AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
SCIENCE A 1

H

Higher Tier Unit 5

Tuesday 17 May 2016 Afternoon Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a ruler
- a calculator
- the Chemistry Data Sheet and Physics Equations Sheet booklet (enclosed).

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 4(b) 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.

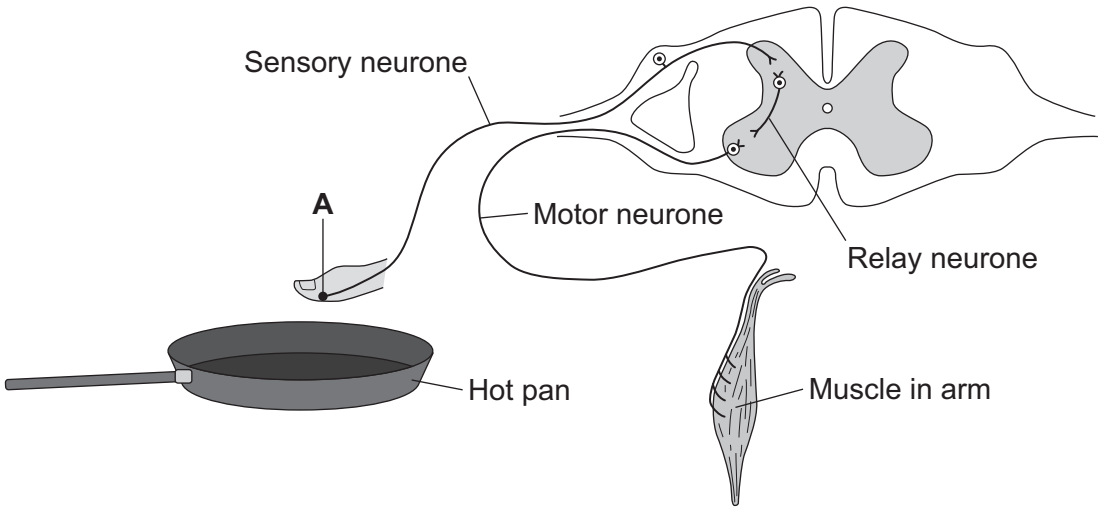
Advice
- In all calculations, show clearly how you work out your answer.

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

Biology Questions

1 **Figure 1** shows the structures involved in a reflex action.

Figure 1



(Not to scale)

1 (a) Structure **A** in **Figure 1** detects the stimulus.

Name structure **A**.

[1 mark]

_____

1 (b) (i) The impulse reaches the muscle. How does the muscle respond?

[1 mark]

_____

1 (b) (ii) Some reflex pathways end with a gland.

When the impulse reaches the gland, how does the gland respond?

[1 mark]

_____

_____

1 (b) (iii) What is the scientific name of a muscle or a gland in a reflex pathway?

[1 mark]

_____

1 (c) Why are reflex actions important to the body?

[1 mark]

_____

_____

5

Turn over for the next question

2 Body mass index (BMI) is a measure of whether a person has a healthy mass for their height.

BMI is calculated using the equation:

$$\text{BMI} = \frac{\text{body mass in kg}}{(\text{height in m})^2}$$

Table 1 shows how the BMI value is used to describe a person.

Table 1

BMI	Description
Less than 18.5	Underweight
18.5 – 24.9	Healthy weight
25 – 29.9	Overweight
30 – 39.9	Obese
40 and above	Severely obese

2 (a) A woman is 1.62 m tall and has a mass of 64 kg.

Which description in **Table 1** is correct for this woman?

You should include a calculation in your answer.

[2 marks]

Description of woman = _____

2 (b) A person's body mass can be affected by their metabolic rate.

2 (b) (i) What does metabolic rate mean?

[1 mark]

Tick (✓) **one** box.

A person's heart rate ☐

A person's breathing rate ☐

The rate of all the chemical reactions in a person's body ☐

The rate of doing work ☐

2 (b) (ii) Give **one** factor that can affect the metabolic rate.

[1 mark]

_____

_____

4

Turn over for the next question

3 Some microorganisms can cause disease.

3 (a) What name is given to microorganisms that cause disease?

[1 mark]

_____

3 (b) Describe **three** ways white blood cells defend the body against microorganisms.

[3 marks]

_____

_____

_____

_____

_____

_____

3 (c) After someone has had chicken pox, they usually develop immunity to the chicken pox virus.

Describe how the white blood cells provide immunity against the chicken pox virus in the future.

[2 marks]

_____

_____

_____

_____

6

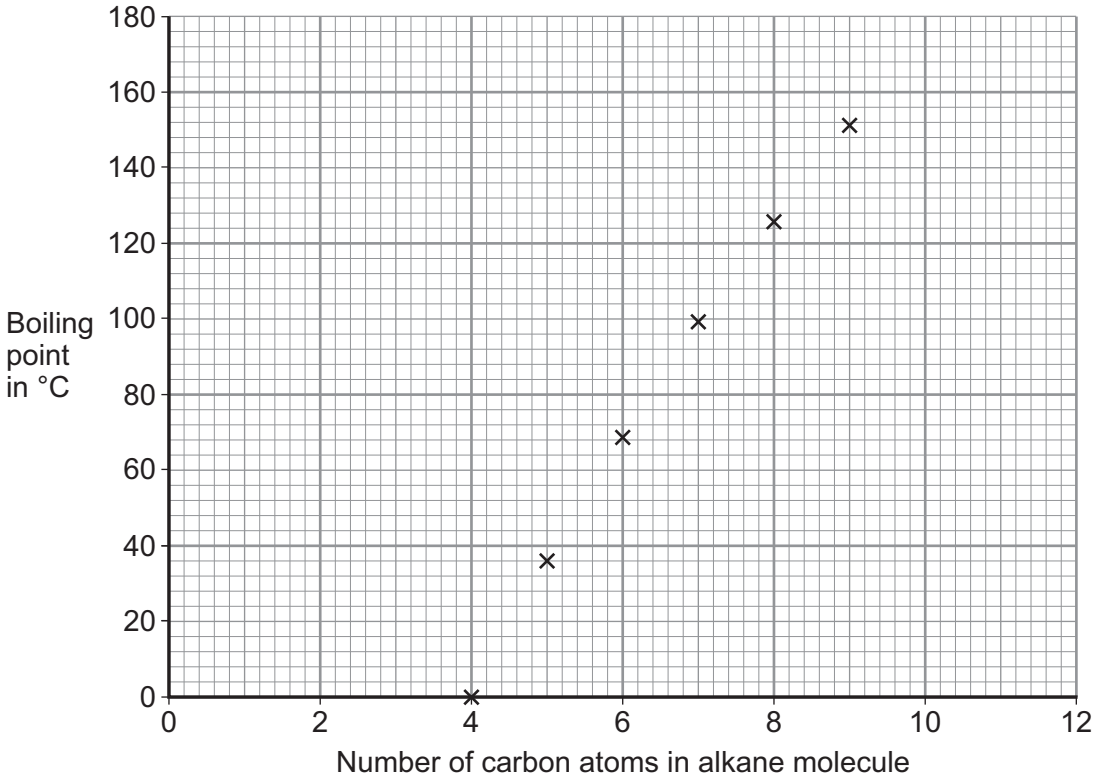
Chemistry Questions

4 This question is about fuels.

4 (a) Many fuels contain alkanes.

Figure 2 shows the boiling points of alkanes plotted against the number of carbon atoms in their molecules.

Figure 2



4 (a) (i) Use **Figure 2** to predict the boiling point of an alkane with 10 carbon atoms.

[1 mark]

_____

4 (a) (ii) The general formula for an alkane is C_nH_{2n+2}

What is the molecular formula of the alkane with 10 carbon atoms?

[1 mark]

Draw a ring around the correct answer.

$C_{10}H_{12}$ **$C_{10}H_{20}$** **$C_{10}H_{22}$** **$C_{10}H_{24}$**

Question 4 continues on the next page

4 (a) (iii) Alkanes are hydrocarbons.

What is meant by a hydrocarbon?

[1 mark]

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

Biodiesel is produced from plants, for example, rapeseed.
Large areas of farmland are being converted into fields growing rapeseed.

Petroleum diesel is produced from crude oil.

Table 2 shows the relative amounts of pollutants released when biodiesel and petroleum diesel are used as fuels.

Table 2

Fuel type	Relative amounts of pollutants released		
	Carbon dioxide	Oxides of nitrogen	Particulates
Biodiesel	0.28	1.13	0.44
Petroleum diesel	1.00	1.00	1.00

Use **Table 2** and your own knowledge to give advantages and disadvantages of using biodiesel instead of petroleum diesel as a fuel.

[6 marks]

Extra space

9

Turn over for the next question

5 This question is about atomic structure.

5 (a) **Figure 3** shows the shells (energy levels) of a beryllium atom.

A beryllium atom has an atomic number of 4 and a mass number of 9.

Use this information to complete **Figure 3** to show the atomic structure of beryllium.

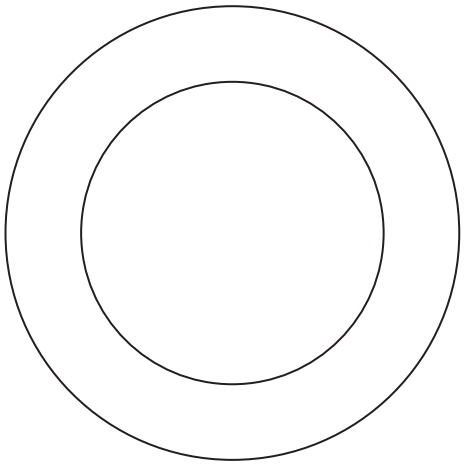
[4 marks]

Figure 3

Represent a proton as ○

Represent an electron as ×

Represent a neutron as ●



5 (b) What is the relative charge on the nucleus of the beryllium atom?

[1 mark]

_____

_____

5

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Physics Questions

6 **Figure 4** shows a tablet. The tablet is powered by a rechargeable battery.

Figure 4

6 (a) (i) Complete the sentences to describe the energy transfers in the tablet.

[2 marks]

The battery transfers chemical energy into _____ energy.

The tablet transfers this energy into useful _____ energy.

6 (a) (ii) Some of the energy is not usefully transferred.

What happens to the energy which is not usefully transferred and what effect does this have?

[2 marks]

_____

_____

_____

_____

6 (b) The battery life is the time that a battery can be used to power a device before the battery is flat.

6 (b) (i) The tablet uses a power of 3 W and has a battery life of 8 hours.

Calculate the energy in joules stored in the battery when it is fully charged.

One hour = 3600 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy stored = _____ joules

6 (b) (ii) A laptop battery stores the same amount of energy as the tablet battery.

The laptop has a power of 50 W.

Explain how the battery life of the laptop will differ from the battery life of the tablet.

[2 marks]

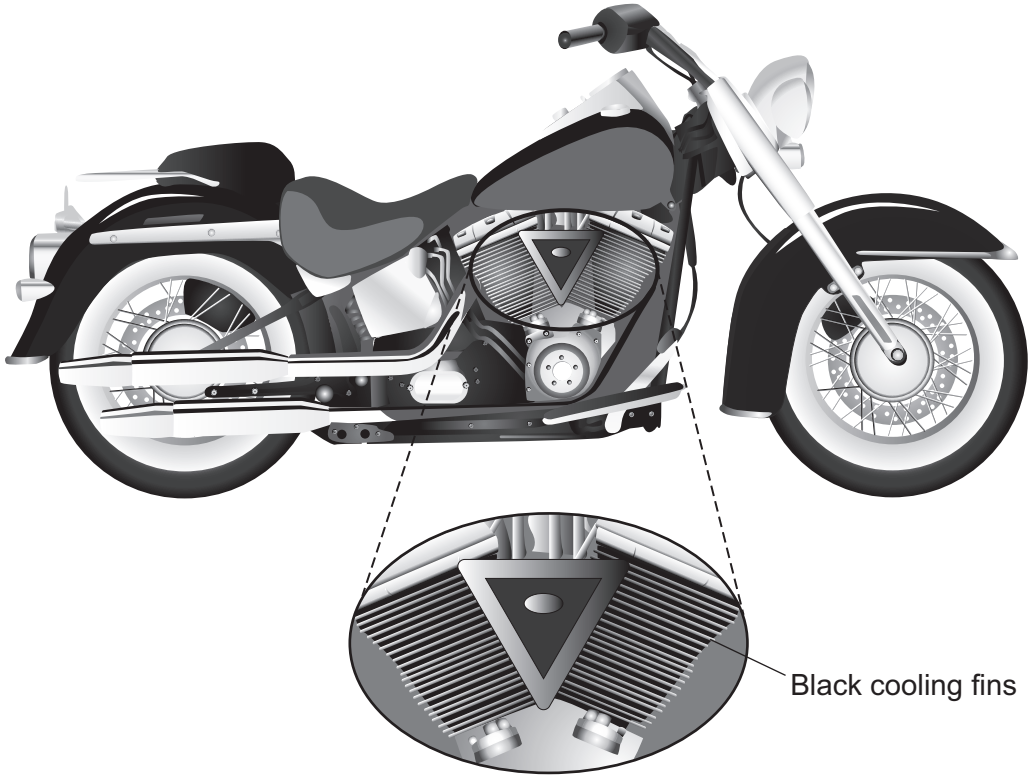
8

Turn over for the next question

7 **Figure 5** shows cooling fins on a motorbike.

Cooling fins help to stop the engine becoming too hot.

Figure 5



7 (a) Explain how **two** features of the cooling fins stop the engine becoming too hot.

[4 marks]

7 (b) What happens to the rate of energy transfer as the engine gets hotter?

Give a reason for your answer.

[2 marks]

_____

_____

_____

_____

_____

6

Turn over for the next question

Biology Questions

8 Many processes in the body are coordinated by hormones.

The hormones FSH, oestrogen and LH are all involved in the menstrual cycle of a woman.

Describe the role of each of these hormones in the menstrual cycle.

[3 marks]

FSH _____

_____

_____

Oestrogen _____

_____

_____

LH _____

_____

_____

3

Turn over for the next question

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9 There are several types of drug that an athlete might take to improve their performance.

All performance enhancing drugs are banned by sporting regulations.

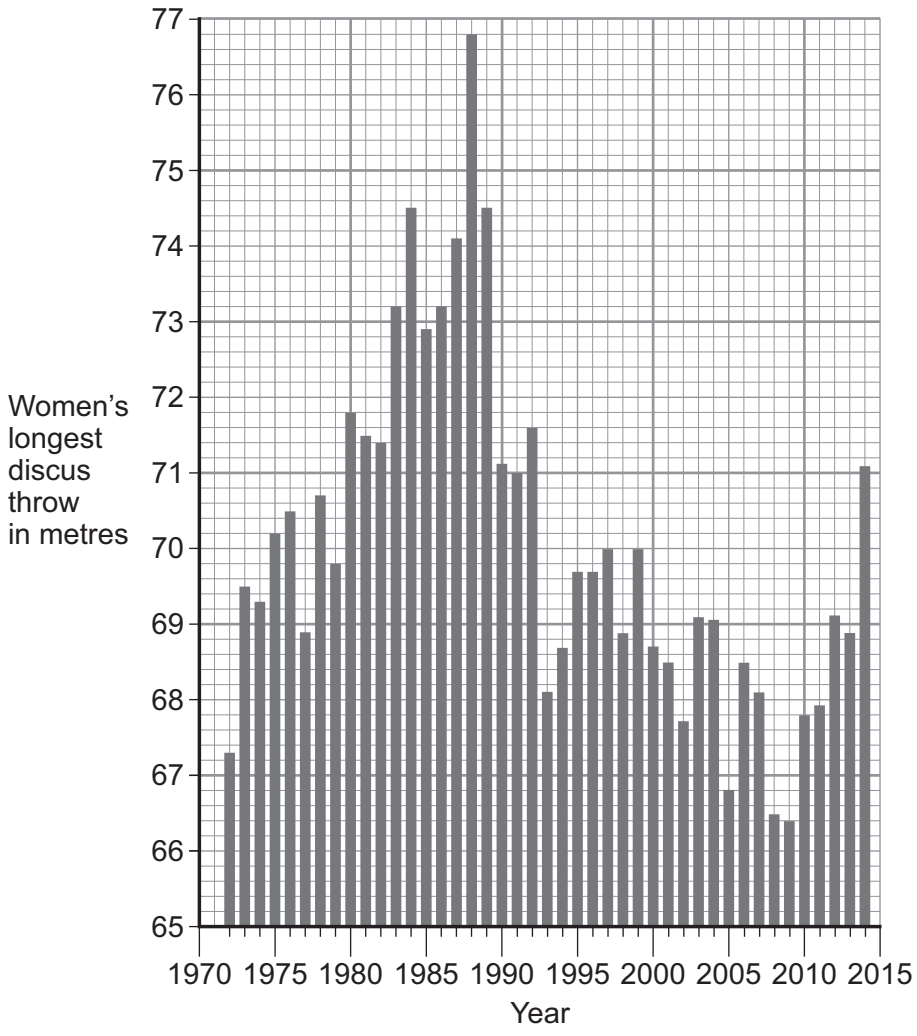
9 (a) Explain how anabolic steroids can improve an athlete's performance.

[2 marks]

9 (b) **Figure 6** shows the longest distance thrown each year in women's discus, from 1972 to 2014.

Before 1988 athletes were only tested for drugs during competitions. In 1988 athletes started to be tested for drugs at any time.

Figure 6



Describe **three** trends shown in **Figure 6**.

Suggest a reason for each trend.

[6 marks]

8

Turn over for the next question

10 Smoking is a major cause of lung cancer. Many smokers would like to stop, but most find it very difficult because they are addicted to nicotine.

Electronic cigarettes (E-cigarettes) might help some people to stop smoking.

Figure 7 shows someone using an E-cigarette.

Figure 7

E-cigarettes do not burn tobacco. They contain a cartridge that releases a vapour. The vapour is breathed in. The cartridges can contain different concentrations of nicotine. The vapour can also be flavoured.

The contents of the cartridges vary. Some cartridges have been found to contain poisonous chemicals. When a smoker breathes out, some of the vapour is released into the air.

Some people are worried that E-cigarettes might encourage young people to start smoking or using other drugs.

Use the information given and your own knowledge to evaluate the use of E-cigarettes.

[4 marks]

4

Chemistry Questions

11 This question is about metals.

Figure 8 shows how some metals are used in electricity transmission.

Figure 8

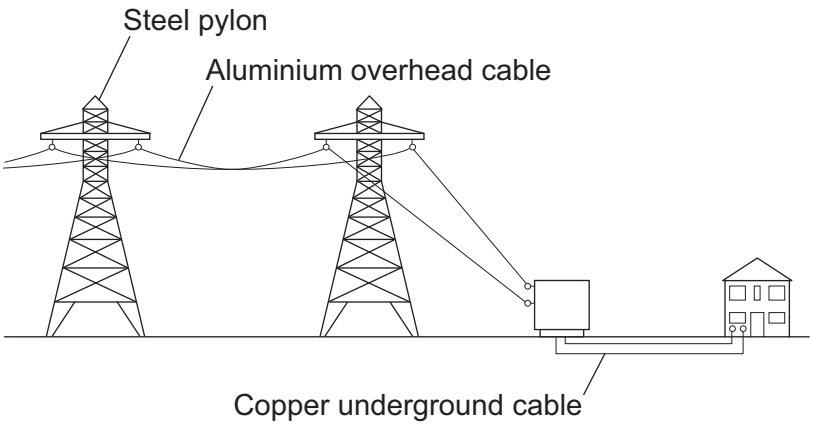


Table 3 gives information about the metals used in electricity transmission.

Table 3

Metal	Main ore	Percentage (%) of metal in Earth's crust	Relative cost of 1 kg of metal	Percentage (%) of metal in ore	Density of metal in g/cm^3	Relative conductivity
Aluminium	Al_2O_3	8.2	4.2	25	2.7	0.64
Copper	$CuFeS_2$	0.58	13.4	2.0	8.92	1.0

11 (a) Explain why aluminium and copper are used for the two different types of cable shown in **Figure 8**.

[2 marks]

Question 11 continues on the next page

11 (b) Steel for the pylons is produced from iron.

The extraction process for iron produces cast iron.

Give **two** reasons why pylons are made from steel and not from cast iron.

[2 marks]

_____

_____

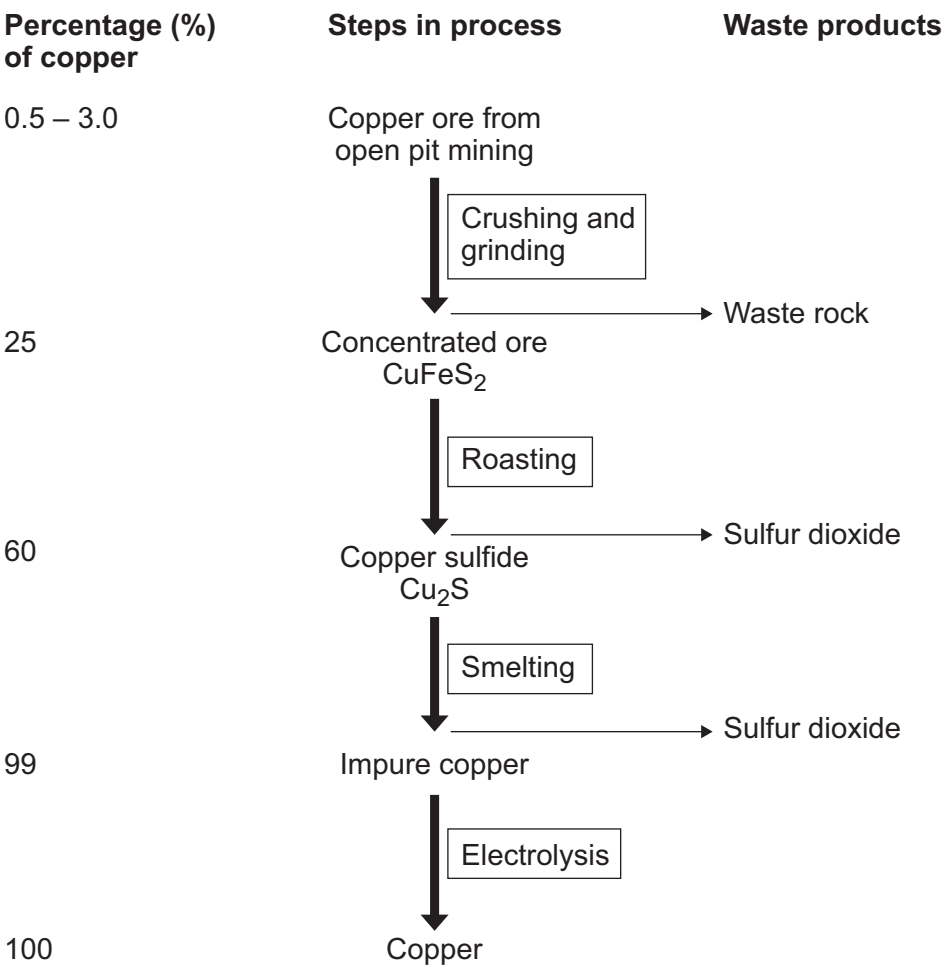
_____

_____

11 (c) The main copper ore is chalcopyrite ($CuFeS_2$)

Figure 9 shows the steps in one process to extract copper from copper ore.

Figure 9



Complete and balance the equation for the reaction taking place when copper sulfide is smelted.

[2 marks]

_____ + O_2 ⟶ _____Cu + _____

11 (d) Large amounts of copper and aluminium are recycled.

Describe the economic **and** environmental benefits of recycling copper and aluminium instead of extracting the metals from their ores.

Use information from **Figure 9** and **Table 3** to help you answer this question.

Table 3 has been repeated below.

[4 marks]

Table 3

Metal	**Main ore**	**Percentage (%) of metal in Earth's crust**	**Relative cost of 1 kg of metal**	**Percentage (%) of metal in ore**	**Density of metal in g/cm^3**	**Relative conductivity**
Aluminium	Al_2O_3	8.2	4.2	25	2.7	0.64
Copper	$CuFeS_2$	0.58	13.4	2.0	8.92	1.0

10

12 This question is about building materials.

12 (a) Limestone is mainly calcium carbonate.

12 (a) (i) What type of reaction takes place when calcium carbonate is heated?

[1 mark]

12 (a) (ii) What are the **two** products of this reaction?

[1 mark]

12 (b) Lime mortar is produced by adding calcium hydroxide to sand and water.

The mortar becomes hard when calcium hydroxide reacts with carbon dioxide to produce water and calcium carbonate.

12 (b) (i) Over time, lime mortar gradually erodes away as a result of atmospheric pollution.

Explain why.

[3 marks]

12 (b) (ii) Give **one** other use for calcium hydroxide.

[1 mark]

6

Turn over for the next question

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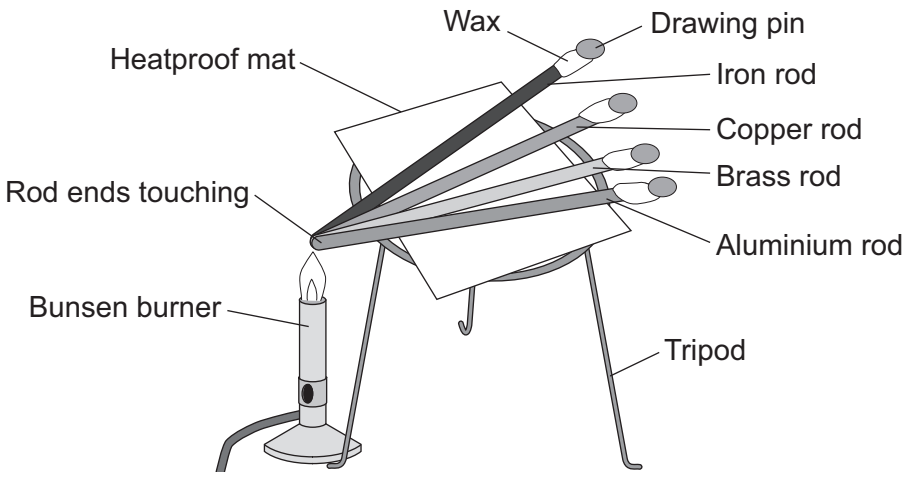
Physics Questions

13 (a) A student investigated conduction in metals. She set up the apparatus shown in **Figure 10** using rods made of four different metals.

Figure 10



The student used the Bunsen burner to heat the rods at one end.

She recorded the time taken for the drawing pin to drop off each rod.

Suggest **two** control variables for this investigation.

[2 marks]

13 (b) Explain why metals are much better conductors than other solids.

[4 marks]

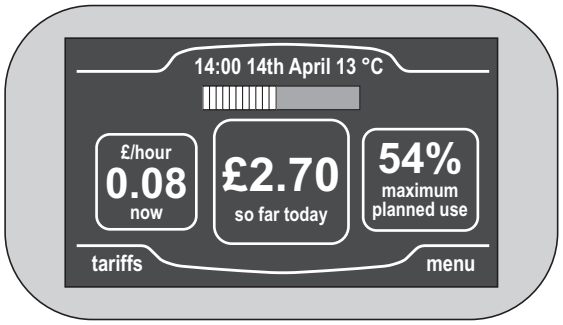
6

Turn over for the next question

14 Some energy companies give smart energy monitors to householders.
Householders can see the cost of the energy they are using at any time.
Householders can set the monitor every day with the maximum energy they want to use.

Figure 11 shows a smart energy monitor.

Figure 11



14 (a) (i) One kWh of electrical energy costs 20p.

Use information from **Figure 11** to calculate the energy used in kWh.

[1 mark]

Energy = _____ kWh

14 (a) (ii) At 6 pm, a householder had used 18 kWh, which was 72% of the maximum planned energy use.

Calculate the maximum planned energy use.

[2 marks]

Maximum planned energy use = _____ kWh

14 (b) Suggest **two** possible advantages to the householder of having a smart energy monitor.

[2 marks]

14 (c) The householder decides to install insulation to reduce energy costs.

Table 4 contains data about three different insulators.

Table 4

Insulator	U-value in W/m^2 °C	Total cost in £	Savings per year in £
Double glazing	2.8	5000	100
Loft insulation	0.16	300	150
Draught excluders	3.0	120	50

Compare the different insulators in terms of:
- their effectiveness as insulators
- their cost-effectiveness over a period of ten years.

Your answer should include appropriate calculations.

[5 marks]

10

END OF QUESTIONS

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