

1 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.

(1)

- A** carbon dioxide and methane
- 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.

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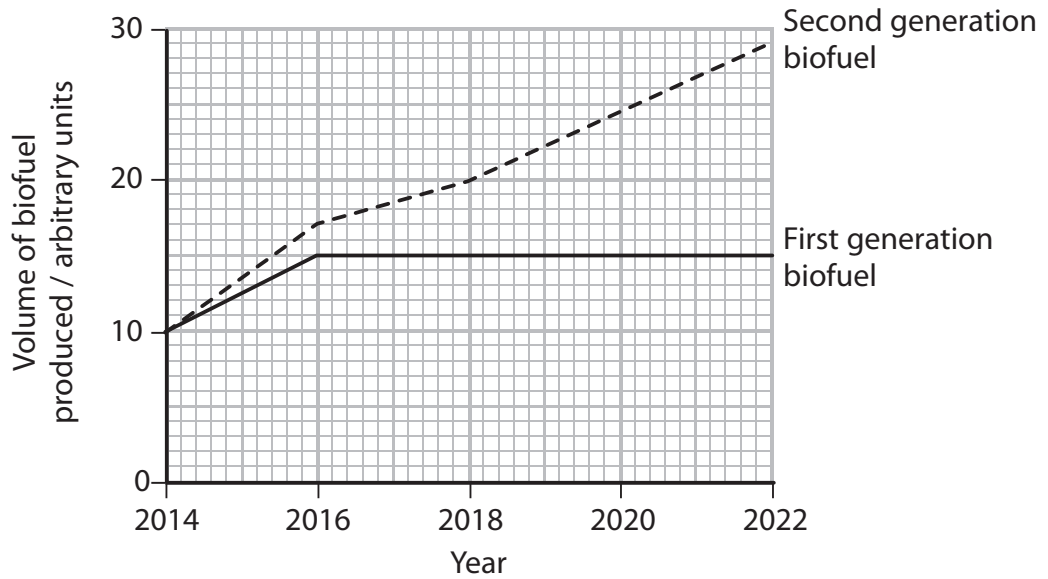
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(ii) Suggest why cellulose has to be treated with enzymes before the bacteria can use it as an energy source.

(2)

(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 1 = 11 marks)

2 Biofuels are being developed to reduce the effect of greenhouse gases on global warming.

(a) The list below shows some of the gases found in the atmosphere:

- carbon dioxide
- helium
- methane
- nitrogen
- oxygen

Place a cross in the box next to the number of greenhouse gases in this list.

(1)

A 1

B 2

C 3

D 4

(b) Biofuels are produced from crop plants.

Bioethanols are produced from carbohydrates, such as corn starch and sugar.

Biodiesels are produced from lipids, such as soybean oil and rapeseed oil.

(i) Describe the structure of lipids.

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(ii) The table below gives some information about the **production** of biofuels from four different crop plants.

Crop plant	Carbon dioxide emissions from the production of biofuels / kg per MJ of energy produced	Level of resources used in production of biofuels		
		water	fertilisers	pesticides
Corn	81 to 85	High	High	High
Sugar cane	4 to 12	Medium to low	High	Medium
Soy	49	High	Low to medium	Medium
Rape	37	High	Medium	Medium

Using the information in the table, discuss the advantages of producing biodiesels instead of bioethanols.

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(iii) Fertilisers contain inorganic ions. Name **three** inorganic ions that could be contained in the fertilisers and explain how these would improve the yield of the crop plants.

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(Total for Question 2 = 10 marks)

3 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

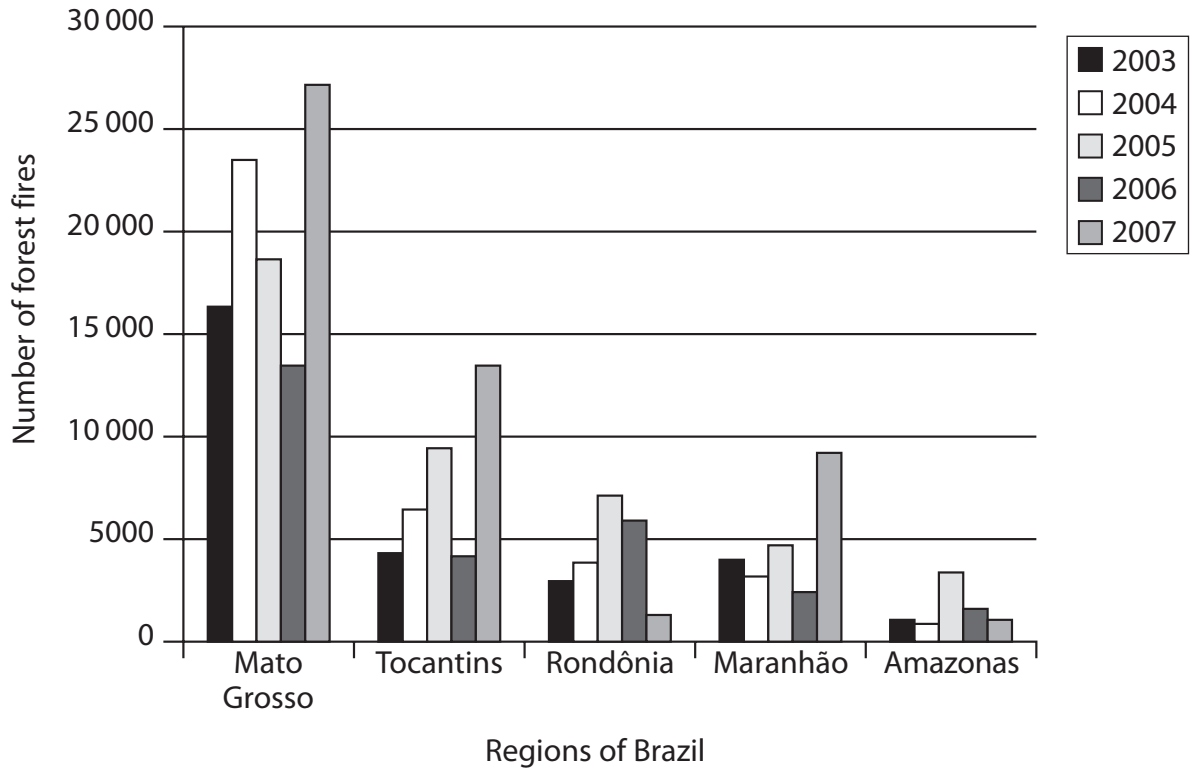
(a) Place a cross ☒ in the box next to the names of the four fuels, shown in the table, that could be considered to be biofuels.

(1)

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

4 Global warming is a worldwide problem that affects climate and the environment.

(a) The graph below shows the number of forest fires in five regions of Brazil, for 2003 to 2007.



(i) Place a cross in the box next to the best conclusion that can be drawn from these results about the number of forest fires in Brazil.

(1)

- A** The number of forest fires has generally decreased
- B** The number of forest fires has generally increased
- C** The number of forest fires in Mato Grosso each year is always higher than in other areas
- D** There are no clear trends

*(ii) Explain how forest fires may lead to global warming.

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(b) (i) Explain why the use of biofuels may help to reduce global warming.

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(ii) Explain **one** disadvantage of using biofuels to reduce global warming.

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(Total for Question 4 = 11 marks)