AQA

GCSE
SCIENCE A 1

H

Higher Tier   Unit 5

Tuesday 16 May 2017   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 1(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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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10	
11	
12	
TOTAL	

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

Biology Questions

1 In 2015 scientists announced that they might have discovered a new type of antibiotic produced by soil bacteria.

This would be the first new antibiotic to be discovered in over 25 years.

1 (a) Suggest why the development of a new type of antibiotic is very important.

[2 marks]

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

A new drug must be tested before it can be sold.

Figure 1 shows a timeline for the stages of testing one new drug.

Figure 1

Time in years

```
0    1    2    3    4    5    6    7    8    9    10
┌──────────────┬───────────┬───────────┬──────────────┐
│  Laboratory  │  Phase 1  │  Phase 2  │   Phase 3    │
│   testing    │           │           │              │
└──────────────┴───────────┴───────────┴──────────────┘
               └──────────── Clinical testing ────────┘
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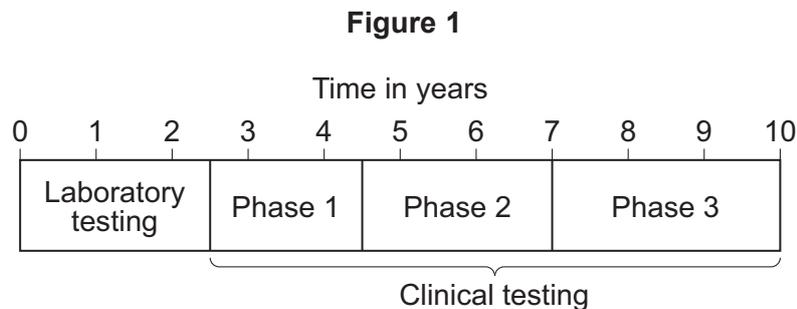
Describe what happens at each stage of drug testing.

Give the reasons for each stage.

You should include how the tests are designed to obtain valid results.

[6 marks]

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Extra space _____

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1 (c)   Independent scientists do not work for the companies making or testing the drug.

Suggest why the results of the tests have to be reviewed by independent scientists.

[1 mark]

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9

Turn over ▶

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2   Plant growth is controlled by hormones.

Figure 2 shows a shoot growing with light shining on it from one side.

Figure 2
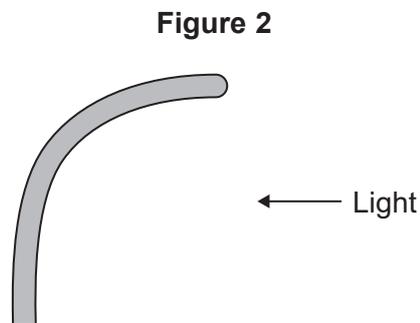
← Light

2 (a) (i)   What name is given to the response of plants to light?

[1 mark]

_____

2 (a) (ii)   Explain why the shoot grew towards the light.

[2 marks]

_____

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_____

Question 2 continues on the next page

2 (b) A student investigated plant growth.

The student set up four shoots.

- Shoot **A** was untreated.
- Shoot **B** had its tip removed.
- Shoot **C** had its tip covered with black paper.
- Shoot **D** had its sides covered with black paper.

The shoots were left for two days with light shining on them from one side only.

Figure 3 shows how each shoot grew.

Figure 3

Start	After two days
Light ⟶ **A** Control	Grows towards the light
Light ⟶ **B** Tip removed	No growth
Light ⟶ **C** Tip covered with black paper	Grows tall and straight
Light ⟶ **D** Sides covered with black paper	Grows towards the light
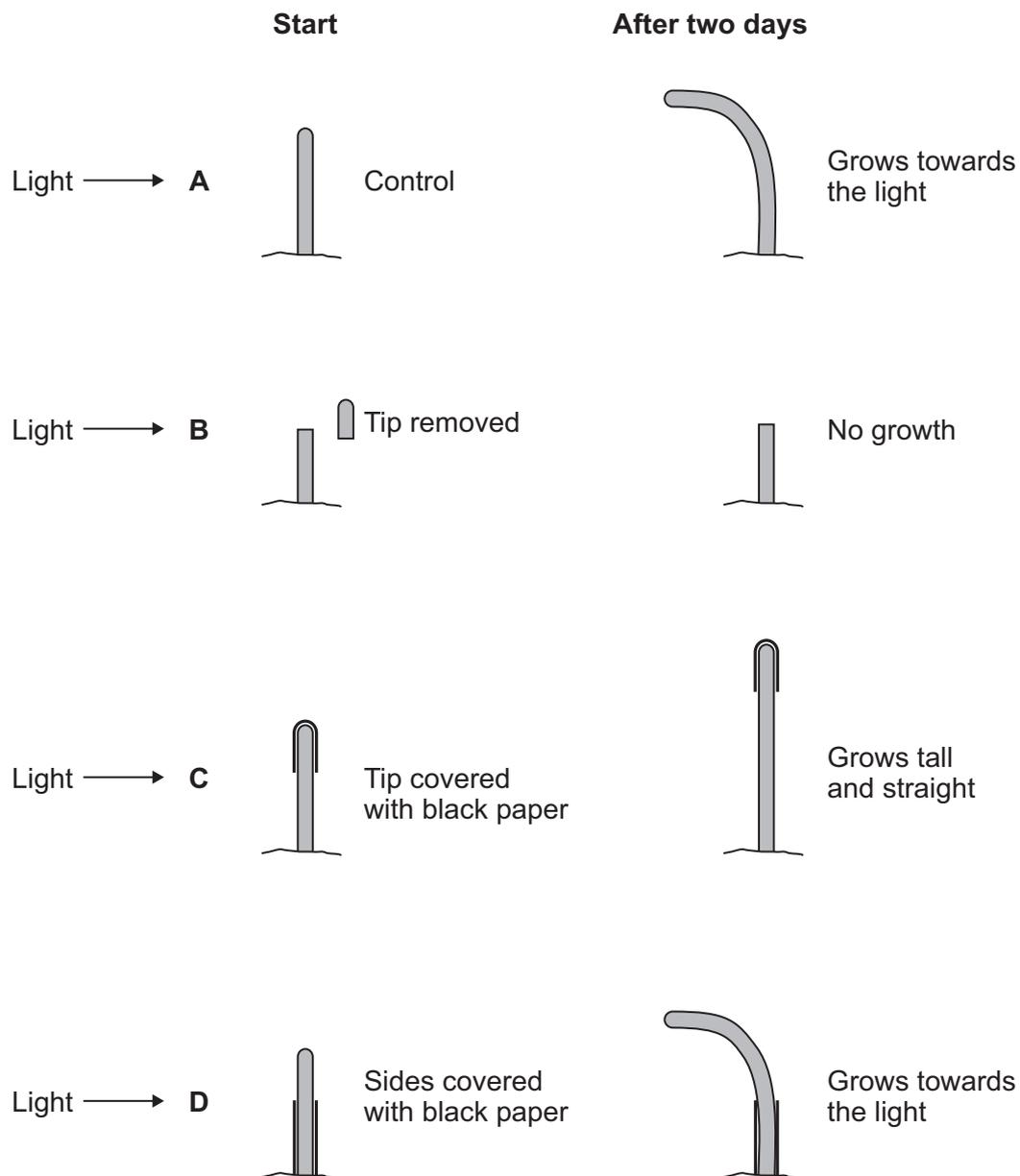
2 (b) (i) The length of time the shoots were left in the light was controlled.

Suggest **one** other variable that should be controlled in this investigation.

[1 mark]

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2 (b) (ii) Look at **Figure 3**.

Give **one** conclusion that can be made from Shoot **B**.

[2 marks]

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Give **one** conclusion that can be made from Shoots **C** and **D**.

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Turn over for the next question

Chemistry Questions

3   **Figure 4** shows the electronic arrangement of an atom.

Figure 4
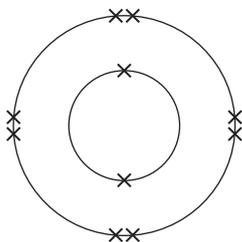
3 (a)   What is the name of the element represented in **Figure 4**?

Use the Chemistry Data Sheet to help you answer this question.

[1 mark]

_____

3 (b)   Explain what the electronic arrangement tells you about the reactivity of this element.

[2 marks]

_____

_____

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_____

4 Fuels have many different uses.

4 (a) (i) Some power stations use coal as the fuel.

The elements in coal include carbon, hydrogen, nitrogen, oxygen and sulfur.

When coal burns, several pollutant gases are produced.

Name **two** of the pollutant gases produced.

For each pollutant gas, describe the effect the gas has on the environment.

[4 marks]

Gas _____

Effect _____

_____

Gas _____

Effect _____

_____

4 (a) (ii) Some power stations use biofuels.

Suggest **one** advantage of using a biofuel rather than coal.

[1 mark]

_____

_____

Question 4 continues on the next page

Turn over ▶

4 (b) Petrol is often used as the fuel in cars.

Which element is removed from petrol, before petrol is burnt in cars?

[1 mark]

Tick (✓) **one** box.

carbon ☐

hydrogen ☐

nitrogen ☐

oxygen ☐

sulfur ☐

6

5 This question is about copper.

5 (a) A building is covered in 3000 kg of copper metal.

1950 kg of the copper used is recycled copper.

5 (a) (i) What percentage of the copper used to cover the building is recycled copper?

[1 mark]

_____

_____

Percentage of recycled copper = _____ %

5 (a) (ii) Using recycled copper conserves copper ores.

Give **two** other advantages of using recycled copper rather than extracting copper from its ore.

[2 marks]

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5 (b) Phytomining is used to extract copper compounds from low grade ores.

Describe the process of phytomining.

[3 marks]

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6

Physics Questions

6   **Figure 5** shows Sankey diagrams for a fossil fuel power station and for a combined heat and power (CHP) station. A CHP station uses waste energy from the electricity it generates to provide heating and hot water for nearby buildings.

Figure 5

Fossil fuel power station

CHP station
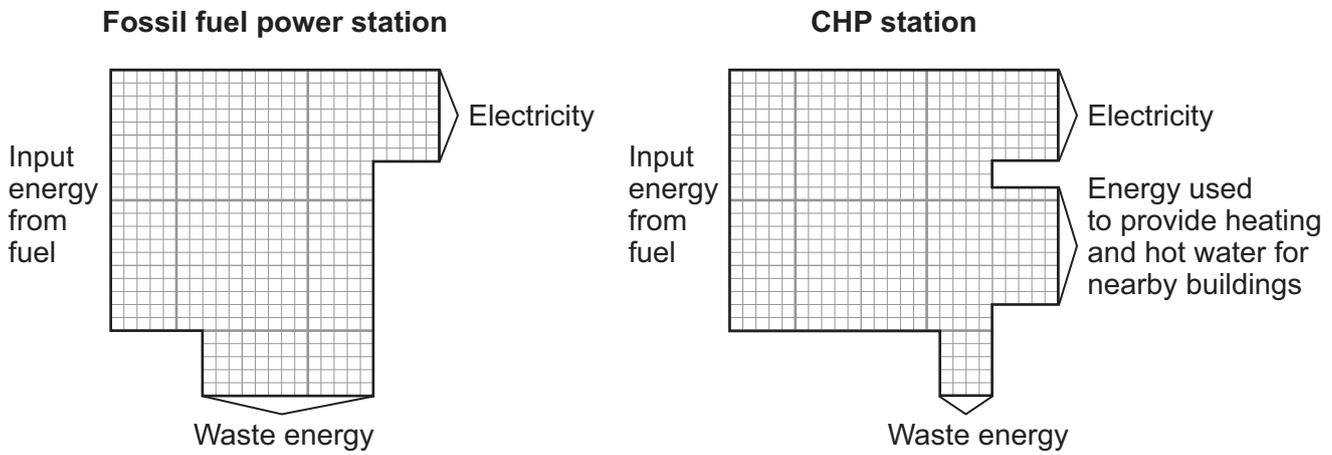
6 (a) (i)   Determine the efficiency of the fossil fuel power station.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Efficiency = _____

6 (a) (ii)   What happens to the waste energy from a fossil fuel power station?

[1 mark]

_____

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6 (a) (iii)   Which is more efficient, a fossil fuel power station or a CHP station?

Give a reason for your answer.

[1 mark]

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6 (b) A heat exchanger in a CHP station transfers energy from hot gases to cold water.

Figure 6 shows the heat exchanger.

Figure 6
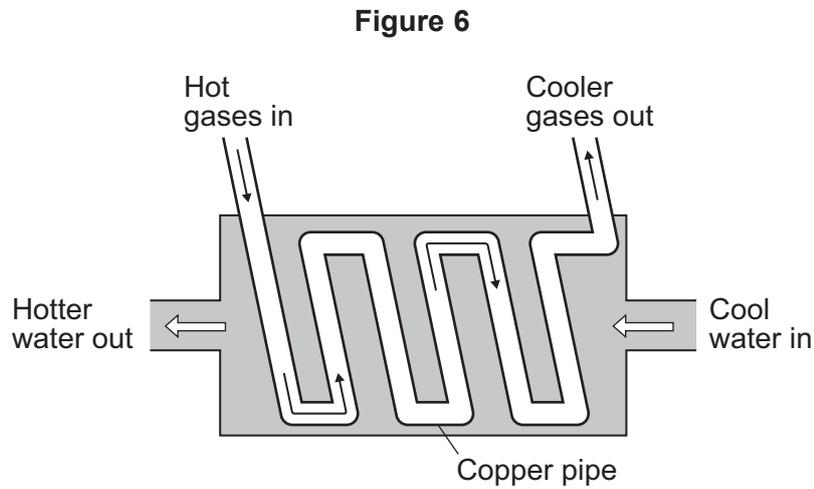
6 (b) (i) Why is the pipe made from copper rather than plastic?

[1 mark]

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6 (b) (ii) Suggest **two** improvements that could be made to this heat exchanger to increase the rate of energy transfer.

For each improvement give **one** reason why this would increase the rate of energy transfer.

[4 marks]

Improvement 1 _____

_____

Reason _____

_____

Improvement 2 _____

_____

Reason _____

_____

9

Turn over ▶

7 **Table 1** gives some information about two oil-filled heaters, **Heater A** and **Heater B**.

Table 1

	Heater A	**Heater B**
Power in watts	2500	1500
Automatic timer	Yes	No
Number of temperature settings	1	3
Can be wall mounted	Yes	No
Protection against overheating	Yes	No
Has a cool air fan	No	Yes

7 (a) A person has a small office in his garden. He needs to heat his office.

Heater A would be a better choice than **Heater B**.

Use the information in **Table 1** to give **four** reasons why.

[4 marks]

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7 (b)   **Heater A** is switched on for 4 hours.

Calculate the energy, in joules, transferred by the heater during this time.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

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Energy transferred = _____ joules

Turn over for the next question

6

Turn over ▶

Biology Questions

8   Drugs such as alcohol can affect reaction time.

The concentration of alcohol is written on all alcoholic drinks as percentage alcohol by volume (% ABV).

The number of units of alcohol in a drink can be calculated using the equation:

$$\text{Number of units of alcohol} = \frac{\text{volume of drink in cm}^3 \times \text{\% ABV}}{1000}$$

8 (a)   The % ABV of one type of alcoholic drink is 38.

Use the equation to calculate the volume of this alcoholic drink that would contain 0.5 units of alcohol.

[1 mark]

Volume of alcoholic drink = _____ cm^3

8 (b)   Scientists investigated the effect of alcohol on the reaction time of university students.

Each student:

• drank either 0.5, 1, 2 or 4 units of alcohol

• sat down for 30 minutes

• then tested their reaction time five times using a computer programme.

8 (b) (i)   Suggest why the students had to sit for 30 minutes before their reaction time was tested.

[1 mark]

8 (b) (ii) For each student these tests were done a number of times and a mean calculated.

Suggest **two** other improvements to the investigation.

Describe how each improvement would increase the validity of the results.

[4 marks]

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Question 8 continues on the next page

Turn over ▶

8 (c)   **Figure 7** shows the method used to measure the students' reaction times.

Figure 7

When a shape appeared on the screen, the student clicked the mouse.

The computer calculated the mean reaction time for the five tests in milliseconds (ms).

8 (c) (i)   Describe the nerve pathway from the receptor in the eye that leads to the voluntary response of the student clicking the mouse.

[4 marks]

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8 (c) (ii)   Suggest how alcohol increases reaction time.

[1 mark]

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9 People can be vaccinated to make them immune to a disease.

Explain how a vaccination provides immunity against a disease.

[4 marks]

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4

Turn over for the next question

Turn over ▶

Chemistry Questions

10   Magnesium is used in the production of titanium.

10 (a) (i)   Magnesium ore is mainly magnesium carbonate.

What is the chemical formula of magnesium carbonate?

Use the Chemistry Data Sheet to help you answer this question.

[1 mark]

_____

10 (a) (ii)   The first step in the process to extract magnesium is to heat magnesium carbonate.

Name the products formed and the type of reaction that takes place when magnesium carbonate is heated.

[2 marks]

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10 (b) Titanium ore is mainly titanium oxide.

Some of the reactions in the extraction of titanium from titanium ore are:

Reaction 1 $TiO_2 + 2Cl_2 + C \longrightarrow TiCl_4 + CO_2$

Reaction 2 $TiCl_4 + 2Mg \longrightarrow Ti + 2MgCl_2$

Electrolysis $MgCl_2 \longrightarrow Mg + Cl_2$
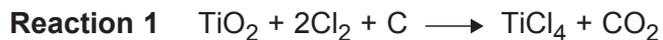
Look at the products of the reactions.

Describe **three** ways that this process makes efficient use of materials.

[3 marks]

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10 (c) Describe what happens to the magnesium ions when magnesium chloride is electrolysed.

[2 marks]

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Turn over for the next question

Turn over ▶

11 Crude oil is a mixture of hydrocarbons.

The hydrocarbons can be separated into fractions using fractional distillation.

11 (a) **Table 2** gives information about three of the fractions.

Table 2

Fraction	Example of alkane in the fraction	Molecular Formula	Boiling Point in °C
Petrol	Octane	C_8H_{18}	126
Kerosene	Dodecane	$C_{12}H_{26}$	216
Diesel	Eicosane		344

11 (a) (i) Eicosane has 20 carbon atoms.

What is the molecular formula of eicosane?

[1 mark]

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11 (a) (ii) Describe how the kerosene fraction is obtained by fractional distillation of crude oil.

[3 marks]

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11 (b) **Table 3** gives information about some properties of the fractions.

Table 3

Fraction	Energy released in MJ/dm³	Flash point in °C	Relative viscosity
Petrol	32.4	−45	0.645
Kerosene	37.4	38	2.71
Diesel	35.8	54	30

The flash point is the lowest temperature at which a fuel vapour catches fire.

Use the information in **Table 3** to compare the fractions in terms of their effectiveness as fuels.

For each fraction, you should consider all three properties.

[3 marks]

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7

Turn over for the next question

Turn over ▶

Physics Questions

12   Solids, liquids and gases consist of particles.

12 (a) (i)   Complete the sentence.

[1 mark]

The difference between solids, liquids and gases can be explained by

the _____ theory.

12 (a) (ii)   Describe the differences between solids and liquids in terms of their particles.

[3 marks]

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12 (b) **Figure 8** shows a glass of water with ice floating in it.

Figure 8

12 (b) (i) Explain how a convection current is set up in the water.

[4 marks]

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Question 12 continues on the next page

Turn over ▶

12 (b) (ii)   The glass contains 50 g of ice.

1890 J of energy are transferred to the ice to increase its temperature from –18 °C to 0 °C.

Calculate the specific heat capacity of ice.

Use the correct equation from the Physics Equations Sheet.

Tick (✓) the correct unit.

[4 marks]

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Specific heat capacity of ice = _____

Unit	Tick (✓)
J kg/°C	
J/kg °C	
J kg °C	

Do not write outside the box

12 (c) Water has a much greater specific heat capacity than ice.

Explain the effect this has on the rate at which water warms compared to ice.

[3 marks]

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15

END OF QUESTIONS

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