



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

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CENTRE  
NUMBER

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**COMBINED SCIENCE**

**0653/22**

Paper 2 (Core)

**May/June 2013**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electrical calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **20** printed pages.



- 1 (a) Fig. 1.1 shows some of the elements in Group 1 of the Periodic Table.

|    |
|----|
| Li |
| Na |
| K  |

Fig. 1.1

- (i) Name the gas which is given off when the metals in Fig. 1.1 react with water.

..... [1]

- (ii) Describe how the rate of reaction between water and the metals in Fig. 1.1 changes as you go down the group.

.....  
 ..... [1]

- (b) Fig. 1.2 shows some of the elements in Group 7 of the Periodic Table.

|    |
|----|
| Cl |
| Br |
| I  |

Fig. 1.2

- (i) Describe how the melting point of the elements in Fig. 1.2 changes as you go down the group.

.....  
 ..... [1]

- (ii) A solution of potassium bromide is colourless and a solution of chlorine is almost colourless.

Describe and explain briefly what would be seen when these solutions are mixed.

what would be seen .....

explanation .....

.....  
 ..... [3]

- (c) Phosphorus is a non-metallic, solid element.

One form of phosphorus is white, has the chemical formula  $P_4$  and has to be kept under water.

Fig. 1.3 shows a bottle containing phosphorus.

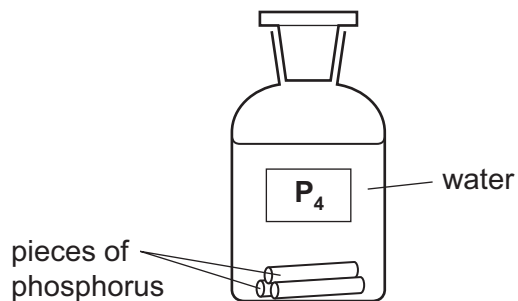


Fig. 1.3

- (i) Suggest why white phosphorus has to be stored under water.

.....

.....

..... [2]

- (ii) Explain the meaning of the chemical formula  $P_4$ .

.....

.....

..... [2]

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- 2 (a) Fig. 2.1 shows a child's toy. As the ball falls, the toy elephant moves across the table.

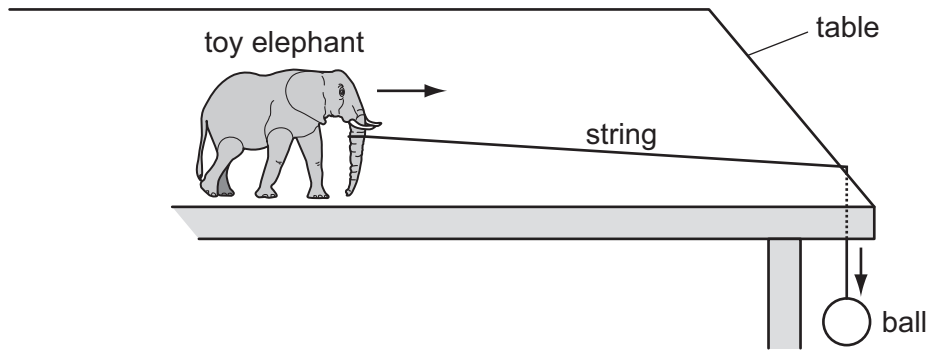


Fig. 2.1

- (i) Name the main force that opposes the motion of the toy elephant.

..... [1]

- (ii) State the unit used to measure forces.

..... [1]

- (iii) Choose words from the list below to complete the sentences. You may use each word once, more than once or not at all.

chemical      electrical      gravitational potential      kinetic  
light      sound      thermal

The useful energy transfer for the toy is ..... energy  
to ..... energy.

The energy wasted by the toy is ..... energy. [2]

- (iv) The toy elephant travels 1.2 metres in 3 seconds.

Calculate the average speed of the elephant.

State the formula that you use and show your working.

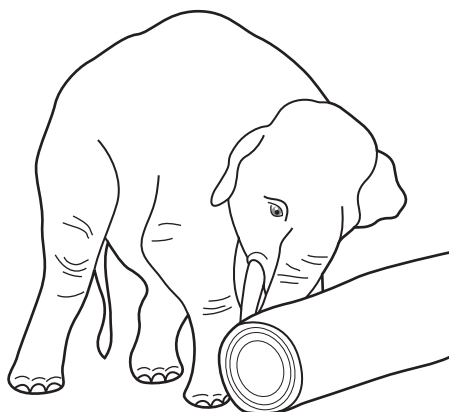
formula

working

..... m/s [2]

- (b) An elephant of mass 5000 kg exerts a constant force to push a tree trunk along at a steady speed of 1.5 m/s.

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State the **two** quantities that would need to be measured to calculate the work done by the elephant.

..... and ..... [2]

- (c) An elephant can communicate with other elephants using infrasound. This is a very low frequency vibration which it is usually impossible for a human to hear.

- (i) Suggest a possible frequency for this vibration and explain why you chose your answer.

frequency ..... Hz

explanation .....

..... [2]

- (ii) State the meaning of the term *frequency*.

.....

..... [1]

- 3 (a) Four sets of pea seeds were placed in Petri dishes containing either damp soil or damp filter paper. They were left in different conditions, shown in Table 3.1.

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**Table 3.1**

| set      | conditions        |      |       |
|----------|-------------------|------|-------|
| <b>A</b> | damp soil         | cold | dark  |
| <b>B</b> | damp filter paper | warm | light |
| <b>C</b> | damp filter paper | warm | dark  |
| <b>D</b> | damp soil         | cold | light |

Predict which sets of seeds will germinate.

Explain your answer.

prediction .....

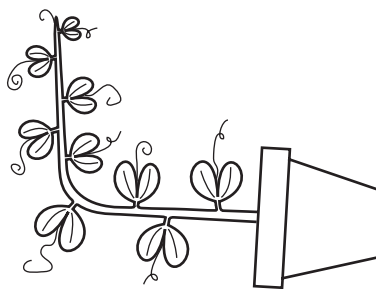
explanation .....

.....

..... [3]

- (b) A pea seed was planted in a pot. When the seed had grown into a young plant, the pot was placed on its side in a room where light was coming from all sides.

Fig. 3.1 shows the young pea plant three days after the pot had been placed on its side.



**Fig. 3.1**

- (i) Which **two** terms describe the response of the plant shown in Fig. 3.1?

Circle the correct answers.

**geotropism**

**photosynthesis**

**phototropism**

**sensitivity**

**transpiration**

[2]

- (ii) Suggest how this response will help the plant to reproduce sexually when it has grown to maturity.

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.....

.....

.....

..... [2]

4 Fig. 4.1 shows a microwave oven.

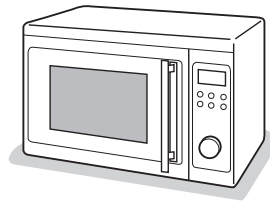


Fig. 4.1

(a) Microwaves cook food by transferring energy to the food.

(i) Choose words from the list to complete the sentences below. You may use each word once, more than once or not at all.

|           |            |            |
|-----------|------------|------------|
| chemical  | conduction | convection |
| potential | radiation  | thermal    |

Microwaves are absorbed by the outer layers of food.

The microwave energy is transferred to water and fat molecules in these layers, increasing the ..... energy of these layers.

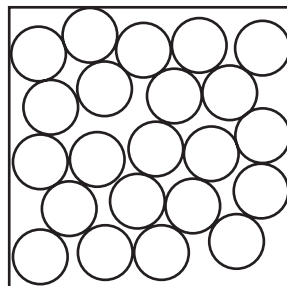
..... energy is mostly transferred to the centre of solid food by ..... [2]

(ii) State **one** use for microwaves other than cooking.

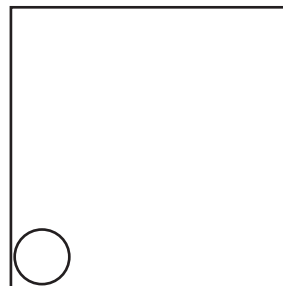
..... [1]

(b) Water can be heated in a microwave oven. The microwave oven is made of solids. The water is a liquid.

Complete Fig. 4.2 to show the arrangement of particles in a solid. The diagram for a liquid has been done for you.



liquid



solid

[2]

Fig. 4.2

- 5 (a) (i) Explain why hydrogen and carbon are described as elements, but hydrocarbons such as methane and ethane are described as compounds.

.....  
.....  
.....  
..... [2]

- (ii) Name the fossil fuel found in the Earth that is the main source of methane.

..... [1]

- (iii) Name **one** type of fossil fuel that is a solid. .... [1]

- (iv) Methane is used as a fuel because it reacts very quickly with oxygen, releasing heat.

Name the **two** compounds that are formed when methane undergoes complete combustion.

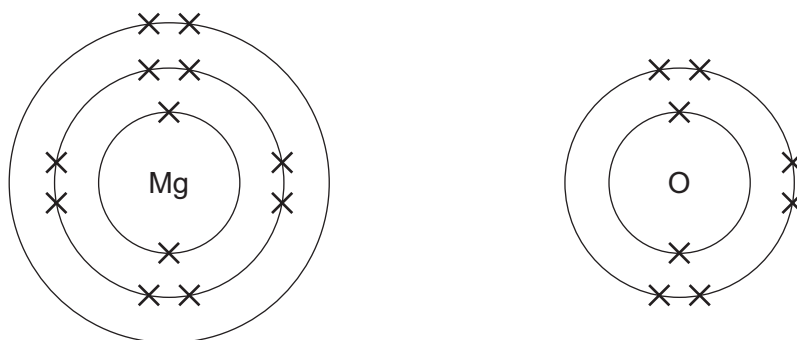
1 .....  
2 ..... [2]

- (b) Magnesium metal also reacts quickly with oxygen, releasing heat.

- (i) Name the compound which is formed when magnesium reacts with oxygen.

..... [1]

(ii) Fig. 5.1 shows diagrams of a magnesium atom and an oxygen atom.



**Fig. 5.1**

When magnesium reacts with oxygen, the atoms shown in Fig. 5.1 first change into electrically charged atoms known as ions.

Describe what happens when these atoms change into ions.

magnesium .....

.....

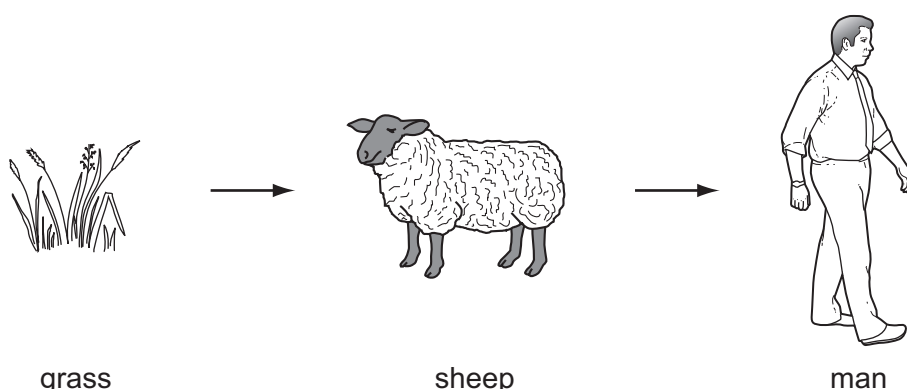
oxygen .....

..... [2]

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- 6 Fig. 6.1 shows a food chain. The arrows show how energy flows from one organism to another, along the chain.

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**Fig. 6.1**

- (a) Energy enters the food chain as sunlight. Plant leaves use this energy to make food.

(i) Name the substance in the leaves of a plant that absorbs this energy.

..... [1]

(ii) Name the **two** raw materials that the plant uses to make food.

1 ..... 2 ..... [2]

(iii) Name the gas released from plant leaves during this process.

..... [1]

- (b) A sheep is a herbivore.

Define the term *herbivore*.

.....  
 ..... [2]

- (c) Meat from the sheep contains protein.

Describe the importance of protein in the diet.

.....  
 .....  
 ..... [2]

- (d) The cells in the man's body use respiration to release useful energy from nutrients that he has absorbed.

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- (i) Tick the processes in the list below that use energy.

the diffusion of oxygen from the lungs into the blood

☐

the passage of nerve impulses along a nerve cell

☐

muscle contraction

☐

protein synthesis

☐

[1]

- (ii) A person living in a very cold climate generally needs to eat more than a person living in a hot climate.

Explain why.

.....

.....

.....

[2]

- 7 (a) The diagrams below show the circuit symbols for three components of an electric torch (flashlight).

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- (i) On the line below each diagram, state the name of the component.



..... [3]

- (ii) Using **only** these symbols, draw a circuit diagram for a torch.

[1]

- (b) Torches are usually powered by electrical cells. They can also be powered by energy from the Sun (solar energy).

Solar energy is a renewable energy resource.

- (i) Name **one** other renewable energy resource.

..... [1]

- (ii) Name **one** non-renewable energy resource.

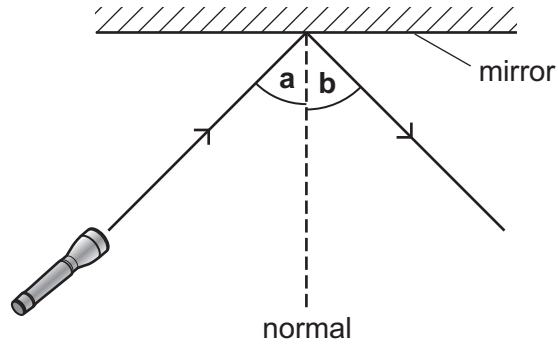
..... [1]

- (iii) Energy is transferred from the Sun to the Earth by radiation.

Explain why energy cannot be transferred from the Sun to the Earth by conduction.

.....  
..... [1]

(c) A ray of light from the torch is reflected by a mirror. This is shown in Fig. 7.1.



**Fig. 7.1**

Angle **a** has a value of  $45^\circ$ .

Name angle **b** and write down its value.

name .....

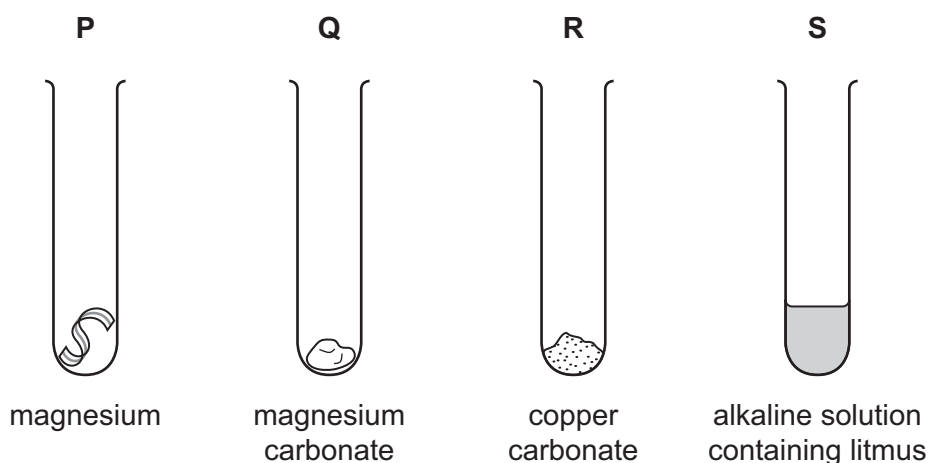
value ..... $^\circ$

[2]

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- 8 (a) A student added a solution of the same dilute acid to each of the test-tubes **P** to **S** shown in Fig. 8.1.

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**Fig. 8.1**

Complete Table 8.1 by matching the test-tubes, **P**, **Q**, **R** and **S**, with the observations which are made when the dilute acid reacts with the contents.

One of the observations applies to more than one of the test-tubes. You may use each letter once, more than once or not at all.

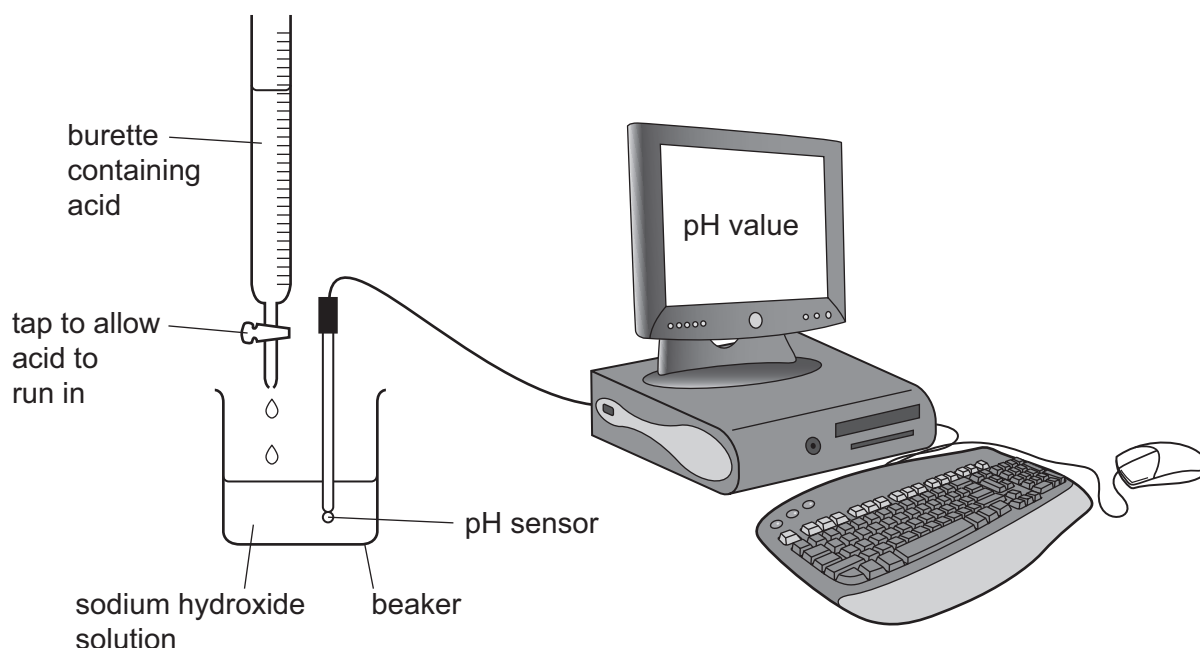
**Table 8.1**

| observations                     | test-tube(s) |
|----------------------------------|--------------|
| Hydrogen gas is given off.       |              |
| A blue solution is formed.       |              |
| Carbon dioxide gas is given off. |              |

[3]

- (b) The student used the apparatus shown in Fig. 8.2 to investigate neutralisation reactions involving three acids, **A**, **B** and **C**.

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**Fig. 8.2**

25.0 cm<sup>3</sup> of the same solution of the alkali, sodium hydroxide, were placed into each of three beakers.

Acid was slowly added to each of the beakers in turn, and the pH values of the mixtures were displayed on the computer screen.

Some of the measurements from the three experiments are shown in Table 8.2.

**Table 8.2**

| acid     | source of acid                   | volume required to neutralise the alkali / cm <sup>3</sup> |
|----------|----------------------------------|------------------------------------------------------------|
| <b>A</b> | sample taken from an acidic lake | 42.0                                                       |
| <b>B</b> | sample taken from a car battery  | 15.0                                                       |
| <b>C</b> | acid from a chemical laboratory  | 60.0                                                       |

- (i) Suggest a possible pH value of the alkali before any acid was added.

..... [1]

- (ii) Describe briefly what the student would observe when the acid had neutralised the alkali.

.....  
..... [1]

- (iii) State, with a reason, which acid, **A**, **B** or **C**, had the highest concentration.

acid .....

reason .....

[1]

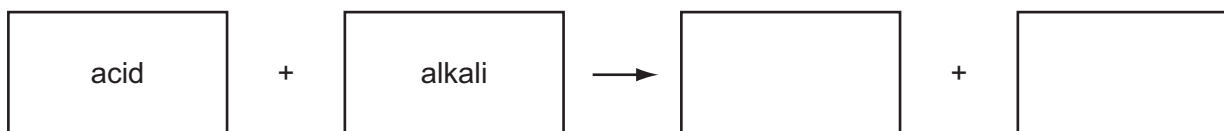
- (iv) The student noticed that, in all three experiments, the temperature of the mixture increased as the acid was added.

Suggest why the temperature increased.

.....

[1]

- (v) Complete the general word equation for the reaction which occurs between an acid and an alkali.



[2]

- 9 Fig. 9.1 shows a section through a small blood vessel.

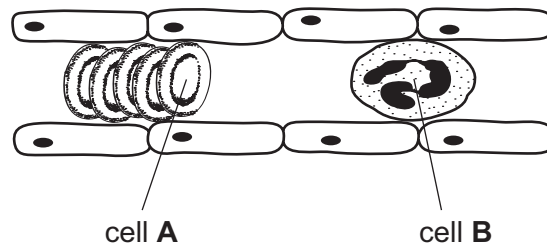


Fig. 9.1

- (a) Cell **A** is a red blood cell.

- (i) Outline **two** ways in which this cell differs from a liver cell.

- 1 ..... [2]  
2 .....

- (ii) Describe the function of a red blood cell.

.....  
.....  
.....  
..... [2]

- (b) Describe the function of cell **B**.

.....  
.....  
.....  
..... [2]

- (c) Complete the sentences about the functions of blood plasma, using words from the list. You may use each word once, more than once, or not at all.

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|                   |                |                  |                        |
|-------------------|----------------|------------------|------------------------|
| <b>adrenaline</b> | <b>enzymes</b> | <b>insoluble</b> | <b>small intestine</b> |
| <b>soluble</b>    | <b>stomach</b> | <b>starch</b>    | <b>vitamins</b>        |

Blood plasma transports ..... nutrients such as sugars.

These nutrients enter the blood in the .....

Blood plasma also transports hormones such as ..... [3]

20

20

20

20

20