FOR OFFICIAL USE

C

	KU	PS
Total Mark		

3700/403

NATIONAL QUALIFICATIONS 2007

MONDAY, 21 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.

SCOTTISH QUALIFICATIONS AUTHORITY

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

1. Complete the following sentences about electrical appliances.

Circle the correct word in each box.

The switch is connected to the [earth / live / neutral] wire. **1**

The fuse is connected to the [earth / live / neutral] wire. **1**

The [earth / live / neutral] wire is connected to the metal casing of an appliance. **1**

2. The boxes below show the names of some gases.

1 sulphur dioxide	2 hydrogen	3 carbon monoxide
4 nitrogen	5 oxygen	6 CFC

Which box shows

(*a*) a gas that causes acid rain pollution?

Box number **1**

(*b*) the gas that is formed by incomplete combustion of fossil fuels?

Box number **1**

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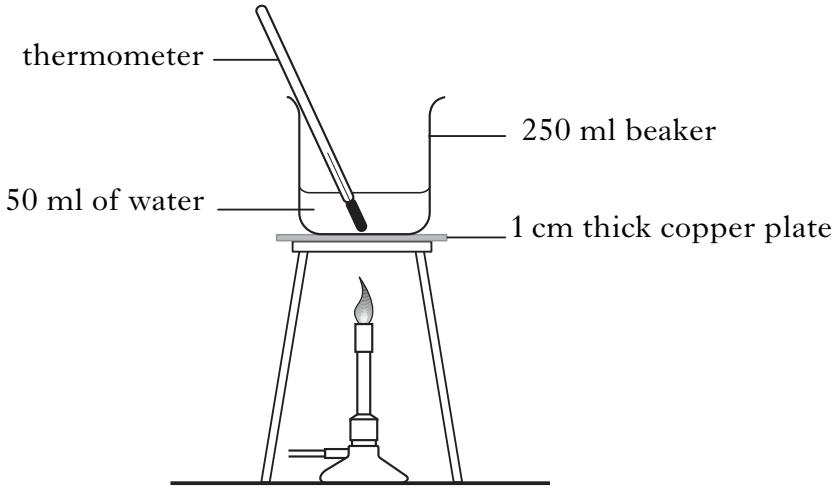
3. Gavin carried out an investigation to find out which metal is the best conductor of heat energy.

He put 50 ml of water into a 250 ml beaker.

He placed the beaker on a 1 cm thick copper plate and noted the temperature of the water.

He then heated the water using a Bunsen burner and timed how long it took for the water temperature to rise by 2 °C.



He carried out further experiments using a 1 cm thick aluminium plate, and then a 1 cm thick steel plate.

Results

Metal	*Time for a 2 °C temperature rise* (s)
Copper	32
Aluminium	34
Steel	37

Although the investigation was **fair**, it could be **improved**.

Suggest **two** improvements to make the investigation more reliable and accurate.

1 .....

.....

2 .....

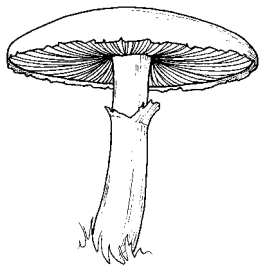
..... **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

4. A mushroom is an example of a fungus.



A fungus is a type of decomposer.

(*a*) Name another type of decomposer.

..... **1**

(*b*) How do decomposers get the energy they need to live?

..... **1**

(*c*) Decomposers are an important part of a natural food web. Explain why.

.....

..... **1**

5. The table below shows the monthly costs of electricity and gas for a house during the first six months of a year.

Month	*Monthly cost of electricity* (£)	*Monthly cost of gas* (£)
January	38·12	68·70
February	37·90	69·04
March	34·46	47·32
April	32·18	38·24
May	31·48	29·40
June	30·46	24·12

Calculate the average monthly cost of gas from the start of February to the end of May.

Space for working

Answer £ **2**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

6. Use the information in the passage below to answer the questions.

Some athletes use the effects of high altitude on the human body to increase the oxygen-carrying efficiency of their circulatory system.

At high altitudes, the oxygen concentration in the air is lower than it is at sea level. In response to lower oxygen concentration, an athlete's breathing quickly becomes deeper and more rapid. This helps to maintain the oxygen level in the blood. The athlete's heart rate also increases quickly so that more oxygen is delivered to the muscles. These changes to the body wear off as soon as the athlete returns to lower altitude.

However, other changes to the body caused by high altitude happen more slowly and last longer. Erythropoietin is a hormone that stimulates the bone marrow to make red blood cells. When there is a fall in the oxygen level in the body, more erythropoietin is produced. This causes an increase in both haemoglobin and red blood cell production, allowing the blood to carry a lot more oxygen.

Hard physical exercise at high altitudes is very difficult. Blood becomes thicker, the body dehydrates, appetite and food intake drops and the body tires more quickly. Many athletes use a high altitude training programme designed to maximise the benefits of increased oxygen-carrying efficiency while minimising the difficulties of hard physical exercise at high altitudes. A well-designed training programme includes periods of exercise at lower altitude combined with periods of rest and sleep at higher altitude.

(*a*) Give two changes to the body, which happen **quickly** in response to the lower oxygen concentration in the air at high altitudes.

1 .....

2 ..... **2**

(*b*) What does the body do to bring about the increase in haemoglobin and red blood cell production?

..... **1**

(*c*) Explain **fully** why a well-designed training programme **does** include sleeping but **not** exercising at high altitude.

.....

.....

.....

..... **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

7. Match each property with its correct description.
(The first one has been done for you)

Property	**Description**
Thermal conductivity	Ability to burn
Strength	Ability to bend without breaking
Wear resistance	Ability to allow heat to flow through a material
Elasticity	Ability to stretch and then return to original shape
Hardness	Ability to resist damage caused by impact
Flammability	Ability to support heavy loads without breaking
Flexibility	Ability to resist damage caused by rubbing

4

8. The "greenhouse effect" causes global warming.

(*a*) Which of these gases is the main cause of the "greenhouse effect"?

A Carbon dioxide

B Carbon monoxide

C Sulphur dioxide

D CFC

Underline the correct answer. **1**

(*b*) Which of these environmental changes would result from global warming?

A Acid rain pollution

B Melting of polar ice

C Destruction of tropical rainforests

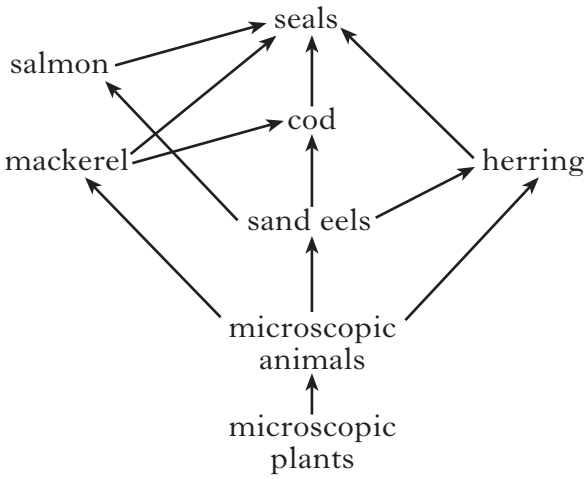
D Breakdown of the ozone layer

Underline the correct answer. **1**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

9. The diagram below shows part of a food web from the North Atlantic Ocean.



(*a*) This is a food chain from the food web.

microscopic plants ⟶ microscopic animals ⟶ mackerel ⟶ seals

(Circle) the correct word in each of the following sentences.

At each step in this food chain, the amount of energy passed on

increases	decreases	stays the same

. **1**

Along a food chain, the concentration of a pollutant in the bodies of the organisms

increases	decreases	stays the same

. **1**

(*b*) These organisms are linked together in a much larger food web.

What is the advantage of a food web having a large number of links?

..... **1**

.

[Turn over

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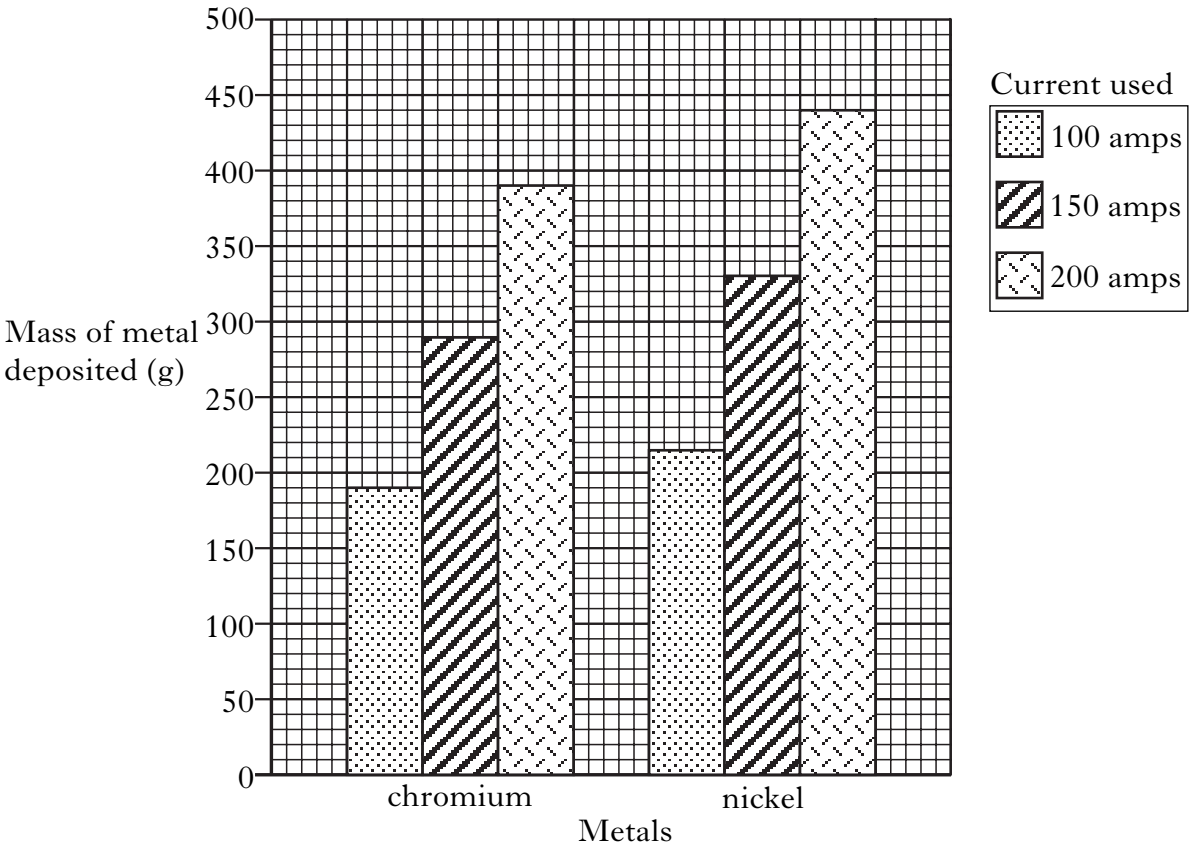
10. Electroplating is used to deposit a layer of one metal on top of another metal.

The bar graph shows the mass of chromium and nickel deposited in one hour using different electrical currents.



(*a*) Draw **two** conclusions from these results.

1 .....

.....

2 .....

..... **2**

(*b*) Predict the mass of nickel deposited when a current of 175 amps flows for one hour.

..... g **1**

DO NOT WRITE IN THIS MARGIN

	Marks	KU	PS

10. (continued)

(*c*) The total mass of metal deposited over a period of time can be calculated using the formula below.

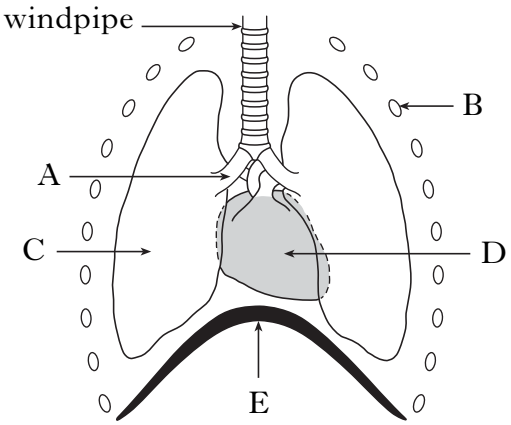
Total mass = mass deposited in one hour × time in hours

Use information from the graph and the formula to calculate the total mass of **chromium** deposited using a current of 150 amps for 2 hours.

Space for working

Answer ..... g **2**

11. The diagram below shows parts of the breathing system.



(*a*) Name structure A.

..... **1**

(*b*) Name the structure which helps to keep the windpipe open.

..... **1**

(*c*) Which **two** structures change the volume of the chest during breathing?

Letters ..... and **1**

[Turn over

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Marks	KU	PS

12. A person's Body Mass Index (BMI) can be used to determine their weight category. The table shows the weight category for different BMI values.

BMI	*Weight Category*
Below 20	underweight
20–25	ideal for height
26–30	overweight
31–40	obese
Over 40	very obese

BMI is calculated using the formula

$$\text{BMI} = \frac{\text{body mass (kg)}}{\text{height (m)} \times \text{height (m)}}$$

Sian is 1·5 m in height and has a body mass of 54 kg.

What is her weight category?

Space for working

Weight category **2**

13. A house owner is choosing a new heating system.

He compared the cost of different fuels.

Give **two** other factors he should consider before making his final choice of heating system.

1 .....

2 ..... **2**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

14.

(*a*) Give **one** example of how the effects of corrosion can add to the costs of a business.

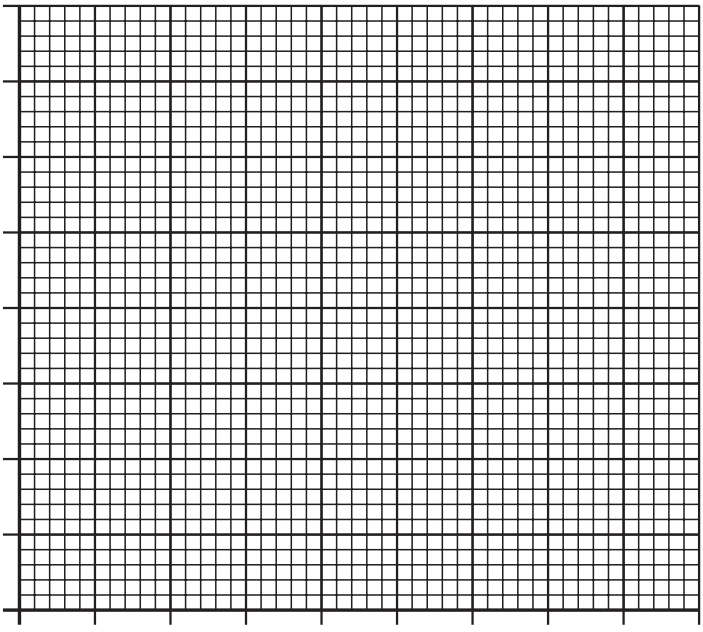
.....

..... **1**

(*b*) The table shows the mass of rust formed on iron plates immersed in different types of water at different temperatures.

Type of water	*Mass of rust* (g)	
	*at 20°*C	*at 40°*C
distilled	0·8	1·3
tap	2·2	3·7
salty	4·8	7·2

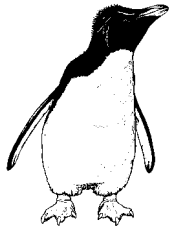
Draw a **single** bar graph to show **all** of this information.
(Additional graph paper, if required, is available on page 25)



3

[Turn over

15. The table and chart show some information about penguins.



Type of penguin	*Where it is found*	*Characteristic feature*	*Number of breeding pairs*
Adelie	Antarctic mainland	white ring around eye	2 500 000
Macaroni	Antarctic islands	yellow and black crest on head	12 000 000
Chinstrap	Antarctic icebergs	black stripe under chin	13 000 000
Magellanic	Argentina, Chile	black stripe on belly and under chin	400 000
Emperor	Antarctic mainland	yellow chin	200 000
King	Antarctic islands	yellow chin	1 000 000
Rockhopper	Antarctic islands	black crest on head	500 000
Gentoo	Antarctic islands	white stripe on head	300 000
Little	New Zealand	white stripe around flipper	500 000

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15. (continued)

Marks

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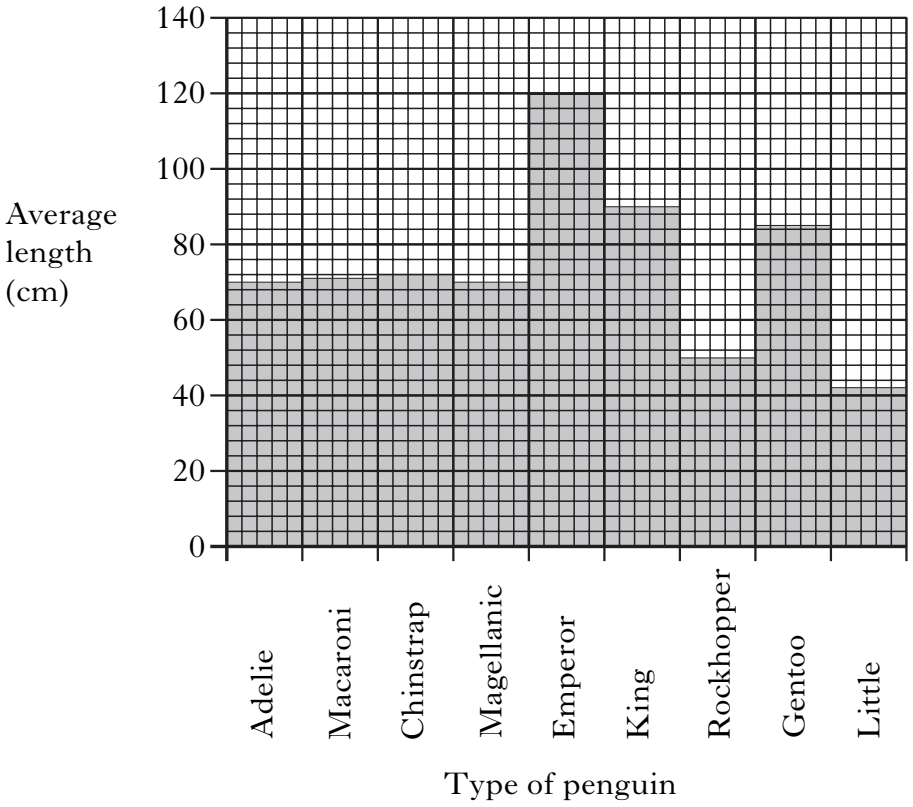
The chart shows the average length of the penguins.



(*a*) Where can the penguin with a population of 200 000 breeding pairs be found?

.... **1**

(*b*) What is the smallest type of penguin with a crest on its head?

..... **1**

(*c*) What is the average length and characteristic feature of the penguin with the largest number of breeding pairs?

Average length ..... cm

Characteristic feature **1**

[Turn over

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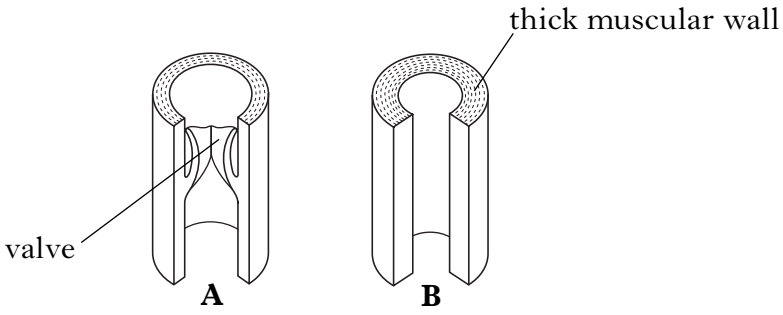
16. Harmful substances can enter the body through the lungs.
Match up each harmful substance with its effect on the body.
(The first one has been done for you.)

Harmful substance	**Effect on the body**
solvent fumes	burns the lining of the lungs
hydrogen chloride	reduces gas exchange in the air sacs
nicotine	affects the nervous system
carbon monoxide	is addictive
tar	stops red blood cells carrying oxygen
hydrogen cyanide	cause brain damage and organ failure

4

17. The diagram below shows two blood vessels.



(*a*) (i) Name each type of blood vessel.

A .....

B **1**

(ii) Explain why blood vessel **B** has a thick muscular wall.

.....

..... **1**

(*b*) Explain how the structure of capillaries allows exchange of gases between the blood and the body cells.

.....

..... **1**

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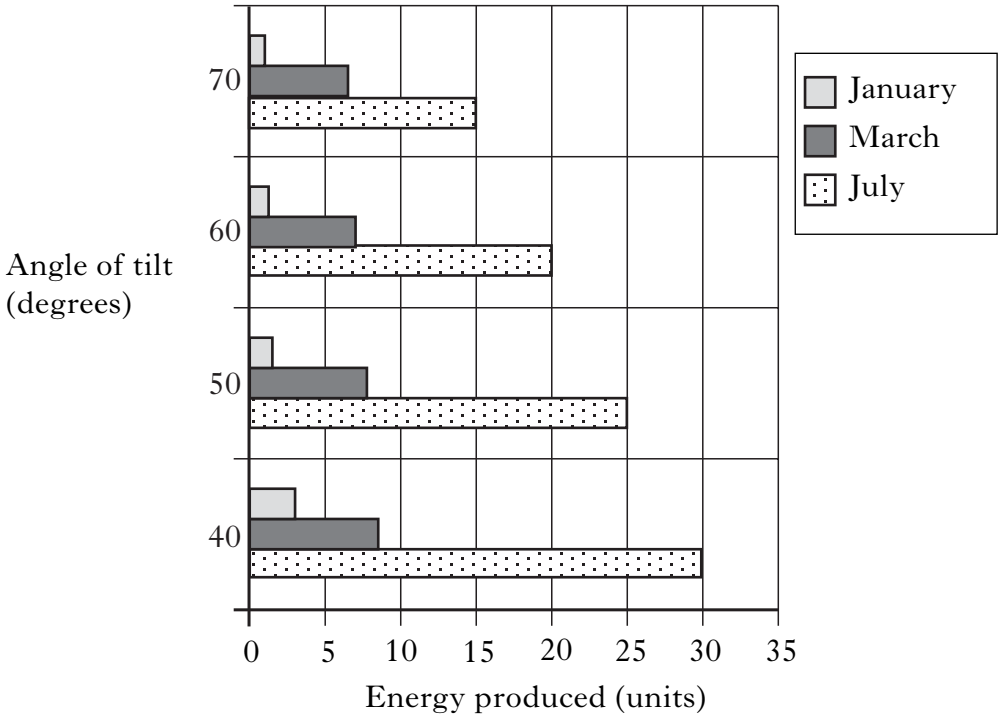
Marks	KU	PS

18. The graph below shows how the energy produced by a solar cell during different months of the year changes as the solar cell is tilted to different angles.



(*a*) Draw **two** conclusions from these results.

1 .....

.....

2 .....

..... **2**

(*b*) Predict how much energy could be produced by a solar cell tilted to 55 degrees during the month of July.

..... **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

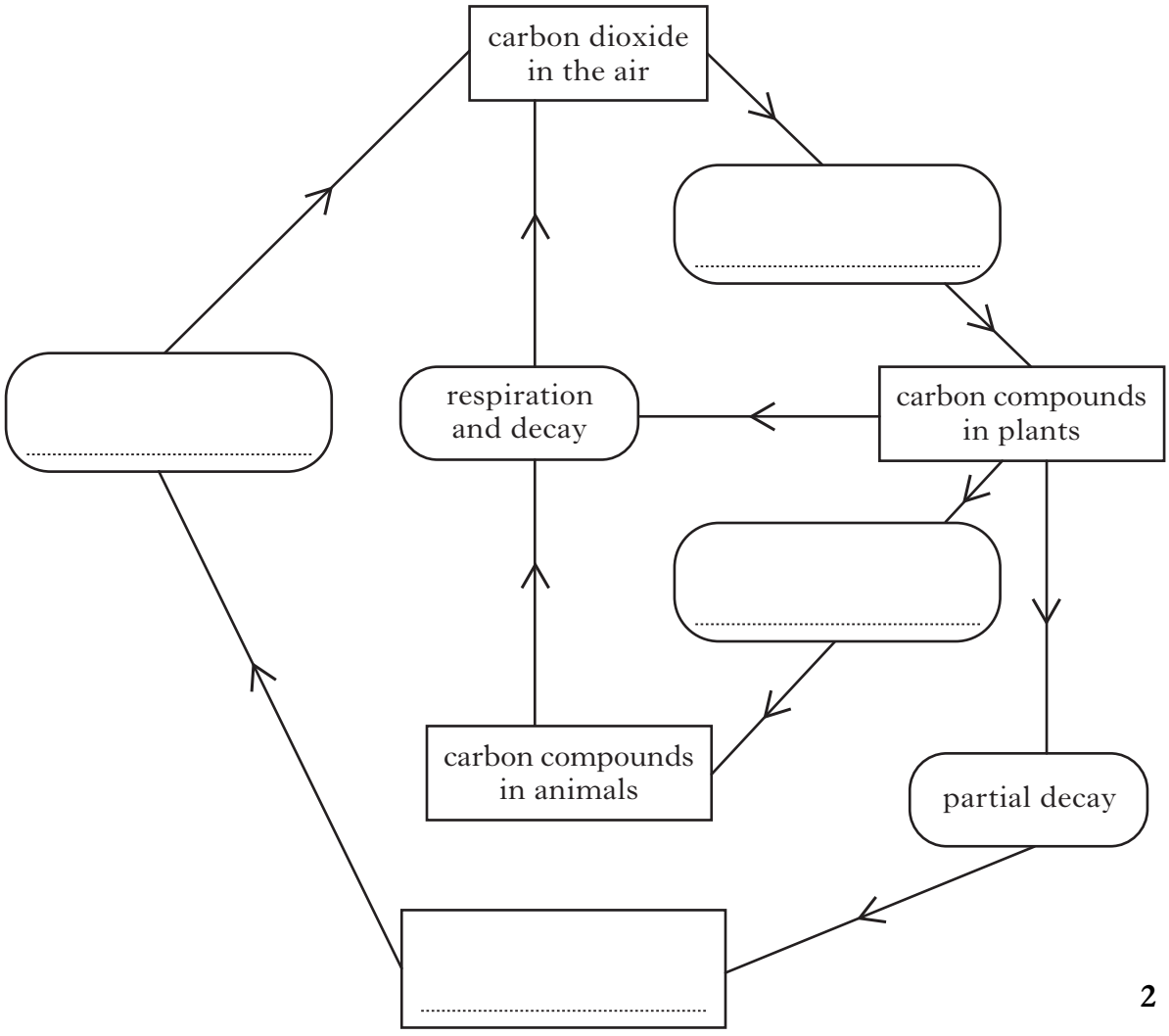
19. Use the information in the passage to complete the **flow diagram** below.

Carbon dioxide is present in the air. In the process of photosynthesis, plants take in carbon dioxide to make carbon compounds. By the process of digestion, animals take in carbon compounds from plants and convert them into other carbon compounds. Both plants and animals release carbon dioxide by the processes of respiration and decay. The carbon dioxide goes back into the air.

Plants which were growing millions of years ago took in carbon dioxide from the air. The plants were changed into coal by a process of partial decay. The process of burning coal releases carbon dioxide back into the air.

KEY

substance ☐ process ▭



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20. A manufacturer has information about different types of flex for electrical appliances. *Marks*

Table 1: Meaning of some electrical symbols or terms.

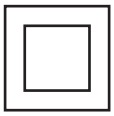
Symbol/term	*Meaning*
	does not need an earth wire.
2 core flex	electric cable which has only a live wire and a neutral wire.
3 core flex	electric cable which has earth, neutral and live wires.

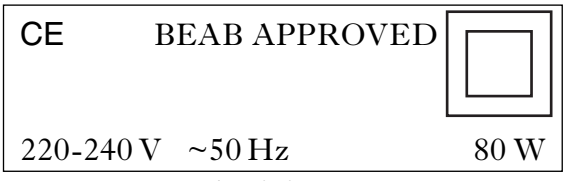
Table 2: Maximum current a flex must be able to carry for appliances of different power ratings.

Power rating (W)	*Current* (amps)
Less than 720	3
More than 720	13

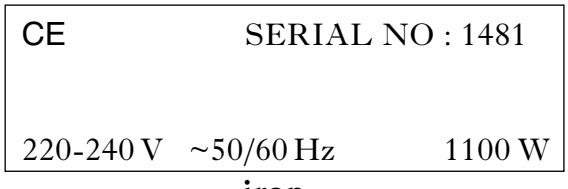
Table 3: Types of flex for electrical appliances and their specification.

Type of flex	*Specification*
A	2 core 3 amps
B	2 core 13 amps
C	3 core 3 amps
D	3 core 13 amps

The information plate found on a television and an iron are shown below.



television



iron

Circle the correct box to show what **type of flex** should be fitted to

(*a*) the television. A B C D **1**

(*b*) the iron. A B C D **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

21. An oil company was looking for new oil fields.

(*a*) The boxes below show different types of survey used to find oil.

1 aerial survey	2 seismic survey
3 test drilling	4 geological survey

(i) Scientists surveyed types of rocks at the surface of the Earth.

What type of survey was carried out?

Box number **1**

(ii) A small explosion was set off and the echoes from the explosion were detected by geophones.

What type of survey was carried out?

Box number **1**

(*b*) The oil company extracted the crude oil from the ground.

The oil had to be separated into useful products.

Name the **process** used to separate crude oil into useful products.

..... **1**

DO NOT WRITE IN THIS MARGIN

KU	PS

22. Different methods of protecting materials against damage are shown below. *Marks*

water-proofing	painting	electroplating	anodising
pesticide treatment	packaging	galvanising	

(*a*) Which method would be most appropriate to protect the outer covering of a tent?

..... **1**

(*b*) Which **two** methods would be most appropriate to protect the steel parts of a bridge?

..... and **1**

(*c*) Which method would be used to protect aluminium window frames?

..... **1**

(*d*) Which method would be most appropriate for protecting wooden rafters against attack by woodworm?

..... **1**

23. (*a*) Actinium-225 is a radioactive substance used in cancer treatment.
It has a half-life of 10 days.

A sample of actinium-225 has an activity of 80 units.
What would its activity be after 10 days?

..... units **1**

(*b*) Radioactive waste substances from nuclear power stations can have very long half-lives.

Explain why this causes problems for storing radioactive waste.

.....

..... **1**

[Turn over

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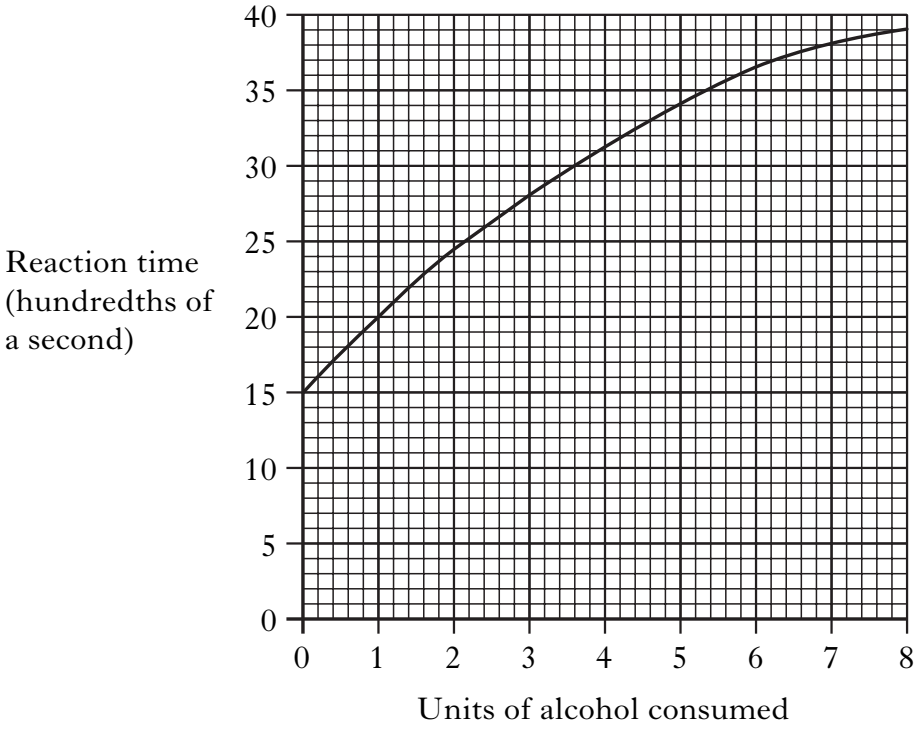
24. The line graph shows how a man's reaction time is affected by drinking alcohol. *Marks*



(*a*) (i) Calculate the change in the man's reaction time when his alcohol consumption increased from 1 unit to 5 units.

Space for working

Answer ..... hundredths of a second **1**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

24. (*a*) (continued)

(ii) Calculate the percentage increase in the man's reaction time when his alcohol consumption increased from 1 unit to 3 units.

Space for working

Answer ..... % increase **2**

(*b*) Drinking large quantities of alcohol over a long period of time increases a person's risk of

A hypothermia and anorexia

B liver damage and kidney damage

C brain damage and bronchitis

D kidney damage and lung cancer.

Underline the correct answer. **1**

[Turn over

Marks | KU | PS

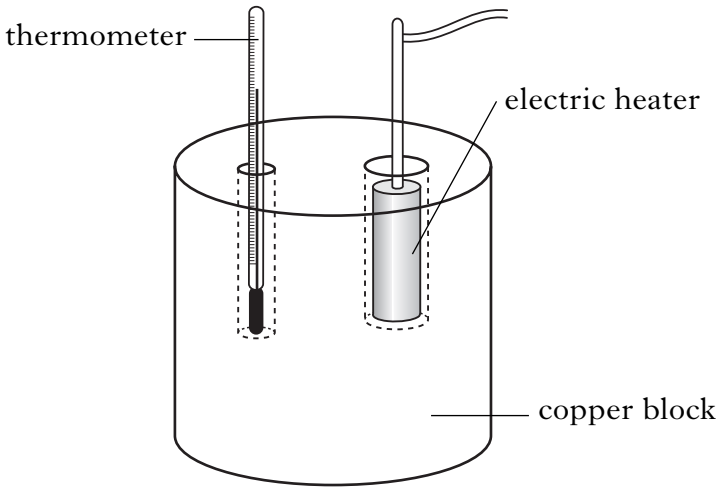
25. The energy needed to heat a metal block can be found from the formula

$$\mathbf{E = c \times m \times \Delta T}$$

where

E is the energy needed (J)
c is the specific heat capacity of the metal block (J/kg/°C)
m is the mass of the metal block (kg)
ΔT is the temperature rise of the metal block (°C)

A pupil heated a 2 kg copper block with an electric heater.



The temperature of the block at the start was 20 °C. After heating, the temperature of the block increased to 32 °C.

(*a*) Calculate the temperature rise, **ΔT**.

Space for working

Answer ..... °C **1**

DO NOT WRITE IN THIS MARGIN

25. (continued)

Marks

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The specific heat capacity for copper is 380 J/kg/°C.

(*b*) Calculate the energy needed, **E**, to heat the block.

Space for working

Answer ..... J **2**

[Turn over

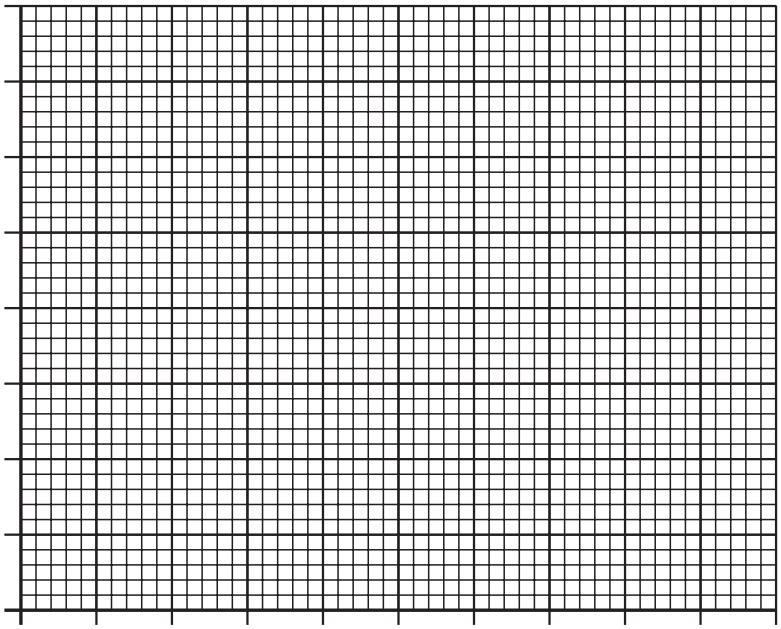
Marks | KU | PS

26. Plants need to obtain a certain mineral from the soil to grow strong roots. Two sets of plants were grown from seeds, one with the mineral and one without. The length of the plants roots was measured every five days and the average length was found.

The results are shown in the table.

Day	*Average length of plant roots* (mm)	
	with mineral	*without mineral*
0	0	0
5	16	8
10	25	12
15	32	14
20	37	15
25	39	16

(*a*) Using the same axes, show these results as **two line** graphs.
(Additional graph paper, if required, may be found on page 25)



3

(*b*) Draw **two** conclusions from the results.

1 .....

.....

2 .....

..... **2**

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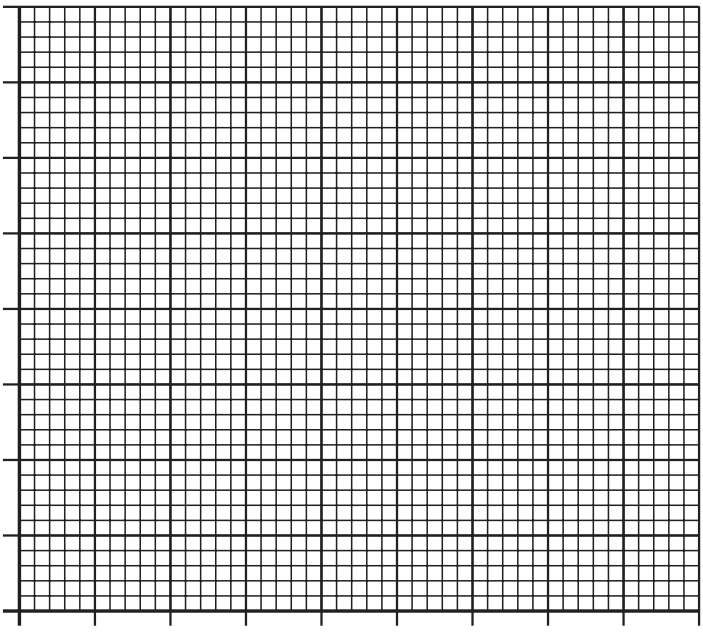
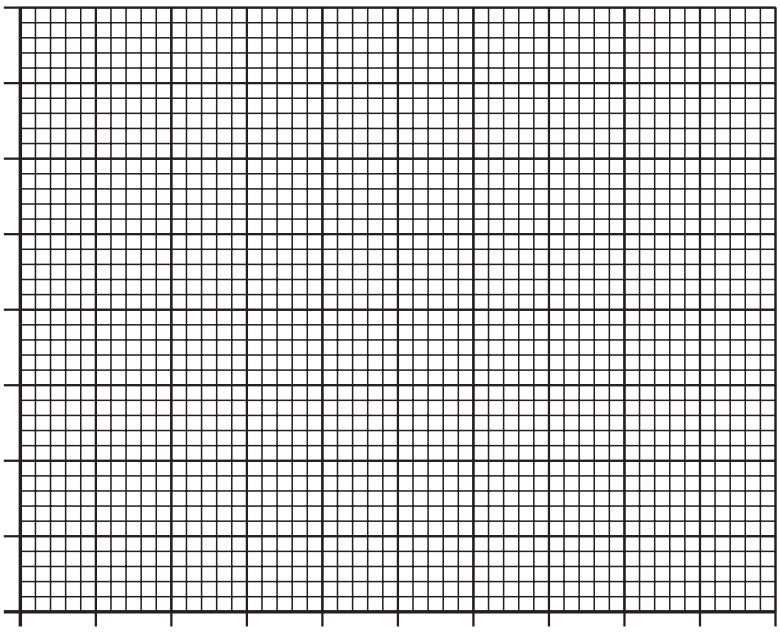
ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 14 (*b*)



ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 26 (*a*)



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