

Climate Change - Questions by Topic

Q1.

The scientific article you have studied is adapted from an article from '*The Scientist*'.

Use the information from the scientific article and your own knowledge to answer the following questions.

Explain why the 'anaerobic oxidation of methane' could be a 'key climate regulator' (paragraph 2).

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(Total for question = 3 marks)

Q2. The carbon cycle describes the movement of carbon within an ecosystem.

In this cycle, carbon neutral processes do not change the concentration of carbon dioxide in the atmosphere.

The table below shows the main sources and combustion products of some fuels.

Fuel	Main sources	Main combustion products
Biodiesel	Oils from crops such as soya beans, rape seeds, palm seeds	Carbon dioxide and water vapour
Ethanol	Fermented sugars from crops such as sugar cane, sugar beet	Carbon dioxide and water vapour
Hydrogen	Catalysis of methane from fossil deposits or biogas generation using waste biomass	Water vapour
Methane	Extracted from fossil deposits or biogas generation using waste biomass	Carbon dioxide and water vapour
Propane	Refining of crude oil from fossil deposits	Carbon dioxide and water vapour

(a) Place a cross in the box next to the names of the four fuels, shown in the table, that could be considered to be biofuels.

(1)

- A** biodiesel, ethanol, hydrogen, methane
- B** biodiesel, ethanol, hydrogen, propane
- C** biodiesel, ethanol, methane, propane
- D** biodiesel, hydrogen, methane, propane

*(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

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(c) Explain how the combustion products, from the burning of fuels, may lead to global warming.

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(Total for Question = 10 marks)

Q3.

First generation biofuels are made from sugars and vegetable oils found in food crops.

(a) Some countries are replacing small percentages of petrol and diesel with first generation biofuels to reduce the effect of greenhouse gases on global warming.

(i) Place a cross in the box next to a pair of greenhouse gases.

- A** carbon dioxide and methane (1)
- B** carbon dioxide and carbon monoxide
- C** carbon monoxide and nitrogen
- D** methane and nitrogen

(ii) Suggest why using first generation biofuels instead of petrol and diesel could reduce global warming.

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(b) Second generation biofuels are now being developed. These will use non-food parts of crops that contain the polymers cellulose and lignin.

Bacteria can be used to synthesise ethanol from these polymers. However, enzyme treatment is necessary before the bacteria can use these polymers.

(i) Name a part of a plant stem that would contain these polymers.

(1)

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(ii) Suggest why cellulose has to be treated with enzymes before the bacteria can use it as an energy source.

(2)

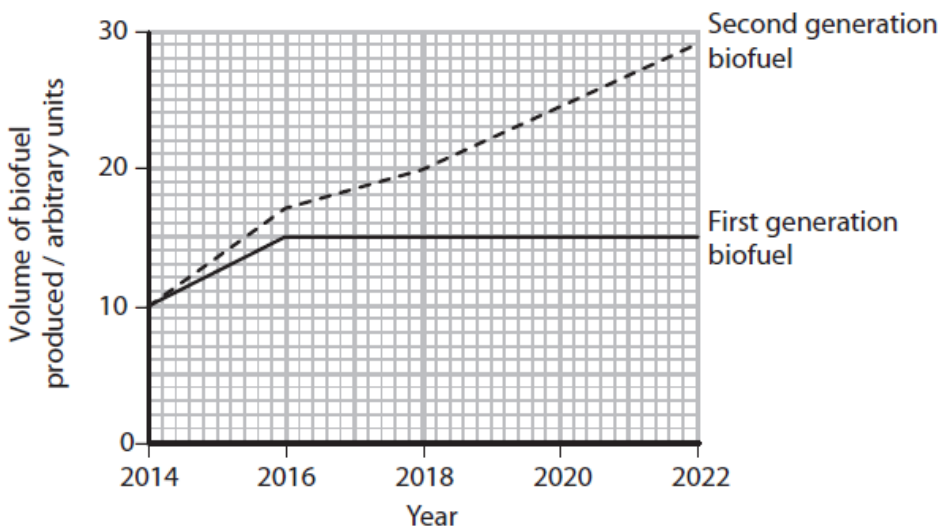
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(c) The graph below shows how the global production of first generation and second generation biofuels could change in the future.



Using the information in the graph, describe the expected changes in the production of first generation and second generation biofuels. Suggest reasons for these changes.

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(Total for question = 11 marks)

Q4.

Climate change has been correlated with changing atmospheric carbon dioxide levels.

Scientists measured the productivity of two types of forest and recorded the mass of carbon taken up per square metre per year ($\text{gC m}^{-2} \text{y}^{-1}$).

The table shows data on the mean net primary productivity (NPP) and mean gross primary productivity (GPP) of these two types of forest.

Type of forest	Mean NPP / $\text{gC m}^{-2} \text{y}^{-1}$	Mean GPP / $\text{gC m}^{-2} \text{y}^{-1}$	Ratio of NPP to GPP
Boreal	322	1013	0.32
Temperate deciduous	1301	2165	0.60

(i) Calculate the percentage increase in mass of carbon released due to respiration by temperate deciduous forests compared with that by boreal forests.

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(ii) The ratio of net primary productivity to gross primary productivity is a measure of the ability of forests to transfer carbon from the atmosphere into biomass.

Scientists concluded that temperate deciduous forests would reduce levels of carbon dioxide in the atmosphere more than boreal forests.

Justify this conclusion.

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(Total for question = 6 marks)

Q5.

Climate change has been correlated with changing atmospheric carbon dioxide levels.

Scientists studying climate change have examined peat bogs to observe pollen grains such as those shown in the photograph.



Explain how studying pollen grains in peat bogs can provide evidence of climate change.

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(Total for question = 4 marks)

Q6.

Climate change can also affect the life cycle of organisms.

The effect of temperature on the lifespan of fruit flies (*Drosophila melanogaster*) was investigated.

The results are shown in the table.

Temperature / °C	Lifespan / days
15	130.3
21	86.3
27	41.6
30	20.4

Determine the relationship between the increase in temperature and the change in lifespan.

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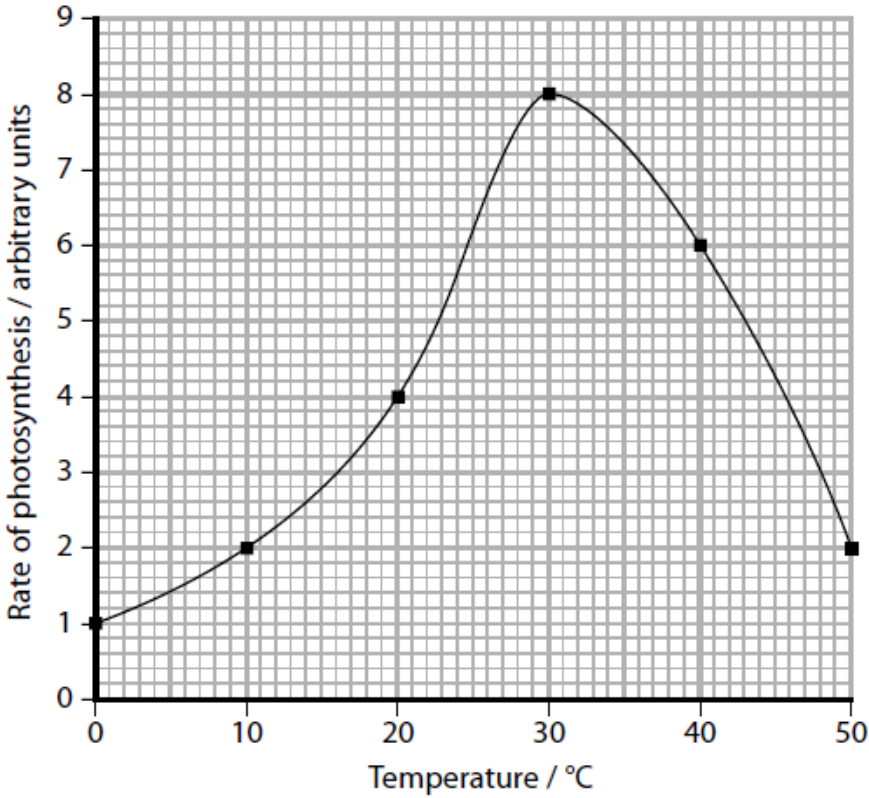
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(Total for question = 2 marks)

Q7.

The reactions involved in photosynthesis are affected by environmental factors. The graph shows the effect of temperature on the rate of photosynthesis in wheat.



Explain the effect of temperature on the rate of photosynthesis in wheat.

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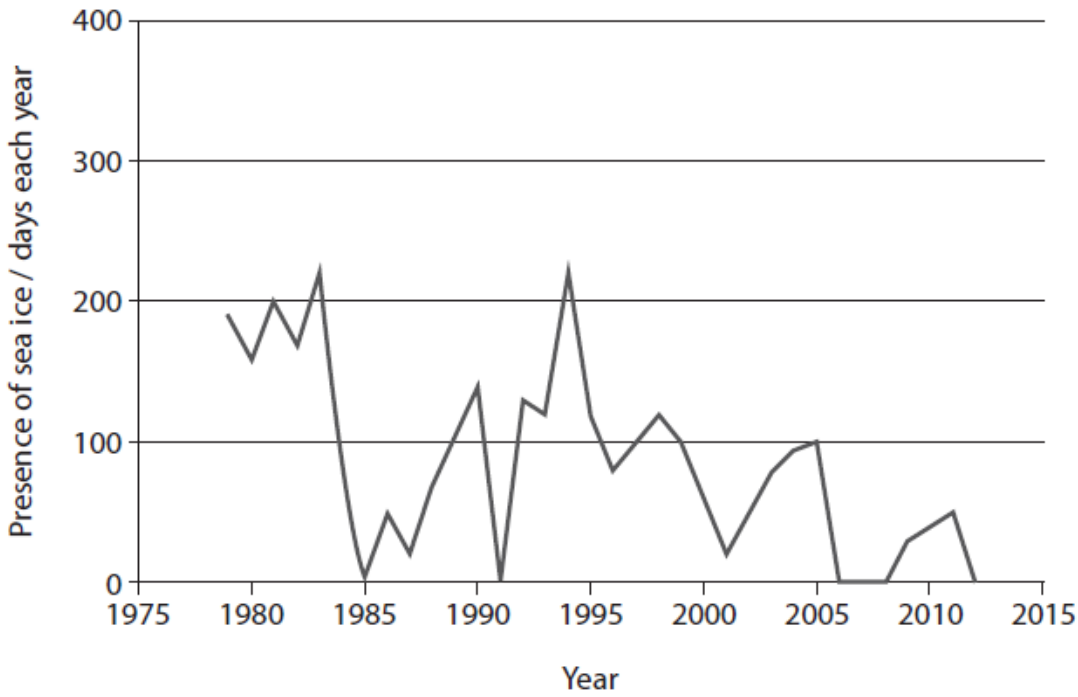
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Q8.

Scientists are concerned that climate change may be affecting the Arctic environment and the polar bears that live there.

In a study, scientists recorded the length of time ice was present each year in the sea around the west coast of Spitsbergen, an island in the Arctic.

The graph shows the number of days each year when sea ice was present.



(i) Explain how the data could support a conclusion that climate change is occurring in the Arctic.

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(ii) Explain why the data may not be useful for predicting future climate change.

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(Total for question = 6 marks)