Candidate Name Mark Sheme

Centre Number	Candidate Number

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

CO-ORDINATED SCIENCES 0654/2

PAPER 2

MAY/JUNE SESSION 2000

2 hours

Candidates answer on the question paper.
No additional materials are required.

Bio ✓
Chem ✓
Phys ✓

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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

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

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
TOTAL	

This question paper consists of 20 printed pages.

[Turn over

1 Fig. 1.1 shows a half flower.

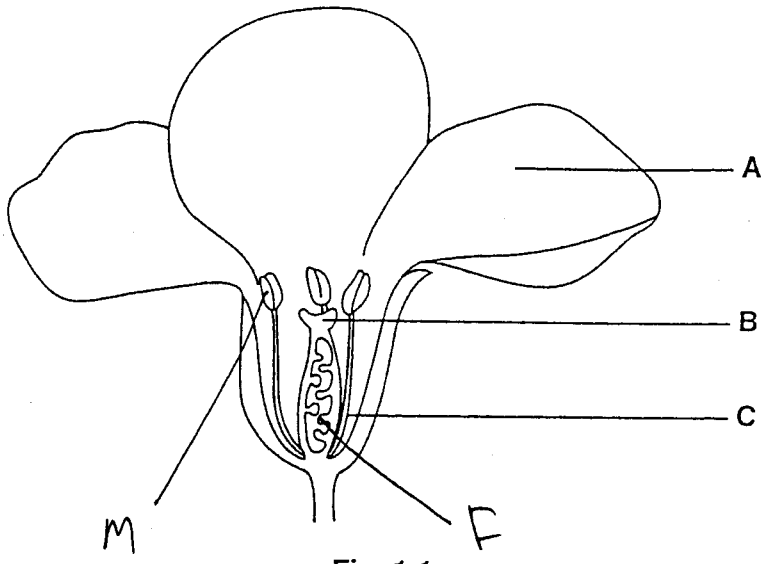


Fig. 1.1

(a) Name the parts labelled **A**, **B** and **C**.

A Petal

B Stigma

C Filament / Stamen [3]

(b) (i) On Fig. 1.1, draw a line to a part where male gametes are made, and label it **M**. [1]

(ii) On Fig. 1.1, draw a line to a part where female gametes are made, and label it **F**. [1]

(c) The flowers of this species of plant may have yellow or white petals. The colour of the petals is controlled by a gene with two alleles, **D** and **d**. **D** is the dominant allele and gives yellow petals.

Half of the gametes produced by a flower contained allele **D** and half contained allele **d**.

(i) What was the genotype of the flower which produced these gametes?

Dd [1]

(ii) What colour was the flower?

Yellow [1]

(iii) This flower was fertilised by gametes from a flower with the same genotype.

What colours of offspring will be obtained?

Yellow + White. [1]

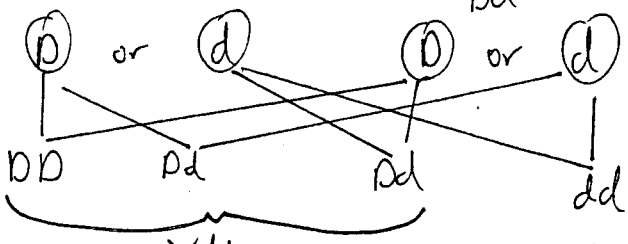
For Examiner Use

(iv) Explain your answer to **(iii)**. You may draw a genetic diagram if you wish.

Phenotypes: Yellow × Yellow

Genotypes: Dd × Dd

Gametes: D or d × D or d



Offspring Genotypes: DD, Dd, Dd, dd

Offspring phenotypes: Yellow, White

Ratio: 3 : 1

.....[2]

(d) Explain why it is useful to the plant to have coloured flowers.

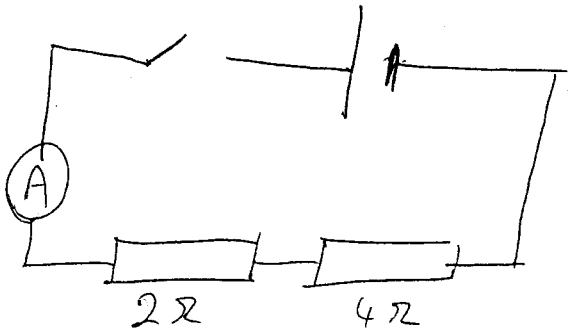
Attract Insects;

For insect pollination;

.....[2]

2 A 2 Ω resistor and a 4 Ω resistor are connected in series with an ammeter, a battery and a switch.

(a) Draw the circuit diagram for this circuit, using the correct symbols.



[3]

(b) Calculate the combined resistance of the two resistors.

6 Ω [1]

(c) The reading on the ammeter was 0.5 A.

(i) What was the current through the 2 Ω resistor?

0.5 A [1]

(ii) Calculate the voltage across the 2 Ω resistor. Show your working and state any formula that you use.

$V = IR = 0.5 \times 2$

1 V [3]

(d) Use

power = *voltage* x *current*

to calculate the power lost in the 2 Ω resistor.

$P = 1 \times 2$

2 W [2]

3 Starch and cellulose are compounds of carbon found in plants.

(a) Describe briefly how the plant obtains carbon atoms needed to make starch and cellulose.

Diffusion through stomata;
Used in chloroplasts;
For photosynthesis; [2]

(b) Starch and cellulose are natural polymers.

(i) Name **one** other natural polymer.

proteins [1]

(ii) Three molecules, **A**, **B** and **C**, can behave as monomers.

Their chemical formulae are shown below.

molecule **A**	C_2H_4
molecule **B**	$C_6H_{12}O_6$
molecule **C**	$C_2H_5O_2N$

State and explain which one of these molecules is the monomer from which starch is made.

B starch is a carbohydrate, therefore contains carbon, oxygen & hydrogen [2]

(iii) Describe briefly what happens when monomer molecules are converted into a polymer molecule. You may draw a **simple** diagram if it helps your answer.

[M] + [M] + [M] etc → ..-[M]-[M]-[M]-..

from double bonds small monomer molecules break and then the units join together in a long chain to form a polymer [2]

For Examiner's Use

4 Fig. 4.1 shows a pond and some of the organisms that live in it.

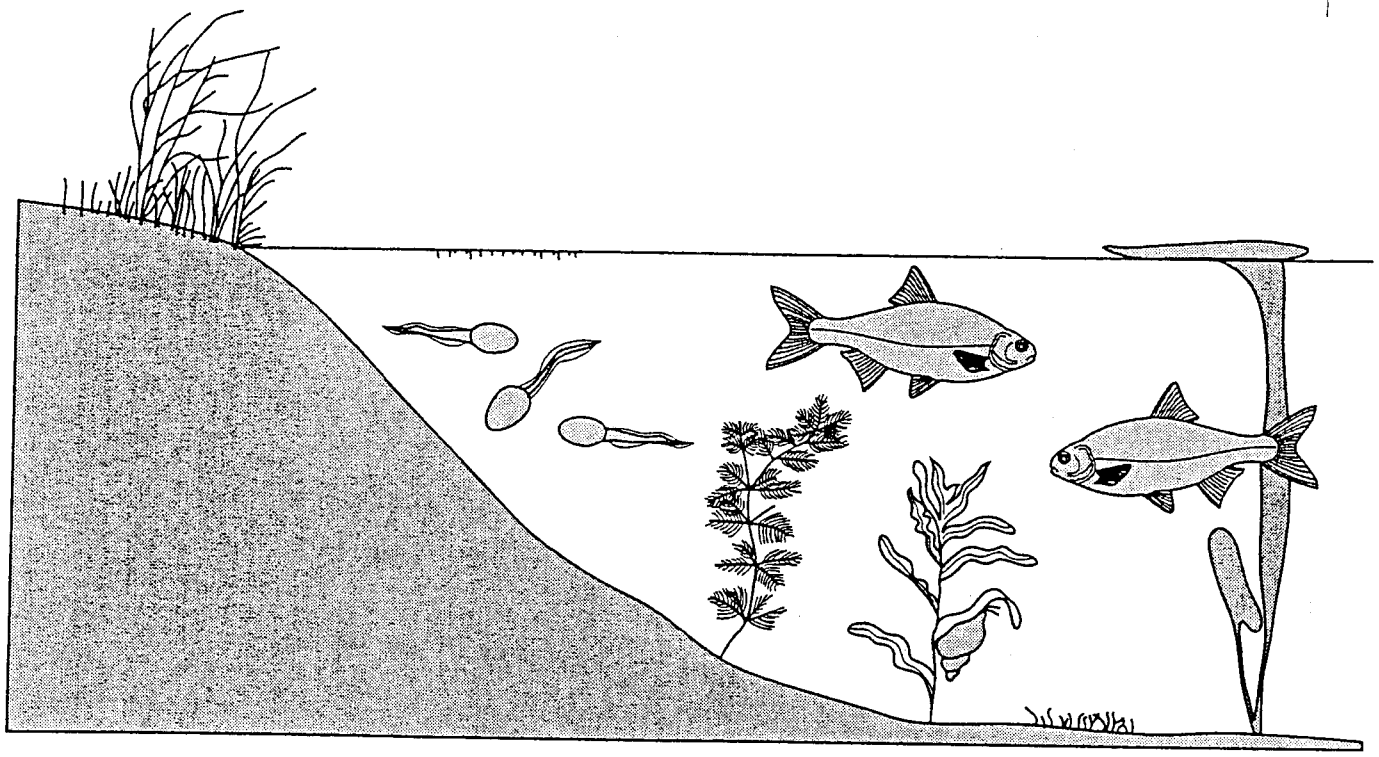


Fig. 4.1

Use some of these words to complete the sentences below.

community	**consumers**	**decomposers**	**ecosystem**
energy	**habitat**	**photosynthesis**	**producers**
scaly	**smooth**	**starch**	**sunlight**

All of the living organisms in a pond make up a .....Community..... . The pond is their .....Habitat..... .

The plants in the pond are the .....producers..... . The plants are eaten by snails and tadpoles, which in turn are eaten by fish. In this way, ...energy..... is passed along a food chain.

Both tadpoles, which are young amphibians, and fish are vertebrates. One difference between them is that tadpoles have .....Smooth..... skin.

[5]

For Examiner Use

5 (a) **Potassium**, **calcium**, **nickel** and **sulphur** each react with **chlorine** to form chlorides and with **oxygen** to form oxides.

(i) From the elements named above, choose **one** that fits each of the following descriptions.

Each element may be used **once**, **more than once** or **not at all**.

- a halogen ..... chlorine .....
- a transition metal ..... nickel .....
- an alkali metal ..... potassium .....
- forms an acidic oxide ..... sulphur .....
- is used as a catalyst in chemical reactions ..... nickel .....[5]

(ii) From the elements named above, suggest **one pair** which would react to form

- an ionic compound;

potassium | calcium | nickel ..... and ..... oxygen | sulphur | chlorine

and suggest **one pair** which would react to form

- a molecular (covalent) compound.

sulphur ..... and ..... oxygen | chlorine .....[2]

(b) (i) Name an element that is **less** reactive than chlorine and is in the same group of the Periodic Table as chlorine.

..... bromine | iodine .....[1]

(ii) Name an element that is **more** reactive than potassium and is in the same group of the Periodic Table as potassium.

..... caesium | rubidium .....[1]

For Examiner's Use

6 A factory produces boxes of detergent. The level of detergent in each box is carefully checked. The boxes are passed between a radioactive source and a detector, as shown in Fig. 6.1.

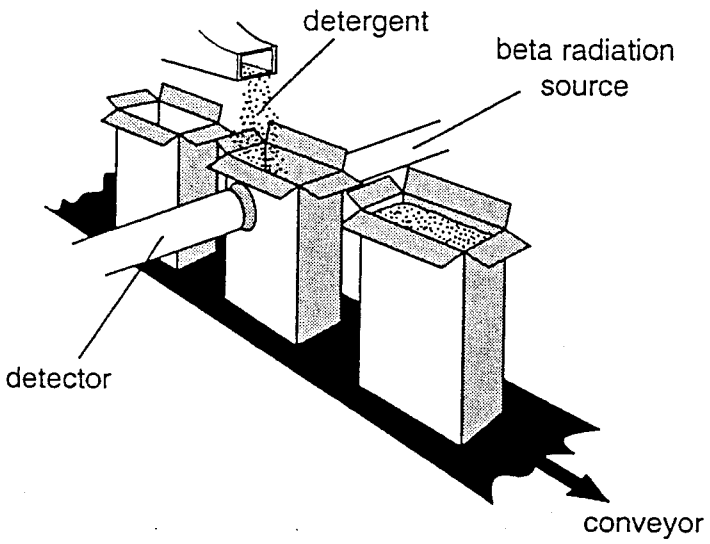


Fig. 6.1

(a) Name a suitable detector.

GM tube .....[1]

(b) The manufacturer decides to use a beta radiation source.

Explain why a beta radiation source was used, rather than

(i) an alpha radiation source,

Alpha would not even pass through an empty box .....[1]

(ii) a gamma radiation source.

Would pass through detergent without any absorption .....[1]

(c) Radioactive materials must be carefully handled as they can be dangerous to humans.

State two ways in which radiation and radioactive materials can harm humans.

1. Cell mutation → Cancer .....

2. Birth defects .....

.....[2]

Radiation burns / sickness

For Examine Use

7 (a) Complete the word equation for aerobic respiration.

oxygen + Glucose → Carbon Dioxide + Water [3]

(b) Where in the human body does aerobic respiration take place?

All living cells/mitochondria [1]

(c) Complete the table to describe **two** differences between aerobic and anaerobic respiration.

aerobic respiration	anaerobic respiration
Needs O_2	Does not need O_2
Produces CO_2 + H_2O	Produces Lactic Acid
In mitochondria	In Cytoplasm

[2]

(d) When a person exercises, the cells in their muscles respire faster than when at rest. The person breathes faster, and it takes several minutes after the exercise has finished before the breathing rate returns to normal.

(i) Explain why muscles respire faster during exercise.

Respire provides Cells/Muscles with En./ATP;
Exercise/Contraction of Muscles needs More En./ATP [2]

(ii) Suggest why a person breathes faster during exercise.

More Oxygen Needed for respiration [1]

(iii) Suggest why the person continues to breathe faster for several minutes after the exercise has finished.

Lactic Acid is Made;
Lactic Acid is Toxic/Poisonous;
Has to Broken down/oxidised; [2]
In the liver;

8 Fig. 8.1 shows two electrochemical cells, **A** and **B**.

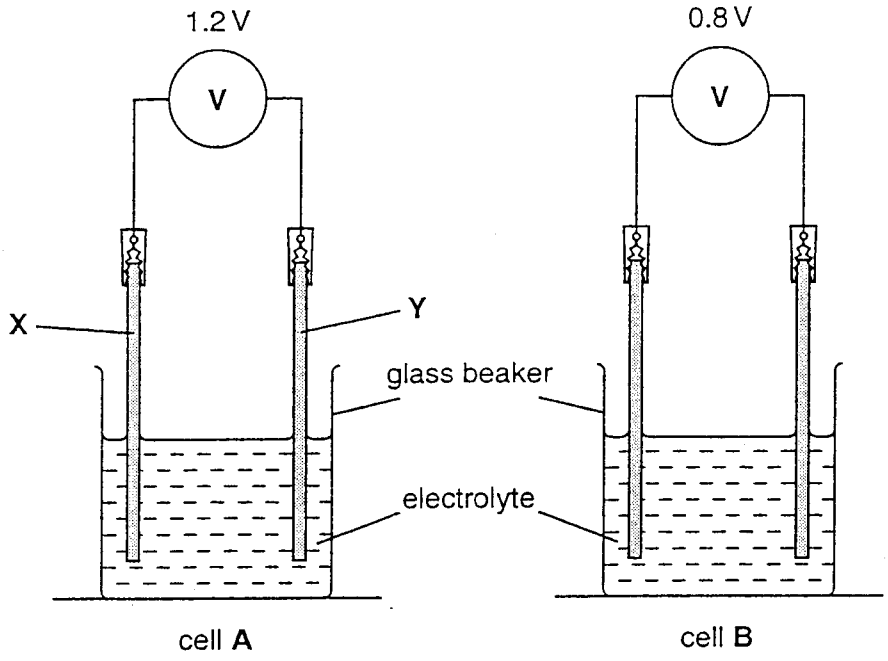


Fig. 8.1

(a) Name the **type** of substance from which parts **X** and **Y** are made.

conductors / metals [1]

(b) **X** and **Y** are placed in a solution called an **electrolyte**.

(i) What does the term *electrolyte* mean?

a liquid which decomposes when a current is passed through (molten salt or solution of an ionic compound which conducts electricity - (ions) [1]

(ii) Explain why an electrolyte must be used.

mobile ions must be present in order to complete the circuit. [1]

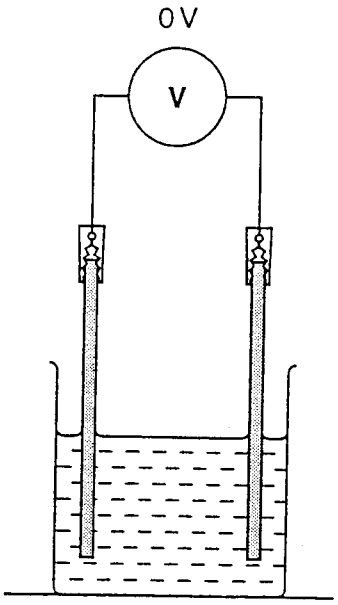
(c) The electrolytes in cells **A** and **B** are identical.

Suggest a reason why the voltages of cells **A** and **B** are different.

different metals, (the voltage depends on the difference in reactivity of the 2 metals) [1]

For Examiner's Use

(d) A student sets up a third cell, **C**.



cell **C**

Suggest two reasons which could explain why the voltage of this cell is zero.

1. Same metals

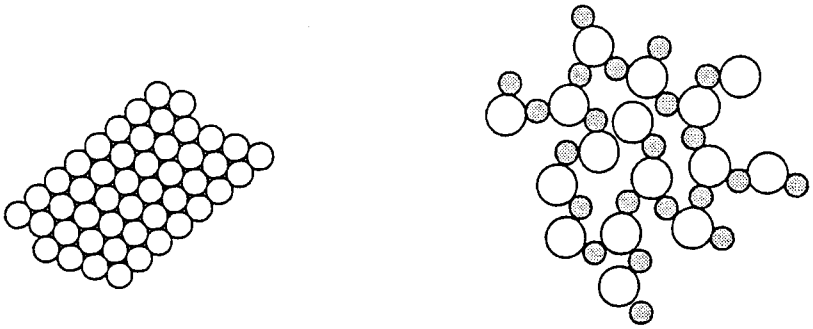
2. Liquid is not an electrolyte

[2]

(not any reference to faulty wiring etc)

For Examiner's Use

(e) Fig. 8.2 shows the arrangement of atoms in two giant structures.



structure 1 structure 2

Fig. 8.2

Explain which of these structures could represent substance **X** in cell **A** and which could represent the glass in the beaker. See Fig. 8.1 on page 10.

Substance **X** is represented by **structure** ...1.....

because ...The electrode X is probably a metal which is made up from closely packed regularly arranged atoms.

The glass in the beaker is represented by **structure** ...2...

because ...glass is a compound and at least 2 types of atom are present, also glass is an irregular giant structure, atoms in structure 2 are arranged irregularly [4]

either point -

9 (a) In 1992, two world records were set.

In speed skating, Thomas Bos skated 3000 metres in 236.16 seconds.
In athletics, Moses Kiptanui ran 3000 metres in 448.96 seconds.

The average speed of Thomas Bos was 12.7 m/s.

Find the average speed of Moses Kiptanui. Show your working.

$v = \frac{d}{t} = \frac{3000}{448.96}$

6.68 m/s [2]

(b) A runner had a mass of 70 kg and ran at 10 m/s.

Calculate the kinetic energy of the runner. Show your working and state any formula that you use. State the units of your answer.

$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 70 \times 10^2$

$= 3500$ J

[4]

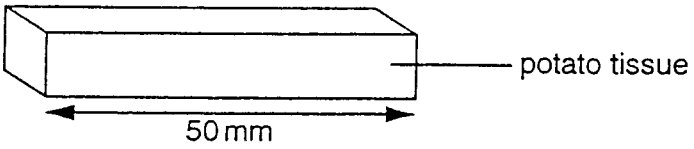
(c) After a long race, such as a marathon, athletes are wrapped in aluminium foil to reduce heat loss.

Explain how the use of aluminium foil might reduce heat loss.

- Foil has a shiny surface
- Loses less heat by radiation (poor emitter of radiation) [2]

10 A student investigated the effects of different concentrations of sucrose (sugar) solution on plant cells in tissue from potatoes.

He cut 25 chips from several raw potatoes. **Each chip was 50 mm long.**



He took 5 beakers. One was half-filled with distilled water, and the other four were half-filled with different concentrations of sucrose solution. He put 5 chips into each of the 5 beakers, and left them for two hours.

Then he took the chips out of the beakers and measured their lengths again. He worked out the average length of the chips in each beaker. His results are shown in Fig. 10.1.

concentration of sucrose solution / mol per dm^3	average length of chips after 2 hours / mm	average change in length of chips / mm
0 (distilled water)	56	+6
0.25	52	+2
0.50	50	0
1.00	46	−4
1.50	43	−7

Fig. 10.1

(a) Complete the table in Fig. 10.1 by filling in the three spaces. [2]

(b) The potato chips in 0.25 mol per dm^3 sucrose solution became longer because the cells in the chips took in water and expanded.

Complete the sentences which describe how this happened.

The concentration of the solution outside the cells was ..weaker.. than the concentration of the solution inside the cells. So water moved into the cells by ..osmosis.. , through the partially permeable ..membrane.. .

[3]

(c) Explain why the potato chips in 1.50 mol per dm^3 sucrose solution became shorter.

Concentration of Solution outside the cells was stronger than the conc. inside the cells;
Water moves out of the cells by osmosis; [2]

(d) Suggest which sucrose solution had a concentration that was the same as the concentration inside the potato cells. Give a reason for your answer.

0.50 mol/dm^3
No (net) Movement of water/osmosis in or out. [1]

[Turn over

For Examiner's Use

11 Cakes rise during baking because compounds in the cake mixture react to produce bubbles of gas. Some bubbles remain in the mixture, as shown in Fig. 11.1.

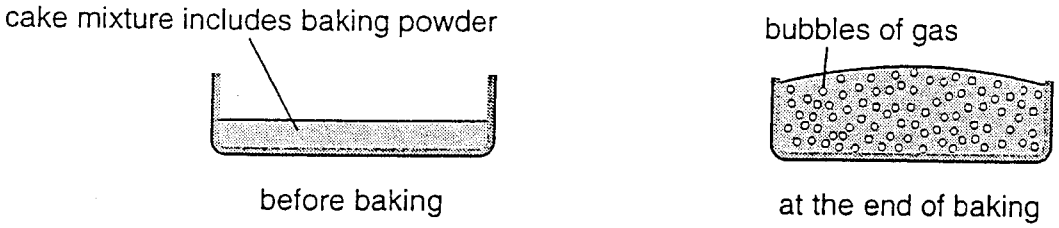


Fig. 11.1

there are different answers - choose one.

(a) (i) Describe briefly **one** difference between a *mixture* and a *compound*.

mixture – contains different elements/compounds which can easily be separated

compound – elements chemically combined, a pure substance

(also mixture can be any proportion of elements/compounds etc
a compound has a fixed proportion of each element) [1]

(ii) Explain, in terms of particles, why the formation of gas bubbles causes the cake to rise.

the gas particles are widely separated and ^ takes up more space forcing the cake to rise.

[2]

(b) Baking powder is a mixture containing sodium hydrogencarbonate and a compound which dissolves **slowly** in water to form an acid.

A student used the apparatus in Fig. 11.2 to study baking powder.

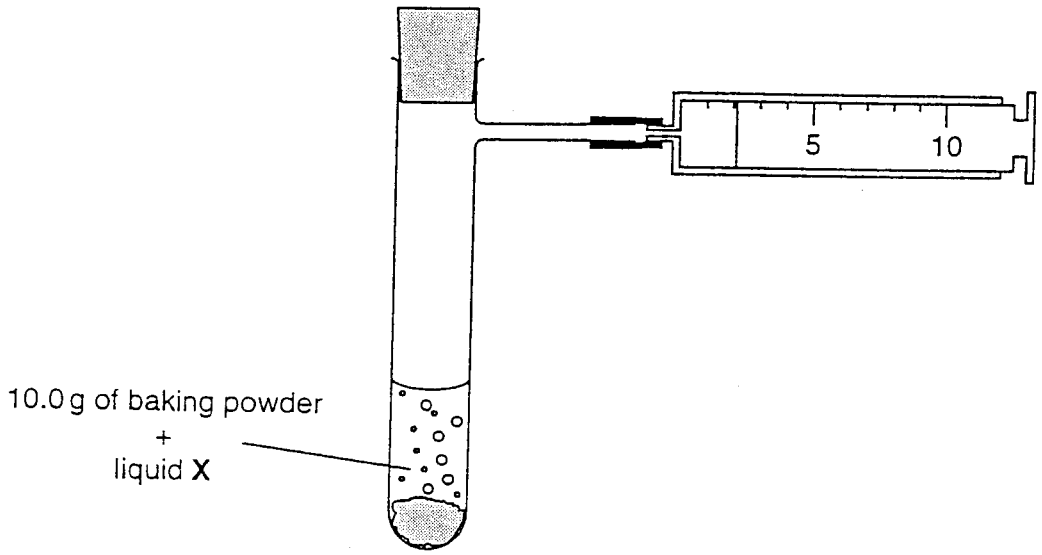


Fig. 11.2

The results from three experiments are shown in Fig. 11.3.

experiment	liquid **X**	temperature of liquid **X** / °C	volume of gas produced after 5 min / dm^3
1	water	20	1.0
2	water	50	7.5
3	vinegar (dilute ethanoic acid)	20	8.0

Fig. 11.3

(i) Suggest which gas is produced in these experiments.

carbon dioxide .....[1]

(ii) Describe a chemical test which could be used to confirm the gas that you named in (i).

bubble the gas through limewater (1)
which turns milky (1)
.....[2]

(iii) Suggest an explanation for the difference between the results for experiment **1** and for experiment **2**.

higher temperature in experiment 2
therefore faster rate of reaction.
.....[2]

(iv) Suggest why the gas is produced more quickly in experiment **3** than in experiment **1**.

additional acid present (vinegar)
therefore higher concentration and faster
reaction.
.....[1]

[Turn over

12 (a) Light energy travels to the Earth from the Sun.

(i) State whether this transfer of energy is by conduction, convection or radiation. Explain your answer.

• Radiation

• Only radiation can travel through a vacuum. [2]

(ii) Name two other forms of electromagnetic radiation which travel to the Earth from the Sun.

1. IR, UV, Gamma

2. [2]

(b) Forest fires may start when pieces of glass act like lenses and focus rays from the Sun on to dry vegetation.

Complete Fig. 12. 1 to show the refracted rays of light after they have passed through a glass lens.

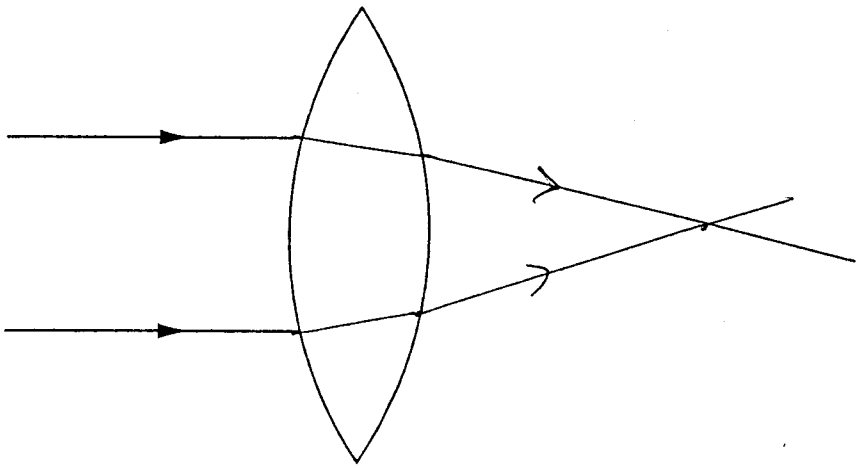


Fig. 12.1

[2]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 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

*58-71 Lanthanoid series

†90-103 Actinoid series

Key

a / X / b	a = relative atomic mass
	X = atomic symbol
	b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).