AQA

General Certificate of Secondary Education
Foundation Tier
January 2012

Science A 1

Unit 5

Thursday 12 January 2012   9.00 am to 10.30 am

SCA1FP

F

For this paper you must have:
- a ruler
- the Chemistry Data Sheet (enclosed)
- the Physics Equations Sheet (enclosed).
You may use a calculator.

Time allowed
- 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 12 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

Biology Questions

1 Cells called receptors detect stimuli in the environment.

1 (a) (i) The diagram shows a light receptor cell.

A ....

B ....

C ....

Use words from the box to label structures **A**, **B** and **C**.

Cell membrane	Cytoplasm	Nucleus	Synapse

(3 marks)

1 (a) (ii) Where in the body are light receptor cells found?

....
(1 mark)

1 (b) The table shows information about receptors found in different sense organs.

Complete the table by filling in the names of the sense organs.

Sense organ	Information
	Contains receptors sensitive to the temperature of the air
	Contains receptors sensitive to changes in body position
	Contains receptors sensitive to chemicals

(3 marks)

7

2 In Vitro Fertilisation (IVF) treatment helps infertile women to become pregnant.

2 (a) Use words from the box to complete each sentence.

ovary	pituitary gland	sperm	uterus

The eggs are collected from the mother's ....

Each egg is fertilised by a ....

Each fertilised egg develops into a ball of cells called an embryo.

One or two of these embryos are inserted into the mother's ....

(3 marks)

2 (b) The table shows the effectiveness of IVF treatment in one clinic in 2010.

Age of women in years	Under 35	35–37	38–40	Over 40
Number of IVF treatments	130.0	100.0	29.0	20.0
Average number of embryos transferred	2.6	2.8	3.3	3.6
Percentage of successful pregnancies	43.0	30.0	21.0	13.0

2 (b) (i) How does the age of the women affect the average number of embryos transferred?

....

....

(1 mark)

2 (b) (ii) Look again at the information in the table.

Suggest **one** ethical reason why many people are against IVF treatment.

....

....

(1 mark)

5

Turn over ▶

3   The body defends itself against pathogens.

3 (a)   Give **three** ways that white blood cells defend the body against pathogens.

Tick (✓) **three** boxes.

Ingest pathogens ☐

Produce antibiotics ☐

Produce antibodies ☐

Produce antitoxins ☐

Produce vaccines ☐

Stop pathogens entering the body ☐

(3 marks)

3 (b)   Bacterial infections can be treated with antibiotics.

Sometimes bacteria are resistant to antibiotics.

What does *resistant to antibiotics* mean?

....

....
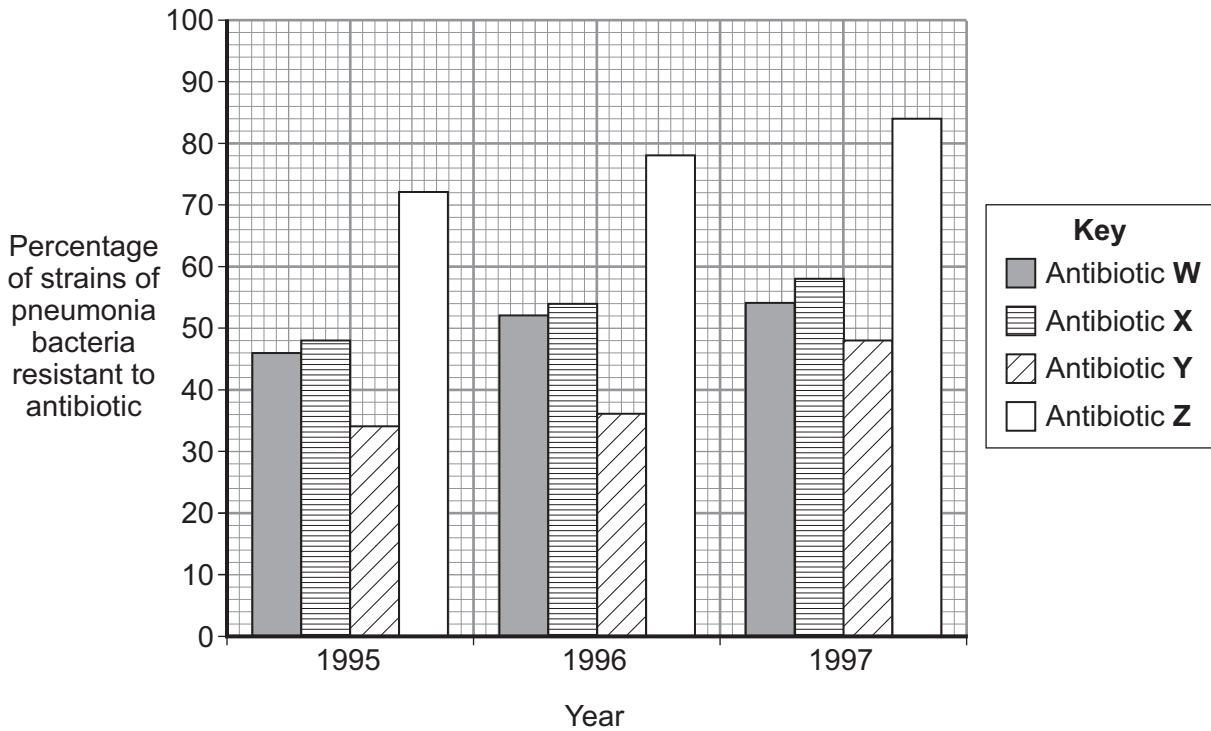
(1 mark)

3 (c) The bar chart shows how the percentage of strains of pneumonia bacteria that are resistant to four different antibiotics changed between 1995 and 1997.

3 (c) (i) Which would have been the best antibiotic to use against pneumonia bacteria in 1995?

Write the correct answer in the box.   Antibiotic ☐

(1 mark)

3 (c) (ii) Calculate the change in the percentage of strains of pneumonia bacteria resistant to antibiotic **W** between 1995 and 1997.

Show clearly how you work out your answer.

....

....

Answer = ... %

(2 marks)

3 (c) (iii) Suggest **two** possible reasons for this change in the number of strains of pneumonia bacteria resistant to antibiotic **W**.

1 ....

2 ....

(2 marks)

9

Turn over ▶

Chemistry Questions

4   Metals are important in our everyday lives.

List **A** gives the names of four metals.
List **B** gives information about each metal.

Draw **one** line from each metal in **List A** to the correct information about the metal in **List B**.

List A **Metal**	**List B** **Information**
	Usually found in the Earth as a pure metal
Aluminium	
	Low density and is resistant to corrosion
Copper	
	Reacts rapidly with water
Gold	
	Used for electrical wiring in the home
Iron	
	Extracted from its ore using a blast furnace

(4 marks)

4

5 Exhaust fumes from petrol engines pollute the air.

5 (a) Which **two** substances are produced when petrol is burned in a plentiful supply of air?

Tick (✓) **two** boxes.

Carbon dioxide ☐

Hydrocarbons ☐

Oxygen ☐

Water ☐

(2 marks)

5 (b) Some petrol contains sulfur.

Use words from the box to complete each sentence.

acid rain	dimming	nitrogen oxide	sulfur dioxide
particles	fuel	warming	carbon dioxide

When sulfur is burned, the gas formed is ....

This gas dissolves in water to form ....

Solid .... in car exhaust fumes cause

global ....

(4 marks)

6

Turn over ▶

6 (a) Describe how a student could test for carbon dioxide.

Give the result of the test.

....

....

....

....

(2 marks)

6 (b) Many useful materials are obtained from limestone. Cement is made from limestone.

Complete the sentence.

Cement is made by heating limestone with ....

(1 mark)

6 (c) Concrete contains cement.
A student tested four concrete slabs.
The student dropped a steel ball onto the
concrete slabs.

- The concrete slabs were of equal
  thickness.

- The concrete slabs contained different
  amounts of fibre.

- The student dropped the steel ball
  from increasing heights until the
  concrete cracked.

Steel ball

Height
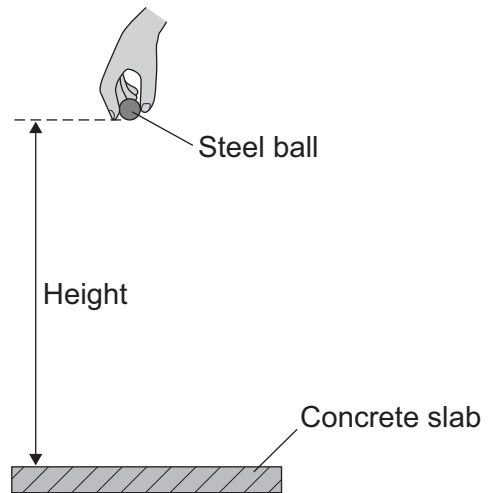
Concrete slab

The results are shown on the graph.

Minimum height
the steel ball
was dropped
to crack the
concrete slab
in cm

Percentage (%) of fibre in the concrete
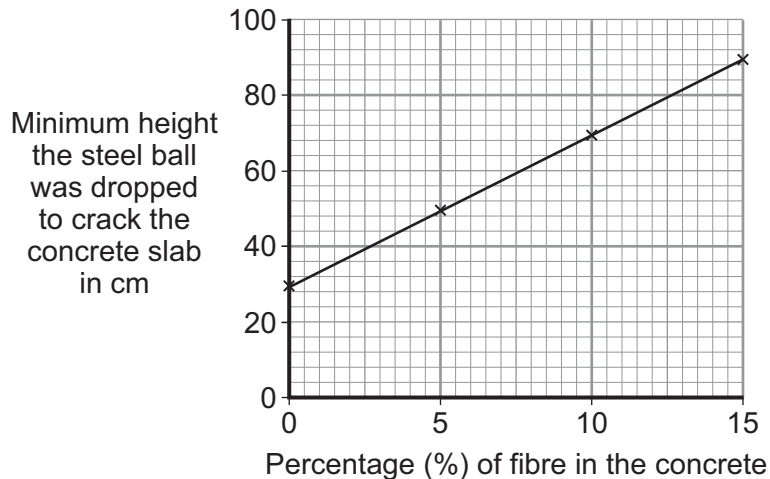
6 (c) (i) Which property of the concrete slabs did the student test?

....
(1 mark)

6 (c) (ii) Give **one** factor that the student kept constant during the investigation.

....
(1 mark)

6 (c) (iii) What was the minimum height the steel ball was dropped from to crack concrete containing 10 % fibre?

Height = ... cm
(1 mark)

6 (c) (iv) Give a conclusion for the student's investigation.

....

....
(1 mark)

6 (d) Calcium hydroxide is an important substance used in the agricultural industry.

6 (d) (i) Calcium hydroxide is made from limestone (calcium carbonate) in a two-stage process.

Complete the word equations which describe the two stages.

Stage 1
calcium carbonate → calcium oxide + ...

Stage 2
calcium oxide + ... → calcium hydroxide
(2 marks)

6 (d) (ii) Calcium hydroxide is an alkali. It is used by farmers to spread on fields where the soil is acidic.

Suggest why farmers use calcium hydroxide in this way.

....

....
(1 mark)

10

Turn over ▶

Physics Questions

7 The picture shows a wind-up radio.
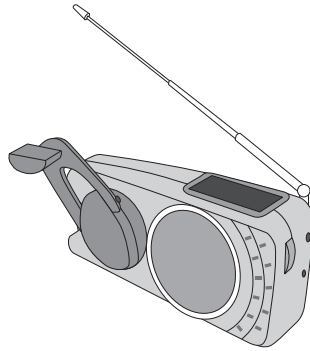
When the handle is turned, a generator inside the radio makes electricity.

The sentences below describe the useful energy transfers that occur when the radio is working.

Use words from the box to complete each sentence.

electrical	kinetic	light	sound

When a person turns the handle, ... energy is transferred to

.... energy by the generator inside the radio.

This energy is transferred to .... energy so that people

can hear the music being played.
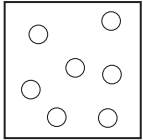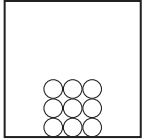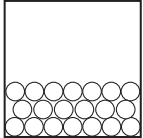
(3 marks)

3

8 (a) The diagrams below show the three states of matter.

Draw **one** line from each diagram in **List A** to the correct state of matter in **List B**.

List A	**List B** **State of matter**

Solid

Gas

Liquid

(2 marks)

8 (b) The particles in the three states of matter have different amounts of energy.

List the **three** states of matter in order of increasing energy.

Least energy ....

....

Most energy ....

(2 marks)

4

Turn over for the next question

Turn over ▶

9 The bar chart shows the amount of energy needed to raise the temperature of 1 kg of three materials by 20 °C. The materials are used inside heaters.

Energy in kilojoules (y-axis, 0 to 90)

Water: 84
Oil: 40
Concrete: 20

Material (x-axis)
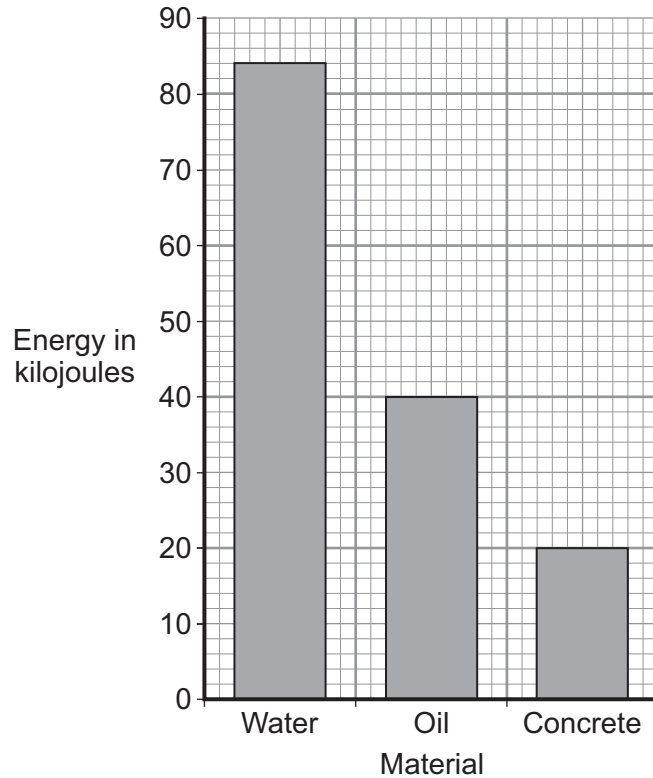
9 (a) Which material stores most energy?

....

(1 mark)

9 (b) The heaters that use the different materials are shown below. The power output when the heaters are being used is shown below each picture.

Water-filled heater
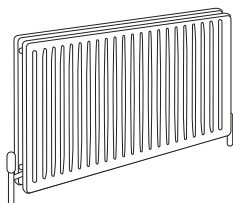
3 kW

Oil-filled heater
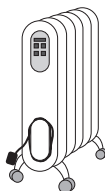
1.5 kW

Storage heater
(has concrete blocks inside)
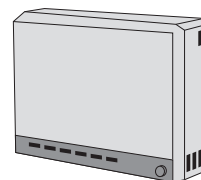
1.7 kW

Each heater is put in one of three identical rooms. Each room's temperature is 10 °C and the heaters are switched on for 5 hours.

9 (b) (i) Which heater would cause the biggest temperature rise in the room?

Give a reason for your answer.

Heater ....

Reason ....
....

(2 marks)

9 (b) (ii) Calculate the energy the oil-filled heater uses in 5 hours.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

....

....

....

....

Energy = ... kWh

(2 marks)

9 (c) Aluminium has a specific heat capacity of 900 J/kg °C.

Calculate how much energy is needed to raise the temperature of 2 kg of aluminium by 15 °C.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

....

....

....

....

Energy = ... J

(2 marks)

Turn over ▶

7

10 A student investigated the emission of infrared radiation from two cans.

- The two cans were the same size.

- One can was painted white and the other can was painted black.

- The student poured the same volume of boiling water into each can.

- A data logger recorded the temperature in each can for the next 14 minutes.

Temperature sensor ——
Plastic lid ——

Can painted white ——

Data logger

—— Temperature sensor
—— Plastic lid

—— Can painted black
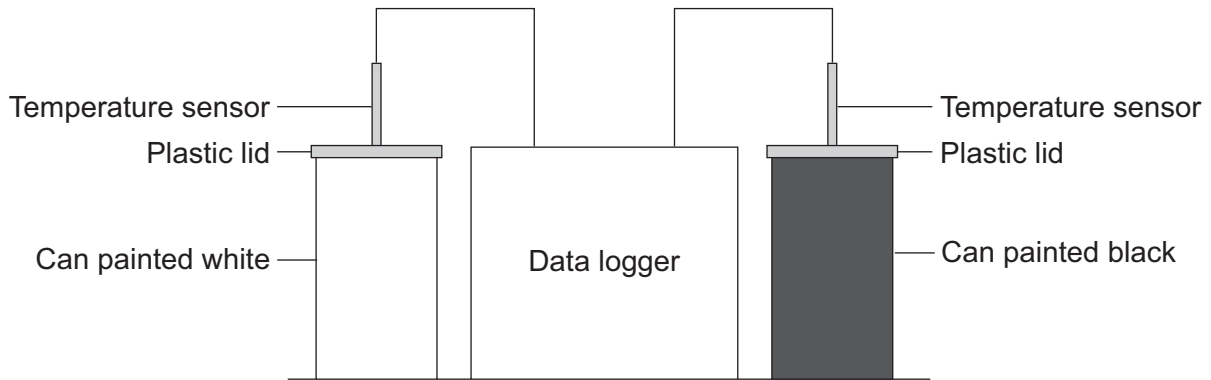
10 (a) Draw a ring around the correct answer in the box to complete the sentence.

The plastic lids prevent energy loss by

| conduction. |
| convection. |
| infrared radiation. |

(1 mark)

10 (b) The data logger takes two temperature readings each second, and then plots a graph for the student.

The student could have used a thermometer to measure the temperature.

Thermometer ——
90
80

Data logger display —— 87.40 °C
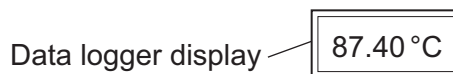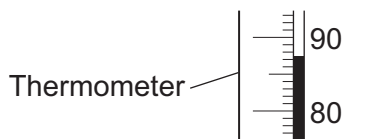
Give **two advantages** of using a data logger instead of the thermometer.

1 ....

2 ....

(2 marks)

10 (c) The graph shows the student's results.
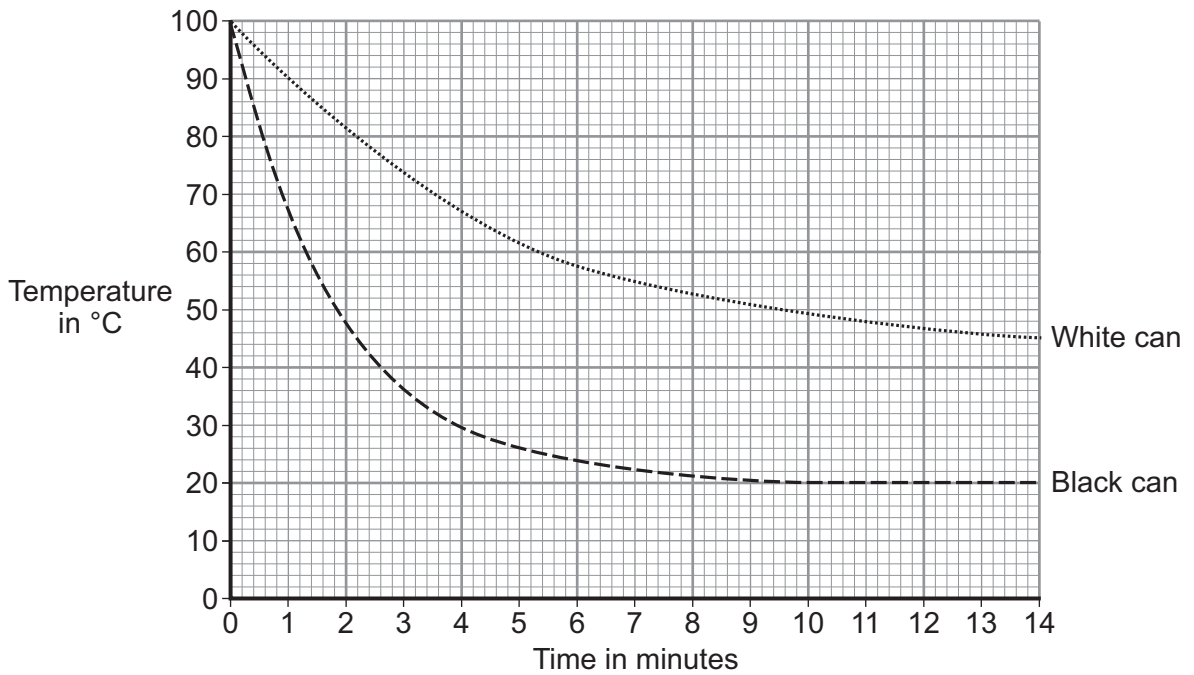
10 (c) (i) Explain the difference in temperature between the water in the two cans after 14 minutes.

....

....

....

....

(2 marks)

10 (c) (ii) The student decided to repeat the investigation using a can painted grey.

On the graph, draw a line for the results you would expect for the can painted grey.

(2 marks)

7

Turn over ▶

Biology Questions

11 Auxins control growth in plants.

In an investigation, scientists illuminated seedlings from one side. They measured the increase in the length of the stems of the seedlings on both the illuminated and the shaded sides.
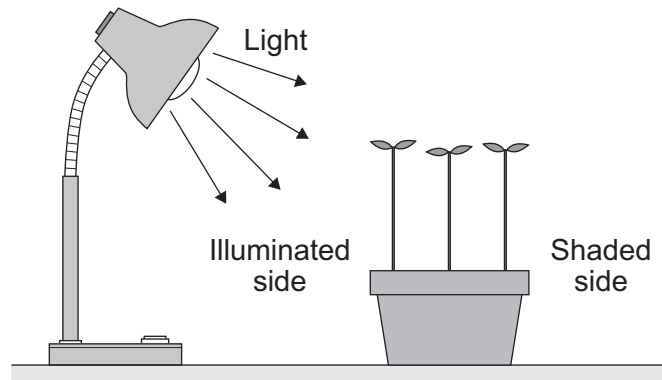
The graph shows their results.
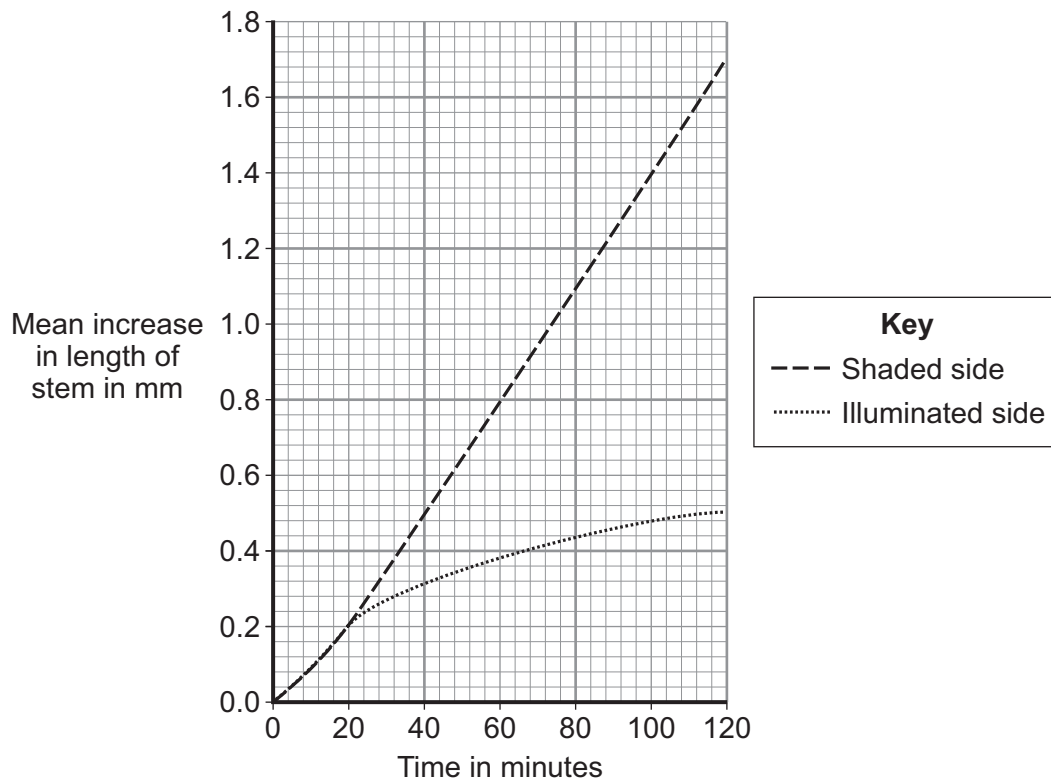
11 (a) Describe the difference between the growth of the illuminated side and the growth of the shaded side.

....

....

(1 mark)

11 (b) Explain the difference you have described in part **(a)** in terms of the distribution of auxins.

....

....

....

....

(2 marks)

3

Turn over for the next question

Turn over ▶

12 Total cholesterol in the blood contains 'good' and 'bad' cholesterol.
High levels of 'bad' cholesterol increase the risk of heart disease.
High levels of 'good' cholesterol reduce the risk of heart disease.

Scientists have suggested that chemicals called polyphenols in dark chocolate may help people with Type 2 diabetes.
Polyphenols may reduce high levels of 'bad' cholesterol in the blood.

The scientists investigated the effect of polyphenols on levels of cholesterol in the blood.

- 7 men and 5 women with Type 2 diabetes had the levels of cholesterol in their blood measured.

- They all ate 45 g of dark chocolate every day for 16 weeks.

- 6 of the people ate dark chocolate that contained polyphenols. The other 6 people ate dark chocolate that did not contain polyphenols.

- All 12 people were allowed to eat and drink anything else they wanted, but **no more** chocolate.

- The levels of cholesterol in their blood were measured again after 16 weeks.

The results showed that for the people who ate dark chocolate with polyphenols:

- there were decreases in total cholesterol and 'bad' cholesterol

- there was an increase in 'good' cholesterol.

A newspaper headline reported the research and wrote:
'Research shows that diabetics should eat dark chocolate.'

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Was the newspaper's statement justified?

Include in your answer evidence that supports the newspaper's statement and evidence that does **not** support the newspaper's statement.

Remember to give a conclusion to your answer.

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(6 marks)

6

Turn over ▶

Chemistry Questions

13   Solder is an alloy of lead and tin.

The table shows how the percentage of tin affects some of the properties of solder.

Percentage (%) of tin	Tensile strength in MPa	Melting point in °C	Density in g per cm^3
0	12	347	11.35
20	33	257	10.40
40	37	187	9.28
60	52	153	8.52

Tensile strength is the ability to support a load without breaking.

Use information from the table to answer these questions.

13 (a)   What is the density of pure lead?

Density = ... g per cm^3
(1 mark)

13 (b)   How does increasing the percentage of tin affect the properties of solder?

....

....

....

....

....

....
(3 marks)

13 (c)   Solder was used when plumbers joined lead pipes together.
Solder, not pure lead, was used to make the joints.

Suggest **one** reason why.

....

....
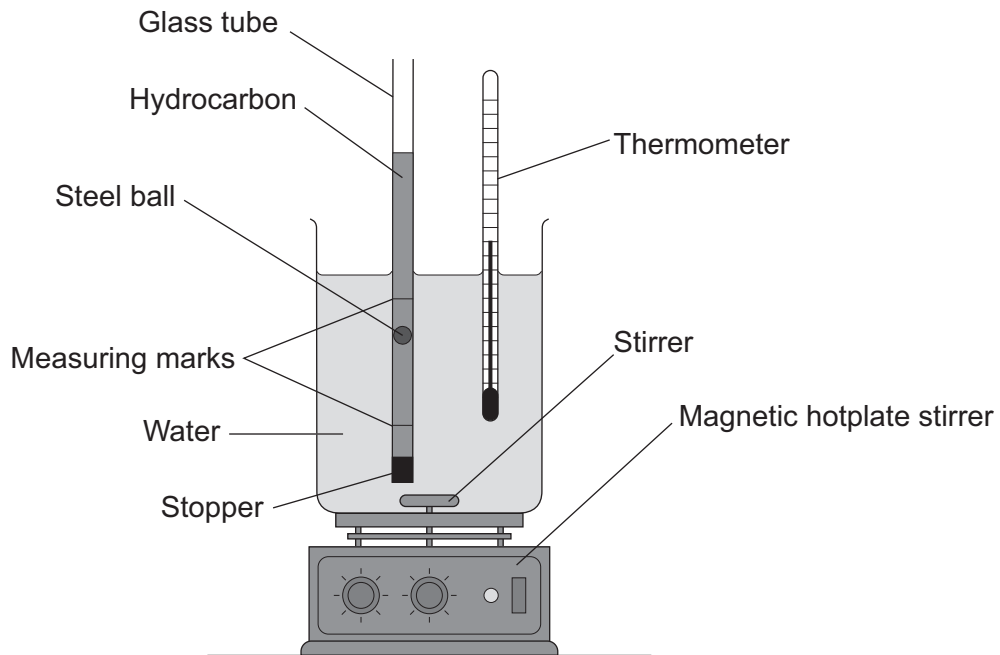
(1 mark)

5

Turn over for the next question

Turn over ▶

14 The diagram shows apparatus used to measure the effect of temperature on the viscosity of two liquid hydrocarbons **A** and **B**.

The time taken for the steel ball to fall between the two measuring marks is recorded for each hydrocarbon at different temperatures.

14 (a) Using the stirrer improved the accuracy of the results.

Explain how.

....

....

....

....
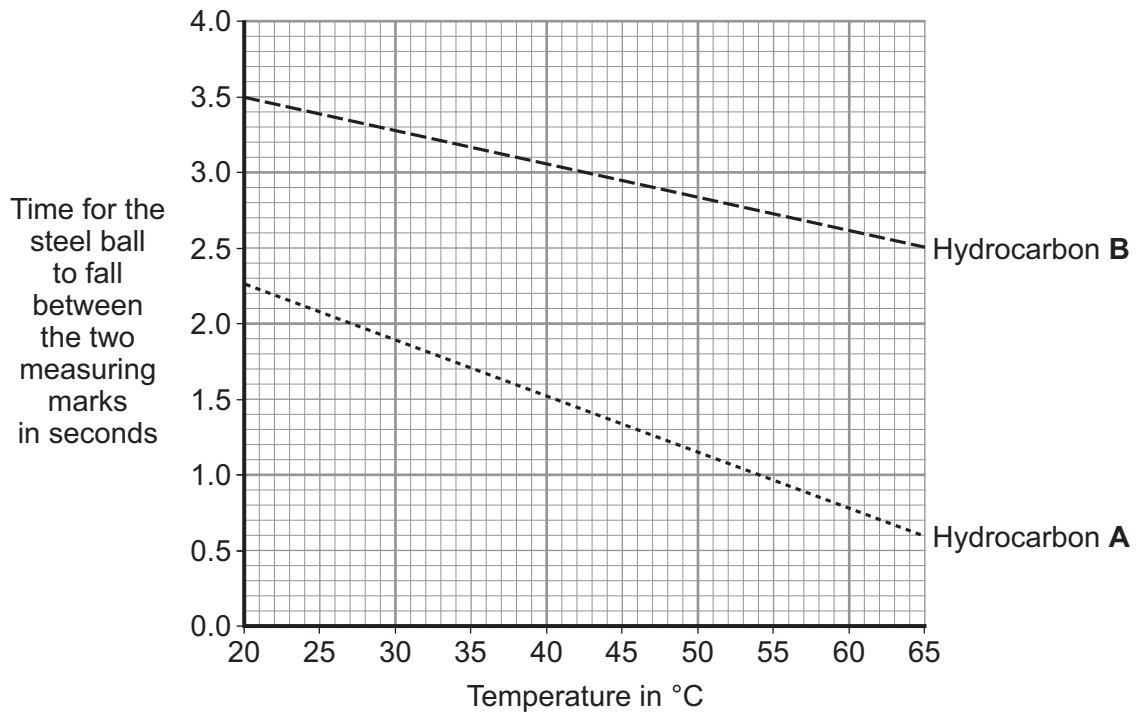
(2 marks)

14 (b) The graph shows the results of the investigation.

14 (b) (i) What conclusions can be drawn from the data?

....

....

....

....

(2 marks)

14 (b) (ii) Give **one** reason for the difference in the viscosities of hydrocarbon **A** and hydrocarbon **B**.

....

....
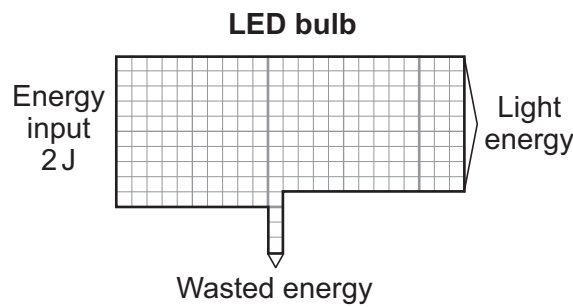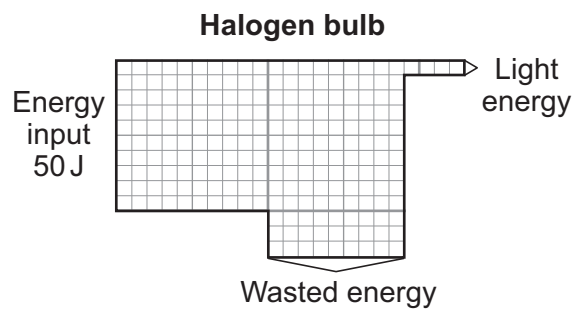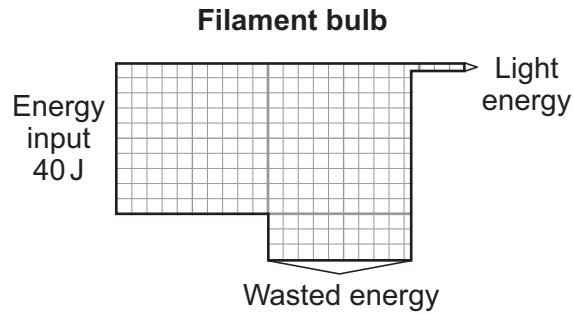
(1 mark)

5

Turn over ▶

Physics Questions

15 The Sankey diagrams show the energy transferred to the surroundings each second by three different bulbs.

Filament bulb

Energy input 40 J

Light energy

Wasted energy

Halogen bulb

Energy input 50 J

Light energy

Wasted energy

LED bulb

Energy input 2 J

Light energy

Wasted energy

15 (a) The filament bulb is the least efficient of the three bulbs.

Explain what *least efficient* means.

....

....

....

....

(2 marks)

15 (b) Calculate the percentage efficiency of the halogen bulb.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

....

....

....

....

Efficiency = ... %

(2 marks)

15 (c) What effect does the wasted energy from a bulb have on the surroundings?

....

....

(1 mark)

15 (d) Use the Sankey diagrams to give a reason why the overall cost of using an LED bulb is the lowest of the three bulbs.

....

....

(1 mark)

Question 15 continues on the next page

Turn over ▶

15 (e) The table gives further information about each type of bulb.

Bulb	Cost to buy in £	Average lifespan in hours
Filament	0.50	1000
Halogen	2.00	2500
LED	15.00	25 000

Use **only** the information in the table to answer the following questions.

15 (e) (i) Which type of bulb is the most cost-effective?

Give a reason for your answer.

Bulb ....

Reason ....

....

(2 marks)

15 (e) (ii) Sales of LED bulbs are increasing.

Suggest **one** reason why.

....

....

(1 mark)

9

END OF QUESTIONS

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