

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2003



SCIENCE: DOUBLE AWARD (MODULAR) 3468/2H
HIGHER TIER
Paper 2

Monday 9 June 2003 9.00 am to 10.30 am

H

In addition to this paper you will require:

- the Data Sheet (enclosed);
- a ruler.

You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		8	
2		9	
3		10	
4		11	
5		12	
6		13	
7		14	
		15	
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

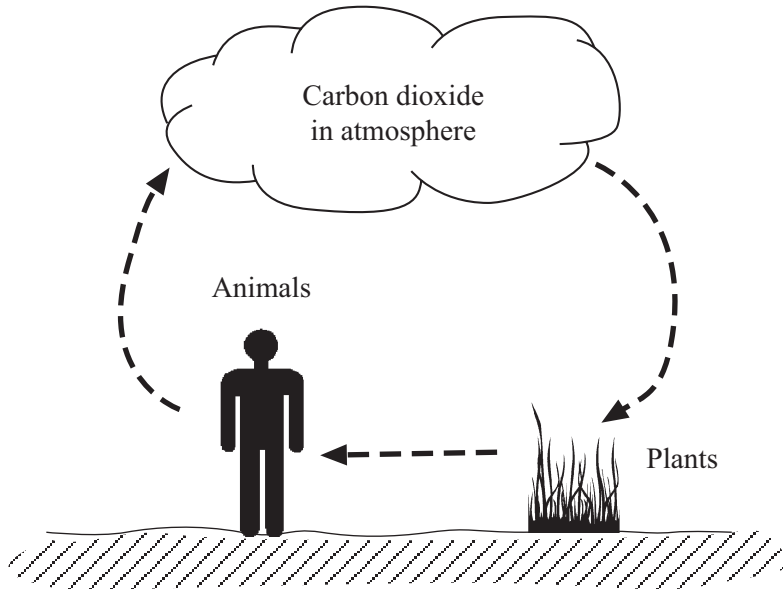
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 90.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

ENVIRONMENT

1 The diagram shows part of the carbon cycle.



Describe the processes shown in the diagram above.

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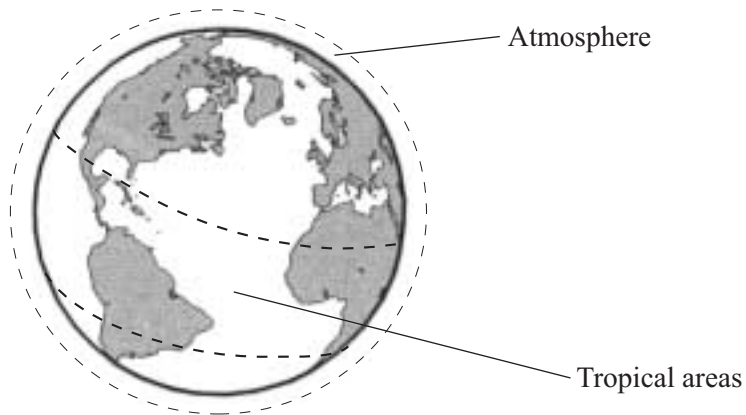
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(4 marks)

4

2 Recently the concentration of carbon dioxide in the Earth’s atmosphere has increased slightly. This may be linked to an increase in the ‘greenhouse effect’.



(a) The human population has grown rapidly. This has caused an increase in the amount of land used for agriculture, especially in tropical areas. This has helped to increase the carbon dioxide in the atmosphere.

Give **two** reasons for this.

- 1
-
- 2
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(2 marks)

(b) The increased ‘greenhouse effect’ has caused an increase in the Earth’s average temperature.

Give **two** possible environmental effects of this increased average temperature.

- 1
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- 2
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(2 marks)

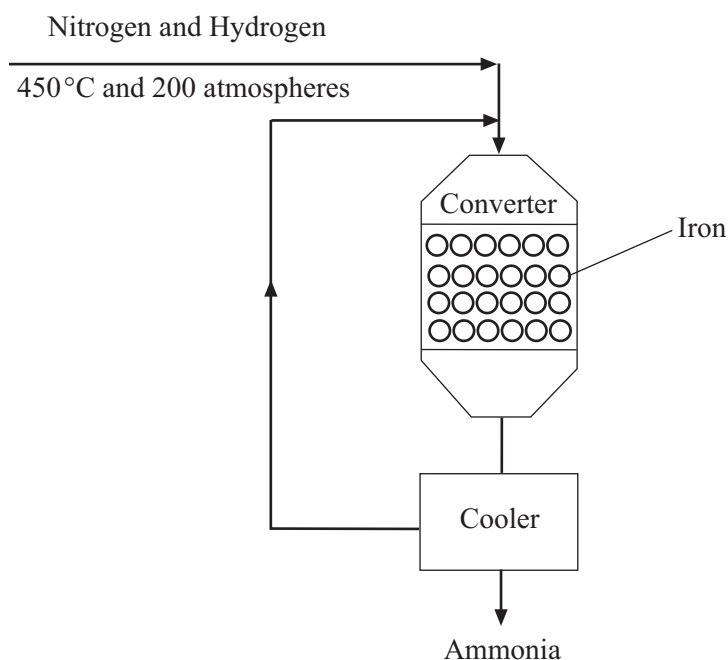
(c) Name another gas, produced by cattle and rice fields, that also helps cause the ‘greenhouse effect’.

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(1 mark)

PATTERNS OF CHEMICAL CHANGE

- 3 The diagram shows the final stages in the manufacture of ammonia.



- (a) Why is iron used in the converter?

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(1 mark)

- (b) Write the word equation for the reaction in the converter.

..... + \rightleftharpoons
(1 mark)

- (c) The yield of ammonia is only about 15%.

- (i) Why can the yield **not** be 100%?

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(1 mark)

- (ii) Describe what happens to the mixture of gases after it leaves the converter.

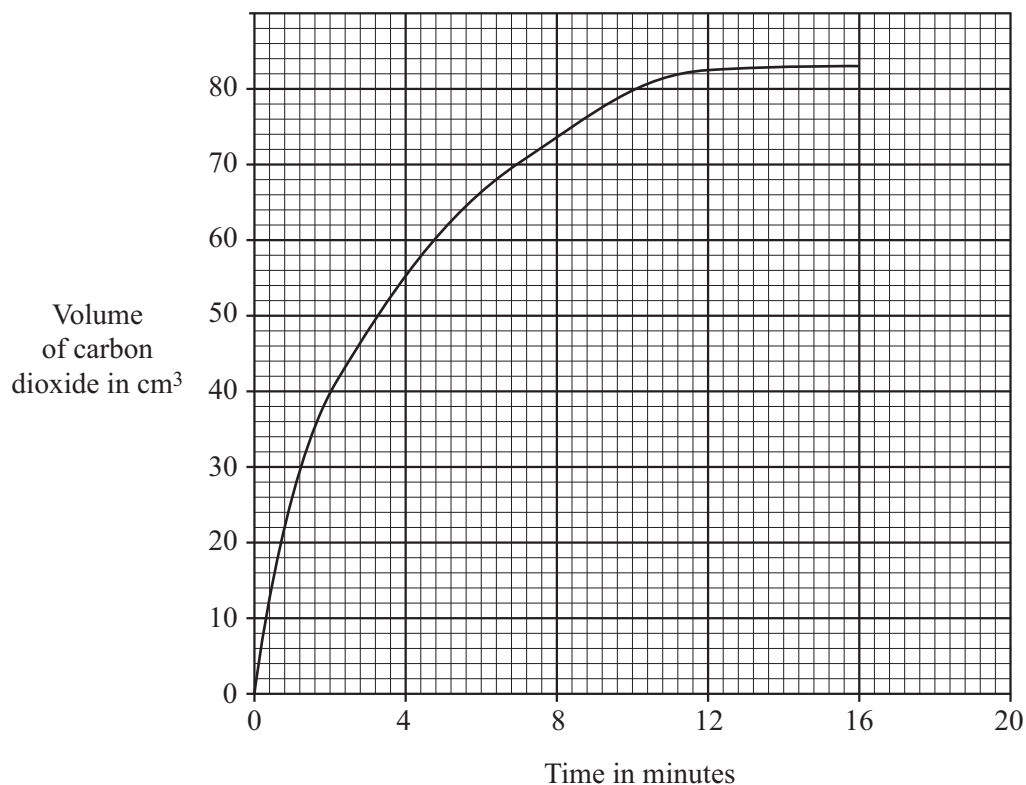
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(2 marks)

- 4 Calcium carbonate reacts with nitric acid to produce carbon dioxide.



A 10 g lump of calcium carbonate was reacted with 20 cm³ of dilute nitric acid. When the reaction was finished, some of the calcium carbonate was left unreacted. The graph shows the volume of carbon dioxide made in each minute for sixteen minutes.



- (a) The volume of carbon dioxide made in each minute decreases until it remains steady at 83 cm³. Explain why.

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(2 marks)

- (b) Draw a graph line, on the axes above, for an experiment where 20 cm³ of the same dilute nitric acid was reacted with 10 g of **powdered** calcium carbonate.

(2 marks)

- (c) Give **one** way of changing the rate of this reaction (other than using powdered calcium carbonate).

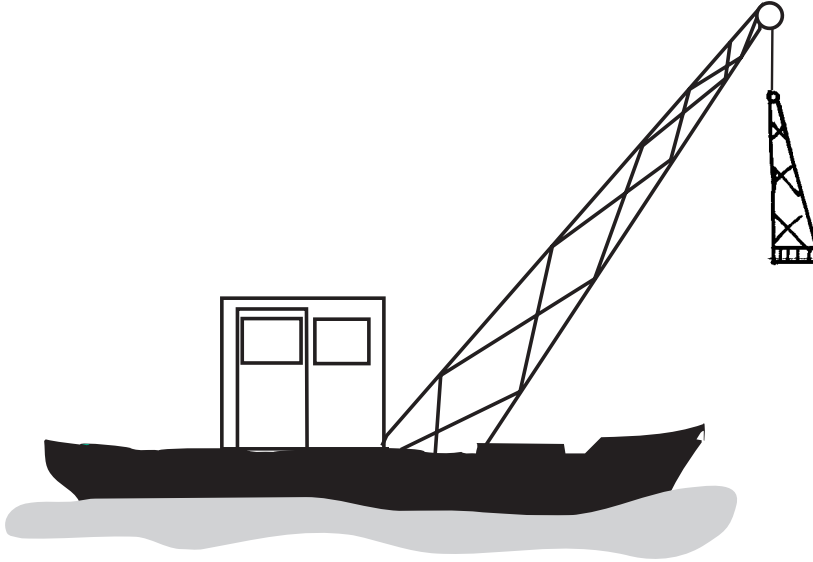
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(1 mark)

FORCES

5 A crane on a barge lifts a girder and then carries it along the river.



The girder has a weight of 1 000 000 N and is lifted to a height of 1500 cm.

(a) Complete the sentence.

The weight of the girder is caused by the Earth's gravitational field strength acting on its

..... (1 mark)

(b) Calculate the work done in lifting the girder.

Write the equation you are going to use.

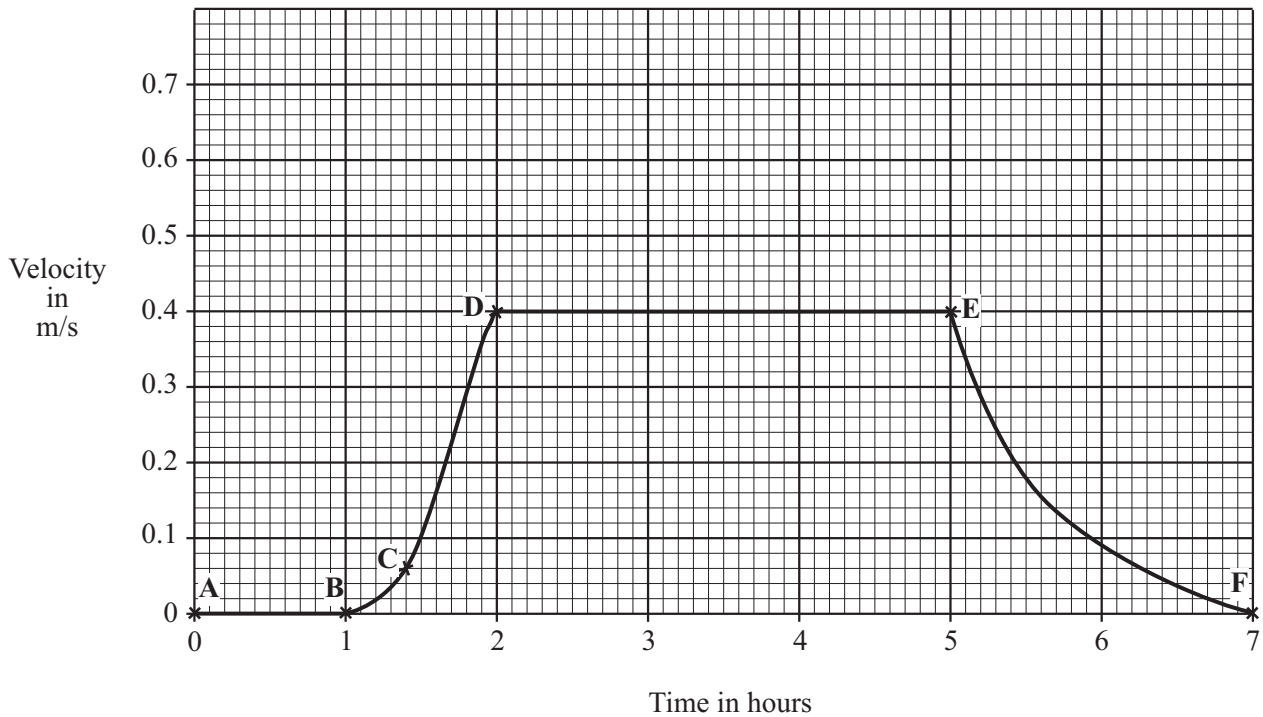
..... (1 mark)

Show clearly how you work out your answer and give the unit.

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Work done = (3 marks)

- (c) The velocity–time graph represents the motion of the barge after the girder had been lifted.



To gain full marks in this question you should write your ideas in good English. Put them in a sensible order and use the correct scientific words.

Describe the motion of the barge over this period of seven hours. You must refer to the points A, B, C, D, E and F in your description.

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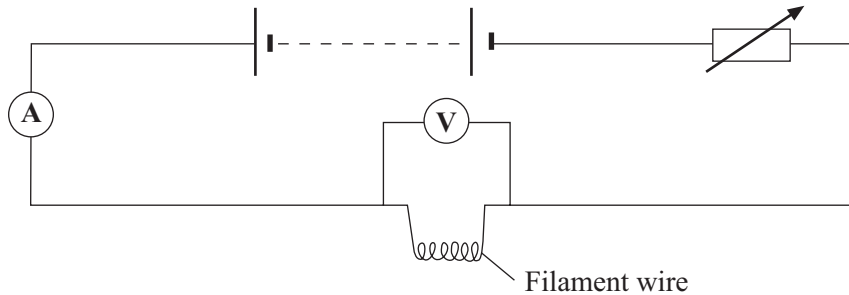
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(5 marks)

10

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 6 A bulb heats up when an electric current passes through the filament wire. The current was measured when different voltages were applied across the filament wire shown in the diagram below.



- (a) (i) Look at the circuit diagram. How was the voltage changed?

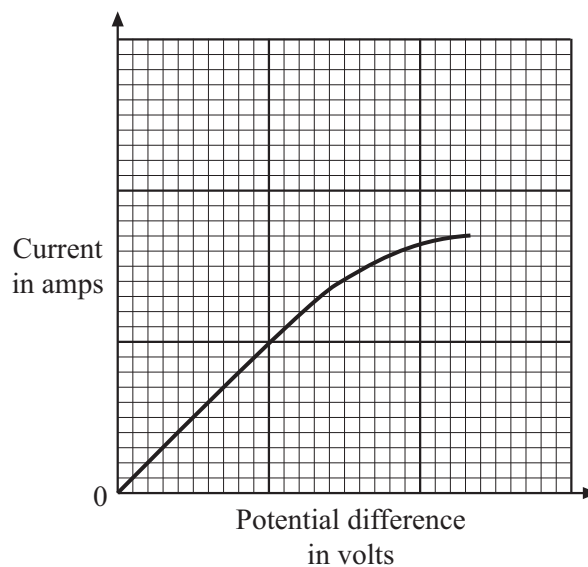
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 (1 mark)

- (ii) Write an equation that shows the relationship between *current*, *potential difference* and *resistance*.

.....
 (1 mark)

- (b) The graph shows how the current through the filament wire changed as the potential difference across it changed.



- (i) Describe the effect of increasing the potential difference on the current flowing through the filament wire.

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(2 marks)

- (ii) Explain this effect in terms of the resistance of the filament wire.

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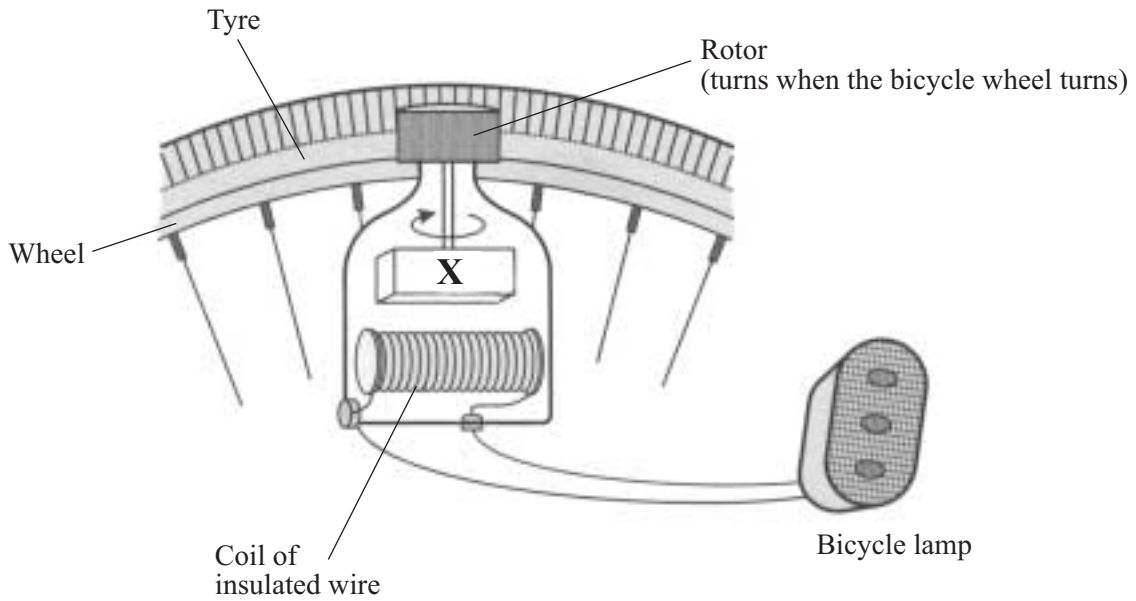
(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

7 A bicycle can use a dynamo to generate electricity.



(a) Name part X.

.....
(1 mark)

(b) Give **three** ways of increasing the size of the induced voltage from a dynamo.

- 1
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- 2
-
- 3
-

(3 marks)

ENVIRONMENT

8

Battery Pigs!

Some countries have battery pigs! Large numbers of pigs are kept indoors and have limited living space which restricts their movement. The temperature of their environment is carefully controlled.



(a) This is a way of producing food efficiently.

These pigs have their movement restricted. Explain why.

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(2 marks)

(b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Sometimes untreated sewage escapes from battery pig farms into nearby rivers. This sewage can lead to the death of fish in the rivers. Explain how.

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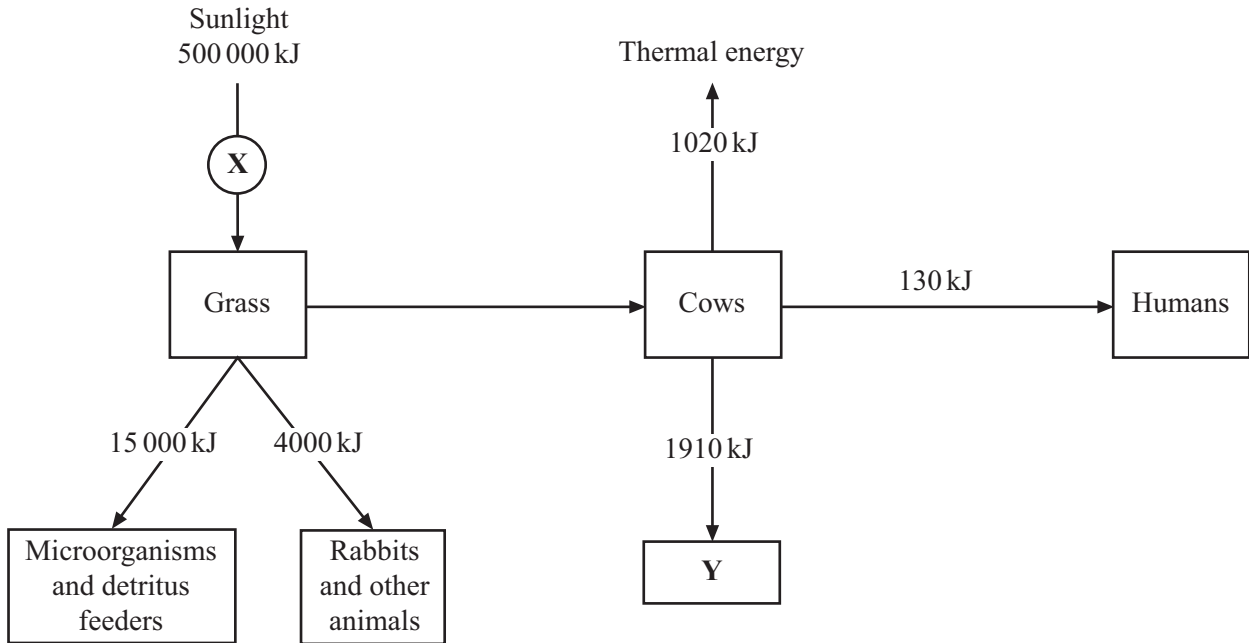
(4 marks)

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6

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 9 The diagram shows the amounts of energy that are transferred, over a period of time, through some living things in a grassland habitat.



- (a) Calculate the amount of energy transferred from the grass to the cows.

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Amount of energy = kJ
 (1 mark)

- (b) X is a process in plants.

- (i) Calculate the amount of energy usefully transferred by process X.

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Amount of energy = kJ
 (1 mark)

- (ii) Name process X.

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 (1 mark)

(c) Give **two** ways in which energy is 'lost' from the cows at **Y**.

1

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(2 marks)

(d) Describe how hormones can be used to improve the efficiency of producing food from plants.

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(2 marks)

7

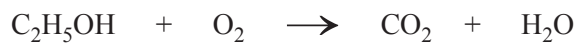
TURN OVER FOR THE NEXT QUESTION

Turn over ▶

PATTERNS OF CHEMICAL CHANGE

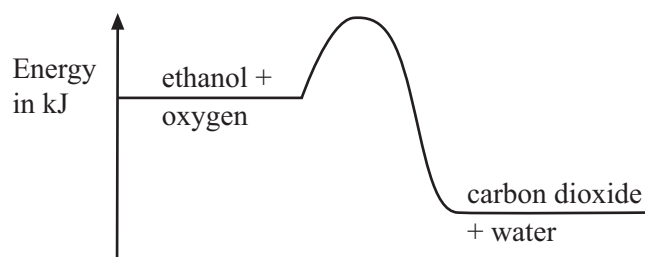
10 Ethanol is used as a fuel.

(a) Balance the symbol equation for the combustion reaction.



(1 mark)

(b) The energy level diagram represents the combustion of ethanol.



Describe what must happen to the molecules of ethanol and oxygen to allow them to react.

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(3 marks)

- (c) We can use bond energies to calculate the energy change for the reaction between hydrogen and oxygen.



Bond	Bond energy in kJ
H—H	436
O—H	464
O = O	498

- (i) Calculate the total bond energy of the reactants.

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Total bond energy of reactants = kJ
(2 marks)

- (ii) Is the reaction between hydrogen and oxygen exothermic or endothermic?
Use bond energies to explain your answer.

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(2 marks)

8

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 11** Iron is the most commonly used metal. Iron is extracted in a blast furnace from iron oxide using carbon monoxide.



- (a) A sample of the ore haematite contains 70% iron oxide.

Calculate the amount of iron oxide in 2000 tonnes of haematite.

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Amount of iron oxide = tonnes
 (1 mark)

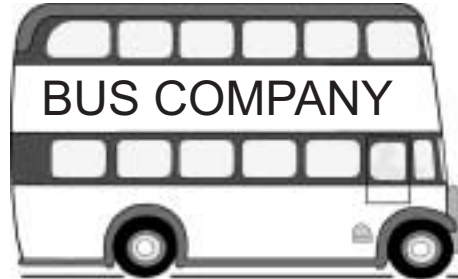
- (b) Calculate the amount of iron that can be extracted from 2000 tonnes of haematite.
 (Relative atomic masses: O = 16; Fe = 56)

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Amount of iron = tonnes
 (4 marks)

FORCES

- 12 'SPEED KILLS' - was the heading of an advertising campaign. The scientific reason for this is that energy is transferred from the vehicle to the person it knocks down.



- (a) The bus and the van are travelling at the same speed. The bus is more likely to cause more harm to a person who is knocked down than the van would. Explain why.

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(2 marks)

- (b) A car and its passengers have a mass of 1200 kg. It is travelling at 12 m/s.

- (i) Calculate the increase in kinetic energy when the car increases its speed to 18 m/s.

Show clearly how you work out your answer and give the unit.

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Increase in kinetic energy =

(5 marks)

(ii) Explain why the increase in kinetic energy is much greater than the increase in speed.

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(1 mark)

8

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

13 Our Sun is just one of many millions of stars in a galaxy called the Milky Way.

- (a) Our Sun is in the main stable period of a star's lifetime. The massive force of gravity draws its matter together. This force is balanced by the very high temperatures, from the fusion of hydrogen atoms, which tend to make the Sun expand. Describe and explain what will happen to the Sun as the hydrogen is eventually used up.

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(3 marks)

- (b) Studies of light from distant galaxies have provided evidence for the theory that the Universe started from one place and is expanding. Explain how.

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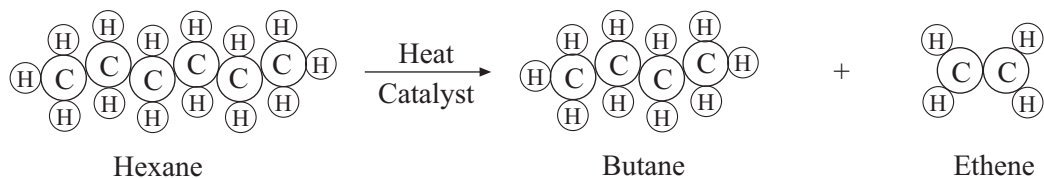
(3 marks)



QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

14 The many hydrocarbons in crude oil are separated into fractions.

- (a) Some of the larger hydrocarbon molecules can be broken down to produce smaller, more useful hydrocarbon molecules.



Hexane and butane are alkanes. Describe the structure of alkanes.

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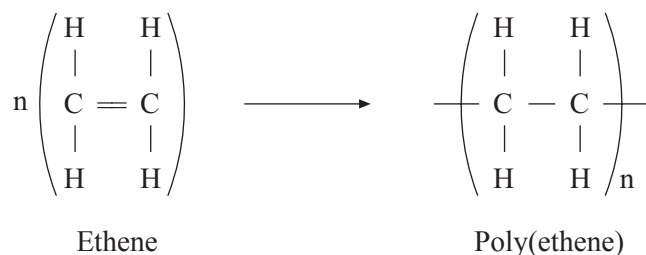
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(3 marks)

- (b) Ethene is used to make poly(ethene).



This process is called polymerisation. Explain what is meant by polymerisation.

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(2 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 15 Use of renewable sources of energy is expected to increase. The table shows the comparative costs of producing 1 kWh of electricity from different energy sources.

Types of energy sources used in the UK	Cost of producing 1 kWh of electrical energy	
Fossil fuels (non-renewable)	Coal	1.0 p
	Gas	1.4 p
	Oil	1.5 p
Nuclear fuels (non-renewable)	Nuclear	0.9 p
Renewable	Hydroelectric	0.2 p
	Wind	0.9 p
Installation and decommissioning costs are not included.		

At present about 2% of electricity generated in the UK uses renewable energy sources. Consider the three types of energy sources in the table and give **one** advantage and **one** disadvantage for each (other than installation and decommissioning costs).

Advantage	Disadvantage
Using fossil fuels	Using fossil fuels
Using nuclear fuels	Using nuclear fuels
Using renewable sources	Using renewable sources

(6 marks)

END OF QUESTIONS