

- 1 The photograph below shows packaging pellets made from thermoplastic starch, which is produced from corn starch. These pellets can be produced from a sustainable resource.



Magnification  $\times 0.5$

- (a) (i) Explain what is meant by the term **sustainable**.

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- (ii) Other packaging pellets contain polystyrene made from crude oil.

Explain why packaging pellets made from thermoplastic starch are sustainable but polystyrene pellets are not sustainable.

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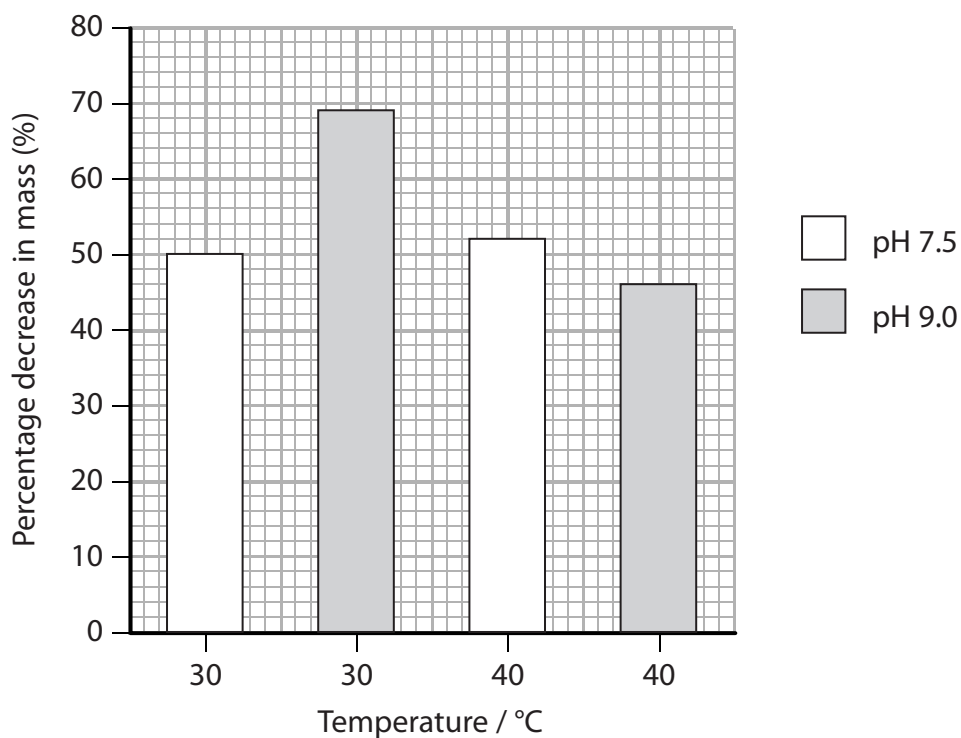
(b) Scientists investigated various factors that affect the breakdown of a starch-based plastic. They tested plastic sheets made from a starch-based plastic.

Pieces of the plastic sheet were placed in beakers containing a solution of an enzyme that breaks down starch.

In one beaker, the enzyme solution had a pH of 7.5 and in the other it had a pH of 9.0. These beakers were then incubated at 30°C for 10 days. The percentage decrease in mass of the plastic sheet was recorded.

The investigation was then repeated at 40°C.

The results are shown in the graph below.



(i) Using information from the graph, suggest which conditions were best for the breakdown of the plastic.

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(ii) Using information from the graph, describe the effect of temperature on the breakdown of the plastic.

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(iii) Suggest **two** factors that would have been kept constant to make this a valid investigation.

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(iv) Suggest why it would not be valid to use these data to predict what would happen at a temperature of 30°C and a pH of 11.0.

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**(Total for Question 1 = 11 marks)**

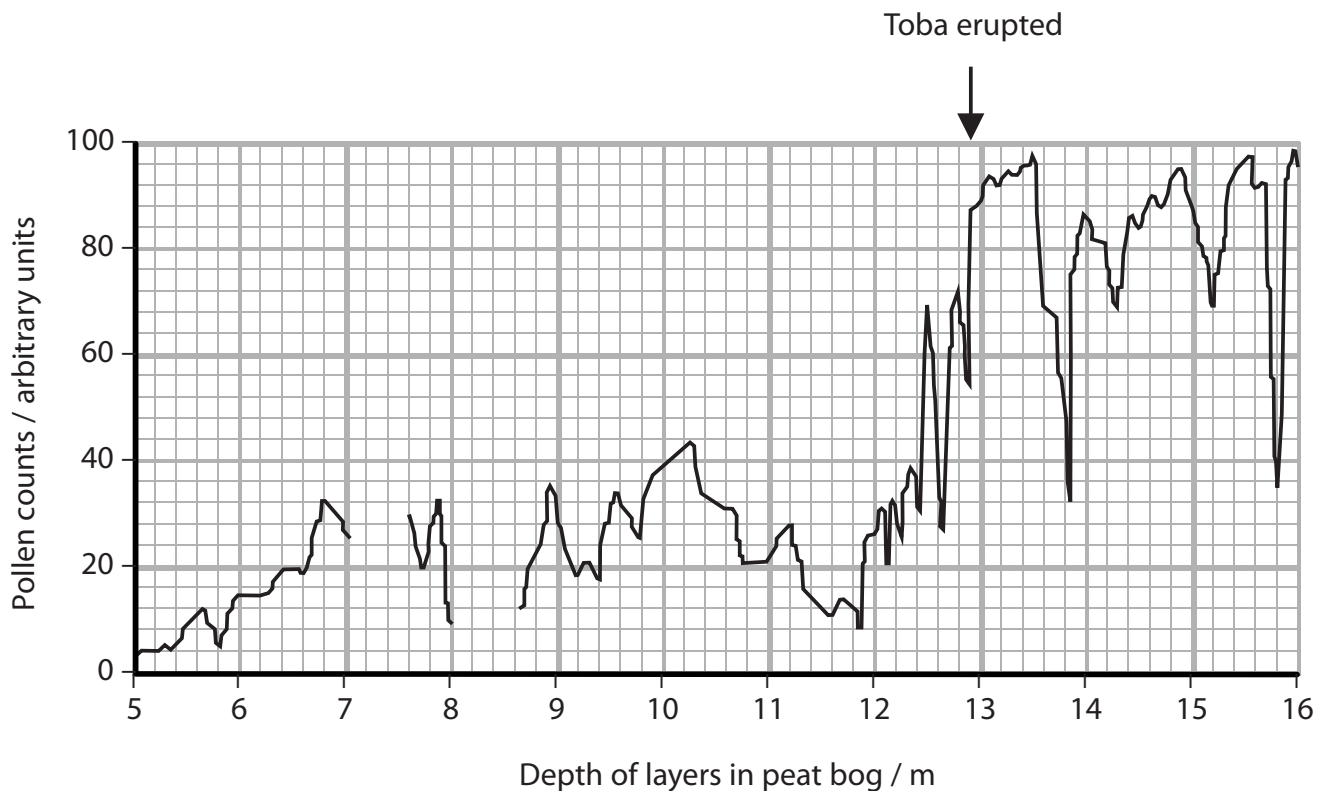
2 Volcanic eruptions have had an effect on the climate and temperature of the Earth.

Analysis of pollen in peat bogs and changes in sea levels give evidence for climate change.

Toba is a volcano in Sumatra that erupted approximately 70 000 years ago. The map below shows the location of Sumatra.



The graph below shows the result of pollen counts at different depths in a peat bog in France.



(a) Using the information in the graph, describe the changes in the pollen count in the layers of peat from a depth of 12.5 m to a depth of 13.5 m.

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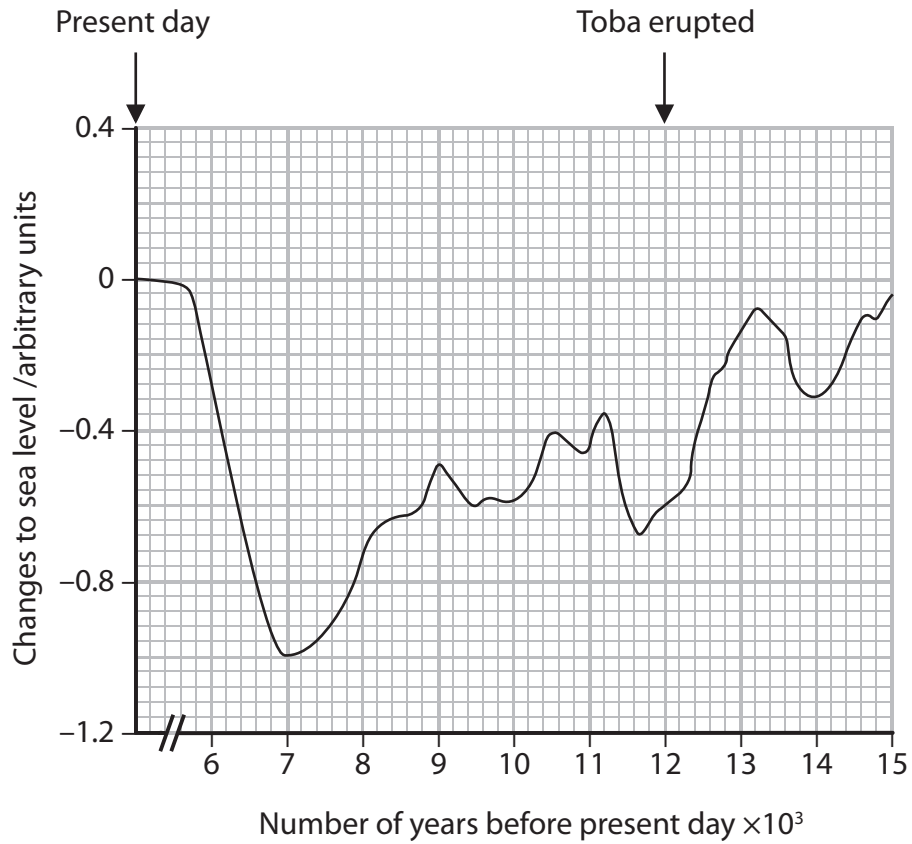
(b) Suggest why there is no data for some of the depths.

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(c) The graph below shows changes to sea levels, compared to the present day, in the oceans around Greenland.



Suggest why temperature changes affect sea level.

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(d) It is claimed that the volcanic eruption of Toba caused a change in world climate.

(i) Using the information in both graphs, describe the evidence that supports this claim.

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(ii) Using the information in both graphs, suggest why this claim may not be true.

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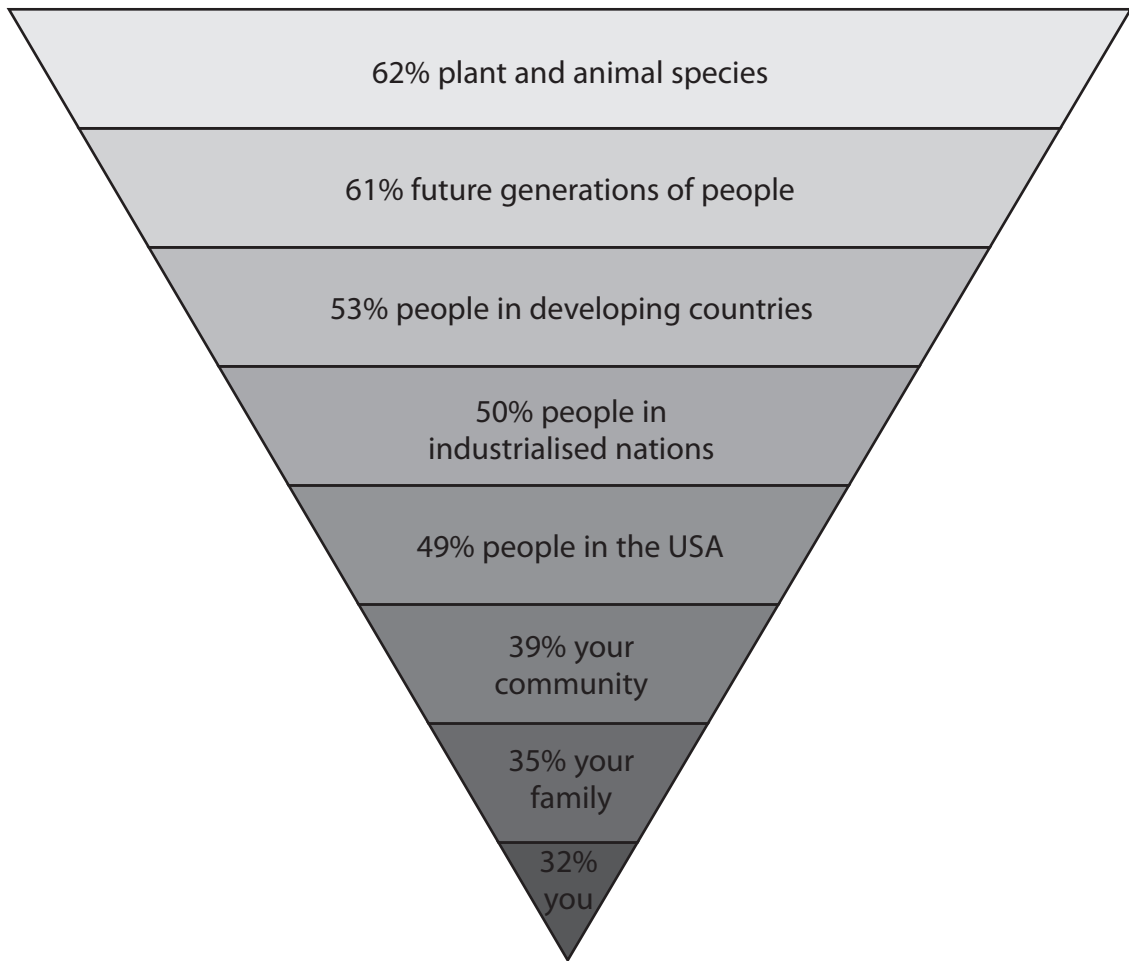
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**(Total for Question 2 = 11 marks)**

3 A survey was conducted in the USA to find out what harm people thought global warming could have.

The people were asked if they thought global warming could harm the eight groups shown in the diagram.

The diagram below shows the percentage of people who thought each group would be harmed.



(a) Explain the meaning of the term **global warming**.

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(b) (i) Describe and explain how global warming could affect plant species.

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(ii) Explain how the effects on plant species could affect animal species.

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(c) This survey shows that 61% thought future generations of people could be harmed by global warming.

Suggest why the rest of the people surveyed thought that future generations of people would **not** be harmed by global warming.

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**(Total for Question 3 = 12 marks)**

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- 4 The photograph below shows seed pods of a Canola plant (*Brassica napus*). Canola is a plant grown as a crop because the seeds are rich in oil. The extracted oil is used in cooking and as a sustainable fuel.



Magnification  $\times 0.1$

- (a) Suggest why the production of oil from Canola seeds can be described as **sustainable**.

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- (b) Farmers provide the plants with fertiliser containing nitrate ions.

Explain the importance of nitrate ions for the growth of plants.

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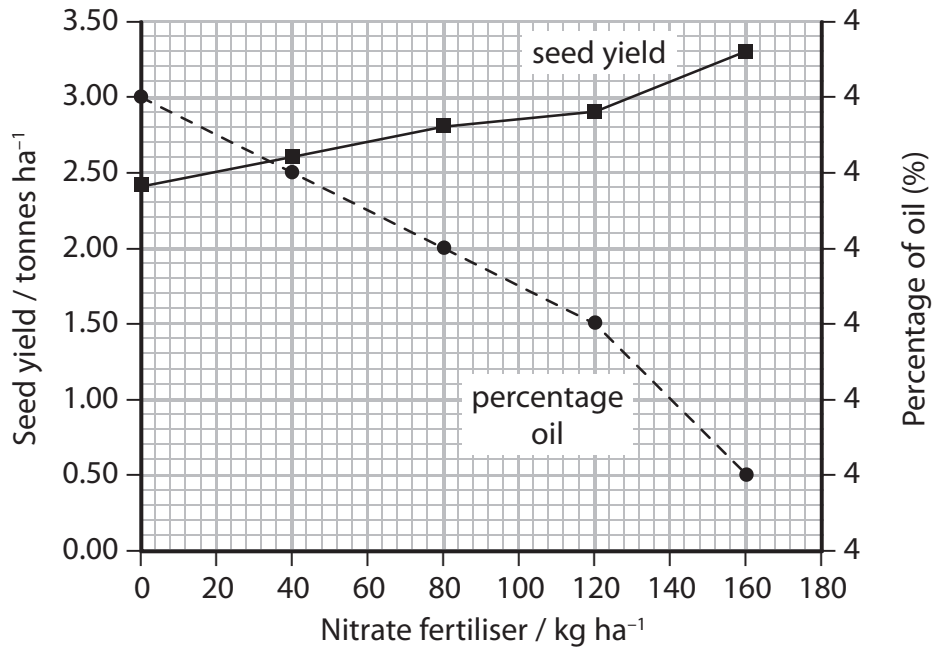
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(c) Scientists carried out an investigation into the effect of nitrate fertiliser on the yield.

The graph below shows the results of this investigation.



(i) Place a cross  in the box next to the correct word or words to complete the following statement.

The mass of nitrate fertiliser added and the percentage of oil produced show

(1)

- A** a negative correlation
- B** no relationship
- C** a positive correlation
- D** a proportional relationship

(ii) Using information in the graph, calculate the percentage change in seed yield when the level of nitrate fertiliser is increased from 0 to 160 kg ha<sup>-1</sup>.

Show your working.

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(iii) Suggest how the scientist could have ensured that this investigation was valid.

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**(Total for Question 4 = 12 marks)**