

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.

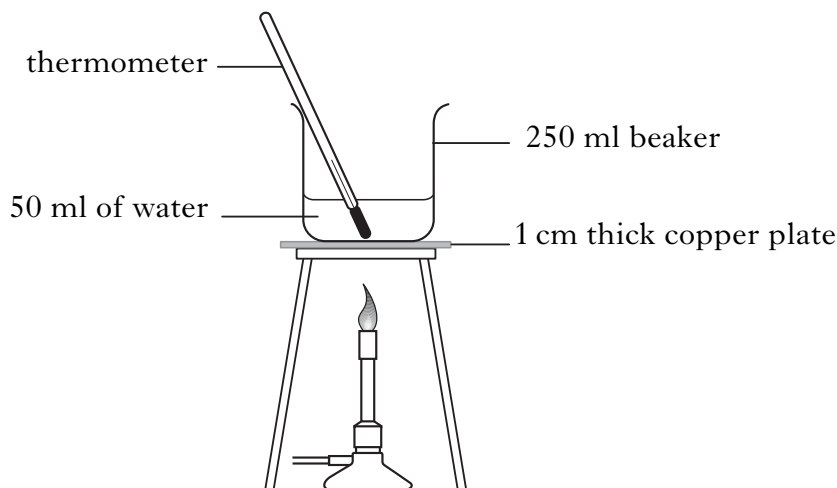


3. Gavin carried out an investigation to find out which metal is the best conductor of heat energy.

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

<i>Metal</i>	<i>Time for a 2 °C temperature rise (s)</i>
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
-

Marks

KU	PS
2	

[Turn over

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.

.....

.....

.....

.....

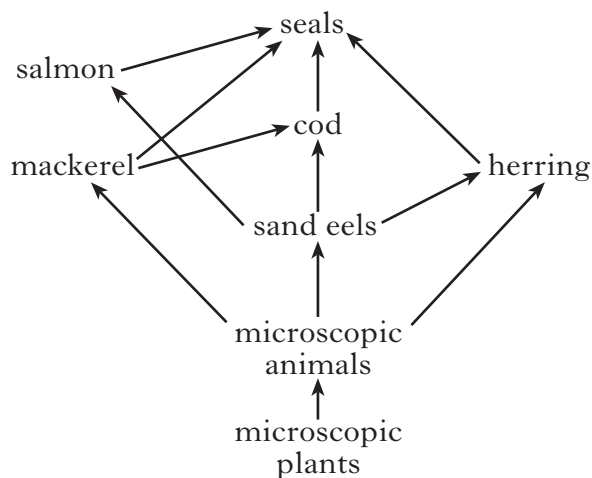
2

[Turn over

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

10. (continued)

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

$\text{Total mass} = \text{mass deposited in one hour} \times \text{time in hours}$

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.

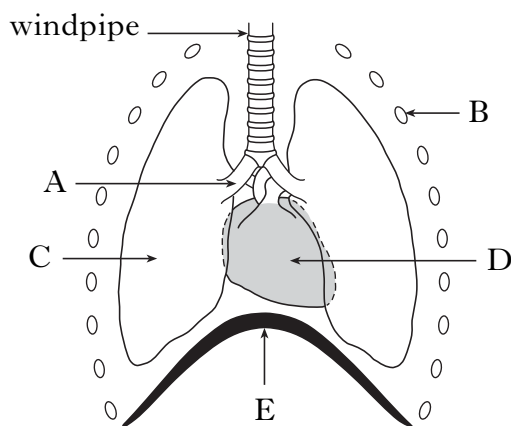
<u>Space for working</u>

Answer g

Marks

	KU	PS
2		
1		
1		
1		
1		

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



- (a) Name structure A.

.....

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

.....

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

Letters and

[Turn over

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.

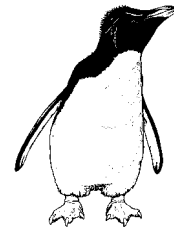
He compared the cost of different fuels.

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

1

2

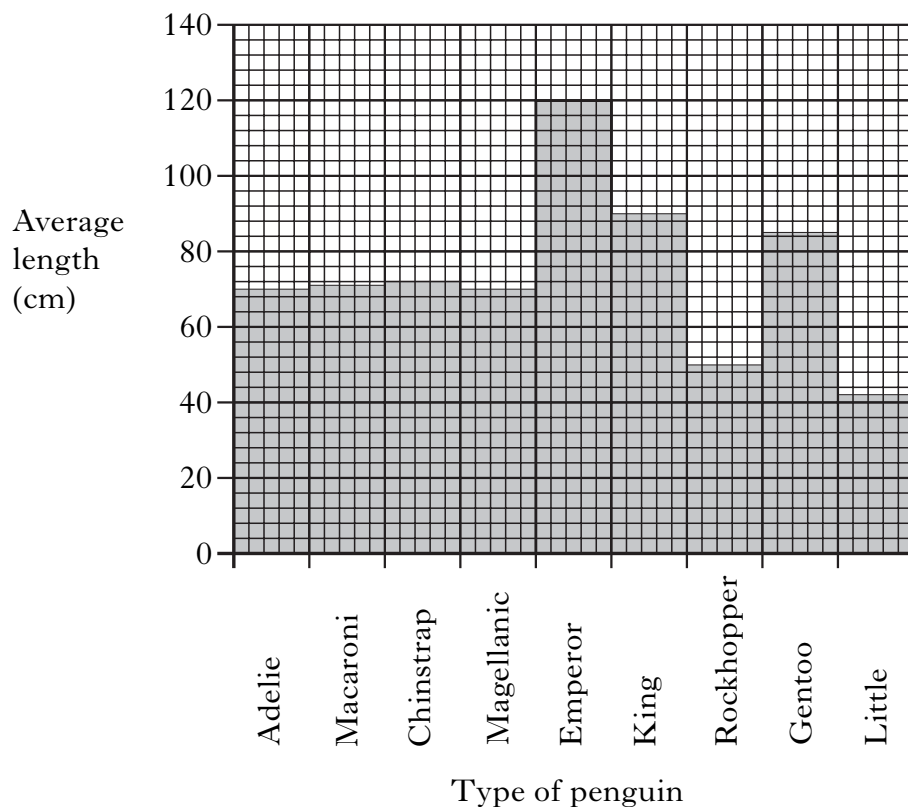
15. The table and chart show some information about penguins.



<i>Type of penguin</i>	<i>Where it is found</i>	<i>Characteristic feature</i>	<i>Number of breeding pairs</i>
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

15. (continued)

The chart shows the average length of the penguins.



Marks

	KU	PS
(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

Marks

KU	PS

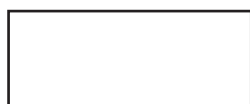
19. Use the information in the passage to complete the **flow diagram** below.

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.

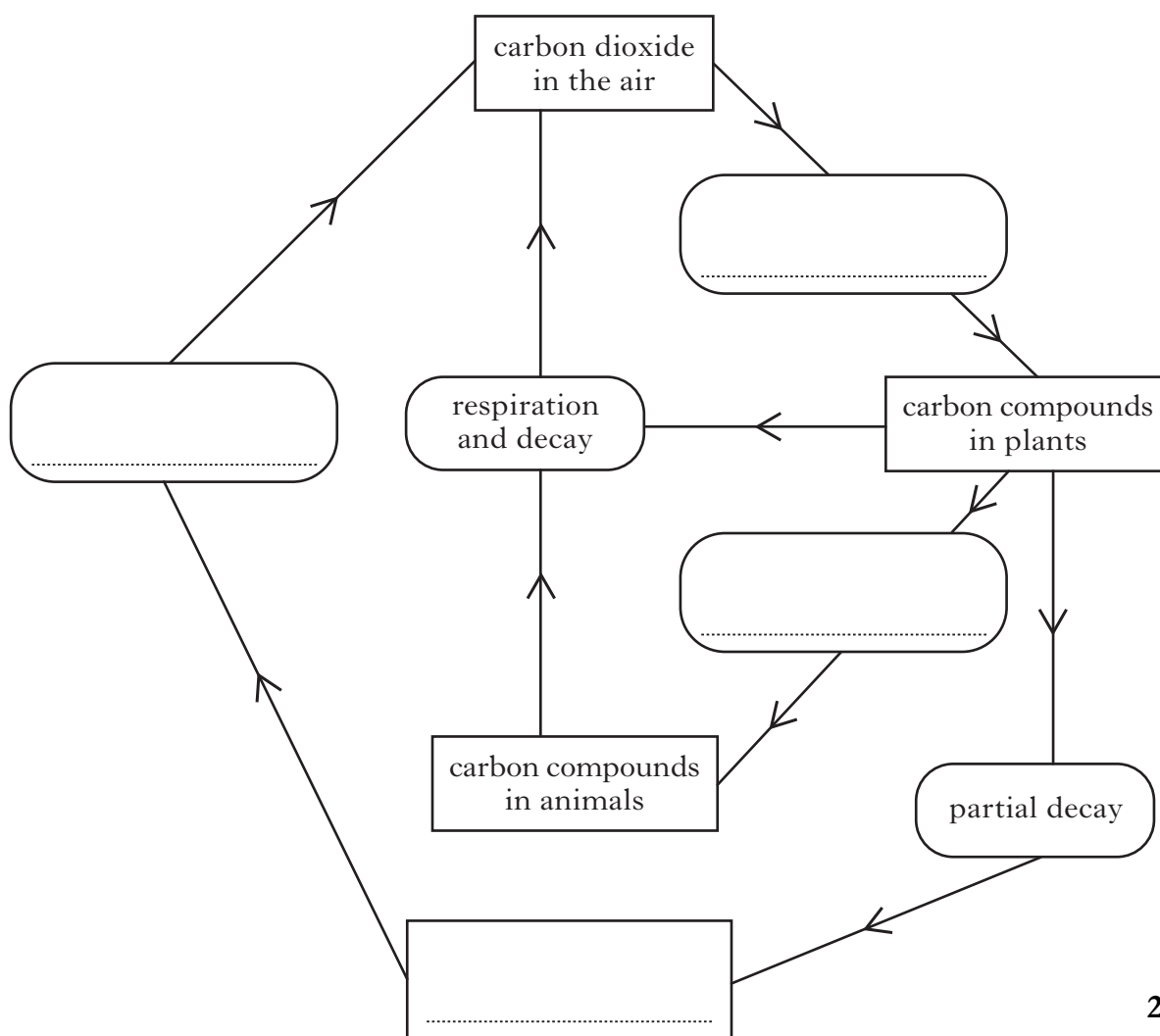
Plants which were growing millions of years ago took in carbon dioxide from the air. The plants were changed into coal by a process of partial decay. The process of burning coal releases carbon dioxide back into the air.

KEY

substance



process



2

Marks	KU	PS
1		
1		
1		

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

(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

(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.

.....

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

water-proofing	painting	electroplating	anodising
pesticide treatment	packaging	galvanising	

Marks

			KU	PS
		1		
		1		
		1		
		1		
		1		
		1		
		1		

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

.....

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

..... and

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

.....

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

.....

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

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

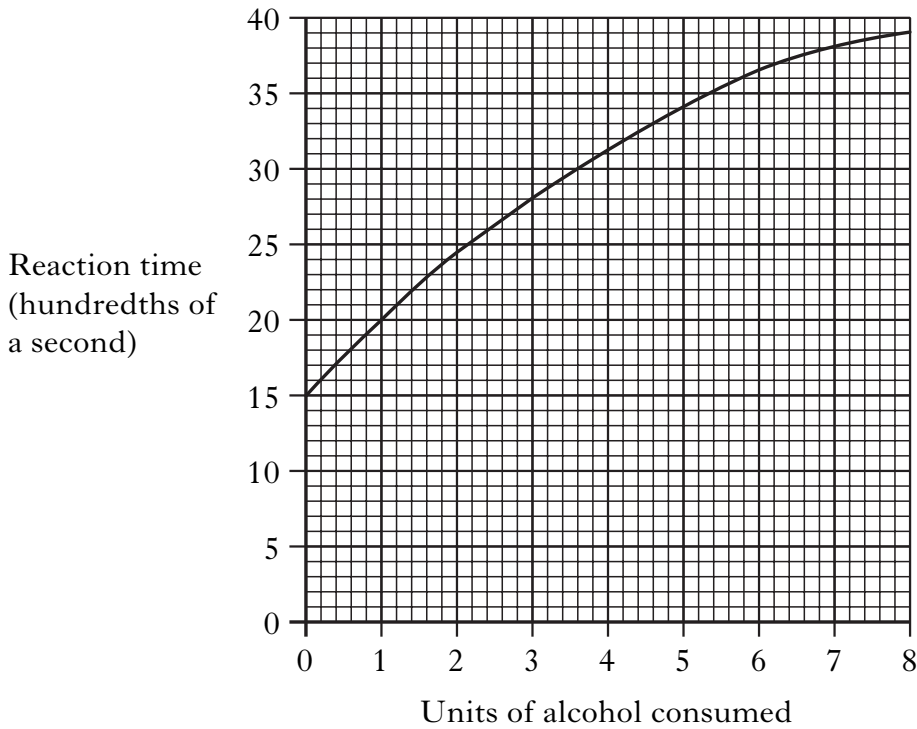
Explain why this causes problems for storing radioactive waste.

.....

.....

[Turn over

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

KU	PS

<i>Marks</i>	KU	PS
2		
1		

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

- (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.

[Turn over

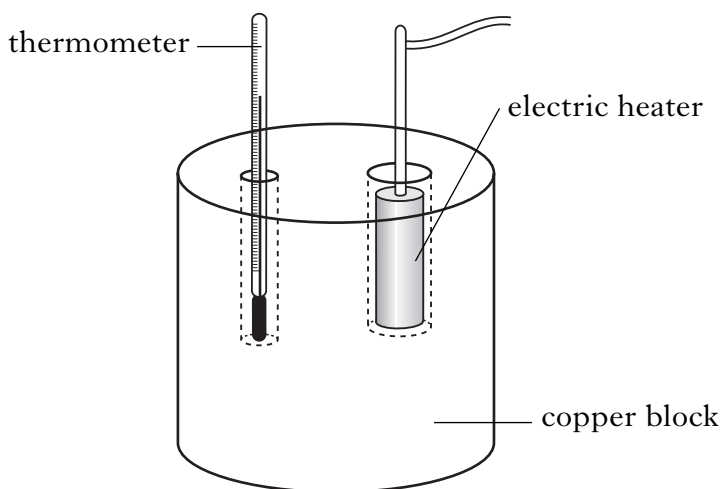
25. The energy needed to heat a metal block can be found from the formula

$$E = c \times m \times \Delta T$$

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**

Marks

KU	PS

25. (continued)

The specific heat capacity for copper is $380 \text{ J/kg/}^\circ\text{C}$.

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

Space for working

Answer J

Marks	KU	PS
2		

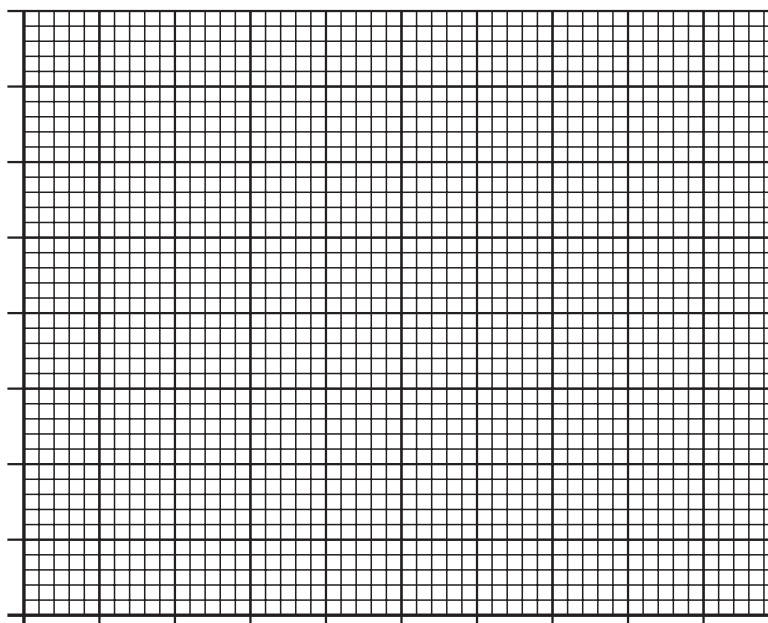
[Turn over

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. Marks

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)



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

1

.....

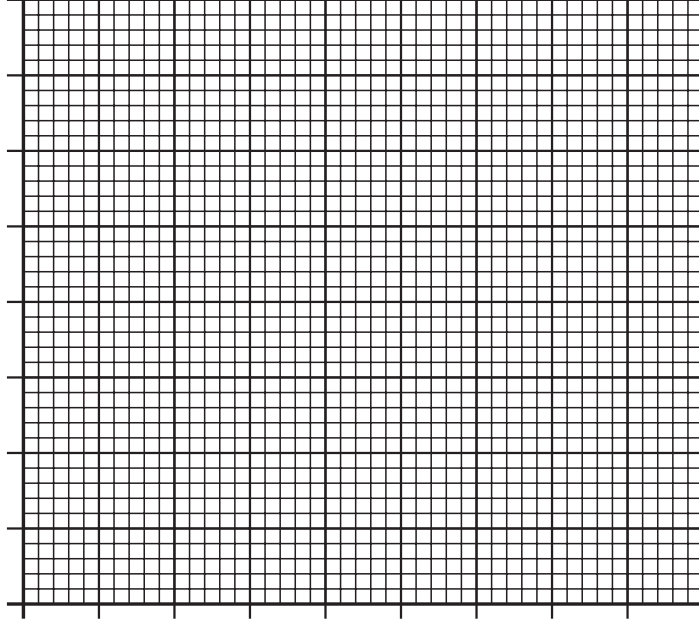
2

.....

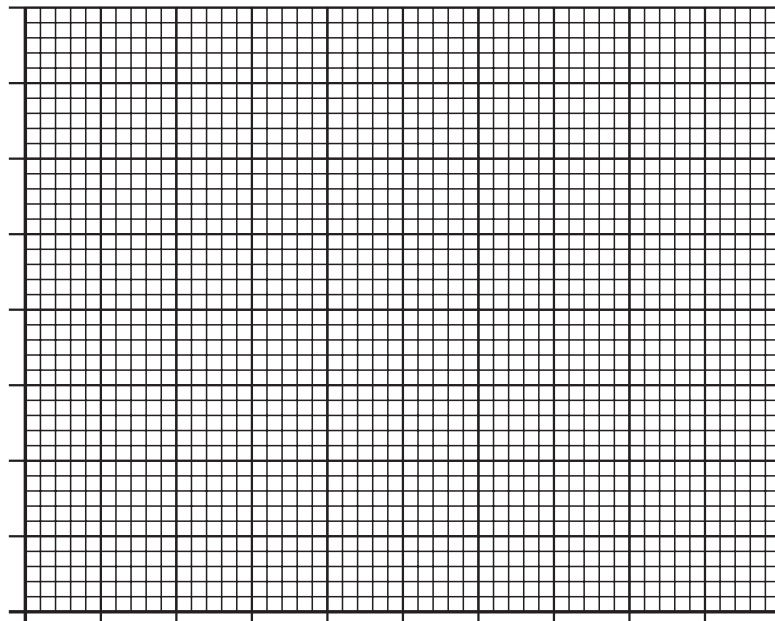
[END OF QUESTION PAPER]

	KU	PS
3		
2		

ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 14 (b)



ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 26 (a)



KU	PS

[BLANK PAGE]

[BLANK PAGE]

[BLANK PAGE]