



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

\* 5 7 2 2 7 6 6 1 4 8 0 \*

**COMBINED SCIENCE**

**0653/33**

Paper 3 (Extended)

**October/November 2011**

**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 soft pencil for any diagrams, graphs, tables or rough working.

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

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

A copy of the Periodic Table is printed on page 24.

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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
<b>Total</b>	

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



1 There are three states of matter – solid, liquid and gas.

Fig. 1.1 shows the arrangement of particles in a solid.

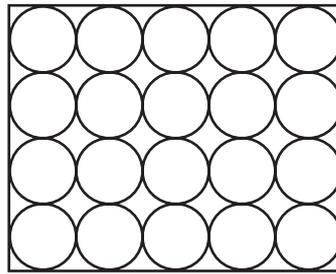
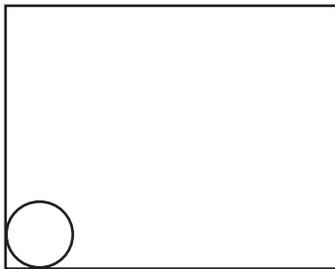
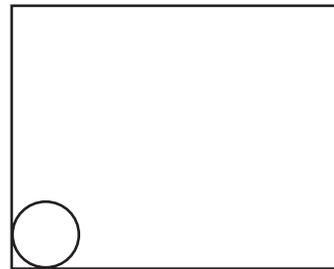


Fig. 1.1

(a) (i) Draw similar diagrams for a liquid and a gas.



liquid



gas

[2]

(ii) Explain the arrangements you have drawn in terms of the forces between the particles.

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

(b) Explain the following using the ideas of conduction, convection and radiation.

(i) Houses in hot climates are often painted white.

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

(ii) A saucepan has a metal base but a plastic or wooden handle.

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

(iii) In a kettle, the water is heated at the bottom but all of the water in the kettle becomes hot.

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

2 (a) Fig. 2.1 shows a flowering plant, and two cells from the plant.

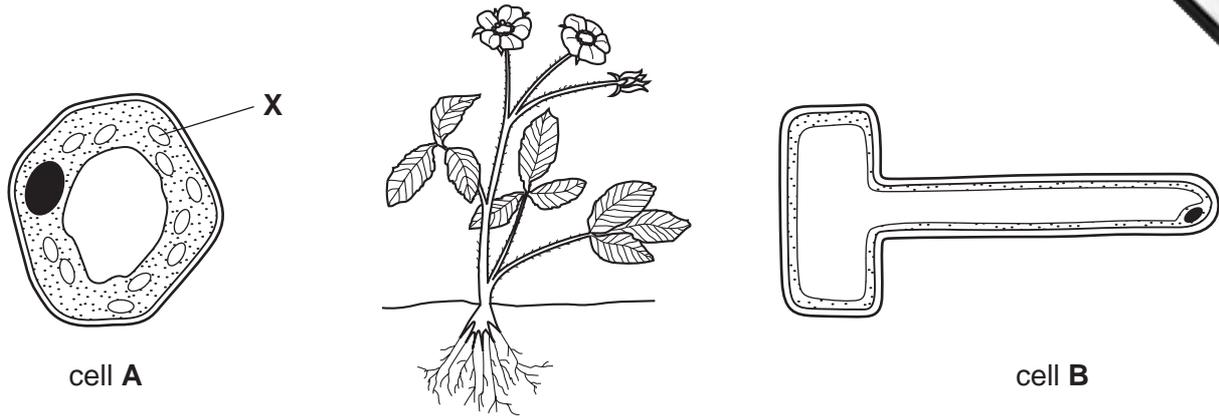


Fig. 2.1

(i) On Fig. 2.1, draw a line from each cell to a part of the plant in which it could be found. [2]

(ii) Explain why cell A contains the structures labelled X, but cell B does not.

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

(iii) Suggest how the shape of cell B adapts it for its function.

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

- (b) The colour of the flower petals is determined by a gene with two alleles, **R** and **r**. **R** is dominant and produces red flowers, and allele **r** produces white flowers.
- (i) Complete Table 2.1 to show the phenotype produced by each of the three possible genotypes.

Table 2.1

genotype	phenotype
<b>RR</b>	
<b>Rr</b>	
<b>rr</b>	

[1]

- (ii) On Table 2.1, draw a circle around **one heterozygous** genotype. [1]
- (iii) Predict the ratio of red to white flowers that would be produced if two plants with the genotypes **Rr** were crossed.

..... [1]

- (c) A grower has a rare variety of orchid with unusual flowers. She decides to produce new plants from this orchid using an asexual method of propagation.

Suggest the advantages to the grower of using asexual propagation to produce new plants, rather than sowing seeds she has collected from the orchid plant.

.....

.....

..... [2]

- 3 (a) Fig. 3.1 shows apparatus a student used to investigate the electrolysis of a solution of potassium sulfate.

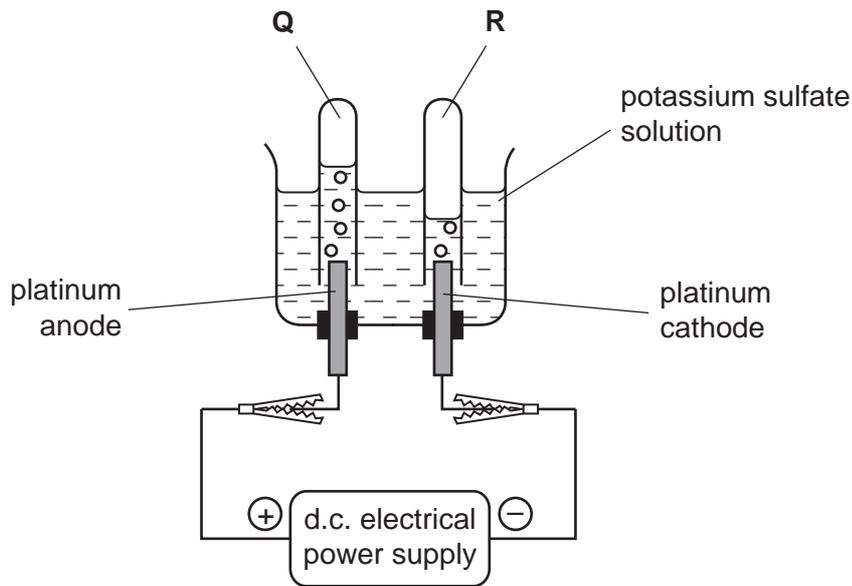


Fig. 3.1

During the experiment shown in Fig. 3.1, two different colourless gases, **Q** and **R**, collected in the small test-tubes. Neither of these gases contained any sulfur.

- (i) Name gases **Q** and **R**.

**Q** .....

**R** .....

[2]

- (ii) Choose **one** of the gases, **Q** or **R**, and describe how the student should test it for the gas you have named.

chosen gas .....

test .....

..... [1]

- (b) Potassium sulfate solution is made in a neutralisation reaction between an acid and an alkali.

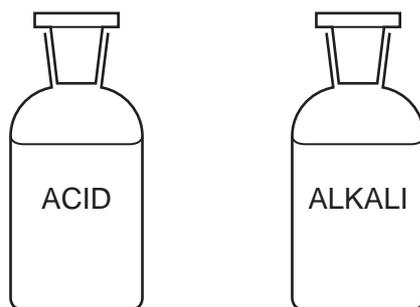
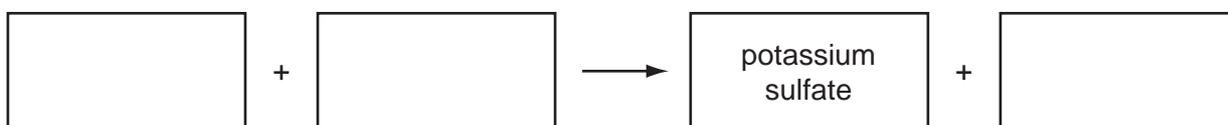


Fig. 3.2

- (i) Suggest a **word** chemical equation for a reaction between a suitable acid and alkali that would produce potassium sulfate.



[2]

- (ii) Describe how a **neutral** solution of potassium sulfate could be obtained using suitable solutions of an acid and an alkali.

.....

.....

.....

.....

.....

[3]

- (iii) State the **ionic** equation which describes the neutralisation reaction between any aqueous acid and any aqueous alkali.

.....

[2]

- 4 (a) Five types of radiation are listed below.

alpha radiation

beta radiation

gamma radiation

infra-red radiation

ultraviolet radiation

- (i) State which of these types of radiation is a stream of electrons.

..... [1]

- (ii) State which of these types of radiation are forms of electromagnetic radiation.

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

- (iii) State **one** use for gamma radiation.

..... [1]

- (iv) Complete Table 4.1 to compare alpha, beta and gamma radiations.

Tick **one** box in each row of the table.

**Table 4.1**

	alpha	beta	gamma
most penetrating			
most ionising			
not deflected by an electric field			

[2]

- (b) Some students measured the level of radiation from a radioactive source for 42 days. Table 4.2 shows the results corrected for background radiation.

Table 4.2

time / days	0	7	14	21	28	35	42
level of radiation / average counts per minute	64	45	33	23	16	12	8

Describe and explain the pattern in these results.

.....

.....

..... [2]

- 5 PTFE is an important plastic which has many uses in the home and industry. PTFE is made from a polymer of polymer molecules.

Fig. 5.1 shows the displayed formula of the monomer that reacts to produce PTFE.

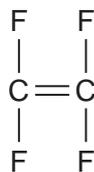


Fig. 5.1

- (a) (i) Explain why the molecule shown in Fig. 5.1 is **not** a hydrocarbon.

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

- (ii) Fig. 5.2 shows the outer shell electrons in a carbon atom and a fluorine atom.

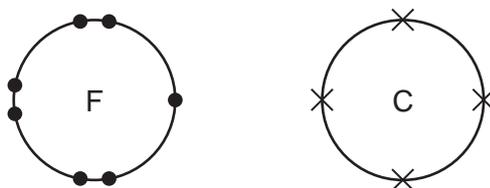
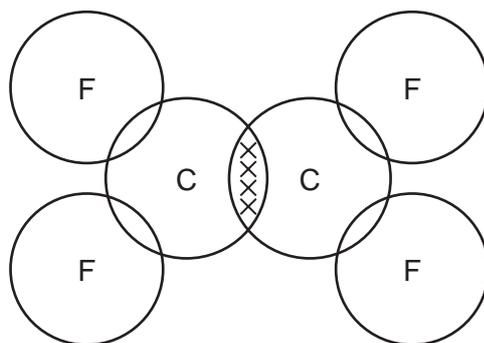


Fig. 5.2

Complete the bonding diagram below to show how the outer electrons are arranged in the molecule whose displayed formula is shown in Fig. 5.1.



[2]

- (iii) Complete the diagram below to show the displayed formula of a small section of a PTFE molecule.

Your completed formula must contain eight fluorine atoms.



[3]

- (b) The element, fluorine, is a halogen in Group 7 of the Periodic Table.

- (i) Use your knowledge of the physical states of the other halogens to predict and explain whether fluorine is a solid, a liquid or a gas at room temperature.

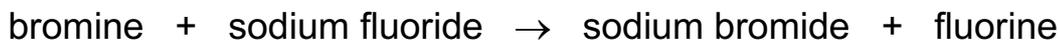
prediction .....

explanation .....

.....

..... [2]

- (ii) Use your knowledge of the reactivities of the other halogens to predict and explain whether or not the following halogen displacement reaction will occur.



.....

.....

..... [2]

6 Fig. 6.1 shows the human digestive system.

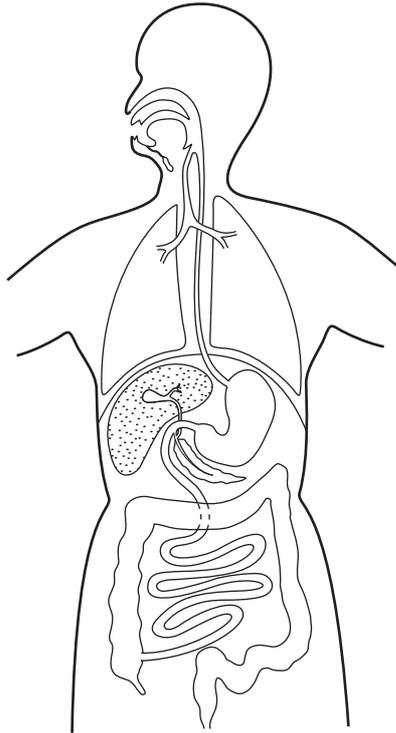


Fig. 6.1

(a) On Fig. 6.1, use label lines to label  
the stomach,  
the colon.

[2]

(b) On Fig. 6.1, label and name **one** part of the digestive system that food does **not** pass through on its way from mouth to anus.

[1]

(c) Describe how digestion takes place inside the stomach.

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

(d) Fig. 6.2 shows a food web involving humans.

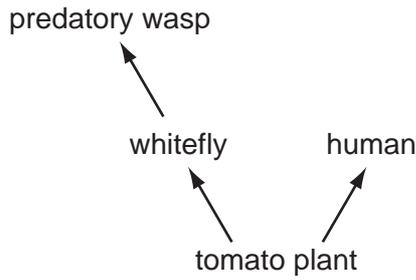


Fig. 6.2

If there are a lot of whitefly feeding on the tomato plants, there will be fewer tomatoes for humans to eat.

(i) Use the information in Fig. 6.2 to suggest how biological control could be used to control the whitefly population.

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

(ii) State **two** reasons, other than cost, why this could be a better way of controlling the whitefly than using pesticides.

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



7 Some coffee drinks are sold in self-heating cans.

Fig. 7.1 shows a cross-sectional diagram of one design of self-heating can.

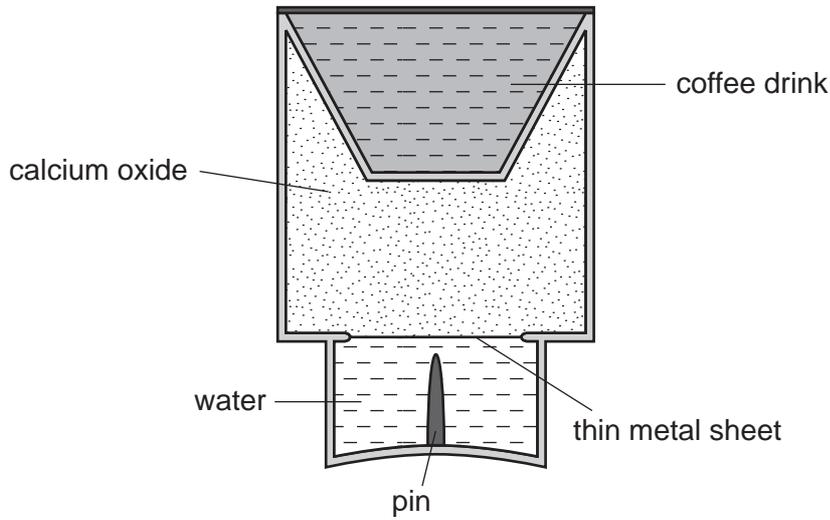


Fig. 7.1

Fig. 7.2 shows the can after it has been turned upside down and the pin pushed through the thin metal sheet. This allows the water to fall into the calcium oxide.

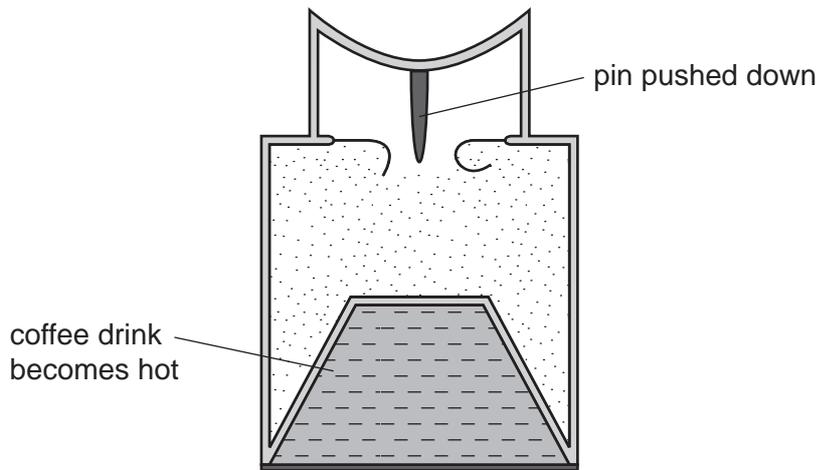


Fig. 7.2

(a) Explain briefly why the coffee drink in the self-heating can becomes hot when the water and calcium oxide mix.

.....

.....

.....

.....

[2]

- (b) (i) Use the position of calcium in the Periodic Table to explain why the electrical charge of a calcium ion is +2.

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

- (ii) The reaction between calcium oxide and water produces the ionic compound calcium hydroxide,  $\text{Ca}(\text{OH})_2$ .

Deduce the electrical charge of the hydroxide ion.

Show how you obtained your answer.

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

- 8 (a) A student set up the circuit shown in Fig. 8.1 to investigate the relationship between voltage across resistor **R** and the current through resistor **R**.

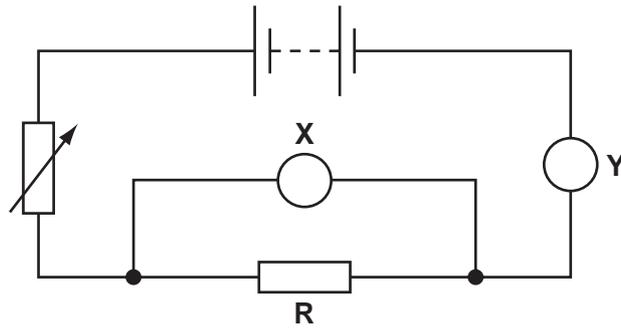


Fig. 8.1

- (i) Name the meters labelled **X** and **Y**.

**X** .....

**Y** .....

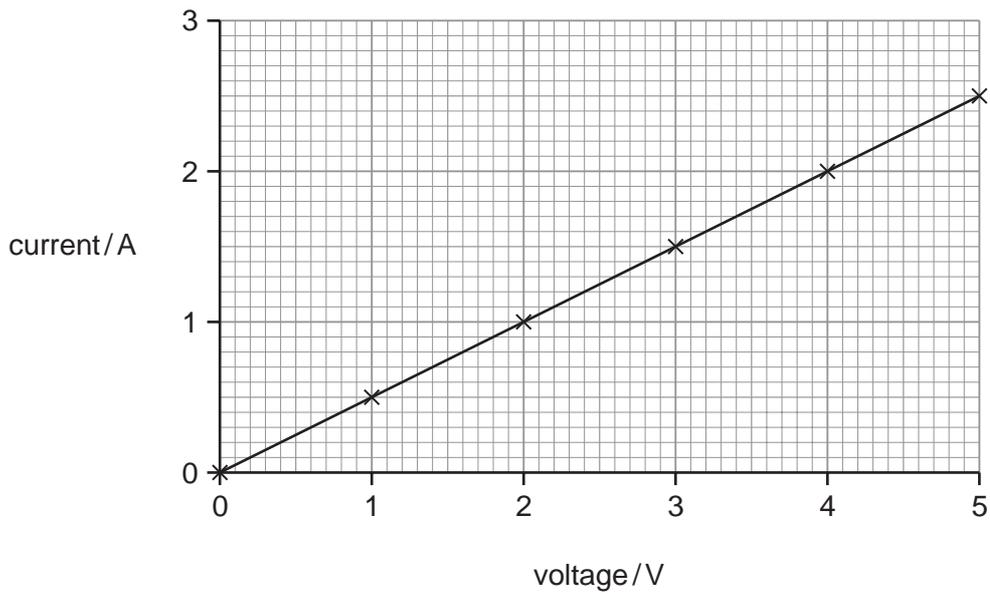
[1]

- (ii) Explain the purpose of the variable resistor in the circuit.

.....

..... [1]

(iii) Fig. 8.2 shows a graph of the results.



**Fig. 8.2**

Use the data on the graph to calculate the resistance of resistor **R**.

State the formula that you use and show your working.

formula used

working

..... [2]

**(b)** Two 10 ohm resistors are placed in parallel in a circuit.

Calculate their total resistance.

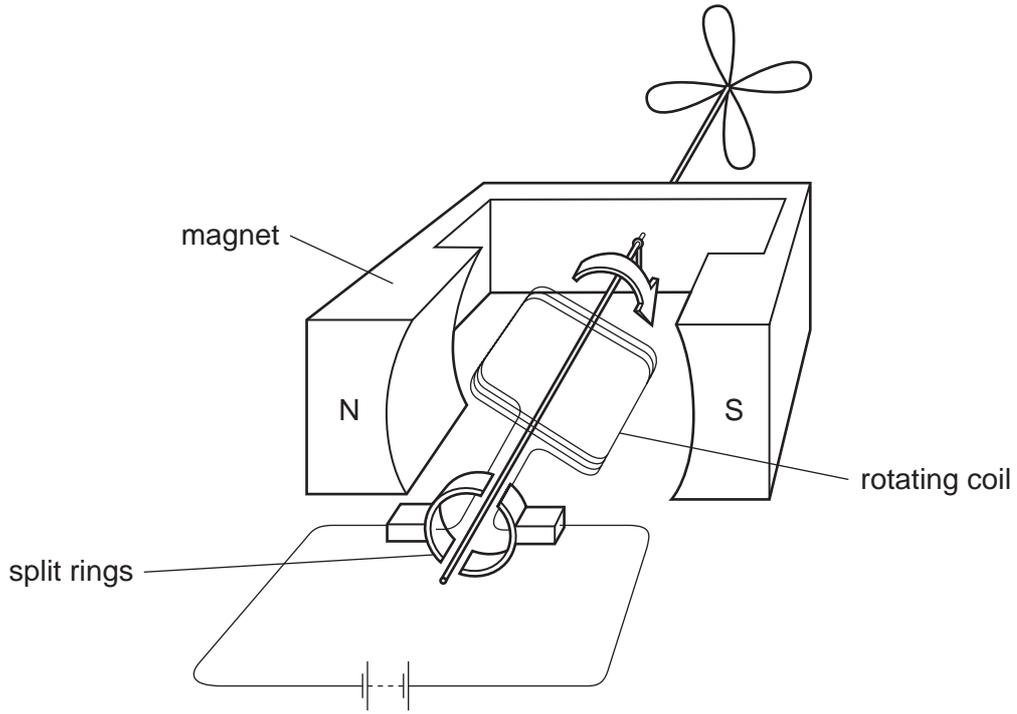
State the formula that you use and show your working.

formula used

working

..... [3]

(c) Fig. 8.3 shows a battery-operated d.c. electric motor driving a fan. When an current passes through the coil it rotates.



**Fig. 8.3**

(i) Describe what happens to the coil if the poles of the magnets are reversed and the rest of the circuit remains the same.

..... [1]

(ii) Describe what happens if a greater electric current is passed through the coil.

..... [1]

(iii) Explain the purpose of the split rings.

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

9 A man walking along a road decided to cross to the other side. As he was walking across the road, a car sounded its horn, which made him jump. He then crossed the rest of the road more quickly.

(a) For each of the actions that the man took, state whether it was a **reflex** action or a **voluntary** action.

- walking along the road .....
- walking across the road .....
- jumping in response to the car horn .....
- crossing the road more quickly ..... [2]

(b) Explain **one** advantage and **one** disadvantage of reflex actions over voluntary actions.

- advantage .....
- .....
- disadvantage .....
- ..... [2]

(c) State the roles of each of the following parts of the nervous system in a reflex action.

- receptor .....
- .....
- motor neurone .....
- ..... [2]

