Your Name:

Your School:

Mark:
(leave blank)

Mill Hill School

13+ & 14+ EAL Entrance Examination – Science

January 2015

Time: 1 hour

Materials required for examination

Information for candidates

The paper consists of three sections, A, B and C. You should answer all of the questions in each section. The marks for individual questions and the parts of questions are shown in brackets.

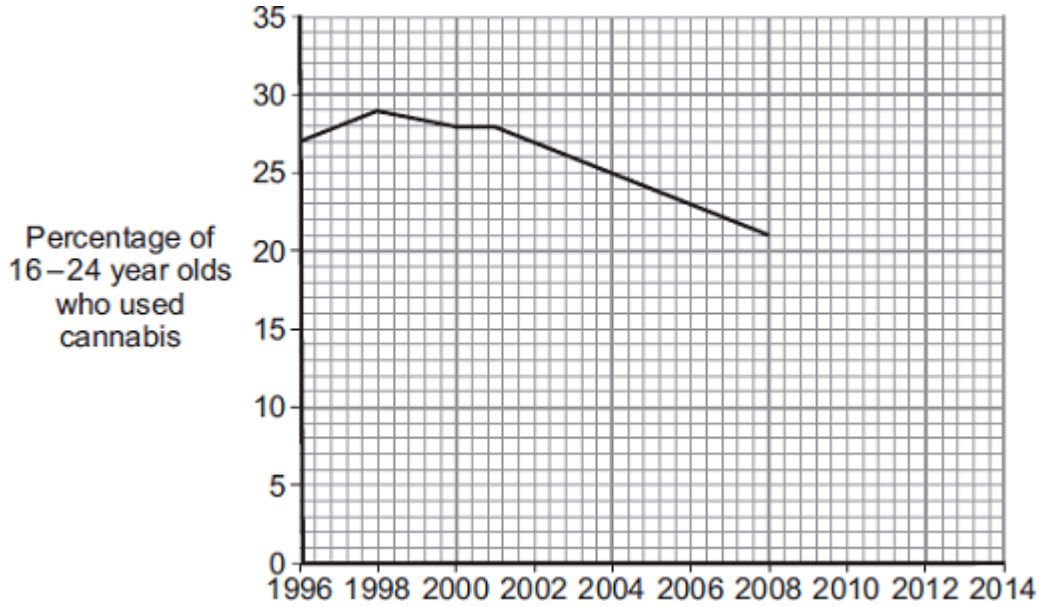**Please ensure your name is written at the top of each section.**

Q1. Cannabis is an illegal drug.

(a)   What type of illness might be caused by smoking cannabis regularly?

....

(1)

(b)   The graph shows the use of cannabis by 16–24 year olds in the UK between 1996 and 2008.

Year

(i)   Use the graph to predict the percentage of 16–24 year olds who will use cannabis in 2014.

Show your working **on the graph**.

Percentage = ...

(2)

(ii)   Illegal drugs are classified as Class A, Class B or Class C.Class C drugs are the least dangerous.

In 2004, the government changed the classification of cannabis from Class B to Class C.

In 2009, the government changed the classification of cannabis back from Class C to Class B.

Do you think that changing the classification of cannabis back to a Class B drug will reduce the percentage of 16–24 year olds who use cannabis?

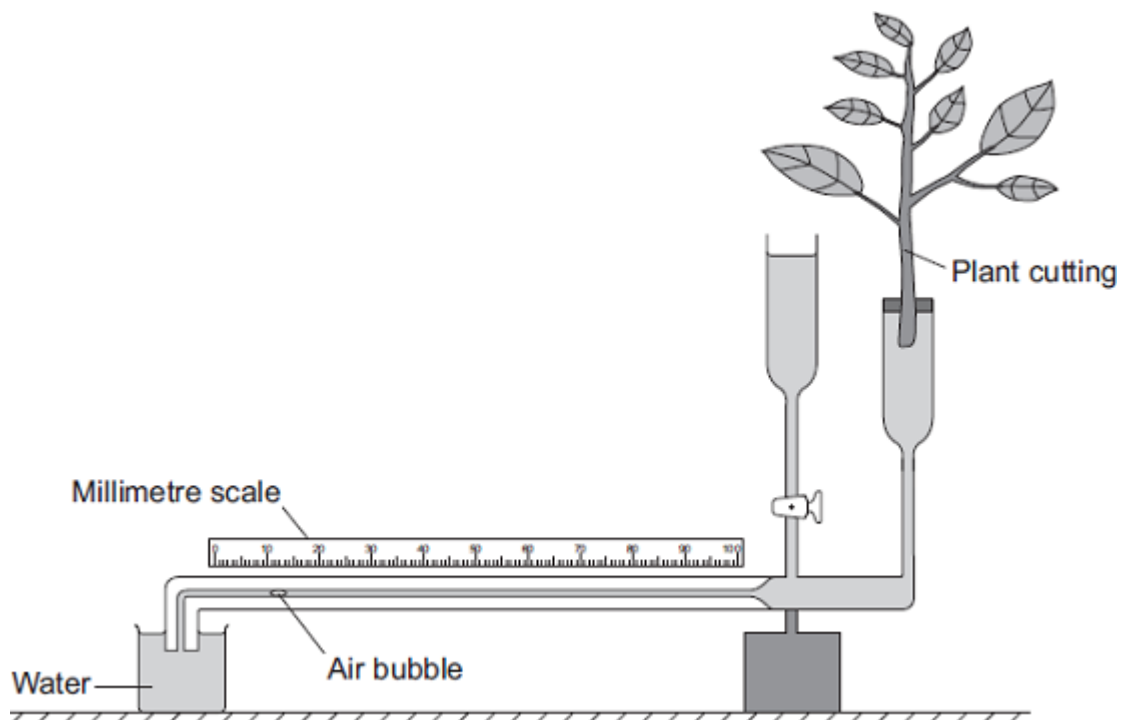Use evidence from the graph to explain your answer.

....

....

....

....

....

....

(2)
(Total 5 marks)

Q2. Some students used the apparatus shown in the diagram to measure the rate of water uptake by a plant cutting.

Plant cutting

Millimetre scale

Water

Air bubble

The students set up the apparatus in three different conditions:

- no wind at 15°C

- no wind at 25°C

- wind at 25°C

For each experiment, the students recorded the movement of the air bubble along the scale.

(a) (i) Name the **two** variables the students chose to change in these experiments.

1 ....

2 ....

(2)

(ii) It was important to use the same plant cutting each time to make these experiments fair.

Explain why.

....

....
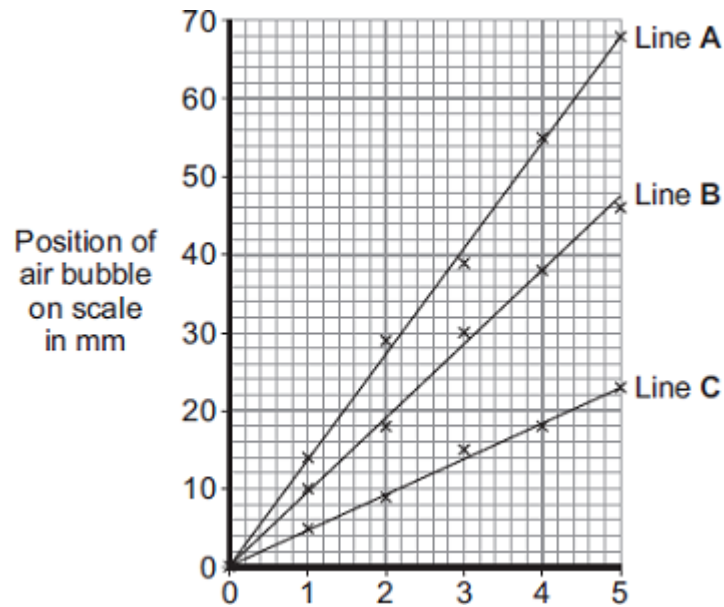
(1)

(b)   The graph shows the students' results.

Time in minutes

Which line on the graph, **A**, **B** or **C**, shows the results for each of the three different experiments?

Write each of the letters, **A**, **B** and **C**, in the correct boxes in the table.

Conditions	Letter
No wind at 15°C	
No wind at 25°C	
Wind at 25°C	

(2)

(c)   Water is lost from the leaves of the plant cutting.

Name this process.

Draw a ring around **one** answer.

distillation	respiration	transpiration

(1)
(Total 6 marks)

Q3. Garden waste can be recycled. One way of recycling garden waste is to use a compost bin.

The diagram shows two types of compost bin. Each bin can contain the same amount of waste.
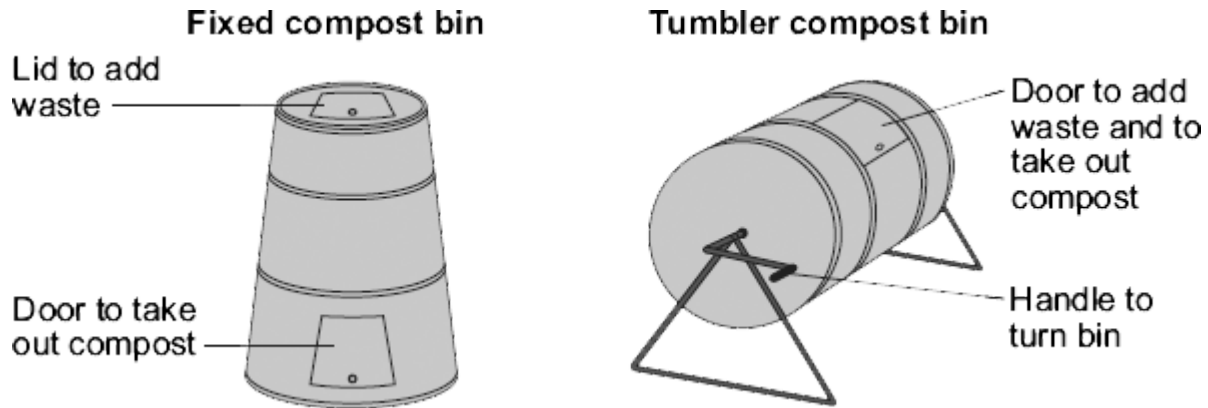
Information about the compost bins is given below.

Fixed compost bin

- Compost can be taken out after two years.

- The bin costs about £40.

- The bin takes up an area of 1 m².

Tumbler compost bin

- The bin is turned twice a day using the handle.

- Six weeks later compost can be taken out.

- The bin costs about £80.

- The bin takes up an area of 2 m².

(a)   A gardener is buying a compost bin.

(i)   Give **one** advantage to the gardener of buying a tumbler compost bin and not a fixed compost bin.
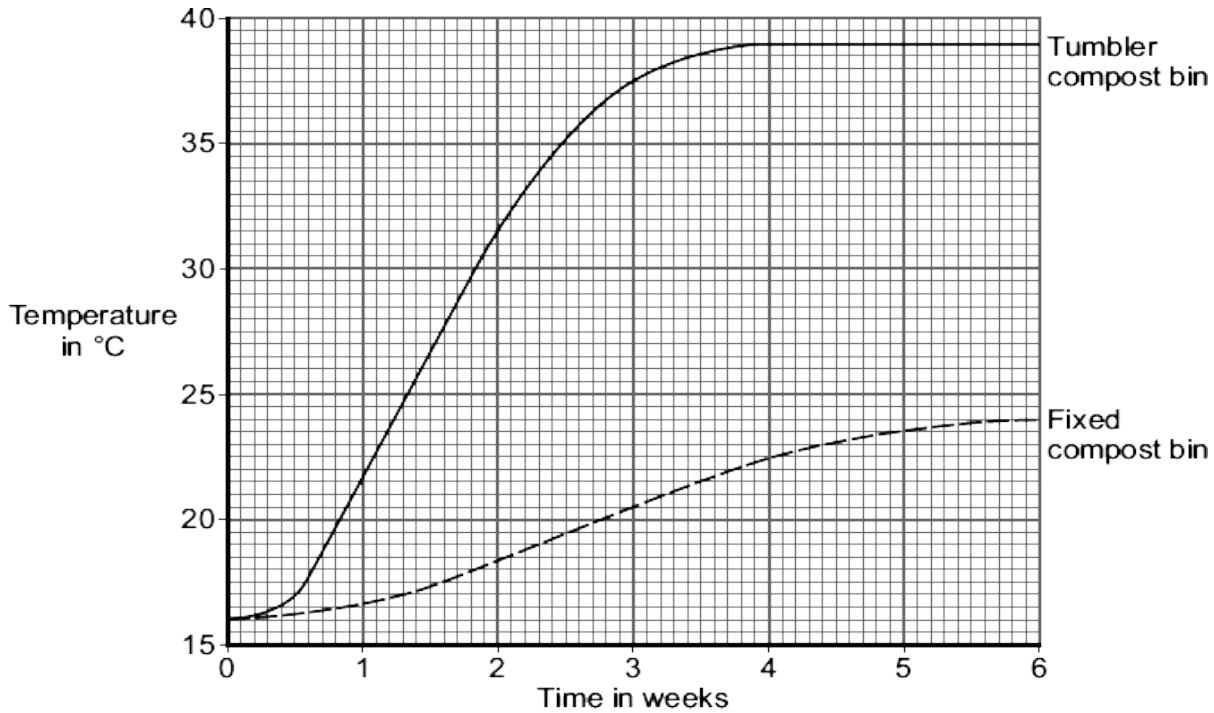
....

....

(1)

(ii)   Give **two** advantages to the gardener of buying a fixed compost bin and not a tumbler compost bin.

1 ....

2 ....

(2)

(b)   The same amounts of waste were added to the two types of bin.The graph shows the temperature in the bins in the first six weeks after the waste was added.

(i)   Give **two** differences between the results for the tumbler compost bin and the fixed compost bin.

1 ....

....

2 ....

....

(2)

(ii)   Complete the sentences.

The waste is converted into compost by organisms called ....

The conversion of waste into compost works best in warm, moist and

.... conditions.

(2)

(iii)   There was a big difference in the final temperatures in the two bins.

Suggest an explanation for this temperature difference.

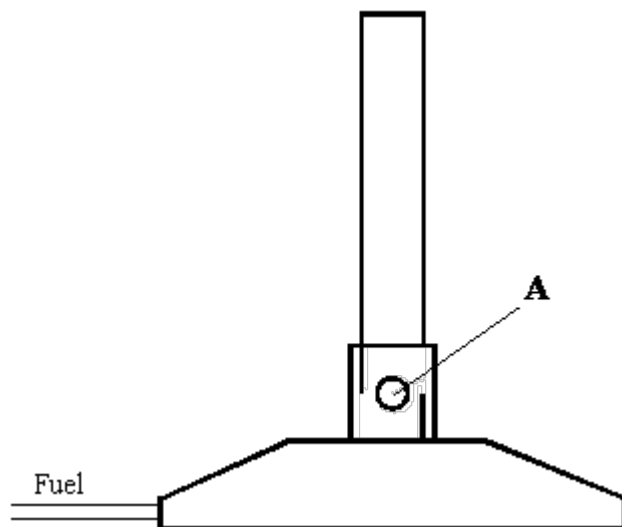...

....

....

(2)(Total 9 marks)

END OF BIOLOGY SECTION

TURN OVER FOR CHEMISTRY SECTION

1.   The diagram below shows a Bunsen burner.

Use words from the list to complete the passage about the Bunsen burner. You may use each word once, more than once or not at all.

air	methane
argon	mechanical energy
carbon dioxide	nitrogen
chemical	physical
electrical energy	potential energy
heat	oxygen
kinetic energy	water vapour

In the Bunsen burner the fuel is mixed with ....

which enters through the hole labelled A.

When the fuel burns it reacts with the gas called ....

and energy is given out as ....

Burning is an example of a .... change because new

substances are formed.

(3)

2. A chemistry teacher demonstrated the reaction between sodium and water to a class of students. One of the students wrote the following notes:

The reaction between sodium and water

A piece of sodium was cut easily into smaller pieces with a knife.

The sodium was added to some water in a trough.

The sodium:

- floated

- melted quickly to give a silvery ball

- moved on the surface of the water

- fizzed.

Use the information in the box to help you answer these questions.

What evidence is there that:

(i)   sodium has a low melting point

....

....

(1)

(ii)   sodium is soft

....

....

(1)

(iii)   a gas was produced?

....

....

(1)

3. Some students slowly add solution Y to solution X.

The graph shows what happens to the pH of the solution in the beaker as they do this.
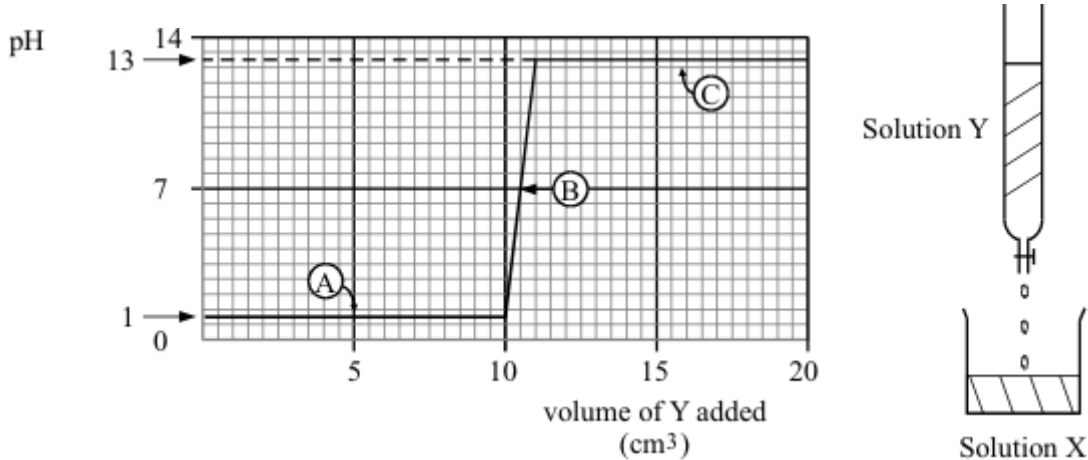
(a) Choose words from this list to complete the sentences below.

acidic **alkaline** **neutral**

At point A on the graph the solution in the beaker is

....

At point B on the graph the solution in the beaker is

....

At point C on the graph the solution in the beaker is

....

(2)

(b) Describe, as fully as you can, what happens to the pH of the mixture as solution Y is slowly added.

....

....

....

....

....

....

(3)

4 In the carbon cycle the amounts of carbon dioxide and oxygen in the air are changed by several processes.
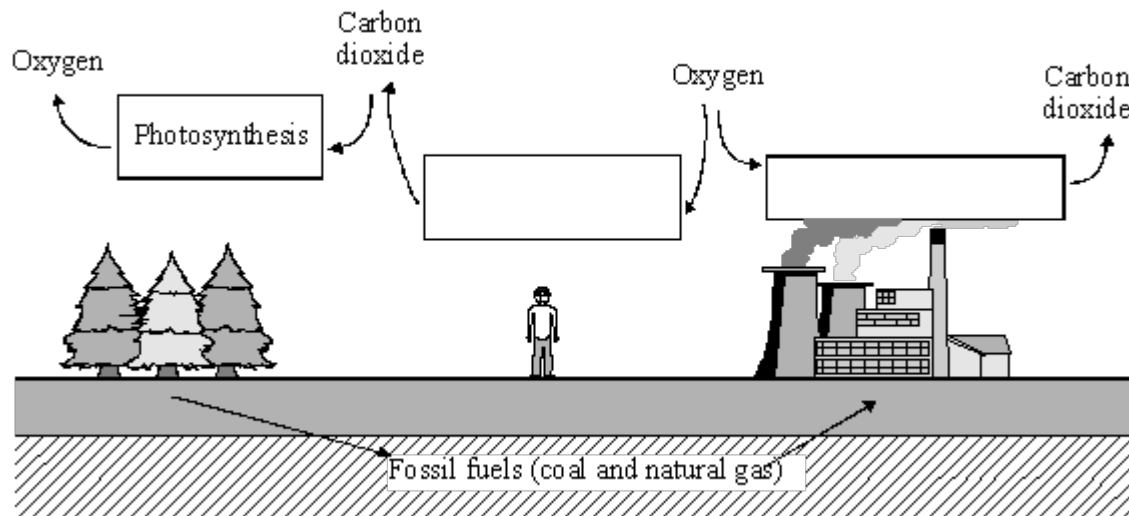
(a)   The names of some processes are given in the box below.

| combustion | decomposition | neutralisation |
| photosynthesis | | respiration |

Choose the correct process for each box in the diagram. The first one has been done for you.

(2)

(b)   Fossil fuels, such as natural gas, react with oxygen.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
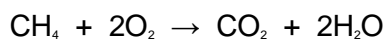
.... + oxygen → carbon dioxide + ...

Complete the word equation for this reaction

(2)

5. The drawings below show three objects made from copper. **<u>Draw a line</u>** from each object

to the reason for using copper for that object. Draw only **three** lines.

object made from copper	reason for using copper

It does **not** rust.

base of a saucepan

It is a good conductor of electricity.

coin

It is a good conductor of heat.

wires in a cable

It is **not** magnetic.

(b) Brass is a mixture of copper and zinc. Some keys are made from brass.

Why is brass more suitable than copper for a **key**? Tick the **two** correct boxes.

|			
Brass does **not** bend as easily as copper.	☐	Brass is a paler colour than copper.	☐
Brass is harder than copper.	☐	Brass is **not** as shiny as copper.	☐
Brass is **not** such a good conductor of electricity as copper.	☐	Brass is **not** such a good conductor of heat as copper.	☐

(2)

6. A student added copper oxide to an acid to make copper sulfate.

The student heated the acid. The student added copper oxide until no more reacted.

(a) The diagram shows the first stage in the experiment.
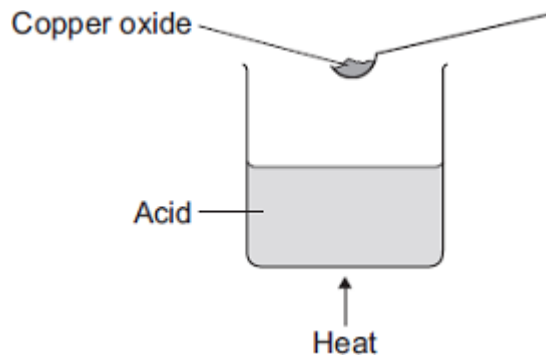
(i) Complete the word equation.

Copper oxide + ... acid → copper sulfate + water

(1)

(iii) Why is the acid heated?

....

....
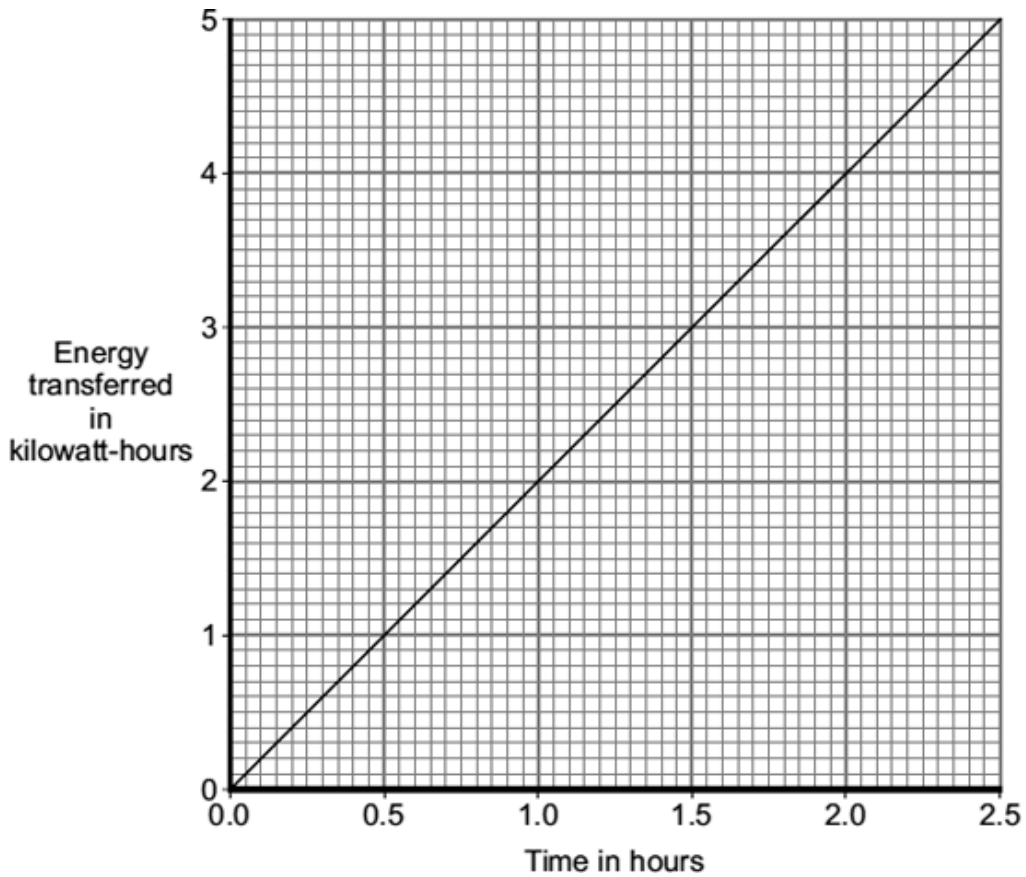
(1)

(b) The student removed the solid copper oxide from the solution.

Suggest what the student should do to the solution to form copper sulfate crystals.

....

....

(1)

END OF CHEMISTRY SECTION

TURN OVER FOR PHYSICS SECTION

Q1. The graph shows how the energy transferred by a 2 kW electric kettle varies with the time, in hours, that the kettle is switched on.

(a)   In one week, the kettle is used for a total of 1.5 hours. Electricity costs 15 p per kilowatt-hour.

Use the equation in the box to calculate the cost of using the kettle for the week.

| total cost | = | number of kilowatt-hours | × | cost per kilowatt-hour |

Show clearly how you work out your answer.

....

....

Cost = ... p
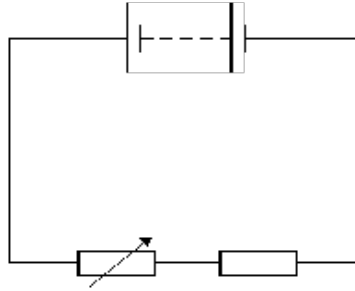
(2)

(b)   Draw a new line on the graph to show how the energy transferred by a 1 kW kettle varies with time.

(1)

(Total 3 marks)

Q2.   (a)   The diagram shows a simple circuit. Add an ammeter and a voltmeter to the circuit to show how to measure the current through the fixed resistor and the voltage across it.
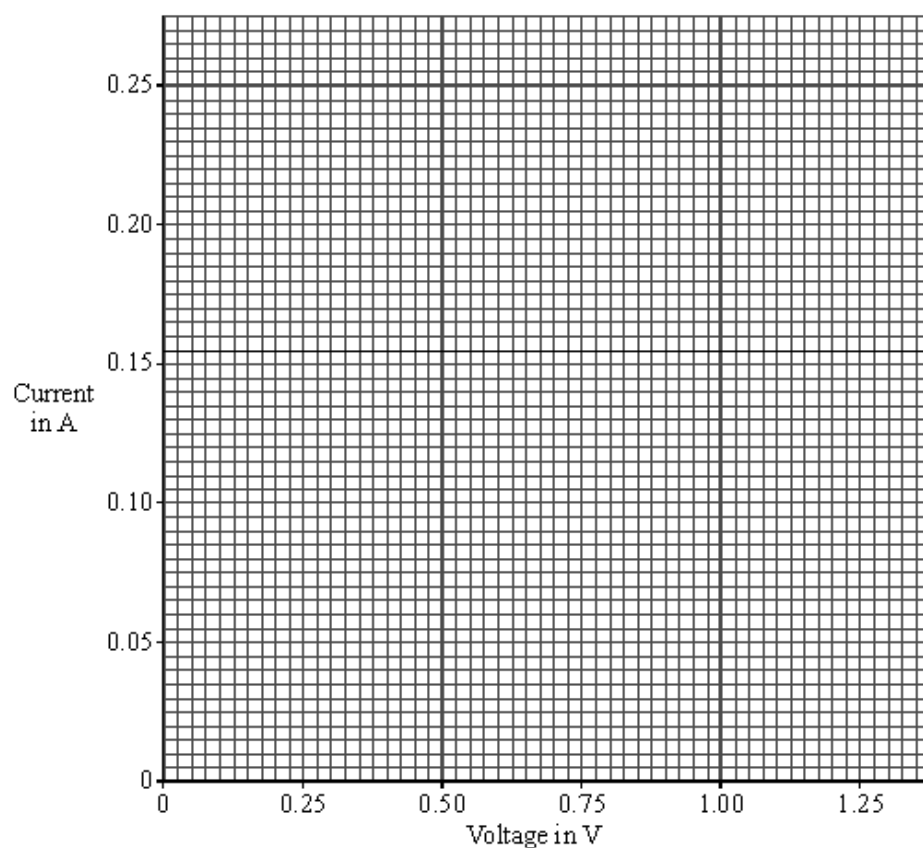

(2)

(b)   An experiment using a circuit like the one above was set up. The following results were obtained when the resistance of the variable resistor was decreased.

(i)   Draw a graph of the results below.

Voltage across fixed resistor in volts	Current in amps
0.50	0.10
0.75	0.15
1.00	0.20
1.25	0.25

(ii)   Use the graph to find the voltage when the current is 0.05 A.

Voltage =.. V
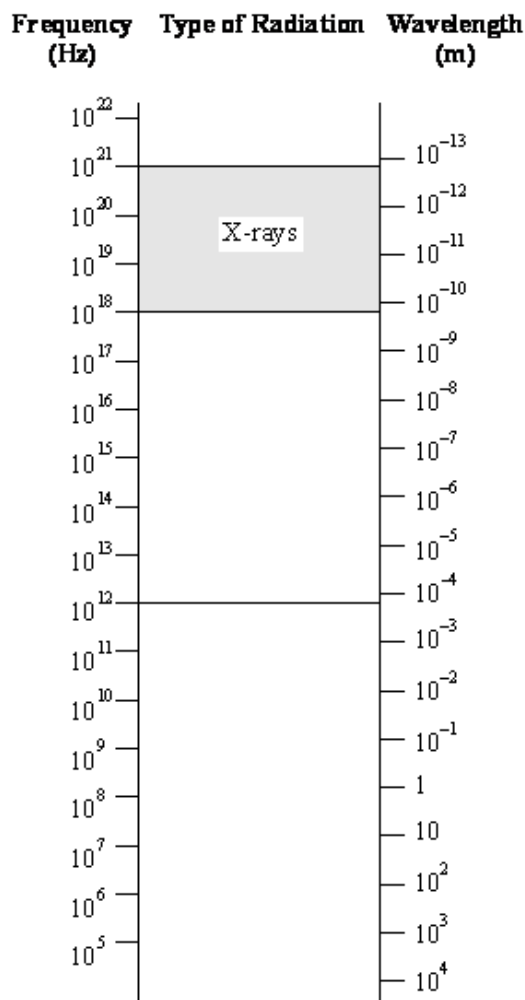
(1)

(Total 5 marks)

Q3. The diagram below shows the range of wavelengths and frequencies for all the types of radiation in the electromagnetic spectrum.

X-rays, which have frequencies in the range 10^{18}–10^{21} Hz are already marked on the diagram.

Frequency   Type of Radiation   Wavelength
(Hz)   (m)

Frequency (Hz)	Type of Radiation	Wavelength (m)
10^{22}		
10^{21}		10^{-13}
10^{20}		10^{-12}
10^{19}	X-rays	10^{-11}
10^{18}		10^{-10}
10^{17}		10^{-9}
10^{16}		10^{-8}
10^{15}		10^{-7}
10^{14}		10^{-6}
10^{13}		10^{-5}
10^{12}		10^{-4}
10^{11}		10^{-3}
10^{10}		10^{-2}
10^{9}		10^{-1}
10^{8}		1
10^{7}		10
10^{6}		10^{2}
10^{5}		10^{3}
		10^{4}

Complete the diagram by adding the following:

(a)   *gamma* radiation, which has shorter wavelengths than X-rays;

(b)   *radio* waves which have wavelengths longer than 0.1m;

(c)   the *visible* spectrum which has wavelengths from 400 nm (violet) to 700 nm (red);

(d)   *ultraviolet* radiation (i.e. radiation with a higher frequency than violet light);

(e)   *microwaves* which have a shorter wavelength than radio waves and *infrared* radiation which has a higher frequency than microwaves;

(f)   an *FM* radio programme on 92MHz. (Show this with an arrow →)

(Total 7 marks)

Q4.   A student used an electric heater to heat a metal block. The student measured the energy input to the heater with a joulemeter.
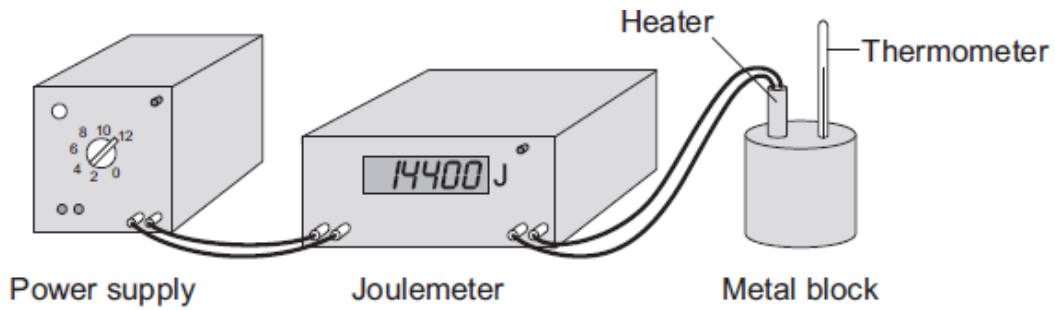
Before starting the experiment, the student reset the joulemeter to zero. The student switched the power supply on for exactly 10 minutes. During this time, the reading on the joulemeter increased to 14 400.

(a)   (i)   Calculate the energy transferred each second from the power supply to the heater.

Show clearly how you work out your answer.

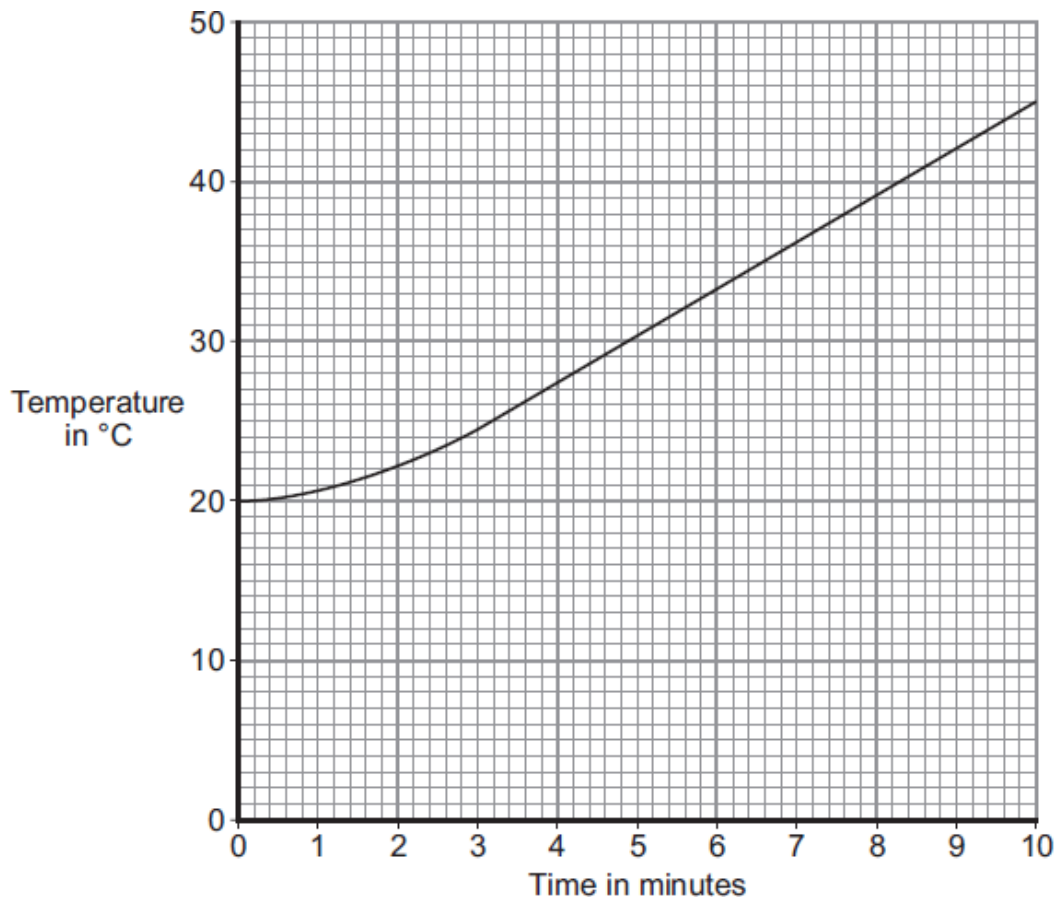.. ....

....

Energy transferred each second = ... J/s

(2)

(ii)   What is the power of the heater?

....

(1)

(b)   The student measured the temperature of the metal block every minute. The data obtained by the student is displayed in the graph.

(i)   What range of temperatures did the student measure?

From .... °C to .... °C

(1)

(ii) Before starting the experiment, the student had calculated that the temperature of the block would go up by 36 °C.

The student's data shows a smaller increase.

Which **one** of the following statements gives the most likely reason for this? Put a tick (✔) in the

box next to your answer.

The student does not read the thermometer accurately.

The block transfers energy to the surroundings.

The power supply is not connected correctly to the joulemeter.

(1)

(Total 5 marks)

END OF EXAM