Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

COMBINED SCIENCE **0653/03**

Paper 3

October/November 2003

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 in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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.
A copy of the Periodic Table is printed on page 16.

For Examiner's Use	
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TOTAL	

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **15** printed pages and **1** blank page.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate
[Turn over

1 **(a)** Fig. 1.1 shows some information about three enzymes which act in the human digestive system.

enzyme	substance which the enzyme digests	substance which is produced	place where the enzyme works
	starch	sugar (maltose)	mouth and small intestine
lipase		fatty acids and glycerol	small intestine
protease	proteins		

Fig. 1.1

Complete the table by writing the appropriate word or words in each of the four spaces. [4]

(b) Seeds and fruits are important sources of nutrients for many animals, including humans. Many seeds and fruits contain sugar, starch and protein.

(i) Explain how the presence of these nutrients can help the seeds or fruits to be dispersed to new areas.

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.....[2]

(ii) Describe how you would test a seed for the presence of protein, and state what you would see if the test was positive.

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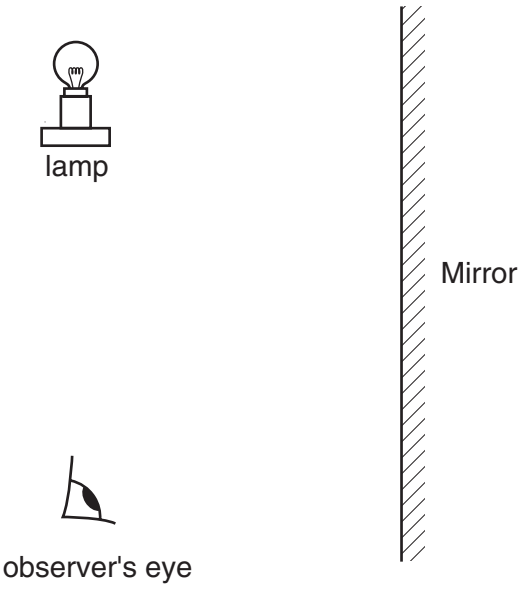
.....

.....[3]

2 **(a)** Fig. 2.1 shows an observer's eye looking at a lamp in a mirrror.

(i) On Fig. 2.1, draw a ray of light to show how the observer is able to see the lamp in the mirror.



[3]

Fig. 2.1

(ii) On Fig. 2.1 show the position of the image. [2]

(b) Light waves and radio waves are both parts of the electromagnetic spectrum.

(i) State **one** property that is the same for both of these waves.

.....[1]

(ii) State **one** property that is different for each of these waves.

.....[1]

3 Fig. 3.1 shows a blast furnace which is used to extract iron from iron ore. Iron ore is a rock containing iron(III) oxide.

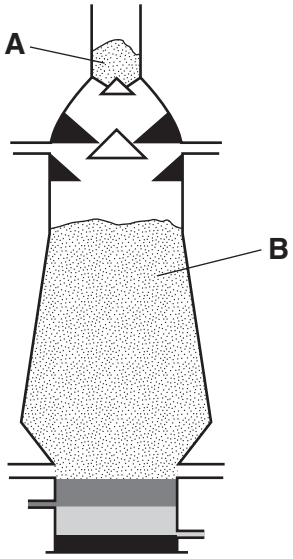


Fig. 3.1

(a) (i) Iron ore and coke are added to the furnace at **A**. Name the other raw material that is added at **A**.

.....[1]

(ii) Iron(III) oxide is reduced to iron at **B**.

Write a **word** equation for the reaction at **B**.

.....[2]

(iii) Explain why iron(III) oxide is said to be *reduced* in this reaction.

.....[1]

(b) (i) The chemical formula of iron(III) oxide is Fe_2O_3.
The formula of the oxide ion is O^{2-}.
Deduce the formula of the iron ion.
Show how you obtained your answer.

.....[2]

(ii) Calculate the relative formula mass of iron(III) oxide.
Show your working.

.....[2]

4 A student investigated the effect of temperature on the transpiration rate of potted plants.

She took three similar plants growing in pots, and added the same volume of water to the soil in each pot. Then she fastened a transparent polythene bag around each one. For plants **A** and **B**, the bag covered the pot only. For plant **C**, the bag covered the pot and also the plant, as shown in Fig. 4.1.

Plants **A** and **C** were left in a room kept at 20°C. Plant **B** was left in a room kept at 10°C.

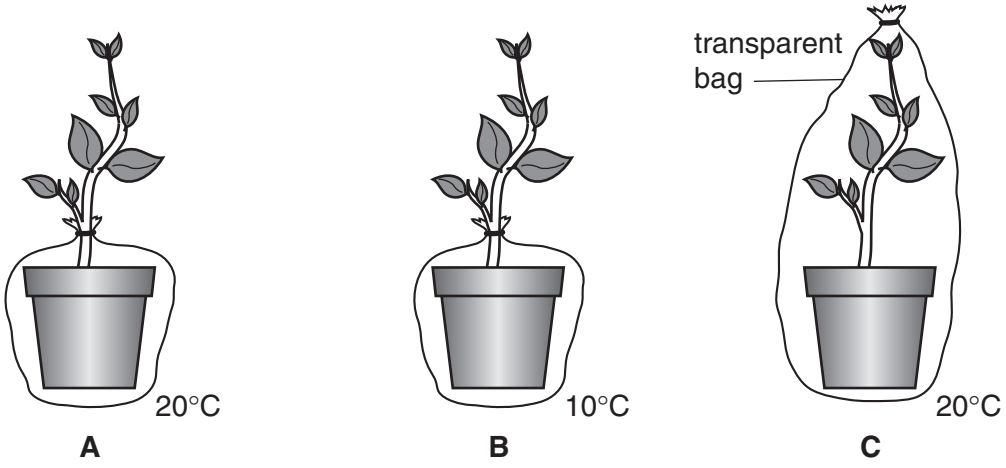


Fig. 4.1

Each plant was placed on a balance and its mass was recorded at the same time each day for one week. The loss of mass was then calculated. The results are shown in Fig. 4.2.

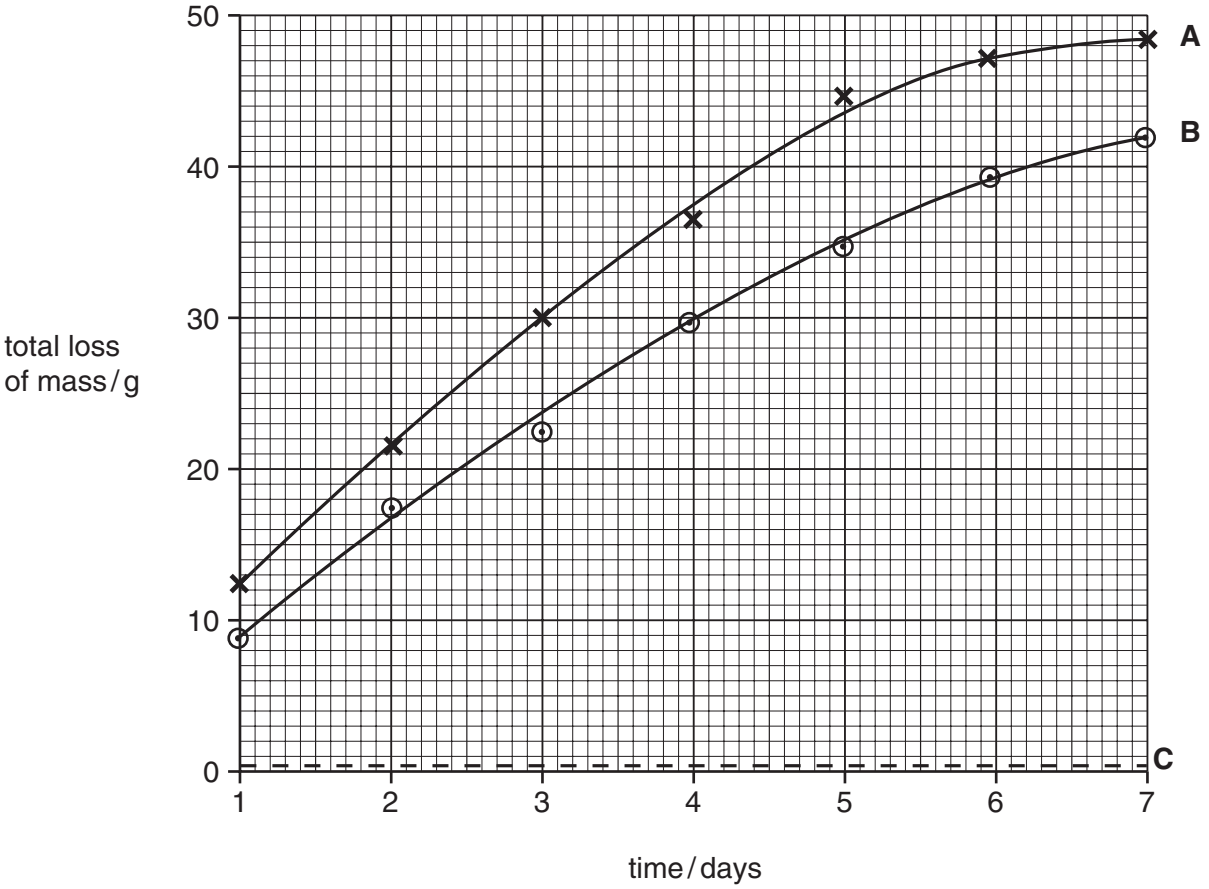


Fig. 4.2

(a) (i) Suggest **one** factor which should have been the same in the two rooms, to make sure that the student's results were valid.

.....[1]

(ii) Explain why the polythene bags needed to be transparent.

.....

.....

.....[2]

(b) (i) Explain why plants **A** and **B** lost mass, but plant **C** did not.

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.....

.....

.....[3]

(ii) Explain why plant **A** lost more mass than plant **B**.

.....

.....

.....

.....[3]

(iii) The conditions in the two rooms were kept constant throughout the experiment. Suggest why plant **A** lost mass more slowly towards the end of the week.

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.....

.....[2]

5 Liquid water may freeze into solid ice on a cold night but may evaporate into water vapour on a hot day.

Explain in terms of particles how water can be found as ice, liquid water or water vapour under these different conditions.

You may wish to use diagrams in your answer.
Your answer must refer to

- the motion of the particles,
- the separation of the particles,
- the forces between the particles.

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.....[5]

6 Most of the compounds in petroleum (crude oil) are hydrocarbons but some sulphur compounds are also present.

(a) (i) Write a **word** equation for the complete combustion of the hydrocarbon, methane.

[2]

(ii) Explain how sulphur compounds may cause damage to the environment if they are not removed from petroleum.

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.....[3]

(b) Some hydrocarbons are cracked to form smaller molecules such as ethene which contains a double bond.

Describe how a hydrocarbon is tested to find out whether it contains a double bond.

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.....[2]

(c) Fig. 6.1 shows the displayed formula of a small part of a molecule of poly(ethene).

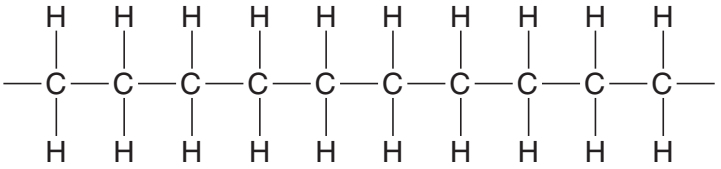

Fig. 6.1

(i) State the number of ethene monomers which have joined to form this section of the poly(ethene) molecule.

.....[1]

(ii) Explain your answer to **(i)**.

.....

.....[1]

[Turn over

7 Fig. 7.1 shows two beakers **A** and **B**, both full of water.

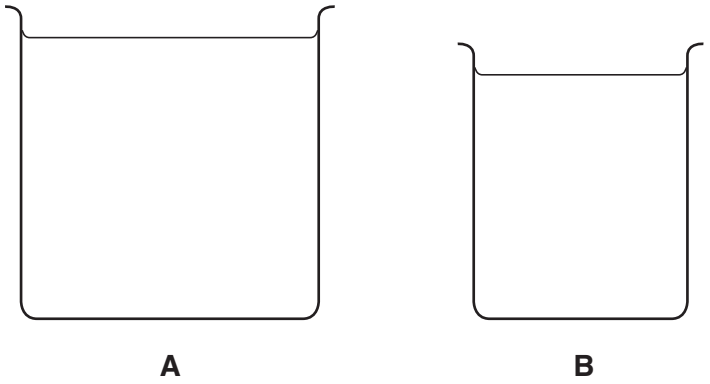

Fig. 7.1

(a) (i) When both beakers are full of water, beaker **A** has twice the weight of beaker **B**. What can be said about the masses of the two beakers when they are full of water?

Explain your answer.

.....

.....

.....[2]

(ii) Fig. 7.2 shows the two beakers balanced on a thin beam.

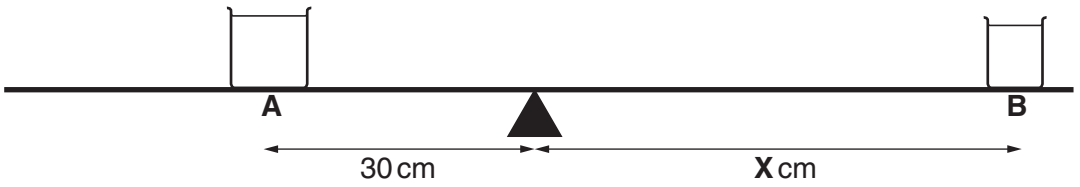

Fig. 7.2

What is the value of **X**?

Explain your answer.

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.....[2]

(b) Fig. 7.3 shows a conical flask and a drinking glass, both full of water.

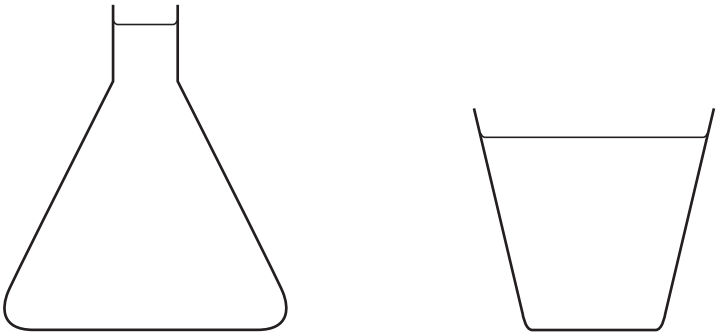

Fig. 7.3

(i) Label each container with a **C** to show the approximate centre of mass in each one. [2]

(ii) Explain why it is more difficult to tip over the conical flask than the drinking glass. You may draw diagrams if it helps your answer.

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.....[2]

8 If an onion bulb is cut open, it can be seen to be made of several different layers. Each layer has a very thin 'skin' covering its inner surface. This skin is called an *epidermal tissue*.

(a) What is the term that is used to describe a structure such as an onion bulb, which is made of several tissues grouped together?

.....[1]

(b) The outline shows the shape of a plant cell in the epidermal tissue of an onion bulb.

(i) In the space below, draw a diagram to show how at least six of these cells are grouped together to form the epidermal tissue.

[3]

(ii) State **one** way in which a cell in onion epidermal tissue differs from a cell in the palisade mesophyll of a leaf. Explain the reason for this difference.

difference .....

.....

reason for this difference .....

.....

.....[3]

9 The pH values of three acidic solutions are shown below.

vinegar	4
lemon juice	3
battery acid	1

(a) The formula of the ion present in all acids is H^+.

(i) Which of the solutions shown above contains the highest concentration of this ion?

.....[1]

(ii) Write an ionic equation which describes the neutralisation of any acid by any alkali.

.....[2]

(b) When sodium carbonate is added to dilute hydrochloric acid, there is a vigorous reaction in which the acid is neutralised and a gas is given off.

Complete the word equation for this reaction.

[3]

(c) Copper(II) oxide is an insoluble base.

Describe how crystals of copper(II) sulphate could be made from copper(II) oxide and dilute sulphuric acid.

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.....[4]

10 Radon is a gas that emits alpha radiation.

(a) Explain why alpha radiation is dangerous to human beings.

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.....[2]

(b) Explain why alpha radiation is affected by an electric field.

.....

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.....[2]

(c) Describe the differences in the structure of the nucleus of a radon-220 atom before and after the emission of an alpha particle.

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.....[2]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	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 Radius 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 = 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.).