FOR OFFICIAL USE

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	KU	PS
Total Mark		

3700/31/01

NATIONAL QUALIFICATIONS 2013

WEDNESDAY, 1 MAY
1.00 PM – 2.30 PM

SCIENCE
STANDARD GRADE
Credit Level

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth
Day Month Year

Scottish candidate number

Number of seat

1 Answer as many questions as you can.

2 Read the whole of each question carefully before you answer it.

3 Write your answers in the spaces provided. Showing working may help in some questions.

4 Before leaving the examination room you must give this book to the Invigilator. If you do not, you may lose all the marks for this paper.

DO NOT WRITE IN THIS MARGIN

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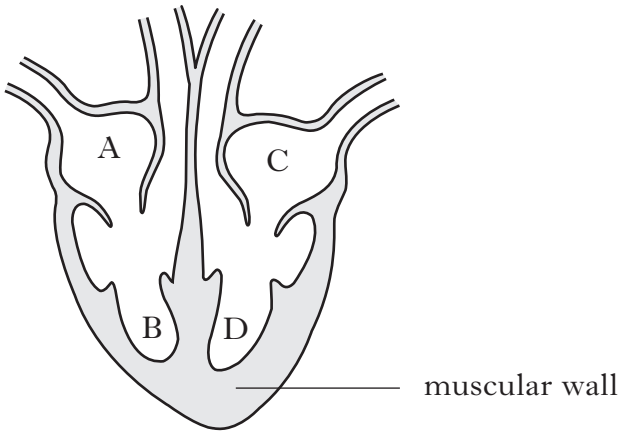
1. The diagram below shows the four chambers inside the heart.



(*a*) Which **two** chambers pump blood **out** of the heart?

Chambers ..... and **1**

(*b*) Name chamber A.

..... **1**

(*c*) Explain why the muscular wall round chamber D is thicker than the muscular wall round chamber B.

.....

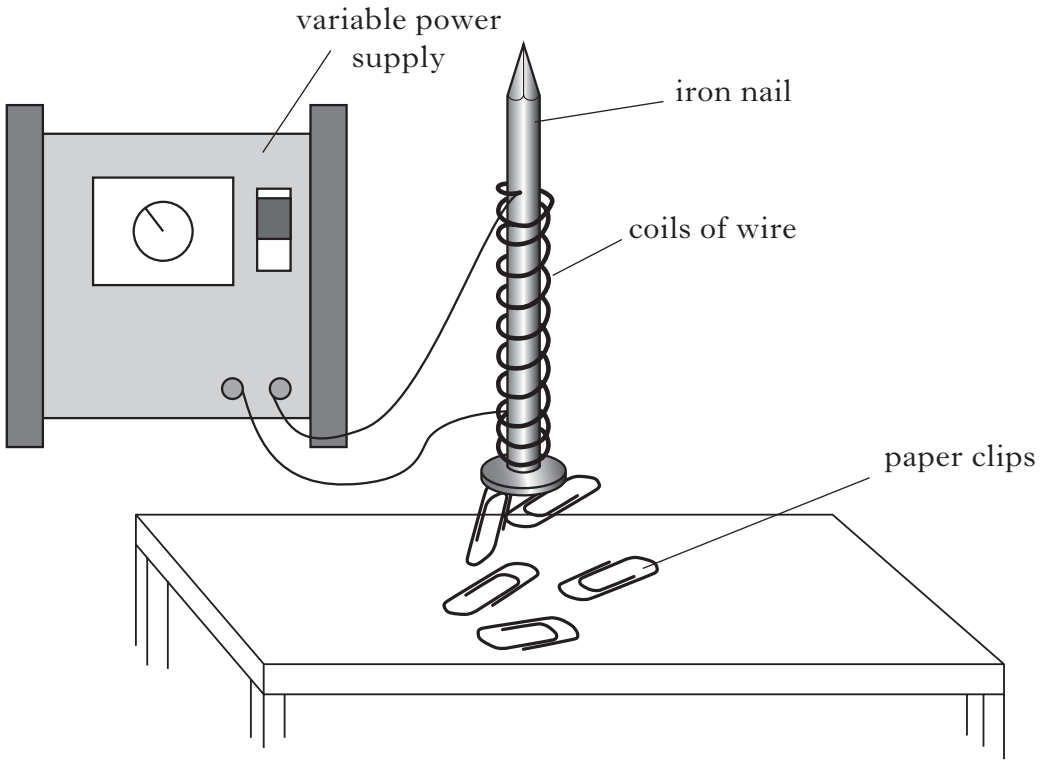
..... **1**

Marks | KU | PS

2. David and Julie investigated factors affecting the strength of an electromagnet.

They made an electromagnet by wrapping wire round an iron nail and connecting the wire to a variable power supply set to 2 V.

They measured the strength of the electromagnet by counting the number of paper clips it could lift.



Their results are shown below.

Number of coils of wire	*Number of paper clips lifted*
10	2
15	3

The investigation was **fair** but could be **improved** to make the results more reliable.

Suggest **two improvements**.

1 .....

.....

2 .....

..... **2**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

3. The boxes show the names of some gases.

1 carbon monoxide	2 carbon dioxide	3 sulphur dioxide
4 oxides of nitrogen	5 CFC	6 nitrogen

(*a*) Which **two** boxes show gases that cause acid rain pollution?

Box numbers ..... and **2**

(*b*) Which box shows a gas that breaks down the ozone layer in the atmosphere?

Box number **1**

(*c*) Which box shows a gas formed by the incomplete combustion of fossil fuels?

Box number **1**

4. Draw lines to match each object to the **most appropriate** method of protecting it from damage.

One has been done for you.

Object	**Method of protection**
aluminium gate	tinplating
leather walking boots	oiling
wooden garden bench	pesticide treatment
bicycle chain	waterproofing wax
food cans	anodising
steel roofing sheet	galvanising

3

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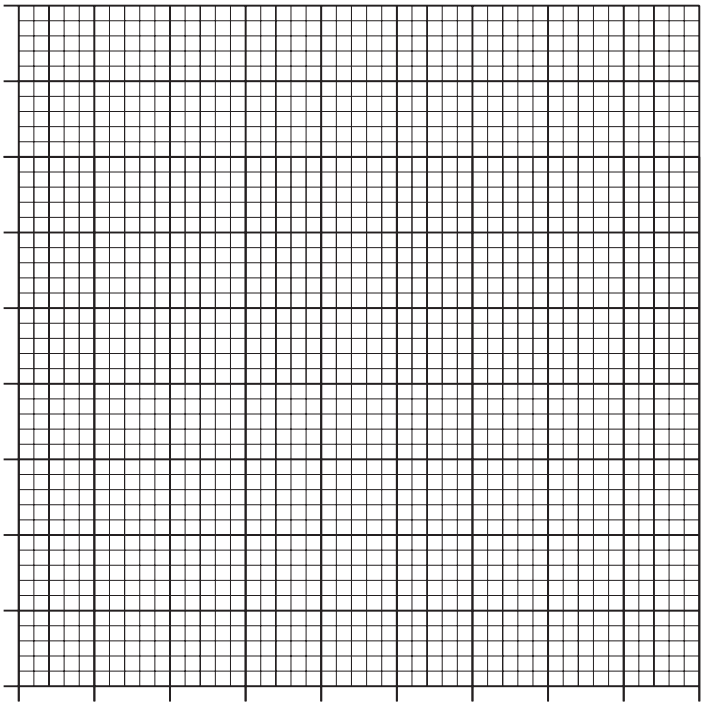
5. The table gives some information about three planets.

Planet	*Distance from the Sun* (millions of km)	
	Minimum	*Maximum*
Mercury	48	70
Venus	108	110
Earth	148	154

Construct a **single bar graph** to show all of the above information. (Additional graph paper, if needed, is provided on *Page twenty-four*.)



3

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6. Burning coal in power stations causes air pollution.

Give **two** ways in which air pollution can be reduced.

1 .....

.....

2 .....

..... **2**

7. A thermostat keeps the temperature inside a freezer constant.
Describe how the thermostat works.

.....

.....

..... **1**

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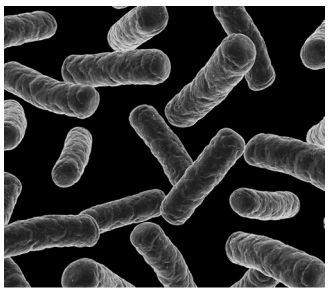
Marks | KU | PS

8. Read the passage below and then answer the questions.



Bacteria are single-celled organisms which are so small they can only be seen through a microscope. One way of identifying different types of bacteria is by their shape. Cocci bacteria are round, vibrios bacteria are shaped like commas and spirilla bacteria are spiral. Bacteria which are rod-shaped are called bacilli bacteria.

Bacteria usually reproduce by a process called binary fission in which each one divides into two equal parts. When the conditions are correct, binary fission can take place every twenty minutes. This is the reason why numbers of bacteria can rapidly increase.

High temperatures can kill bacteria. During pasteurisation, milk is kept at a temperature of 72 °C for fifteen seconds and then rapidly cooled to 10 °C. This process kills disease-causing bacteria, but less harmful bacteria are able to survive, causing milk to go sour after a few days. Ultra-heat treatment of milk involves heating the milk to 132 °C for one second. This kills most bacteria allowing the milk to last for several months.

Antibiotics are drugs which can kill bacteria and are used to treat diseases caused by bacterial infection. However, some types of bacteria such as *Mycobacterium tuberculosis*, which causes tuberculosis, and *Staphylococcus aureus,* which causes blood poisoning, are becoming resistant to most antibiotics. To overcome this problem, medical researchers are developing treatments that use bacteriophages. These are viruses which kill bacteria.

(*a*) What type of bacteria are shaped like commas?

..... **1**

(*b*) Name the process by which bacteria usually reproduce.

..... **1**

(*c*) Explain why milk that has been heated to 132 °C can last for several months.

.....

..... **1**

(*d*) State **two** ways of treating diseases caused by bacterial infection.

1 .....

2 ..... **1**

DO NOT WRITE IN THIS MARGIN

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9. The boxes show the names of parts of the human breathing system.

1 diaphragm	2 rib cage	3 air sacs
4 windpipe	5 bronchioles	6 capillaries

(*a*) Which part is kept open by cartilage rings?

Box number **1**

(*b*) Which **two** parts are needed for gas exchange between the lungs and blood?

Box numbers ..... and **1**

(*c*) Which part causes an increase in lung pressure when it moves upwards?

Box number **1**

10. Which box below shows the **three** reasons why corrosion increases the cost to industry?

A Cost of additional labour Cost of lost production Cost of replacing corroded parts	B Cost of additional labour Cost of lost production Cost of heat treating metals
C Cost of lost production Cost of improving wear resistance Cost of replacing corroded parts	D Cost of replacing corroded parts Cost of additional labour Cost of heat treating metals

Box letter **1**

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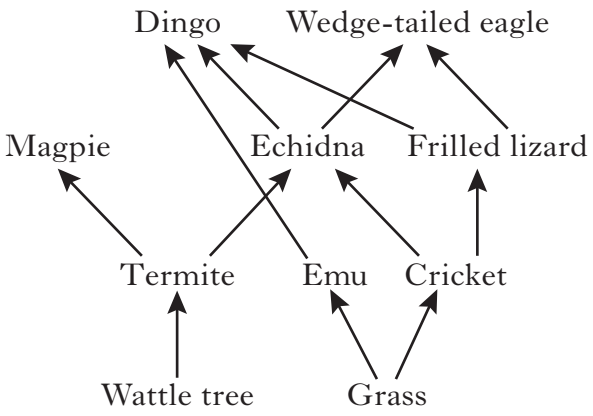
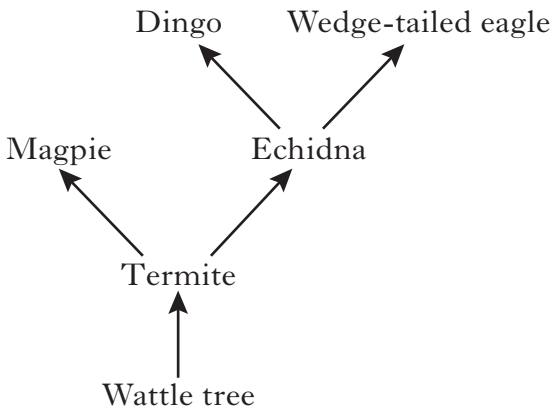
11. Two food webs from Australian grasslands are shown below.



Food web A



Food web B

(*a*) (Circle) the correct answers in the following sentence.

Food web | **A** | **B** | is more stable because it has | **more** | **fewer** | links. **1**

(*b*) One food chain from food web A is shown below.

grass ⟶ cricket ⟶ echidna ⟶ dingo

Give **two** ways in which the energy is lost from this food chain.

1 .....

2 ..... **2**

(*c*) The grass was sprayed with pesticide.

Which of these organisms will build up the highest concentration of pesticide in its body?

A Cricket

B Frilled lizard

C Magpie

D Wedge-tailed eagle

Underline the correct answer. **1**

(*d*) What word is used to describe the number of animals of the same species living in an area?

..... **1**

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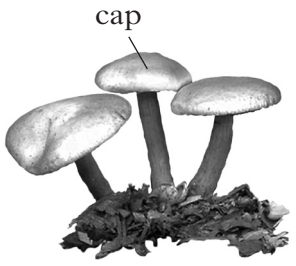
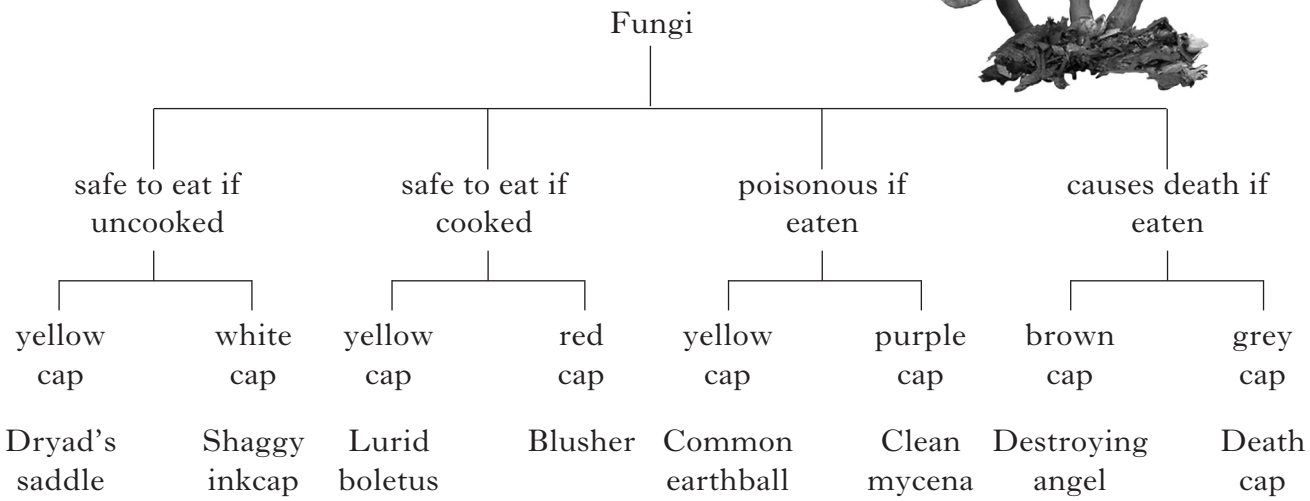
12. The key shows information about types of fungi.





The table gives some more information about these fungi.

Common name	*Species*	*Diameter of cap* (cm)
Dryad's saddle	*Polyporus squamosus*	40 to 50
Shaggy inkcap	*Coprinus comatus*	8 to 10
Lurid boletus	*Boletus luridus*	9 to 12
Blusher	*Amanita rubescens*	10 to 15
Common earthball	*Scleroderma citrinum*	5 to 8
Clean mycena	*Mycena pura*	2 to 3
Destroying angel	*Amanita virosa*	5 to 9
Death cap	*Amanita phalloides*	6 to 12

(*a*) Which **species** has a yellow cap and is poisonous if eaten?

..... **1**

(*b*) What is the colour of the cap with the smallest diameter?

..... **1**

(*c*) Use both the key and the table to **fully** describe the *Amanita virosa* species.

.....

.....

..... **2**

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13. Human activity has destroyed much of the African rain forest, limiting the number of gorillas which can live there.

(*a*) Give **two** other factors which can limit the number of animals in an area.

1 .....

2 ..... **2**

(*b*) What word is used to describe the environmental area in which a type of animal lives?

..... **1**

14. (*a*) Draw lines to match each part of the blood to its correct function.

Part of the blood	**Function**
plasma	to destroy bacteria
white blood cells	to carry oxygen
platelets	to carry dissolved food
red blood cells	to seal cuts by clotting blood

3

(*b*) Blood is carried around the body in different types of blood vessel.
Which type of blood vessel has

(i) thick walls?

..... **1**

(ii) valves?

..... **1**

[Turn over

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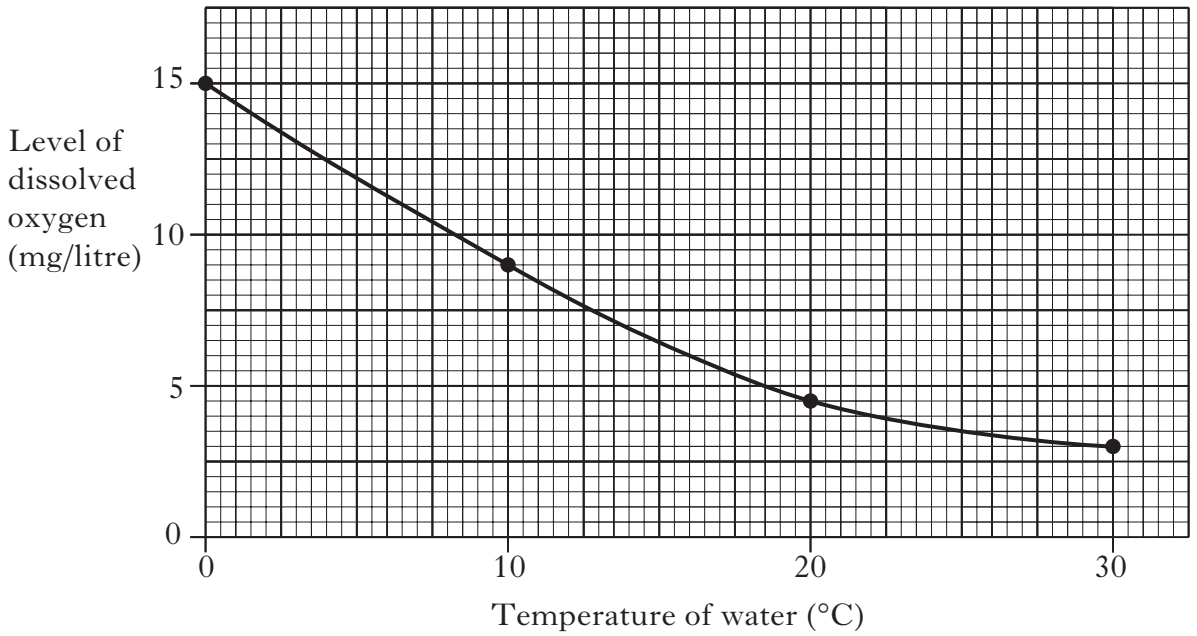
15. The graph below shows how the level of dissolved oxygen is affected by water temperature.

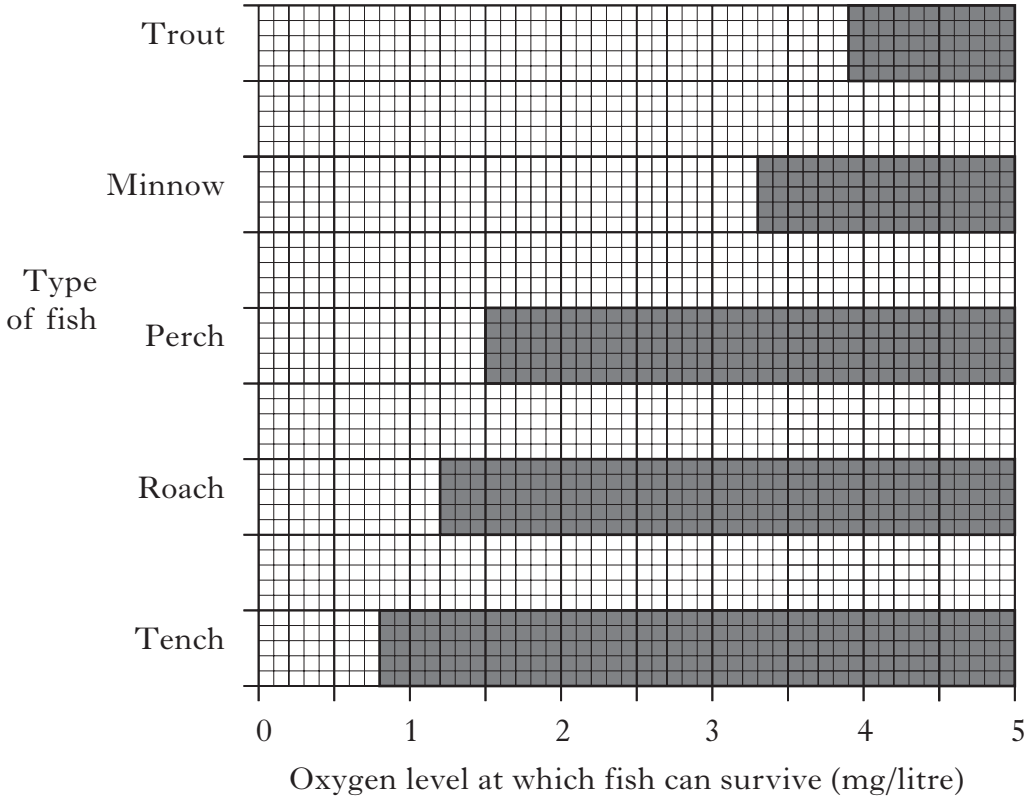


(*a*) Draw **one** conclusion from the graph.

.....

..... **1**

(*b*) The following chart shows the level of dissolved oxygen at which different types of fish can survive.



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15. (*b*) (continued)

(i) How many types of fish can survive in water with a level of dissolved oxygen below 3 mg/litre?

..... **1**

(ii) What is the minimum level of dissolved oxygen needed for perch to survive?

..... mg/litre **1**

(*c*) A factory discharges hot water into the river.

The table shows the water temperature in the river downstream from the factory.

Distance downstream (m)	*Temperature of water* (°C)
0	30·0
10	25·0
20	22·0
30	19·0
40	17·0
50	16·5
60	16·0

Use information from the graph, chart and table to answer the following questions.

(i) What is the level of dissolved oxygen in the water 60 m downstream from the factory?

..... mg/litre **1**

(ii) Which type of fish could **not** survive in the river 10 m downstream from the factory?

..... **1**

[Turn over

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Marks | KU | PS

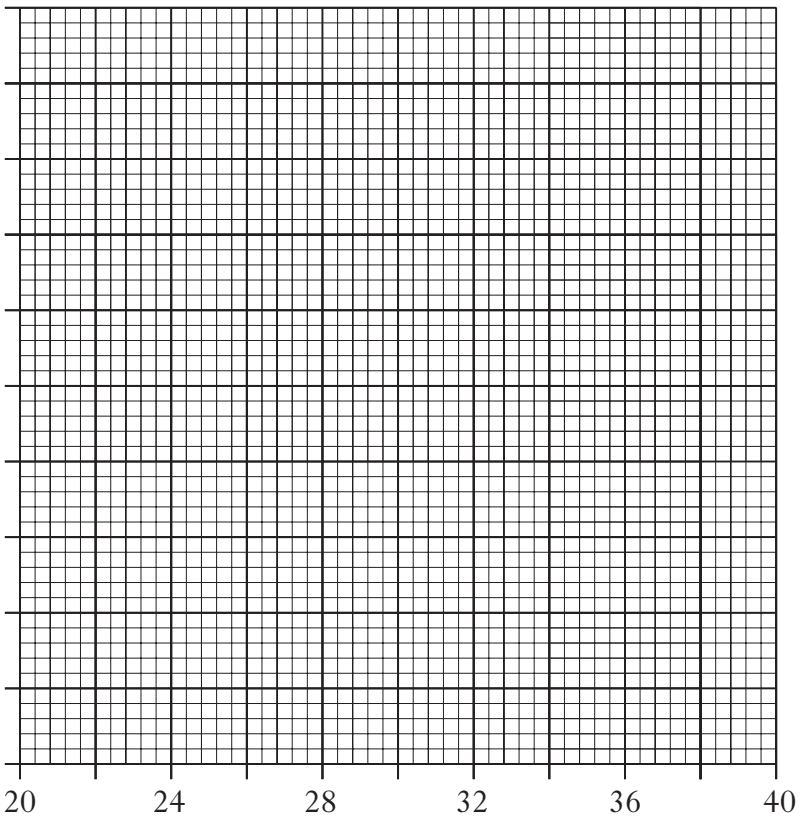
16. The table shows the number of twin births per 1000 pregnancies for women of different ages in Britain.

Age of women (years)	*Number of twin births per 1000 pregnancies*	
	Non-identical twins	*Identical twins*
20	4·0	2·0
24	6·0	2·4
28	9·0	3·0
32	16·0	3·6
36	13·0	4·0
40	10·0	4·0

Using the **same axes**, show the results as two **line** graphs.

Label each line clearly.

(Additional graph paper, if required, may be found on *Page twenty-four*.)



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17. What name is given to each of the following processes?

(*a*) Converting sugar into alcohol

..... **1**

(*b*) Using sound waves to detect underground deposits of oil and gas

..... **1**

(*c*) Separating fractions from crude oil in an oil refinery

..... **1**

18. The grid shows some properties of materials.

1 thermal conductivity	2 strength	3 wear resistance
4 flexibility	5 electrical conductivity	6 hardness

Which property means

(*a*) the ability of a material to allow heat to flow through it?

Box number **1**

(*b*) the ability of a material to resist damage caused by impact?

Box number **1**

(*c*) the ability of a material to bend without breaking?

Box number **1**

(*d*) the ability of a material to support a heavy load without breaking?

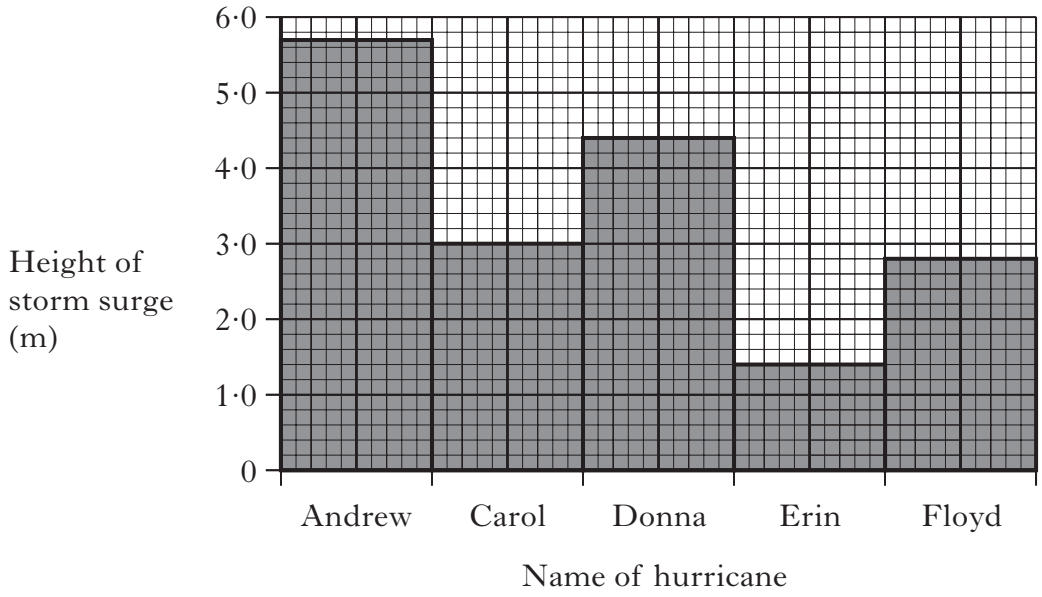
Box number **1**

[Turn over

19. The table gives some information about hurricanes.

Category of hurricane	*Height of storm surge* (m)	*Wind speed* (km/hr)	*Damage to houses*
1	1·2 to 1·7	120 to 154	none
2	1·8 to 2·6	155 to 179	light
3	2·7 to 3·9	180 to 209	moderate
4	4·0 to 5·5	210 to 249	severe
5	more than 5·5	250 or more	very severe

The bar graph shows the height of the storm surge for some hurricanes.



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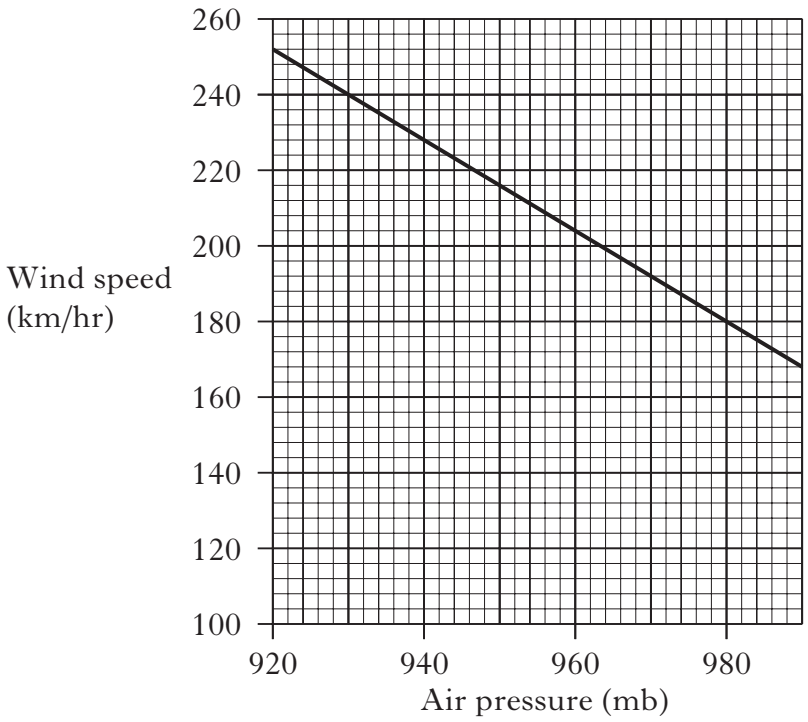
19. (continued)

The line graph shows how the wind speed of a hurricane is related to the air pressure.



Use all of the information given to answer the following.

(*a*) What damage to houses was caused by hurricane Floyd?

.....

1

(*b*) Name the hurricane with an air pressure of 920 mb.

.....

1

(*c*) Predict the air pressure of a category 3 hurricane.

..... mb

1

[Turn over

20. The diagrams below show possible positions for the **switch** and the **fuse** in the electrical supply to a toaster.

Key

E	earth wire	fuse
N	neutral wire	switch
L	live wire	

Diagram **A**

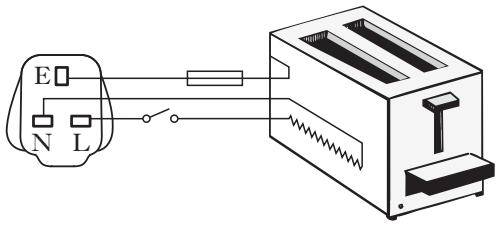


Diagram **B**

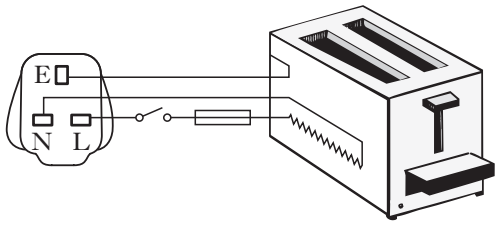


Diagram **C**

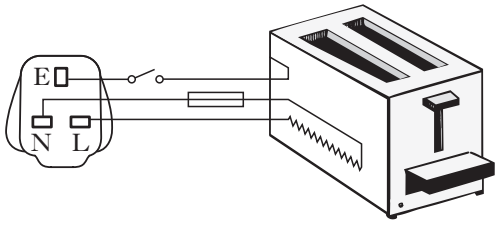
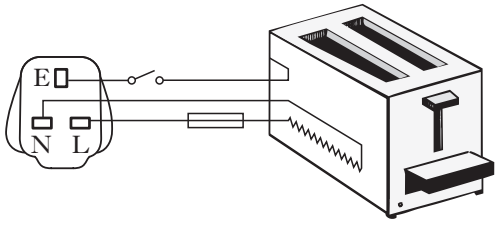


Diagram **D**



(*a*) Which diagram shows the **correct** position of the switch and fuse?

Letter..... **1**

(*b*) The power rating of the toaster is 1500 W.

What is the correct **fuse rating** of the toaster?

Circle the correct answer.

1A 3A 5A 13A **1**

(*c*) The metal casing of the toaster is connected to the **earth** wire.

Explain how the earth wire acts as a safety device.

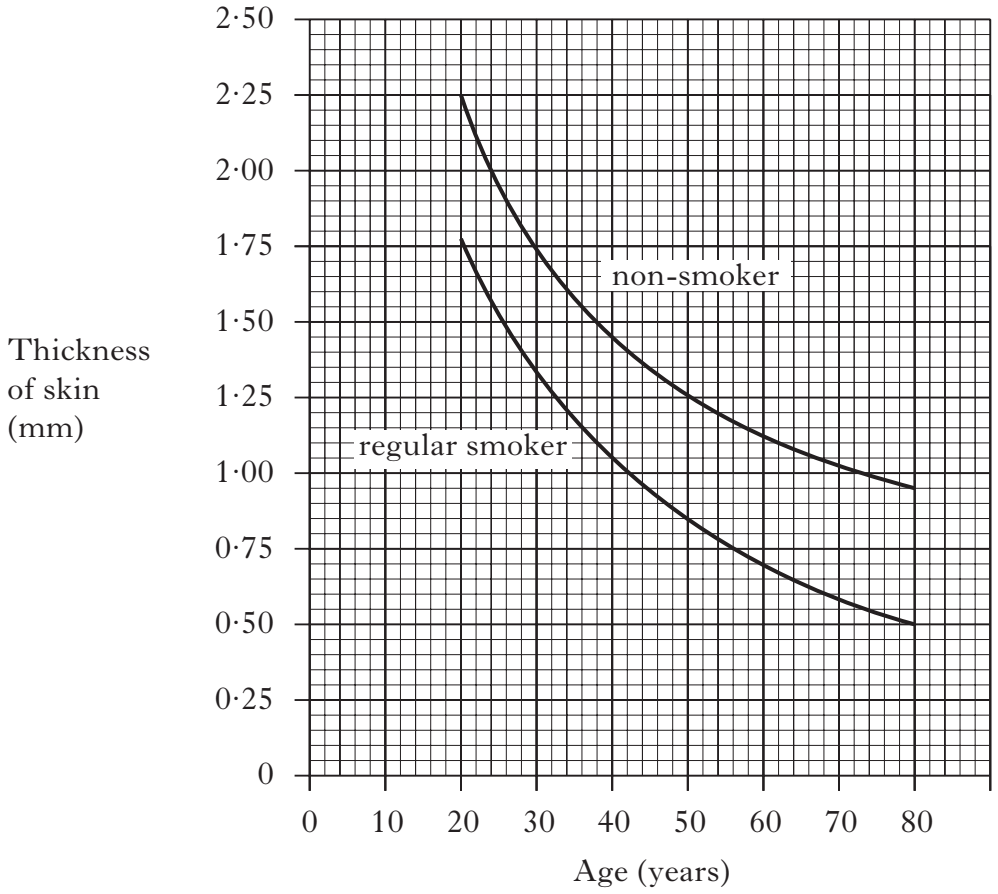
.....

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

21. The graph shows how the thickness of skin on the face changes with age.



(*a*) Draw **two** conclusions from this graph.

1 .....

.....

2 .....

..... **2**

(*b*) What is the difference in skin thickness between a 40 year old regular smoker and a 40 year old non-smoker?

Space for working

Answer.....mm **2**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

22. To measure the water speed in a local river, Brian timed how long it took for a piece of wood to travel 100 metres. He carried out the experiment five times.

His results are shown in the table.

Experiment number	*Time taken* (s)
1	41
2	39
3	42
4	37
5	41

(*a*) Calculate the average time taken for the wood to travel 100 m.

Space for working

Answer ..... s **1**

(*b*) The average water speed can be found using the formula

$$\text{average water speed} = \frac{\text{distance travelled}}{\text{average time taken}}$$

(i) Use your answer to part (*a*) to calculate the average water speed.

Space for working

Answer .....m/s **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

22. (*b*) (continued)

(ii) Further downstream, the average water speed was 0·8 m/s.

Calculate the average time taken for the wood to travel 100 m.

Space for working

Answer ..... s **2**

[Turn over

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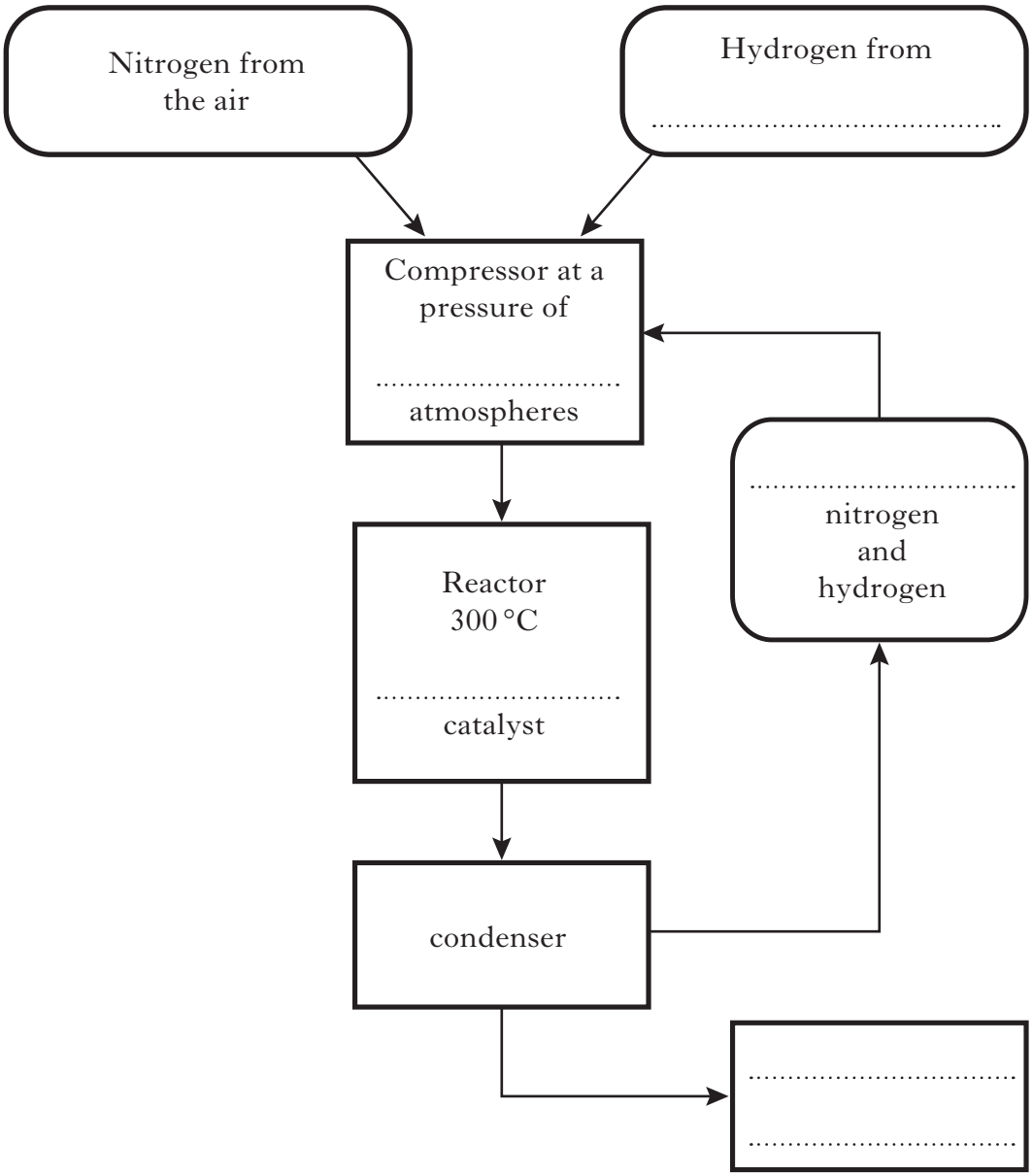
Marks | KU | PS

23. Use the information in the passage to complete the **flow diagram**.

Ammonia is made by combining nitrogen from the air and hydrogen from methane. The nitrogen and hydrogen gases pass through a compressor to increase the pressure to 200 atmospheres. The compressed gases pass into the reactor. The reactor is heated to 300°C and contains an iron catalyst. A mixture of ammonia, unreacted nitrogen and unreacted hydrogen passes from the reactor into a condenser. The mixture is cooled forming liquid ammonia which is then separated from the gases. The unreacted nitrogen and hydrogen are passed back into the compressor.



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24. The graph below shows the solubility of carbon dioxide gas in water at different temperatures and pressures.

Temperature (°C)	*Solubility of carbon dioxide* (g/100 g of water)		
	Pressure 1·0 atm	Pressure 1·3 atm	Pressure 1·5 atm
10	225	325	380
20	180	300	365
30	135	275	350
40	105	255	335
50	85	240	320

(*a*) Draw **two** conclusions from this information.

1 .....

.....

2 .....

..... **2**

(*b*) Predict the solubility of carbon dioxide when the pressure is 1·4 atm and the temperature is 20 °C.

..... g/100 g of water **1**

(*c*) Calculate the percentage decrease in solubility of carbon dioxide at 50 °C when the pressure is reduced from 1·5 atm to 1·3 atm.

Space for working

.....% **2**

[*END OF QUESTION PAPER*]

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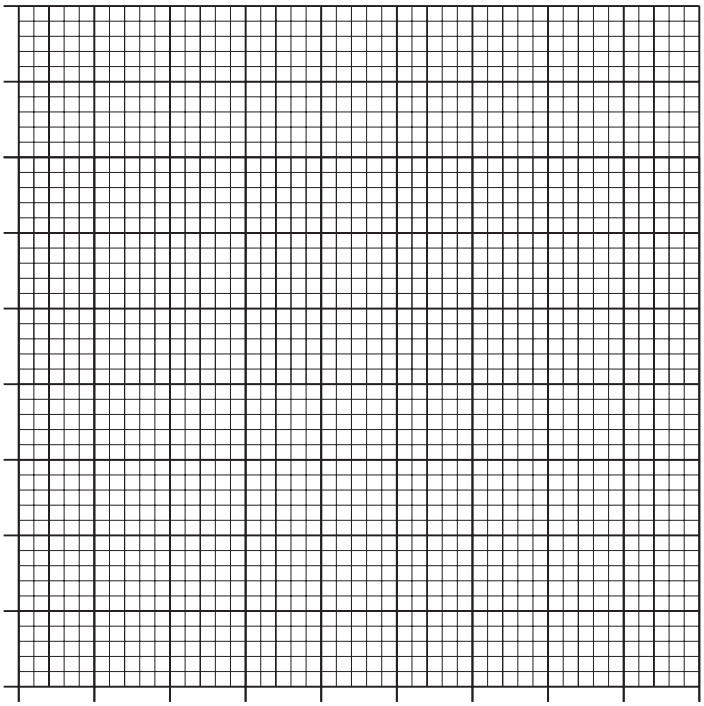
ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 5



ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 16