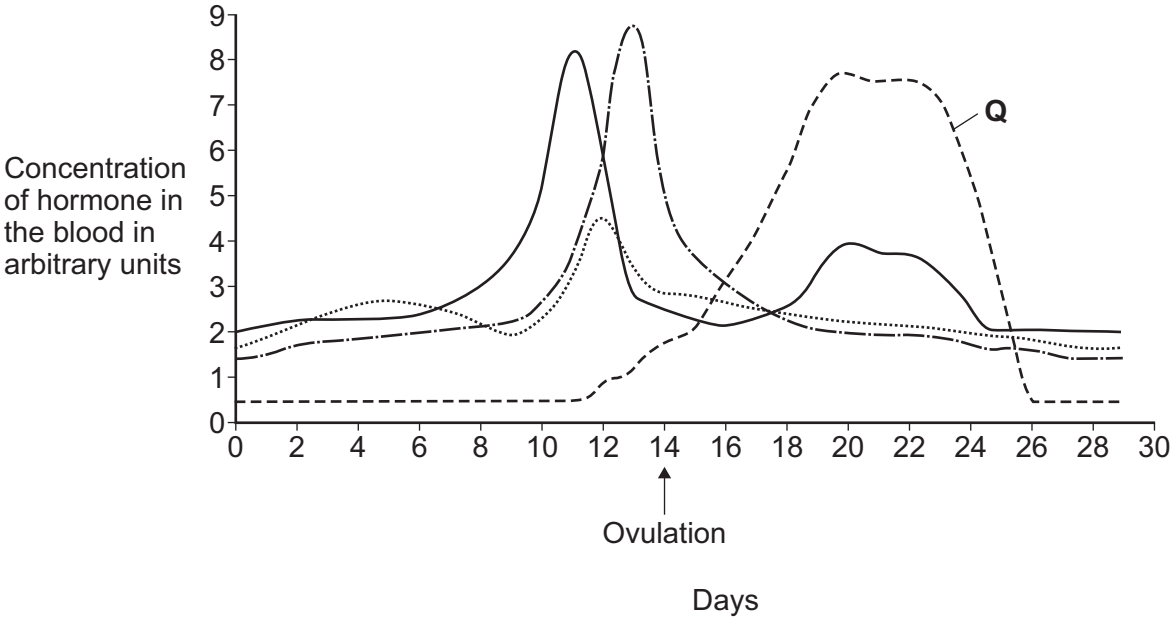
[2 marks]

1 _____

2 _____

Figure 6 shows some of the hormones involved in the menstrual cycle.

Figure 6



Do not write outside the box

0 3 . 2 Which hormone peaks on day 13?

Use **Figure 6**.

[1 mark]

Tick (✓) **one** box.

- Follicle stimulating hormone ☐
- Luteinising hormone ☐
- Oestrogen ☐
- Progesterone ☐

0 3 . 3 What is the function of hormone **Q**?

Use **Figure 6**.

[1 mark]

Tick (✓) **one** box.

- Causes an egg to mature ☐
- Maintains the uterus lining ☐
- Stimulates release of the egg ☐

Question 3 continues on the next page

Do not write outside the box

The number of twins born increased from the year 1980 to the year 2013.

0 3 . 4 Approximately two-thirds of twins born in the UK are **not** identical twins.

Suggest how non-identical twins are formed.

[3 marks]

0 3 . 5 Explain how **one** type of treatment for infertility could have caused the increase in the number of twins born between 1980 and 2013.

[4 marks]

11

Do not write outside the box

0 4 In 1986 an accident at a nuclear power station released radioactive isotopes into the environment.

Radioactive isotopes have a half-life.

0 4 . 1 What is meant by 'half-life'?

[2 marks]

0 4 . 2 During the accident, 28 kg of caesium-137 was released into the environment.

Caesium-137 has a half-life of 30 years.

Calculate the mass of the caesium-137 released in 1986 that will still be present in the environment in 2136.

Give your answer in grams.

[4 marks]

Mass = _____ grams

Question 4 continues on the next page

Do not write outside the box

After the accident scientists investigated the effect of ionising radiation on the population of dragonflies.

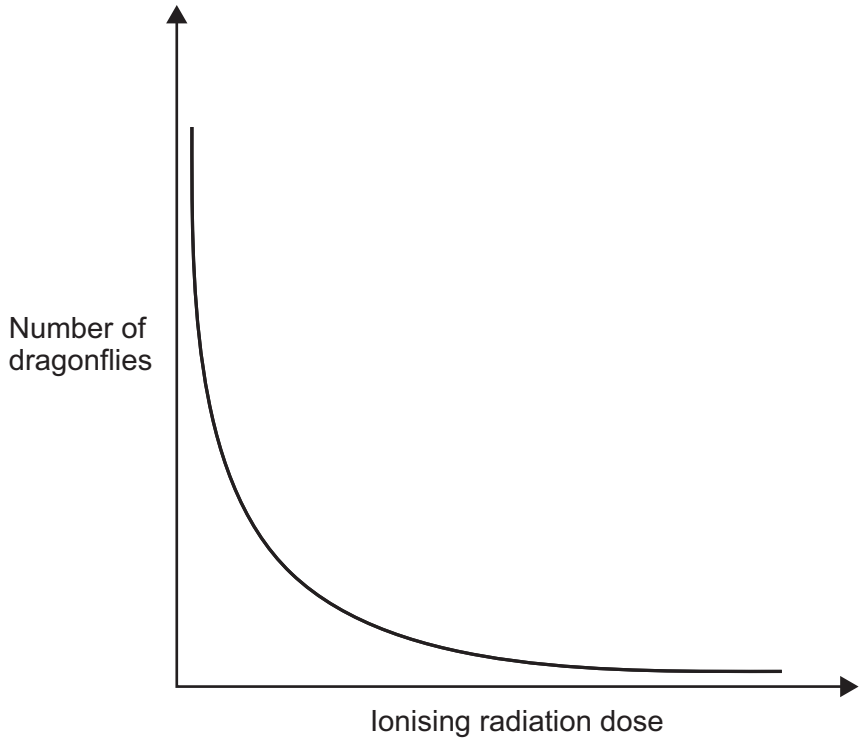
Dragonflies are insects.

The scientists placed transects in different directions from the site of the nuclear power station.

The scientists recorded the number of dragonflies and the ionising radiation dose along the transects.

Figure 7 shows the results.

Figure 7



Do not write outside the box

0 4 . 3 Describe the relationship between the ionising radiation dose and the number of dragonflies.

[2 marks]

0 4 . 4 Suggest **one abiotic** factor that could affect this investigation.

Do **not** refer to ionising radiation dose in your answer.

[1 mark]

0 4 . 5 Explain how the ionising radiation dose can affect the dragonfly population.

[3 marks]

12

Do not write outside the box

0 5 Water that is safe to drink is called potable water.

0 5 . 1 Why is some potable water **not** pure water?

[1 mark]

0 5 . 2 Explain how potable water is obtained from sea water by distillation.

[4 marks]

Potable water can be obtained from sea water using reverse osmosis.

0 5 . 3 Describe the function of the membrane in reverse osmosis.

[2 marks]

Do not write outside the box

0 5 . 4 Give **one** reason why the process of reverse osmosis is expensive.

Do **not** refer to the cost of the membrane.

[1 mark]

0 5 . 5 A new method involving solar panels can be used to obtain potable water.

Table 1 compares the costs involved with the solar panel method and the reverse osmosis method.

Table 1

	Solar panel method	**Reverse osmosis method**
Cost to install in £	3942	1538
Cost of replacement parts each year in £	0	270
Cost of electricity each year in £	0	230

Calculate the time in years until the solar panel method becomes as cost effective as reverse osmosis.

[3 marks]

Time = _____ years

11

Turn over ▶

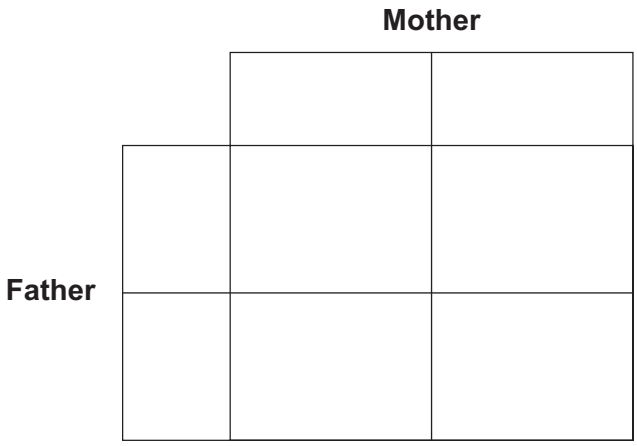
Do not write outside the box

0 6 This question is about inheritance.

0 6 . 1 Complete **Figure 8** to show why the probability of a child being a male is 0.5

[2 marks]

Figure 8



Do not write outside the box

Cystic fibrosis is an inherited disorder.

The allele for cystic fibrosis is recessive, **r**.

The dominant allele is **R**.

A man and a woman plan to have a child.

The man and the woman are both heterozygous for cystic fibrosis.

0 6 . 2 Determine the probability that the child will be a male with cystic fibrosis.

You should:

- use the symbols **R** and **r**
- draw a Punnett square diagram
- identify which of the offspring genotypes will have cystic fibrosis.

[5 marks]

Probability of male with cystic fibrosis = _____

Question 6 continues on the next page

Turn over ▶

Do not write outside the box

Some sheep have been genetically modified to develop the symptoms of cystic fibrosis.

0 6 . 3 Give **one** ethical argument **for** the production of sheep with the symptoms of cystic fibrosis.

Do **not** refer to religion in your answer.

[1 mark]

_____

_____

0 6 . 4 Give **one** ethical argument **against** the production of sheep with the symptoms of cystic fibrosis.

Do **not** refer to religion in your answer.

[1 mark]

_____

_____

Do not write outside the box

0 6 . 5 The sheep were genetically modified as embryos.

Describe the stages involved in producing a genetically modified sheep that shows symptoms of cystic fibrosis.

[4 marks]

13

Turn over for the next question

Do not write outside the box

0 7 On aeroplanes, pathogens can easily spread from one person to another person.

0 7 . 1 Suggest **one** way pathogens can spread from one person to another person on an aeroplane.

[1 mark]

_____

The manufacturer of a nose spray claims that:

'The nose spray defends against diseases such as the common cold.'

The nose spray puts a thin layer of gel in the airways between the nose and the lungs.

0 7 . 2 Describe how the nose spray and the body's natural defences in the airways work in similar ways to defend against pathogens.

[3 marks]

_____

_____

_____

_____

_____

_____

Do not write outside the box

0 7 . 3 The nose spray was tested as a new medical drug.

The manufacturer of the nose spray claims:

'The nose spray can decrease the number of days that a person has symptoms of the common cold.'

Suggest **one** reason why this claim is difficult to test.

[1 mark]

_____

_____

0 7 . 4 The nose spray contains a mixture of ingredients.

Suggest **two** reasons why the nose spray is a mixture of ingredients.

[2 marks]

1 _____

_____

2 _____

_____

0 7 . 5 Late-stage HIV (AIDS) affects the immune system.

A person with AIDS is more likely to suffer from another infectious disease.

Give **one** other example of how having one disease can affect the development of a different disease.

Do **not** refer to HIV or AIDS.

[1 mark]

_____

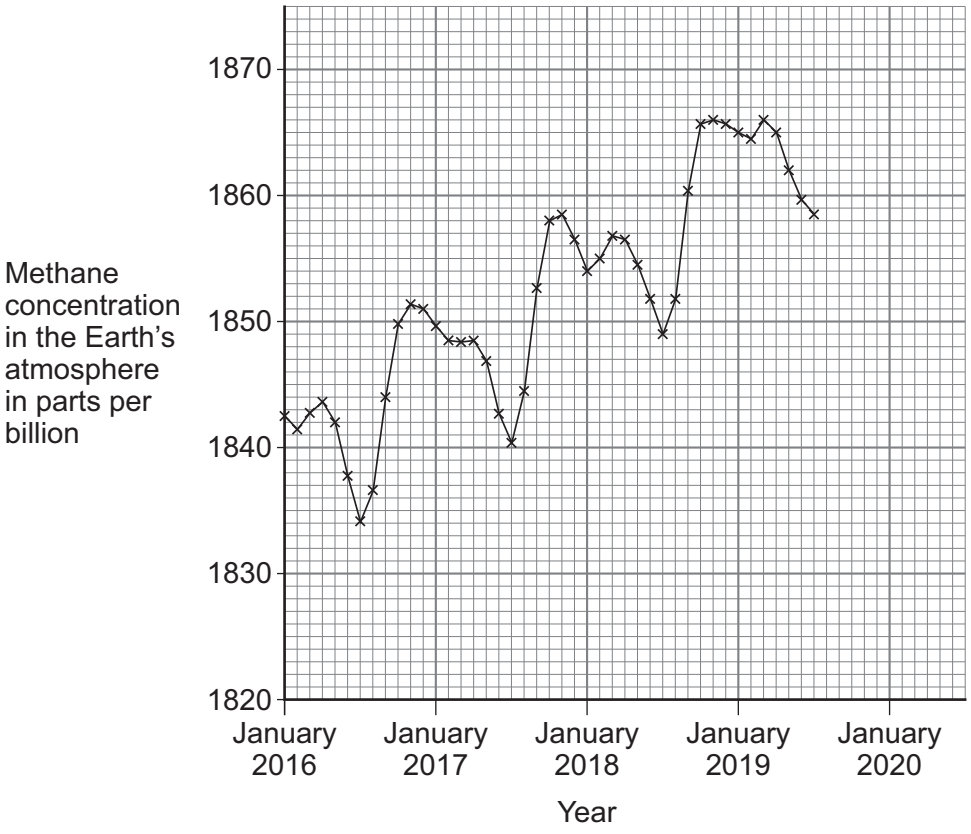
_____

8

Do not write outside the box

0 8 **Figure 9** shows recent changes in the methane concentration in the Earth's atmosphere.

Figure 9



0 8 . 1 Determine the percentage increase in methane concentration in the Earth's atmosphere from January 2018 to January 2019.

[3 marks]

Percentage increase = _____ %

Do not write outside the box

0 8 . 2 Methane is a greenhouse gas.

Scientists **cannot** make accurate predictions about the concentration of methane in the Earth's atmosphere in the future.

Give **one** reason why.

Use **Figure 9**.

[1 mark]

0 8 . 3 Explain why protecting peat bogs may reduce global warming.

[2 marks]

Question 8 continues on the next page

Do not write outside the box

0 8 . 4 Greenhouse gases maintain temperatures on Earth high enough to support life.

Describe the greenhouse effect in terms of the interaction of short-wavelength and long-wavelength radiation with matter.

[4 marks]

Do not write outside the box

0 8 . 5 The Earth is estimated to be 4.6 billion years old.

The Earth's early atmosphere changed over time.

Describe the evidence scientists use to form theories about:

- how the Earth's atmosphere was formed
- how the composition of the Earth's atmosphere changed.

[6 marks]

16

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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