

Please write clearly in block capitals.

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# GCSE COMBINED SCIENCE: SYNERGY

# H

Higher Tier Paper 1 Life and environmental sciences

Tuesday 14 May 2019

Afternoon

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.
- 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.
- 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.

## 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.

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



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Answer **all** questions in the spaces provided.

0 1

Grey wolves (*Canis lupus*) can be found in the USA.

0 1 . 1

Give the genus name of the grey wolf.

[1 mark]

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0 1 . 2

Describe how biological classification systems have changed over time.

[4 marks]

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0 1 . 3

Population and community are terms used to describe the organisms in an area.

Describe the difference between the terms population and community.

[2 marks]

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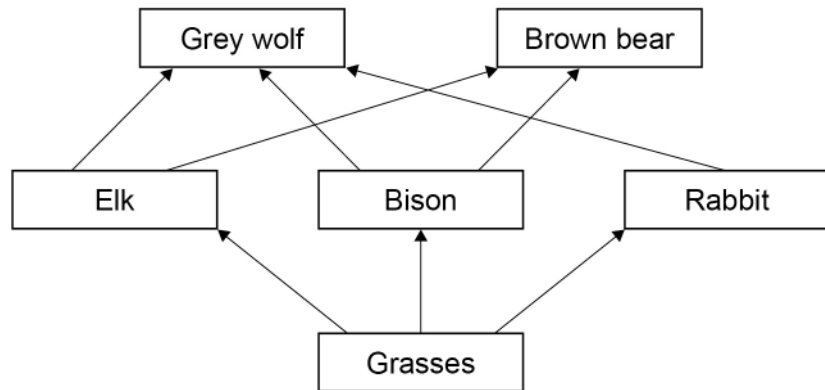
Question 1 continues on the next page

Turn over ►



Figure 1 shows part of a food web.

Figure 1



0 1 . 4

Look at **Figure 1**.

Explain how killing all the grey wolves could affect the populations of the other organisms.

**[6 marks]**

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In Yellowstone Park in the USA, grey wolves were hunted and killed until there were none left by 1926.

Grey wolves were reintroduced to Yellowstone Park in 1995.

The wolves came from several family groups in different parts of Canada.

**0 1 . 5** Why should scientists select animals from more than one area for reintroduction programmes?

**[1 mark]**

Tick (✓) **one** box.

To reduce the effect of inbreeding

To choose similar characteristics

To reduce genetic diversity

**Question 1 continues on the next page**

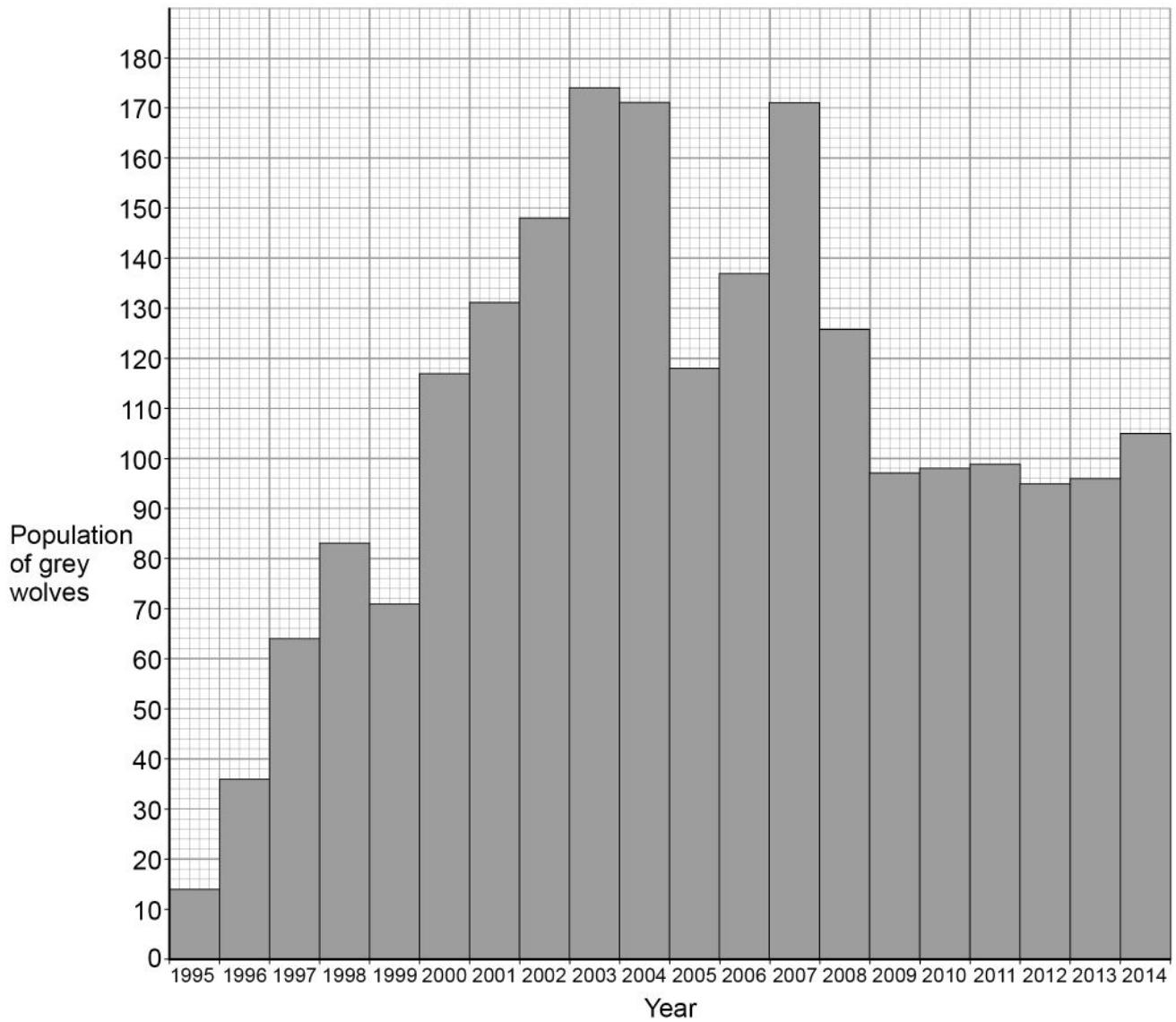
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**Figure 2** shows the change in the population of grey wolves in Yellowstone Park since 1995.

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**Figure 2**



**0 1 . 6** The wolf population in 2014 was greater than the wolf population in 1995.

Calculate how many times greater.

**[1 mark]**

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Number of times greater = \_\_\_\_\_

**0 1 . 7** Scientists now believe the population of wolves in Yellowstone Park is **not** likely to decrease to zero.

Describe how the data since 2009 support this belief.

**[1 mark]**

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16

**Turn over for the next question**

**Turn over ►**



**0 2**

Polonium is an element with 33 isotopes.

**0 2 . 1**

What is the difference between isotopes of the same element?

**[1 mark]**Tick (✓) **one** box.

The number of electrons

The number of neutrons

The number of protons

**0 2 . 2**An isotope of polonium is  ${}_{84}^{210}\text{Po}$  (polonium-210).

Polonium-210 emits alpha radiation.

Alpha particles can be represented by the symbol  ${}^4_2\text{He}$ 

An alpha particle consists of sub-atomic particles.

What are these sub-atomic particles?

**[2 marks]**Tick (✓) **two** boxes.

Electrons

Gamma rays

Neutrons

Protons

X-rays

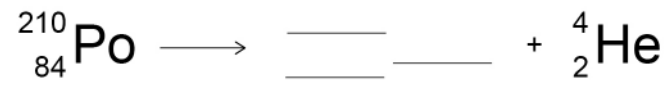




0 2 . 3

Complete the nuclear equation to show the radioactive decay of polonium-210

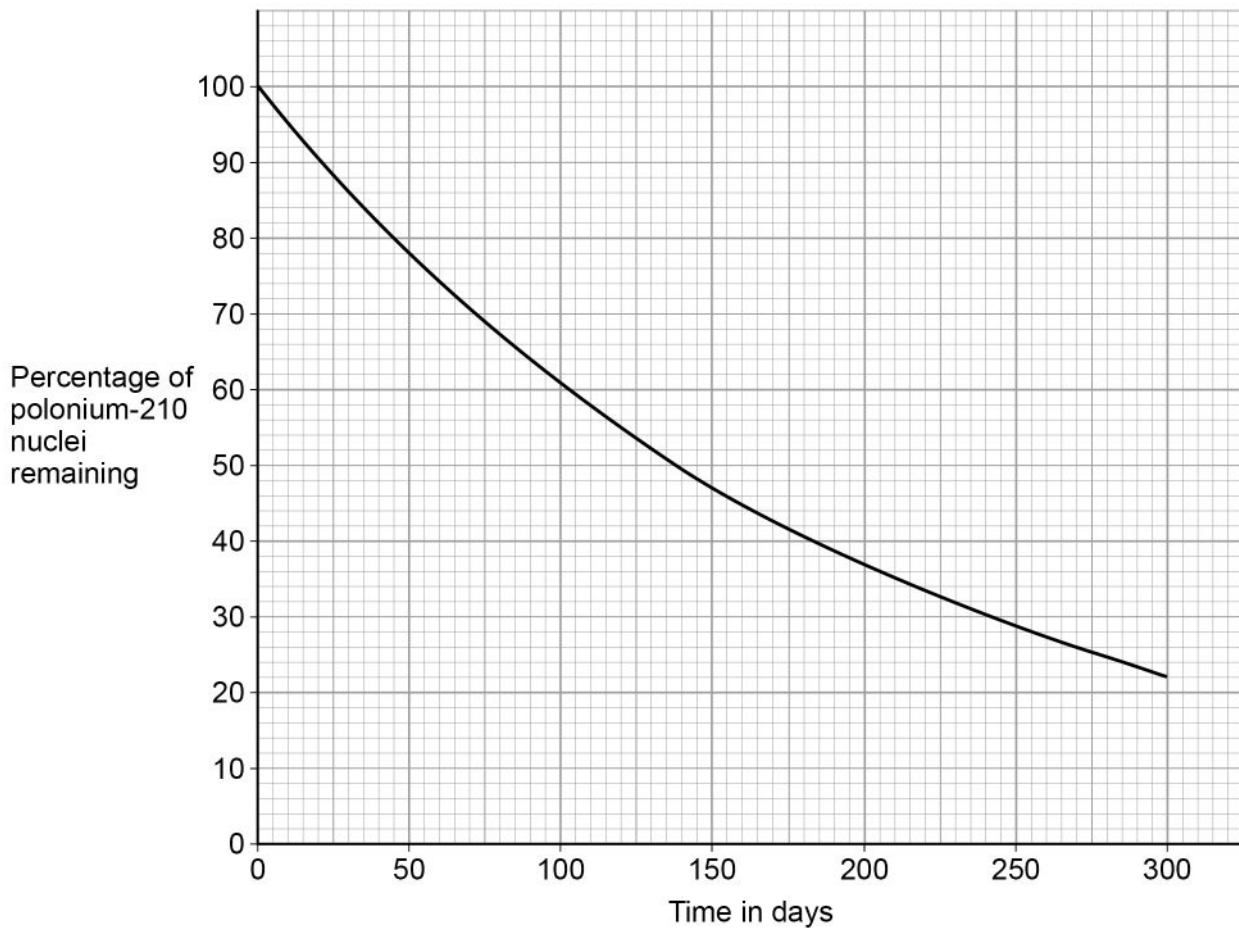
Use the periodic table to help you.

**[3 marks]****Question 2 continues on the next page****Turn over ►**

**0 2 . 4** A sample of polonium-210 decays.

**Figure 3** shows how the percentage of polonium-210 nuclei remaining varies with time.

**Figure 3**



Determine the half-life of polonium-210

**[1 mark]**

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Half-life = \_\_\_\_\_ days



**0 2 . 5** Another isotope of polonium, polonium-206, has a half-life of 8.8 days.

A 5.0 mg sample of polonium-206 was left to decay.

Calculate what mass of polonium-206 remained after 44 days.

**[2 marks]**

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Mass of polonium-206 after 44 days = \_\_\_\_\_ mg

**0 2 . 6** If polonium-210 were to enter the body, the alpha radiation it emits would cause harm.

Explain why alpha radiation emitted inside the body is harmful.

**[2 marks]**

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**0 2 . 7** Isotopes that emit alpha radiation can be transported safely in a glass bottle.

Suggest why.

**[1 mark]**

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12

Turn over ►



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**0 3**

Lipids are an essential part of our diet.

**0 3 . 1**

Describe how a student could test a food for lipids and the positive result for the test.

**[2 marks]**

Test for lipids \_\_\_\_\_

\_\_\_\_\_

Positive result for lipids \_\_\_\_\_

\_\_\_\_\_

A high concentration of cholesterol in the blood has been linked with coronary heart disease (CHD).

**0 3 . 2**

Name the type of drug used to reduce the concentration of cholesterol in the blood.

**[1 mark]**

\_\_\_\_\_

**Question 3 continues on the next page****Turn over ►**

0 3 . 3

A new CHD drug has been trialled to reduce the concentration of cholesterol in the blood.

Patients were given the new CHD drug or a placebo.

One possible side effect of the new CHD drug is an increased risk of diabetes.

**Table 1** shows some of the results.

**Table 1**

	<b>Group 1: New CHD drug</b>	<b>Group 2: Placebo</b>
Number of patients	12 562	12 541
Number of patients developing diabetes during the trial	636	606

Calculate the difference between the percentage of patients developing diabetes in group 1 compared to group 2.

Give your answer to 3 significant figures.

**[4 marks]**

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Difference = \_\_\_\_\_ %



**0 3 . 4** The new CHD drug causes liver cells to remove more cholesterol from the blood.

Explain how the drug could reduce the risk of CHD.

**[4 marks]**

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**0 3 . 5** Give **three** factors doctors should consider when they plan to use a new drug with a patient.

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

**[3 marks]**

1 \_\_\_\_\_

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2 \_\_\_\_\_

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3 \_\_\_\_\_

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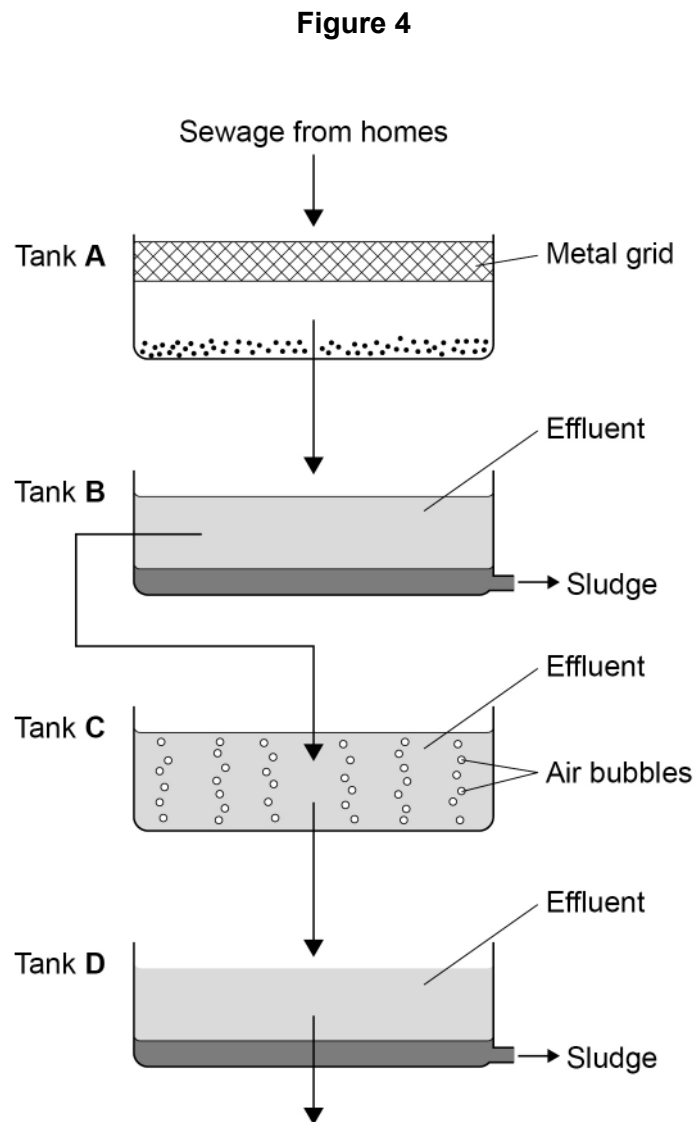
14

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0 4

Figure 4 shows part of the process of sewage treatment.



0 4 . 1

Name the **two** processes happening in tank **A**.

[2 marks]

1 \_\_\_\_\_

2 \_\_\_\_\_





**0 4 . 2** Explain the processes happening in tank **C**.

**[4 marks]**

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**0 4 . 3** The water from tank **D** is sterilised.

Why is the water from tank **D** sterilised?

**[1 mark]**

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**0 4 . 4** Seawater can be desalinated by distillation.

Name **one** other method of desalination.

**[1 mark]**

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**Question 4 continues on the next page**

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**0 4 . 5**

Describe a method to measure the concentration of dissolved solids in a sample of seawater.

**[6 marks]**

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**14**



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**0 5**

Scientists investigated the temperature changes when gaseous substances cool.

**Table 2** shows the results for substance **A**.

**Table 2**

<b>Time in seconds</b>	<b>Temperature in °C</b>
0	400
60	357
120	357
180	223
240	92
300	-39
360	-39

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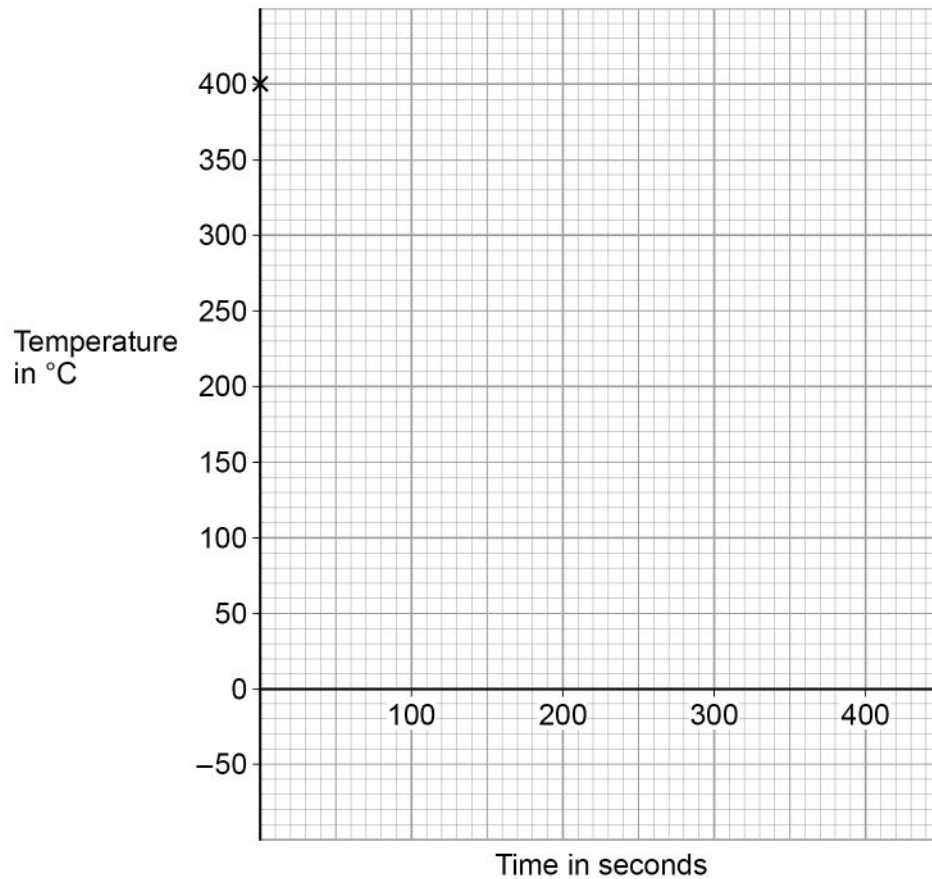
**0 5 . 1** Complete **Figure 5**.

You should:

- plot the data for substance **A** from **Table 2**.  
The first result has been plotted.
- join the data points for substance **A** with straight lines.

**[3 marks]**

**Figure 5**

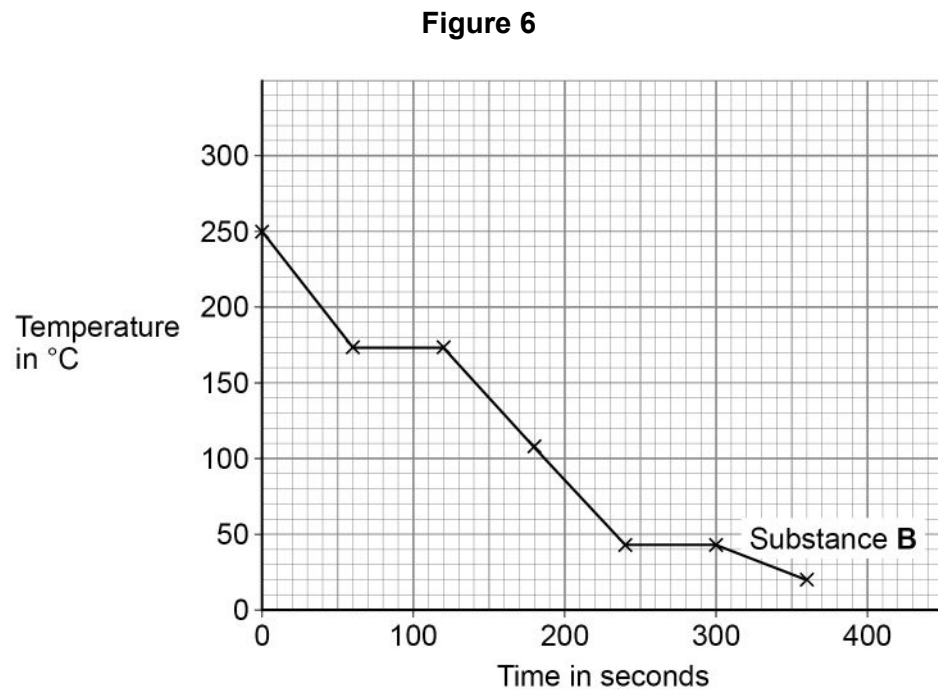


**Question 5 continues on the next page**

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**Figure 6** shows the results for substance **B**.



**0 5 . 2** How does **Figure 6** show that substance **B** is a pure substance?

[1 mark]

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**0 5 . 3** Determine the melting point of substance **B**.

Use **Figure 6**.

[1 mark]

Melting point = \_\_\_\_\_ °C



0 5 . 4

The rate of temperature change can be determined from the gradient of the graph.

At 120 seconds, the temperature of substance **B** was 173 °C

Determine the rate of temperature change for substance **B** between 120 seconds and 240 seconds.

Use **Figure 6**.

[3 marks]

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Rate of temperature change = \_\_\_\_\_ °C/s

8

**Turn over for the next question**

**Turn over ►**



0 6

Field studies can be used to investigate the abundance and distribution of a species.

0 6 . 1

Define the following biological words.

[2 marks]

Abundance \_\_\_\_\_

\_\_\_\_\_

Distribution \_\_\_\_\_

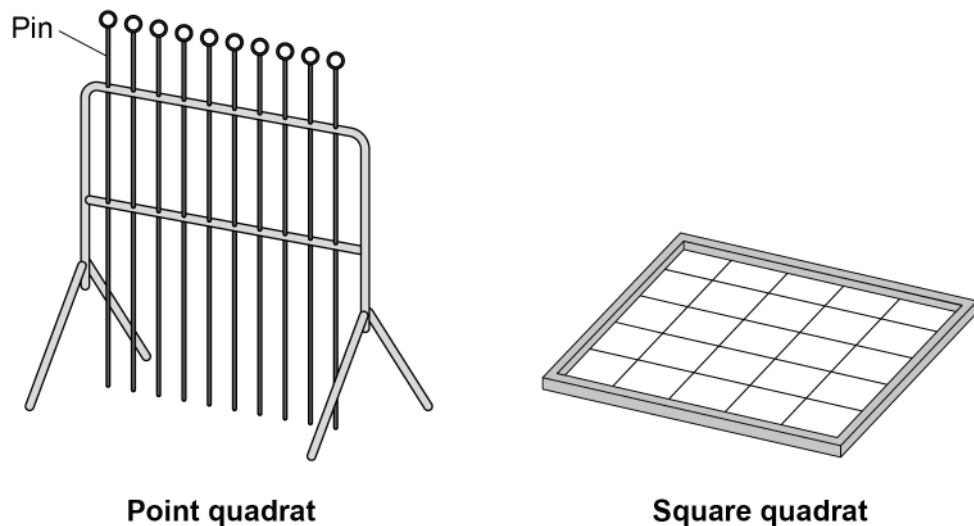
\_\_\_\_\_

Quadrats can be used to estimate the percentage cover of plants in an area.

A point quadrat can be used instead of a square quadrat.

**Figure 7** shows a point quadrat and a square quadrat.

**Figure 7**



**Point quadrat**

**Square quadrat**

When using a point quadrat, any plant species touching a pin is recorded.





Students investigated the percentage cover of different plant species at increasing distances from a school building.

0 6 . 2

Describe how students could collect data for this investigation using a point quadrat.

**[4 marks]**

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0 6 . 3

The percentage cover of each species can be estimated using the equation:

$$\text{percentage cover} = \frac{\text{number of times a pin touches a species}}{\text{total number of pins used}} \times 100$$

30 students each collected results from 80 pins. The students then put all their results into one results table.

Dandelions had a mean percentage cover of 6.25%.

Calculate the number of times dandelions touched a pin.

**[3 marks]**

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Number of times dandelions touched a pin = \_\_\_\_\_

**Turn over ►**



0 6 . 4

Describe why this investigation would only give an estimate of the percentage cover of dandelions.

**[1 mark]**

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0 6 . 5

Point quadrats give a more accurate estimate of percentage cover than square quadrats.

What is a **disadvantage** of using point quadrats rather than square quadrats?

**[1 mark]**

Tick (✓) **one** box.

Results collected using point quadrats are more biased

Plants at all heights are recorded

Point quadrats need a judgement of percentage cover

Rare species are less likely to be sampled



06.6

Describe the process of evolution by which some plants survive in fields where animals eat the plants.

[4 marks]

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0 7

**Figure 8** shows a sealed balloon containing helium.

**Figure 8**



0 7 . 1

The balloon is squashed so its volume decreases.

No helium enters or leaves the balloon.

What happens to the density of the helium in the balloon?

**[1 mark]**

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**0 7 . 2** The volume of the balloon is  $14\,000\text{ cm}^3$

The density of the helium in the balloon is  $0.180\text{ kg/m}^3$

Calculate the mass of helium in the balloon.

$$1\text{ cm}^3 = 1 \times 10^{-6}\text{ m}^3$$

**[4 marks]**

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Mass = \_\_\_\_\_ kg

**0 7 . 3** Explain how a decrease in temperature inside the balloon can change the volume of the balloon.

**[4 marks]**

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0 8

Hormones can have effects on the body far from the gland that releases the hormone.

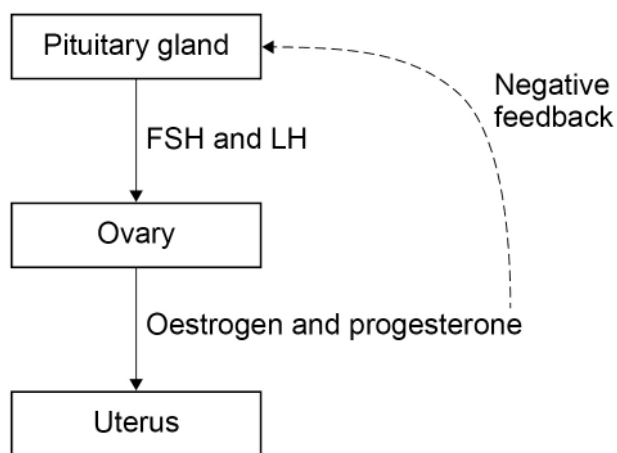
0 8 . 1

Name the system in the body that releases hormones.

[1 mark]

Figure 9 shows part of the hormonal control of the menstrual cycle.

Figure 9



0 8 . 2

Describe how FSH and LH travel from the pituitary gland to the ovaries.

[1 mark]

0 8 . 3

Explain how the body regulates the production of oestrogen and progesterone for most of the menstrual cycle.

Use the information shown in Figure 9.

[3 marks]



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0 8 . 4

A woman is most fertile at about day 15 of the menstrual cycle.

From day 12 to day 14 of the menstrual cycle, the negative feedback shown in **Figure 9** stops.

Explain what happens when the negative feedback stops.

**[3 marks]**

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0 8 . 5

A contraceptive injection contains progestin.

Progestin is a synthetic form of progesterone.

Explain how the progestin injection prevents pregnancy.

**[4 marks]**

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**END OF QUESTIONS**



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