FOR OFFICIAL USE

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	KU	PS
Total Mark		

3700/403

NATIONAL QUALIFICATIONS 2011

MONDAY, 23 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

Marks | KU | PS

1. (*a*) Different parts of the blood have different functions.

Draw lines to match each part of the blood with its correct function.

The first one has been done for you.

Part of the blood	**Function**
plasma	produce antibodies
white blood cells	carry oxygen
platelets	carries dissolved food and carbon dioxide
red blood cells	seal cuts by clotting blood

2

(*b*) Blood is carried around the body in different blood vessels.

What type of blood vessel has

(i) thick walls?

..... **1**

(ii) valves?

..... **1**

2. The names of some toxic gases produced by burning plastics are shown below.

hydrogen chloride	carbon monoxide	hydrogen cyanide

(*a*) Which gas combines with haemoglobin in red blood cells?

..... **1**

(*b*) Which gas burns the lining of the lungs?

..... **1**

(*c*) Which gas affects the nervous system?

..... **1**

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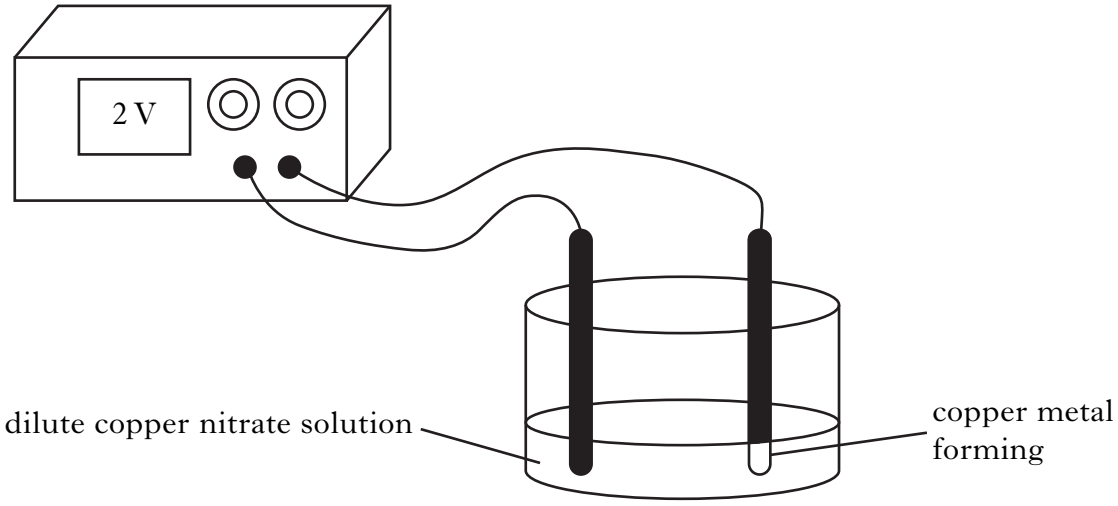
3. Julie carried out an investigation to measure the mass of metal formed when electricity is passed through different solutions.



She put 50 ml of dilute copper nitrate solution into the beaker and set the power supply to 2 volts. After 2 minutes, she measured the mass of copper metal which had formed. She then carried out the experiment using dilute nickel nitrate solution.

Here are Julie's results.

Solution	*Mass of metal formed* (g)
copper nitrate solution	0·08
nickel nitrate solution	0·07

The investigation was **fair** but could be **improved** to make it more accurate and reliable.

Suggest **two improvements**.

1 .....

.....

2 .....

..... **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

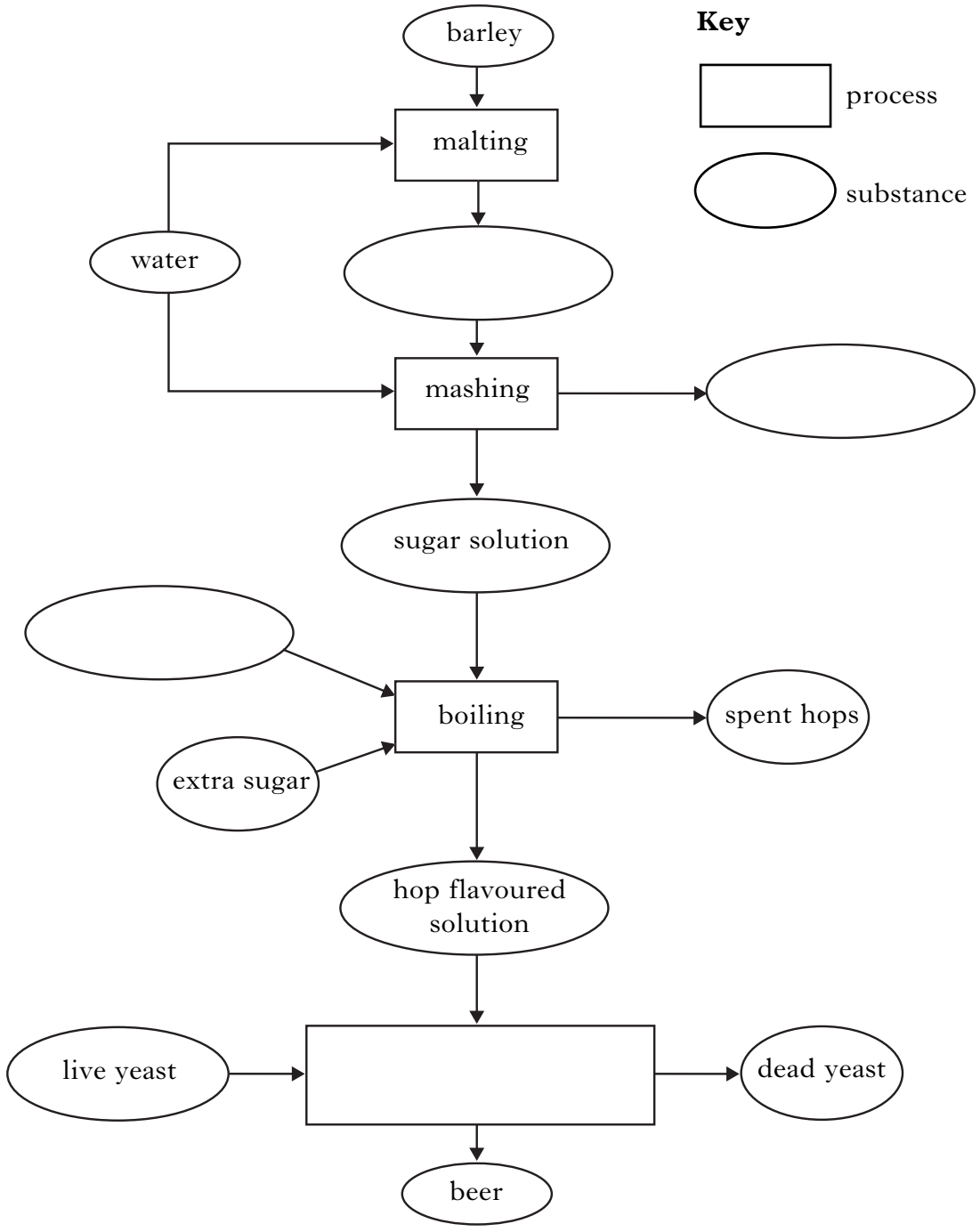
4. Use the information in the passage to complete the **flow diagram**.

Beer is made from barley. Water is added to start the malting process. The substance produced by malting is called **mash**. The mash then undergoes mashing, where water is added to dissolve the sugar out of the spent barley. The **spent barley** is removed.

The sugar solution is then boiled with **hops** and extra sugar. Boiling extracts the flavour from the hops. The spent hops are removed.

The resulting hop-flavoured solution then undergoes **fermentation**. Live yeast is added at this stage. When the yeast dies, it is removed. The final product is beer.

Complete the flow diagram.



2

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Marks KU PS

5. Some objects that can be protected against damage are shown below.

Steel farm gate	Leather walking boots
Aluminium window frame	Aluminium garage door
Wooden floor boards	Steel bridge supports

(*a*) Which **one** of these objects can be protected by

(i) treating with a pesticide?

..... **1**

(ii) spraying with a water-proofing chemical?

..... **1**

(*b*) Which **two** of these objects can be protected by anodising?

1 .....

2 ..... **1**

[Turn over

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

Polymers

Polymers are materials made of giant molecules. Polymer molecules can be linear, branched or cross-linked. Linear and branched molecules form thermoplastic polymers such as polythene, polystyrene and nylon. Thermoplastic polymers soften when heated. Cross-linked molecules form thermosetting polymers. These polymers do not soften when heated. Urea-formaldehyde is a thermosetting polymer used to make electrical plugs and sockets. Bakelite, the first commercially produced man-made polymer, is also thermosetting.

Polymers have a wide range of applications due to their useful properties, including strength, good electrical and thermal insulation and resistance to attack by corrosive chemicals. Low density polythene or LDPE is widely used in the packaging industry as a tough, transparent film. High density polythene or HDPE is used where greater strength is required. HDPE is used to make heavy duty bottles and traffic cones. HDPE is also used in the construction industry to make pipes and gutters.

Polymer properties can be changed by using additives, such as plasticisers, lubricants, pigments and anti-oxidants. Plasticisers give the polymer more flexibility and lubricants reduce friction. Pigments are used to make final products of different colours. To protect polymers against attack by oxidising agents, anti-oxidants are added.

(*a*) What happens to nylon when it is heated?

..... **1**

(*b*) What type of molecules are present in Bakelite?

Tick (✓) the correct answer.

linear	
branched	
cross-linked	

1

(*c*) (i) Why are traffic cones made from HDPE and not LDPE?

..... **1**

(ii) What type of additive can be used to make HDPE bright orange in colour?

..... **1**

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7. (*a*) The formula below can be used to estimate the adult height of a girl.

$$h = \left(\frac{f + m}{2}\right) - 7$$

where h = estimated adult height (cm)
f = height of father (cm)
m = height of mother (cm)

Katie's mother has a height of 159 cm and her father's height is 175 cm.

What is Katie's estimated adult height?

Space for working

Answer..... cm **2**

(*b*) The heights of some children in Katie's nursery were measured.

The results are shown below.

Child	*Age* (years)	*Height* (cm)
Cameron	4	110
Jasmine	4	103
Katie	3	92
Ryan	3	96
Sophie	4	98
Stuart	4	109
Vitek	4	115

What is the average height of the children aged **four** years?

Space for working

Answer..... cm **2**

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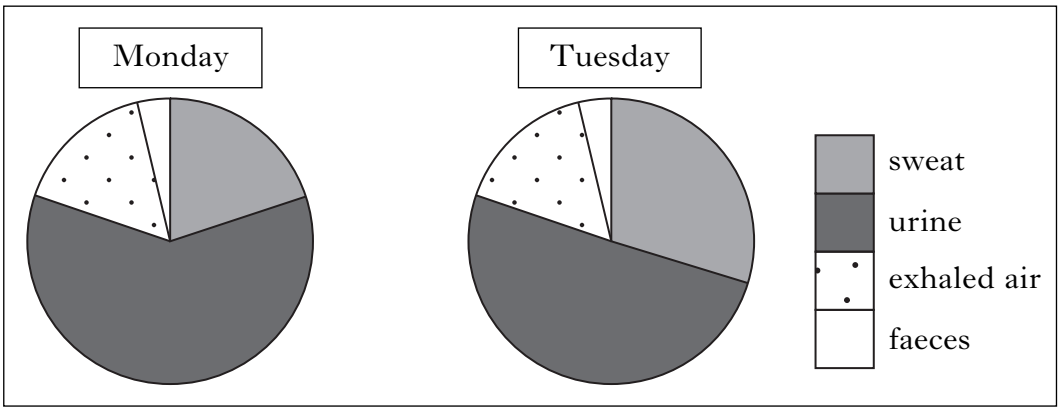
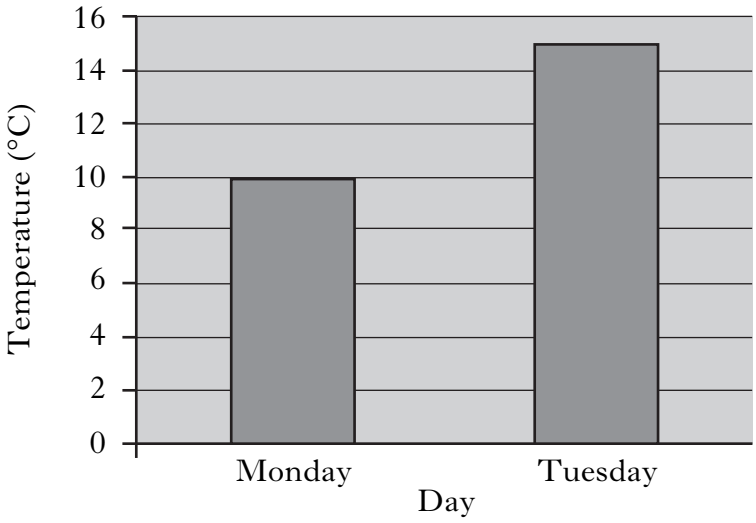
Marks | KU | PS

8. The pie charts below show how a man lost water from his body on two different days.



The graph shows the air temperature for each day.



Draw **two** conclusions using both the pie charts **and** the graph.

1 .....

.....

2 .....

..... **2**

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9. Gregor is trying to reduce the cost of heating his home.

Gregor's heating system is controlled by a thermostat.

(*a*) Describe how a thermostat keeps the temperature steady.

.....

.....

.....

..... **1**

(*b*) Gregor investigates other factors which might affect the cost of heating his home.

Which of the factors listed below **will not** affect the cost of heating his home?

A The type of fuel used in the heating system

B The air temperature outside his home

C The size of the garden outside his home

D The length of time his heating system is switched on

Underline the correct answer. **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

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10. Air pollution damages the environment.

(*a*) Use the information in the boxes to answer the questions below.

1 destruction of northern pine forests	2 increased erosion of limestone buildings	3 decrease in skin cancer
4 increased exposure to ultraviolet radiation	5 increase in fresh water fish populations	6 decrease in thickness of the ozone layer

Which **two** boxes describe the damaging effects of

(i) increasing CFC concentrations?

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

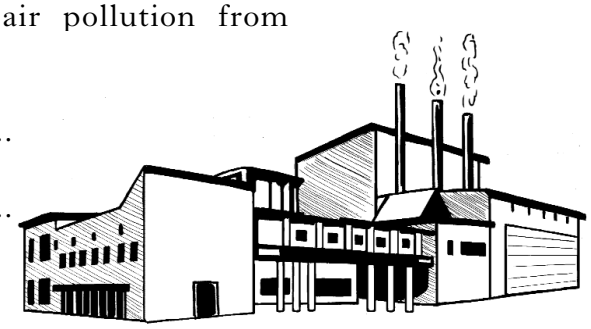
(ii) burning fossil fuels?

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

(*b*) Give **one** way in which air pollution from factories can be reduced.

.....

..... **1**



11. The half-lives of three radioactive sources are shown below.

Radioactive source	*Half-life*
Thorium-234	24·1 days
Lead-210	21·0 years
Radon-220	55 seconds

Which radioactive source would have to be stored for the longest time before it becomes safe?

..... **1**

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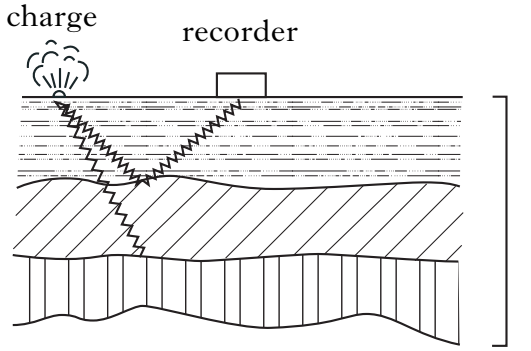
12. (*a*) An oil company carried out a **seismic survey** to search for oil and gas.



Explain how a seismic survey can find oil and gas.

.....

.....

..... **2**

(*b*) Crude oil is separated into fractions in a refinery.

Name the process used to separate the oil into fractions.

..... **1**

13. Some properties of materials are shown below.

thermal conductivity	strength	wear resistance
flexibility	electrical conductivity	hardness

Select the property which means

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

..... **1**

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

..... **1**

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

..... **1**

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

..... **1**

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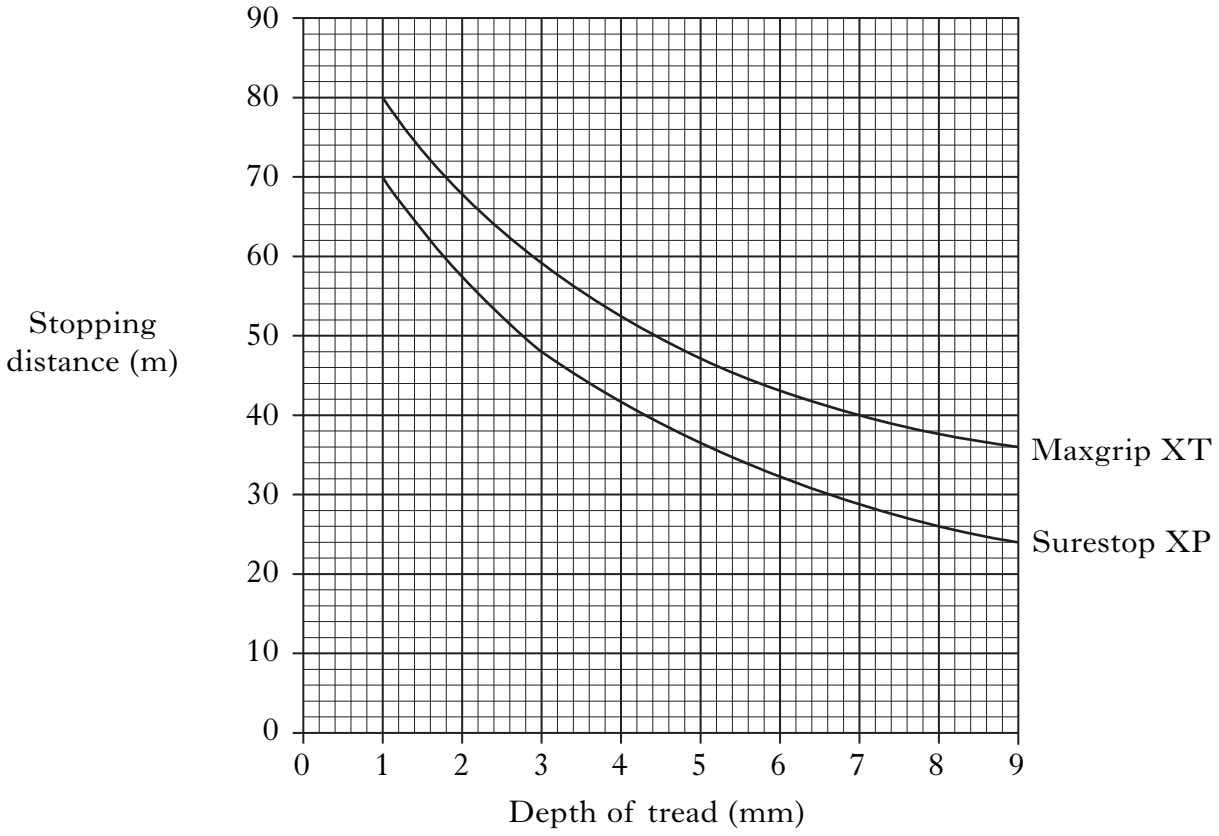
Marks | KU | PS

14. A car manufacturer tested two types of tyre with different depths of tread to compare stopping distances on wet roads.



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

1 .....

.....

2 .....

..... **2**

(ii) The legal minimum tread for a tyre is 1·6 mm.

What is the difference in stopping distance between a car with Maxgrip XT tyres and one with Surestop XP tyres when both have a tread of 1·6 mm?

Space for working

Answer ..... m **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

14. (continued)

(*b*) Tread allows the tyre to give better road grip by displacing water on the road as spray.

The table shows the volume of water that each tyre can displace in one second.

Maxgrip XT	Depth of tread (mm)	2	3	4	5	6	7	8	9
	Volume of water displaced (litres)	3·4	3·8	4·3	4·8	5·4	6·0	6·7	7·4
Surestop XP	Depth of tread (mm)	2	3	4	5	6	7	8	9
	Volume of water displaced (litres)	4·6	5·3	5·9	6·4	7·0	7·7	8·4	9·2

Use the information in the graph **and** the table to answer the following questions.

(i) A car fitted with Surestop XP tyres has a stopping distance of 48 metres.

What volume of water is displaced by each tyre in one second?

..... litres. **1**

(ii) A car is fitted with Maxgrip XT tyres.

Each tyre displaces 6·0 litres of water in one second.

What is the car's stopping distance?

..... m. **1**

15. Replacing corroded machinery adds to the costs of industry.

Which **two** of the following show other ways in which corrosion adds to the costs of industry?

Cost of fuel for heating	
Cost of additional labour	
Cost due to lost production	
Cost of advertising	
Cost of sound-proofing machinery	

Tick (✓) the **two** correct answers. **1**

16. Many people in the UK suffer from medical conditions which affect what they can eat.

The table below gives information about some of these conditions.

Condition	*Symptoms*	*Dietary advice*
coeliac disease	diarrhoea, malnutrition, tiredness	wheat free diet
diabetes (Type 2)	increased thirst, loss of weight, blurred vision	low fat and low sugar diet
heart disease	pain in chest and arms, heart attacks	low fat and low sugar diet
lactose intolerance	bloating, nausea, abdominal pain	lactose free diet

A menu from a restaurant is shown below.

Starters

Garlic bread	V
Sweet potato soup	L V W
Red pepper soup	♥ W
Vegetable tartlets	♥ V

KEY

♥	low in fat and sugar
L	lactose free
V	vegetarian
W	wheat free

Main courses

Bean and green pepper salad	♥ V
Chicken and melon shells	♥
Chicken with grapefruit glaze	L
Thai beef salad	♥ W
Tomato and feta tarts	V W

Desserts

Chocolate and pear tart	L V W
Fig and apricot crunch	♥ V
Strawberry ice cream	V W
Summer fruit mousse	L V W

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

16. (continued)

Use the table **and** the menu to answer the questions below.

(*a*) Mr Thomson has to eat a wheat free diet.

(i) From which condition does he suffer?

..... **1**

(ii) Which **two** main courses can he eat?

1 .....

2 ..... **1**

(*b*) Mr Davidson has diabetes.

Which dessert should he choose?

..... **1**

(*c*) Mr Smith should **only** choose chicken with grapefruit glaze as his main course.

Give **two** symptoms of the condition from which he suffers.

..... **1**

(*d*) Mrs Herd has heart disease. She is also a vegetarian.

Complete her menu order card.

Order Card	
Starter	.....
Main course	.....
Dessert	.....

1

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

17. Increasing carbon dioxide levels in the atmosphere cause the "greenhouse effect", which results in global warming.

(*a*) Describe **two** environmental changes which result from global warming.

1 .....

2 ..... **2**

(*b*) Burning fuels, such as petrol and diesel, produces carbon dioxide.

The table gives information about some alternative fuels.

Alternative fuel	*Elements present*
biodiesel	carbon, hydrogen and oxygen
ethanol	carbon, hydrogen and oxygen
hydrogen	hydrogen
biogas	carbon and hydrogen

Which of these alternative fuels does **not** produce carbon dioxide?

..... **1**

18. Parts of the human respiratory system are shown in the boxes below.

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

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

Box number **1**

(*b*) Which **two** parts work together to change the pressure in the lungs?

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

(*c*) Which part is needed for gas exchange between lungs and the blood?

Box number **1**

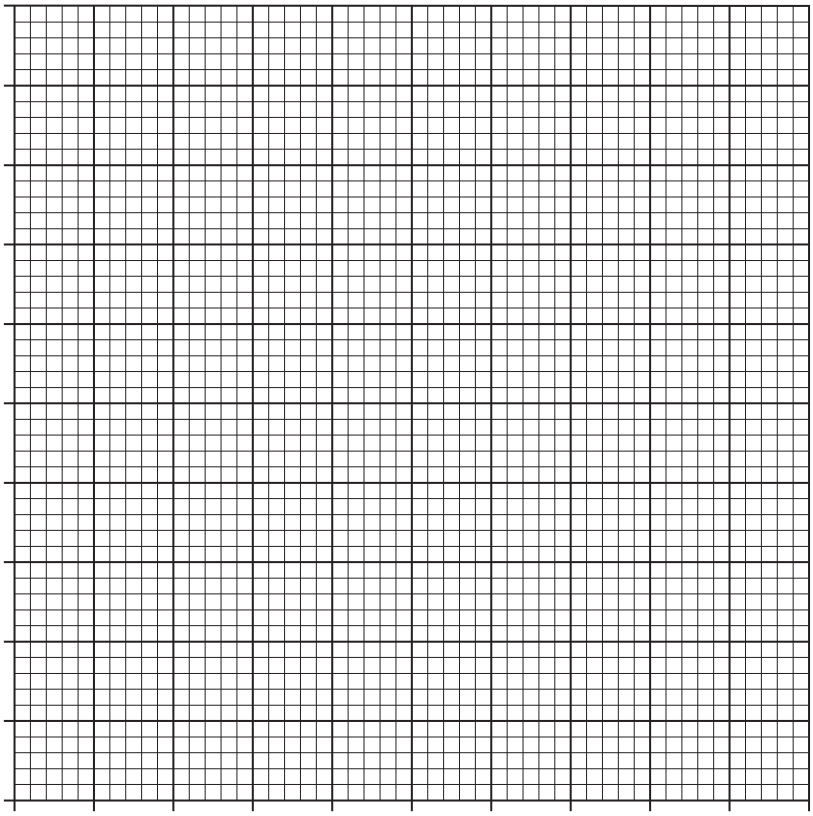
DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

19. The table shows the cost of fitting different types of insulation in a house and the annual saving in the cost of heating.

Insulation	*Cost (£)*	
	Fitting	*Saving*
Cavity wall	250	160
Underfloor	90	50
Loft	250	205

(*a*) Construct a **single** bar graph to show all of the information in the table.
(Additional graph paper, if required, can be found on *Page twenty-five*.)



3

(*b*) Which type of insulation gives savings that pay for the fitting costs most quickly?

..... **1**

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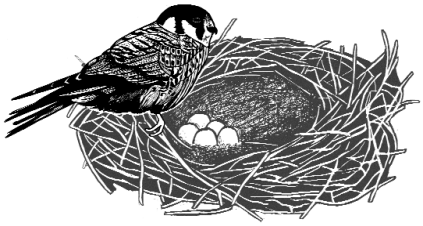
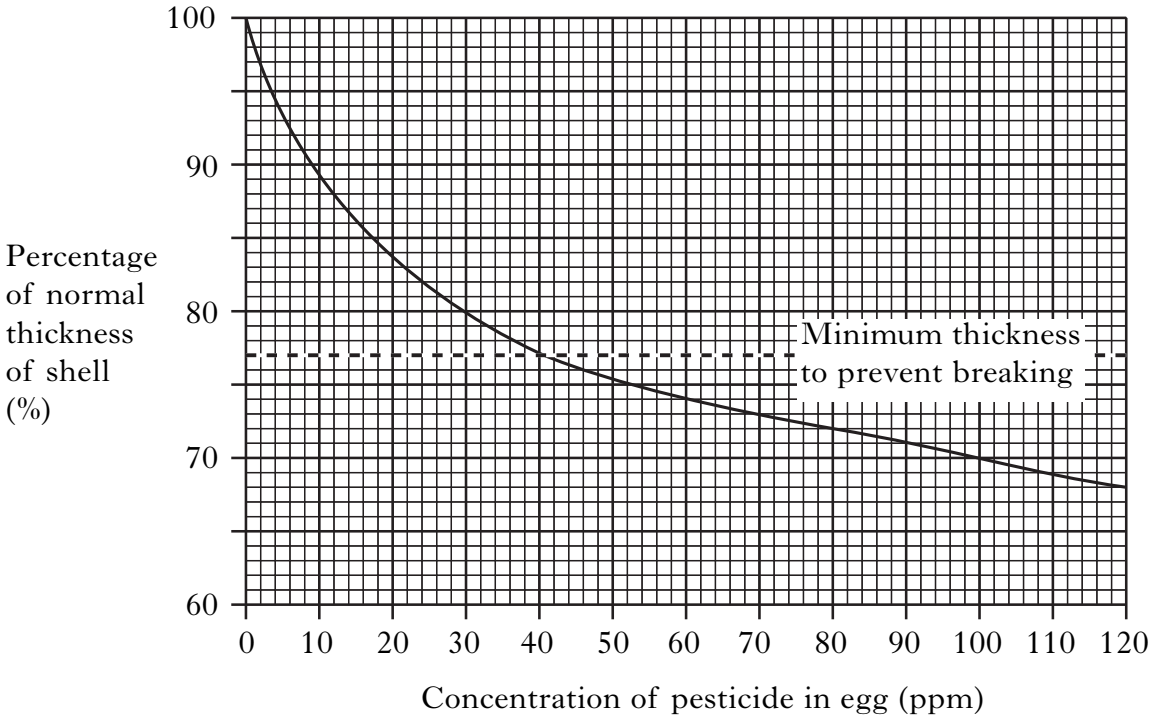
Marks | KU | PS

20. The shell of an egg should be thick enough to prevent the egg from breaking when the parent bird sits on it.



The thickness of the shell is affected by pesticides, as shown in the graph below.



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

.....

..... **1**

(*b*) If a shell is 72% of normal thickness, what is the concentration of pesticide in the egg?

..... ppm **1**

(*c*) Predict the percentage of normal thickness of the shell if an egg has a pesticide concentration of 140 ppm.

..... % **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

20. (continued)

(*d*) An egg has a pesticide concentration of 38ppm.
Will the egg break when the parent sits on it?

.....

Explain why.

.....

..... **1**

21. (*a*) Different methods of heat loss are described below.

A Currents of hot gas move upwards.

B Heat energy is passed through solid from particle to particle.

C Energy travels in electromagnetic waves.

Which letter shows a correct description for

(i) conduction? Letter.....

(ii) convection? Letter.....

(iii) radiation? Letter..... **2**

(*b*) Heat loss from hot water tanks can be reduced by **lagging**.

Explain how this type of insulation reduces heat loss.

.....

..... **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

22. Alcohols can be burned to give out energy.

The **table** shows information about some alcohols.

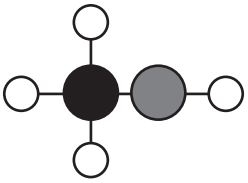
Name of alcohol	*Boiling point* (°C)	*Energy given out* (kJ/mol)
methanol	65	727
ethanol	79	1367
propanol	97	2020
butanol	117	2677

The **diagrams** show the number of carbon atoms, hydrogen atoms and oxygen atoms in each alcohol.

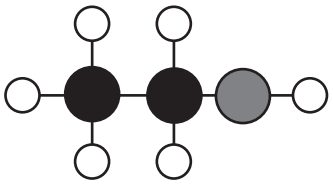
KEY carbon atom

hydrogen atom

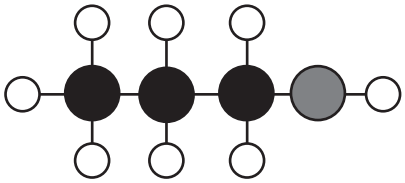
oxygen atom



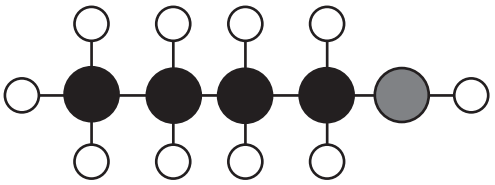
methanol



ethanol



propanol



butanol

(*a*) Draw **two** conclusions using information from **both** the table **and** the diagrams.

1 .....

.....

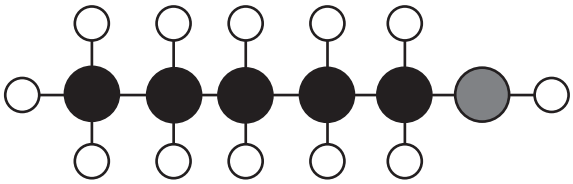
2 .....

..... **2**

Marks | KU | PS

22. (continued)

(*b*) Predict the boiling point for the alcohol shown in the diagram below.



Predicted boiling point .....°C **1**

23. Tobacco smoke contains many harmful substances.

(*a*) Name the substance that is addictive.

..... **1**

(*b*) The table shows the percentage of adults, aged 16 to 49, who smoke cigarettes.

Gender	*Age range* (years)	*Percentage who smoke cigarettes* (%)
Female	16–19	31
	20–24	35
	25–34	30
	35–49	27
Male	16–19	24
	20–24	39
	25–34	38
	35–49	31

In a sample of 250 women aged 25–34 years, how many are smokers?

Space for working

Answer **1**

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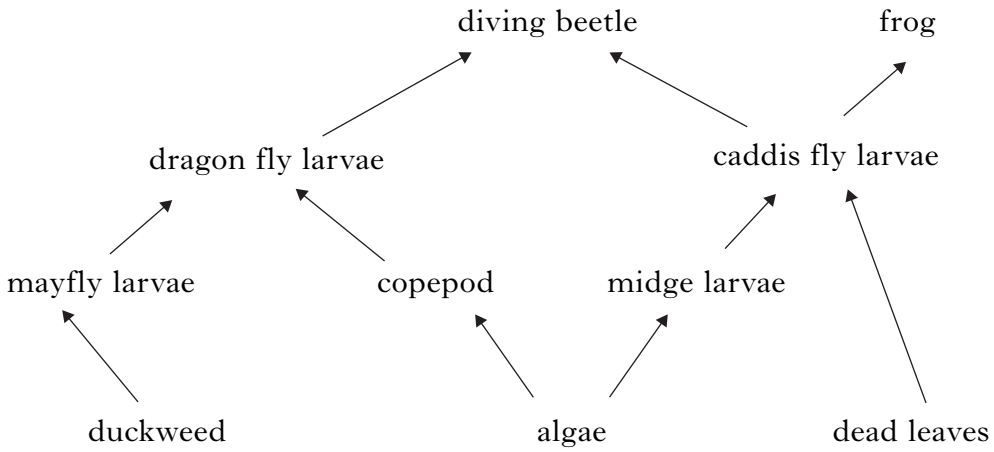
24. The diagram below shows part of a fresh water food web.



(*a*) 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**

(*b*) All of the mayfly larvae die out.

The number of copepods would | decrease | increase | stay the same | .

Circle the correct answer.

Explain your answer.

.....

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

24. (continued)

(*c*) Dead leaves provide energy for the caddis fly larvae and other decomposers.

(i) Decomposers break down waste and release substances from it.

Which organism **from the food web** can make use of these substances again?

A algae

B copepod

C dragon fly larvae

D diving beetle

Underline the correct answer. **1**

(ii) Name an organism **not shown in the food web** which is a decomposer.

..... **1**

[Turn over

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25. The power output of two wind turbines, A and B, was measured at different wind speeds.

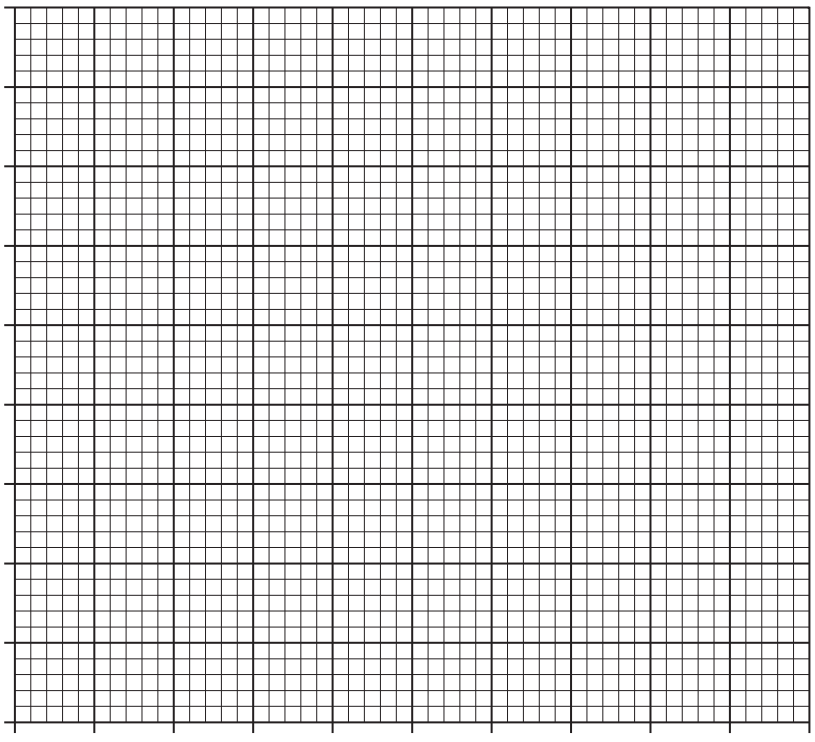
The results are shown in the table.

Wind speed (km/h)	*Power output* (W)	
	Turbine A	*Turbine B*
5	200	500
10	500	1400
15	1200	3000
20	2200	5200
25	3500	7600

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

Label each line graph clearly.

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



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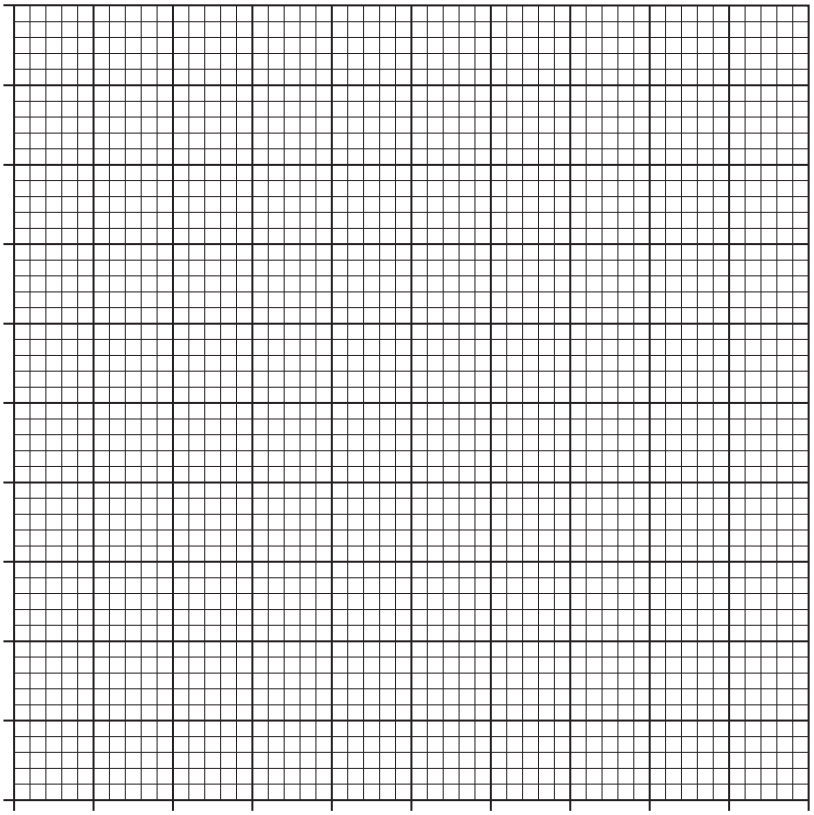
Marks	KU	PS

ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 19(*a*)



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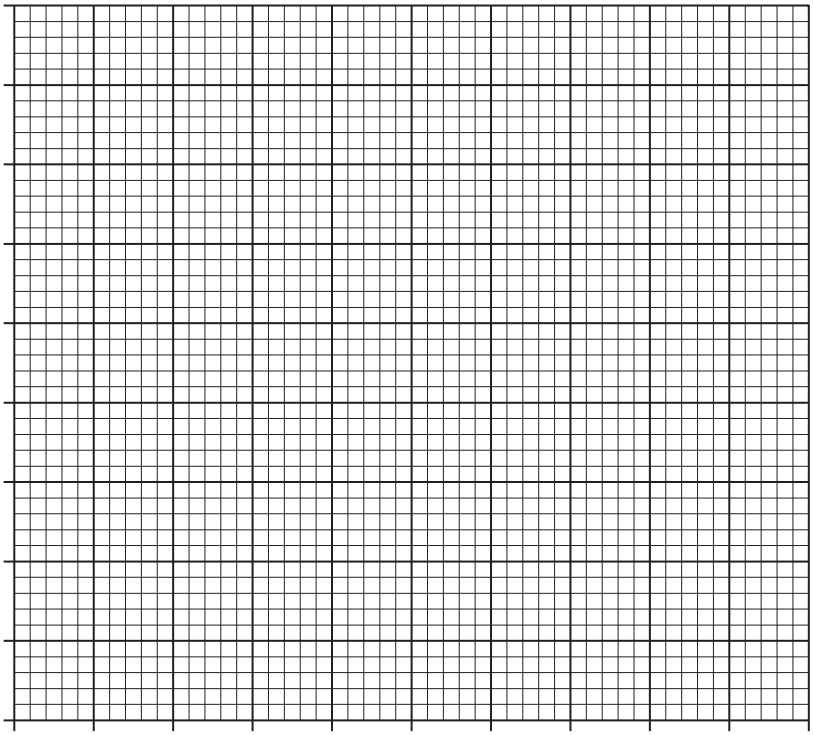
ADDITIONAL GRAPH PAPER FOR USE IN QUESTION 25



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