



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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COMBINED SCIENCE

0653/03

Paper 3 (Extended)

May/June 2008

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 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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

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



1 (a) Give the term that matches each of these definitions.

a green pigment, found in some plant cells, which absorbs light energy

.....

an organelle, found in some plant cells, where photosynthesis occurs

.....

a fully permeable layer surrounding a plant cell

.....

a partially permeable layer surrounding all cells

.....

[2]

(b) During photosynthesis, glucose is produced in the leaves of a plant. Some of the glucose is changed to a different sugar and transported to the roots, where it is converted into starch and stored.

(i) The diagram represents a glucose molecule. Complete the diagram to show part of a starch molecule.



[1]

(ii) If the outer parts of a plant stem are damaged, this can prevent sugars being transported to the roots.

Explain why this happens, and why it can kill the plant.

.....

.....

.....

[2]

(c) Fig. 1.1 shows one of the ways in which a plant called *Bryophyllum* reproduces. It grows new plantlets from its leaves.

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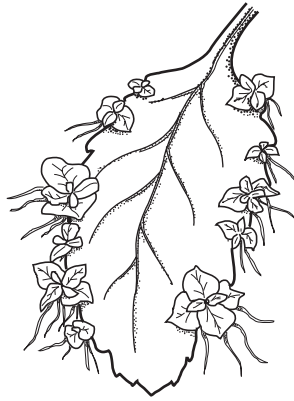


Fig. 1.1

(i) Name the type of reproduction that is taking place.

..... [1]

(ii) Explain why reproducing in this way, rather than by producing seeds, might be an advantage to the plant.

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

(d) Describe **one** other function of plant leaves, apart from photosynthesis and reproduction.

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

2 (a) A student wrote down some properties of alpha, beta and gamma radiations.

Draw a line from each property to the correct radiation.

contains negatively charged particles	alpha
passes through several centimetres of lead	
has no mass	beta
is deflected towards a negatively charged plate	
is not affected by an electric field	gamma
is the most ionising in air	

[3]

(b) Cobalt-60 is a radioactive isotope of cobalt.

Explain what is meant by the word *isotope*.

.....

 [2]

(c) Gamma radiation can be used to sterilise surgical instruments. What property of gamma radiation makes it suitable for this purpose?

..... [1]

(d) A scientist investigated the activity of a radioactive isotope. She measured a count rate of 8000 per second.

20 minutes later the count rate was 2000 per second.

(i) Calculate the half-life of the isotope.

..... [1]

- (ii) Predict how long after the start of the experiment the scientist could expect to measure a count rate of 250 per second.

Show your working.

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..... [2]

- (e) In an experiment, a radiation detector was set up and used to measure background radiation. The background radiation in the laboratory was found to be 40 counts per minute.

- (i) What is *background radiation*?

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

- (ii) A radioactive source was placed near the detector and a reading of 1200 counts per minute was recorded. What was the count rate of the radioactive source?

..... counts per minute [1]

- 3 Kerosene is a mixture of hydrocarbons used as a fuel for aircraft and for lighting and cooking.

For
Examiner's
Use

Kerosene is obtained from petroleum (crude oil) and is a liquid which boils in the range 150 °C – 200 °C.

- (a) (i) Name **one** other type of liquid fuel which is obtained from petroleum.

..... [1]

- (ii) State the important difference between the various compounds in petroleum which enables them to be separated by fractional distillation.

..... [1]

- (b) A typical molecule in kerosene has the formula $C_{13}H_{28}$.

Complete the balanced equation below for the complete combustion of $C_{13}H_{28}$.



[2]

- (c) Fig. 3.1 shows a dot-and-cross diagram of a molecule of carbon dioxide.

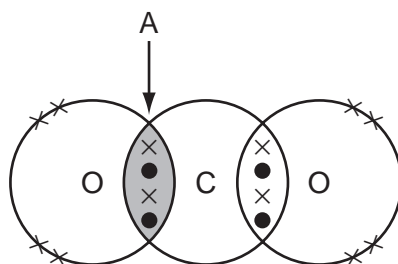


Fig. 3.1

Describe in detail what is shown by the shaded area, **A**.

.....

 [2]

- 4 Fig. 4.1 shows the quantity of nitrogen oxides and sulphur dioxide that was emitted to the atmosphere by a large industrial company between 2001 and 2005.

For
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Use

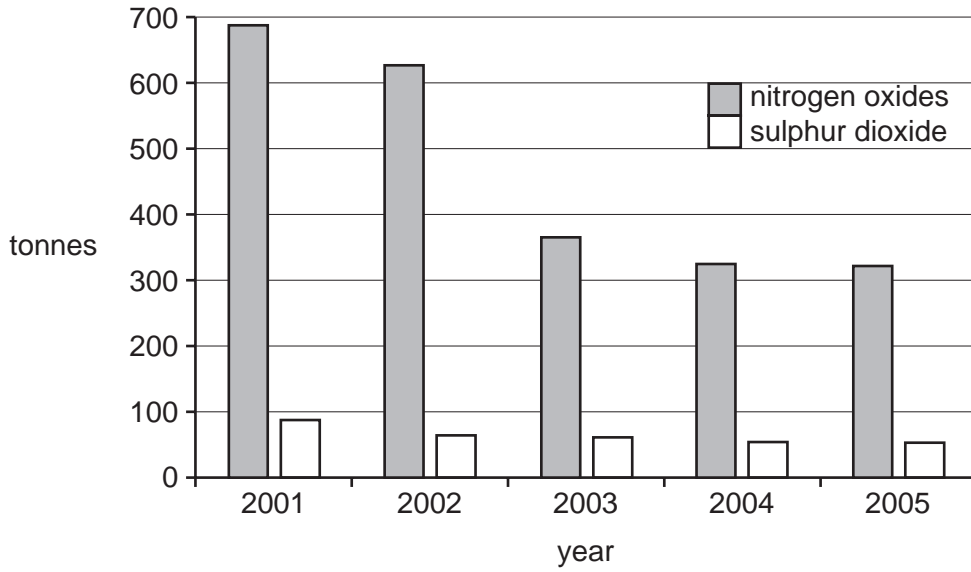


Fig. 4.1

- (a) Describe the change in emissions of nitrogen oxides between 2001 and 2005.

.....

 [2]

- (b) Suggest **two** ways in which the changes in sulphur dioxide emissions may have been brought about.

.....

 [2]

- (c) Explain why reducing the quantities of nitrogen oxides and sulphur dioxide that are emitted to the air would be beneficial to the environment.

.....

 [3]

5 A man is playing golf.

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(a) As the golfer moves around the course in a golf cart, his movement is measured. The measurements are plotted on the graph in Fig. 5.1.

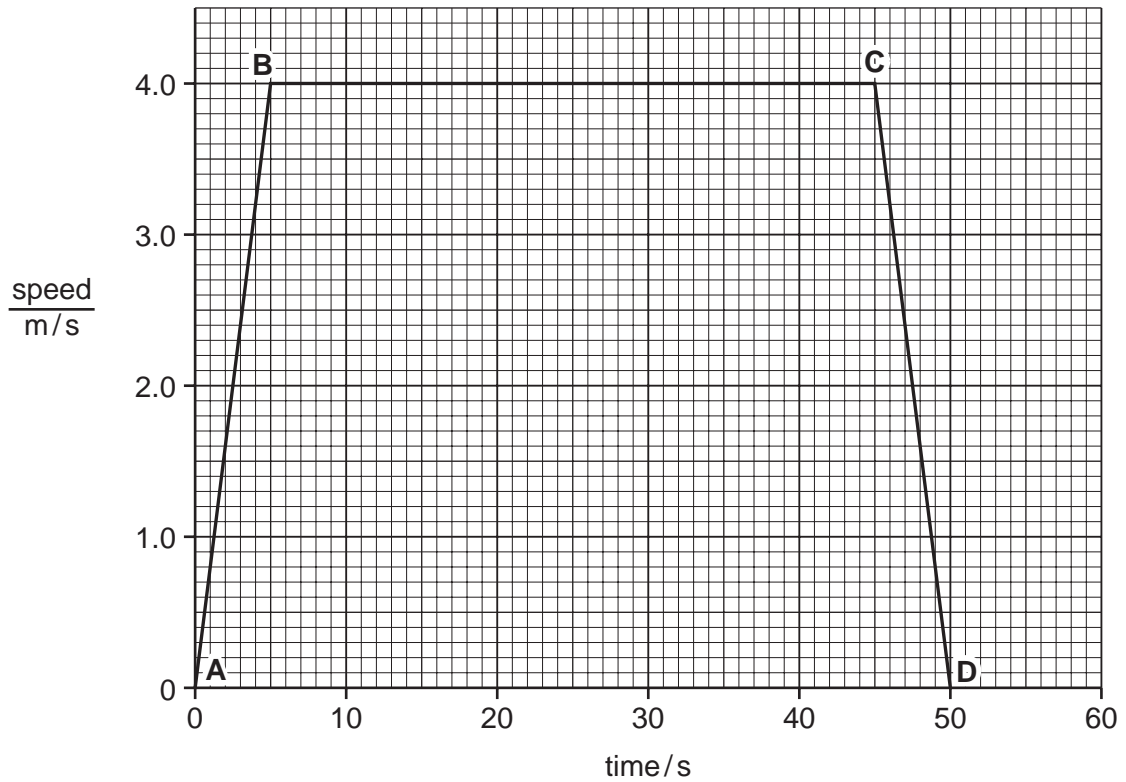


Fig. 5.1

Describe what is happening between

A – B

.....

B – C

..... [2]

(b) Calculate the total distance covered.

Show your working.

..... [3]

- 6 Fig. 6.1 shows apparatus which can be used to reduce copper oxide to copper.

Copper oxide is a black powder and during the reaction metallic copper forms inside the reaction tube.

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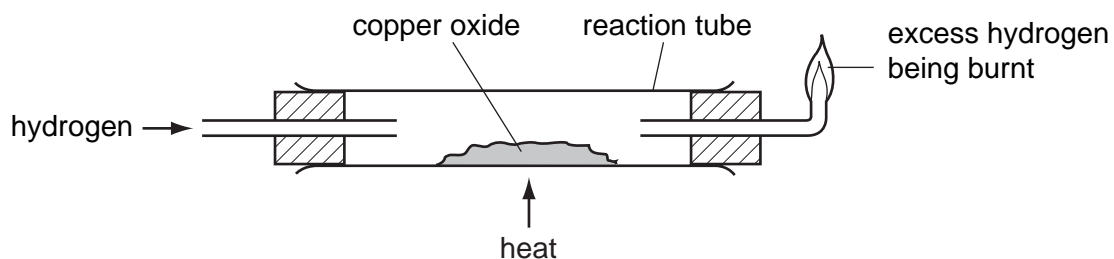
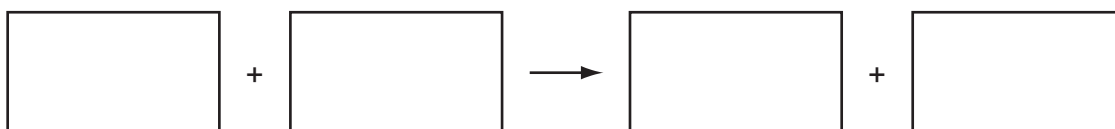


Fig. 6.1

- (a) (i) Select from the list of substances below to complete the word equation for the reaction in Fig. 6.1.

air	copper	copper oxide
hydrogen	oxygen	water



[1]

- (ii) Describe **one** piece of evidence which would show that copper had been formed in this reaction.

.....
 [1]

- (b) Copper oxide is an ionic compound.

- (i) Explain why an oxide ion has an electrical charge of -2 but an oxygen atom is electrically neutral.

.....

 [2]

- (ii) The formula of copper oxide is CuO .

State the number of electrons which each copper ion gains to become a copper atom during the reaction in Fig. 6.1.

Explain your answer.

.....

.....

..... [2]

- (c) Fig. 6.2 shows another method of producing copper from copper oxide.

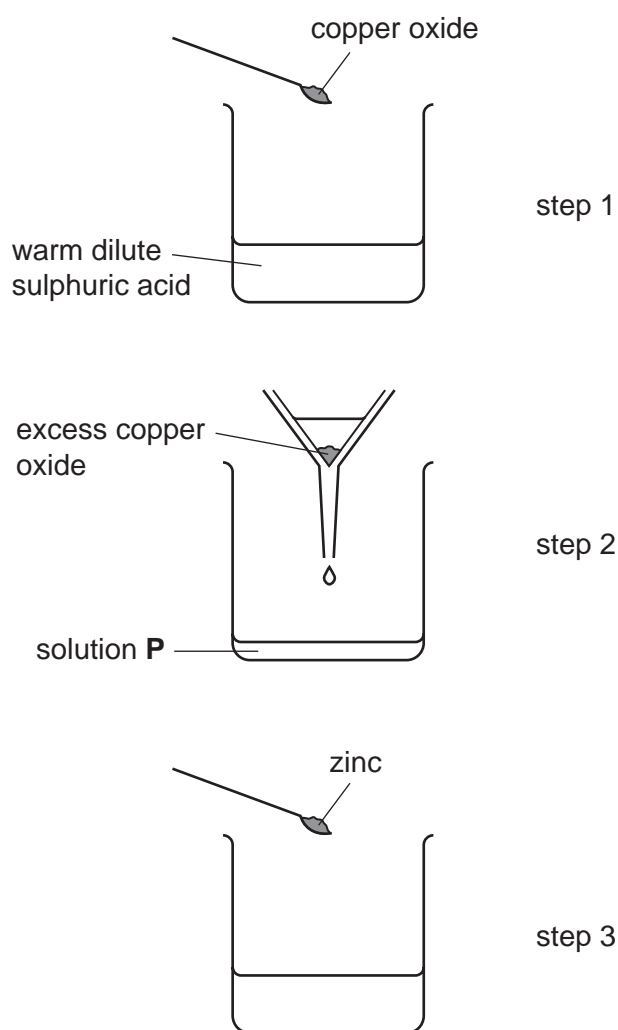


Fig. 6.2

- (i) Write the name of the salt dissolved in solution **P** in Fig. 6.2.

..... [1]

- (ii) Explain why zinc is able to react with the salt in solution **P**.

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

- (iii) Explain, in terms of the transfer of electrons, which substance is oxidised when zinc reacts in solution **P**.

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

7 Fig. 7.1 shows the structure of the human thorax.

For
Examiner's
Use

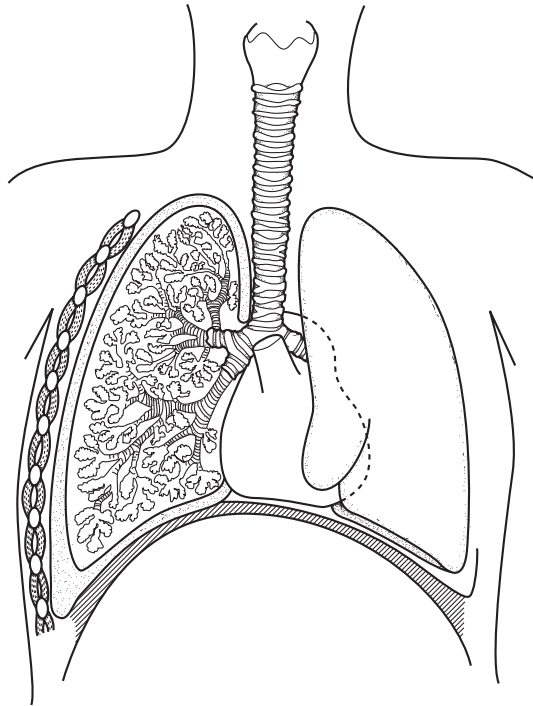


Fig. 7.1

(a) Using label lines, label each of the following structures.

- bronchus
- pleural membrane
- trachea
- rib

[2]

(b) Gas exchange takes place in the alveoli. When a person smokes for a number of years, the walls of the alveoli start to break down. This is called emphysema.

Explain why emphysema makes it more difficult for oxygen to get into the blood.

.....

.....

..... [2]

(c) Oxygen is transported around the body in red blood cells. Fig. 7.2 is a diagram of a group of red blood cells.

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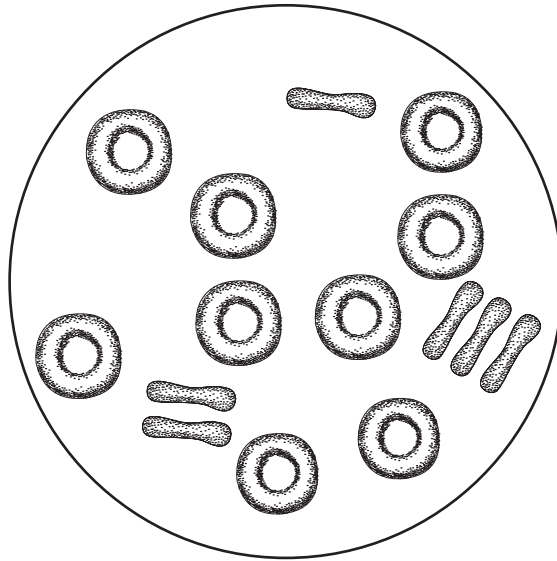


Fig. 7.2

Choose **three** features of red blood cells and for each of them explain how this adapts them for their function.

.....

.....

.....

..... [3]

(d) Explain why body cells need a constant supply of oxygen.

.....

.....

..... [2]

8 (a) A car travels 2 kilometres, at a steady speed, in 100 seconds. The total force driving the car forward is 1000 N.

(i) Calculate the work done by the total driving force over this distance.

State the formula that you use and show your working.

formula

working

..... [2]

(ii) Calculate the useful power output of the engine during this time.

State the formula that you use and show your working.

formula

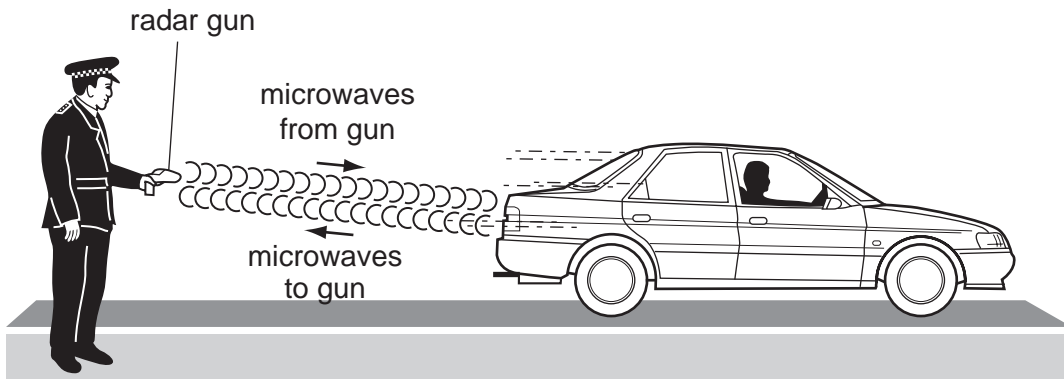
working

..... [2]

(b) A policeman is using a radar gun to measure the speed of a car.

The radar gun emits microwaves which hit the moving car and bounce back to a receiver in the radar gun.

A computer in the radar gun calculates the speed of the car.



(i) What type of waves are microwaves?

..... [1]

(ii) The waves bounce off the car back towards the radar gun. Name this process.

..... [1]

(c) The headlamps on the car are connected in parallel as shown in Fig. 8.1.

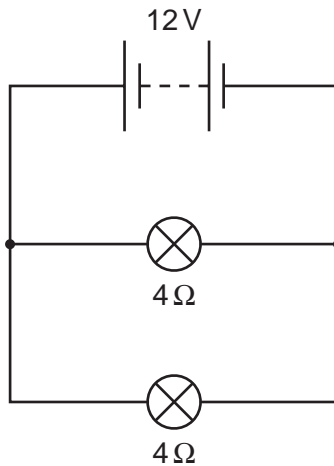


Fig. 8.1

Each headlamp has a resistance of 4 ohms.

Calculate the combined resistance of the two headlamps.

State the formula that you use and show your working.

formula

working

..... [3]

- (d) Fig. 8.2 shows a spring. The spring is 10 cm long. A 50 g mass is hung on the spring and the length of the spring increases to 13 cm.

For
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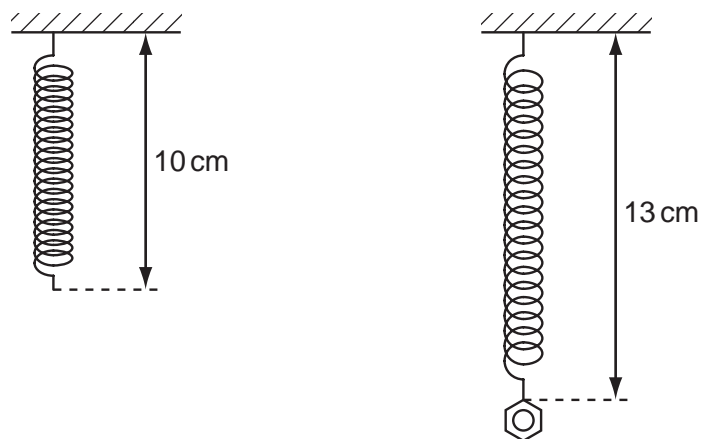


Fig. 8.2

The 50 g mass is replaced by an object of unknown mass. The new length of the spring is 22 cm.

Calculate the value of the unknown mass.

Show your working.

..... [2]

- 9 The Periodic Table shows all of the chemical elements arranged into groups and periods.

Fig. 9.1 shows part of the Periodic Table. The letters in this table are **not** the normal chemical symbols of the elements.

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Use

	I	II									III	IV	V	VI	VII	0	
1																	A
2	F																E
3	C										H						
4	G																D

Fig. 9.1

- (a) Complete the statements below using letters, chosen from **A** to **H**, which refer to elements in Fig. 9.1. Letters may be used once, more than once or not at all.

- The three elements shown as letters , and have the same number of electrons in the outer shells of their atoms.
- The element shown as letter is a very reactive non-metal. [2]

- (b) A student used the apparatus shown in Fig. 9.2 to investigate the decomposition of the compound hydrogen peroxide, H_2O_2 .

The balanced equation for the decomposition of hydrogen peroxide is shown below.

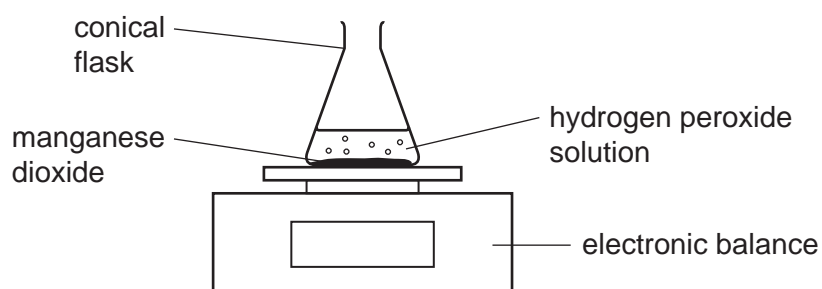
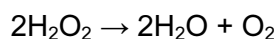


Fig. 9.2

The student measured the decrease in mass of the conical flask and its contents which occurred during the reaction.

Table 9.1 shows the measurements the student made in a series of trials using different masses of manganese dioxide.

The initial concentration and volume of the hydrogen peroxide solution in each trial were the same.

Table 9.1

trial	mass of manganese dioxide /g		time for reaction to finish / seconds	decrease in mass during trial /g
	start	end		
1	0	0	too long to measure	0
2	0.5	0.5	540	1.6
3	1.0	1.0	270	1.6
4	2.0	2.0	135	1.6

- (i) Explain why the mass of the flask and contents decreased in trials **2** to **4**.

.....
 [1]

- (ii) What effect does the mass of manganese dioxide have on the rate of decomposition of hydrogen peroxide?

.....
 [1]

- (iii) Use the information in Table 9.1 to explain the role of manganese dioxide in this reaction.

.....

 [3]

(iv) The rate of chemical reactions increases if the temperature increases.

Explain in terms of collisions between particles why this happens.

.....

.....

.....

..... [2]

(c) Calculate the relative molecular mass (M_r) of hydrogen peroxide.

Show your working.

..... [1]

DATA SHEET
The Periodic Table of the Elements

		Group																						
		I	II	III	IV	V	VI	VII	VIII	IX	X													
		1 H Hydrogen 1																						
7	9	Li Lithium 3	Be Beryllium 4																					
23	24	Na Sodium 11	Mg Magnesium 12																					
39	40	K Potassium 19	Ca Calcium 20	45	48	51	52	55	56	59	59	64	65	70	73	75	79	80	84					
85	88	Rb Rubidium 37	Sr Strontium 38	Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41	Mo Molybdenum 42	Tc Technetium 43	Ru Ruthenium 44	Rh Rhodium 45	Pd Palladium 46	Ag Silver 47	Cd Cadmium 48	In Indium 49	Sn Tin 50	Sb Antimony 51	Te Tellurium 52	I Iodine 53	Xe Xenon 54					
133	137	Cs Caesium 55	Ba Barium 56	La Lanthanum 57	Hf Hafnium 72	Ta Tantalum 73	W Tungsten 74	Re Rhenium 75	Os Osmium 76	Ir Iridium 77	Pt Platinum 78	Au Gold 79	Hg Mercury 80	Tl Thallium 81	Pb Lead 82	Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86					
	226	Fr Francium 87	Ra Radium 88	Ac Actinium 89																				
		*58-71 Lanthanoid series †90-103 Actinoid series																						
		a		X		b																		
		Key		X		b																		
		a = relative atomic mass		X = atomic symbol		b = proton (atomic) number																		
												140	141	144	150	152	157	159	162	165	167	169	173	175
		Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	Eu Europium 63	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69	Yb Ytterbium 70	Lu Lutetium 71									
		232	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238	238		
		Th Thorium 90	Pa Protactinium 91	U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103									

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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