Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/03**

Paper 3

May/June 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 pencil for any diagrams, graphs, tables 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.

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.

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

This document consists of **13** printed pages and **3** blank pages.

1 Fig. 1.1 shows the trends in some of the properties of the elements in Group V of the Periodic Table.

nitrogen	non-metal	acidic oxide	gas at 20°C
phosphorus	↓	↓	↓
arsenic	↓	↓	↓
antimony	↓	↓	↓
bismuth	metal	basic oxide	solid at 20°C

Fig. 1.1

(a) **(i)** Describe the structure and bonding in nitrogen.

.....

.....

(ii) Explain how this structure relates to the properties shown above.

.....

.....[3]

(b) Suggest, with a reason, the type of oxide you would expect arsenic to form.

.....

.....

.....[2]

(c) Antimony is a metallic element. Suggest why you would expect antimony to have a higher melting point than bismuth.

.....

.....

.....

.....[2]

(d) Write down the formula that you would expect for a chloride of phosphorus.

.....[1]

2 A child throws a beach ball, of mass 0.075 kg, vertically upwards from the ground. It takes 0.3 s to accelerate from rest to 11 m/s.

(a) Calculate the acceleration of the ball. Write down the equation that you use and show all your working.

acceleration = ... [3]

(b) Calculate the maximum kinetic energy of the ball. Write down the equation that you use and show all your working.

maximum kinetic energy = ... [3]

(c) The ball reaches a vertical height of 2.7 m. Calculate the maximum gravitational potential energy of the ball. Write down the equation that you use and show all your working. [$g = 10$ N/kg]

maximum gravitational potential energy = ... [3]

(d) **(i)** Explain what is meant by the term *efficiency*.

.....

.....

.....[2]

(ii) Discuss whether or not the energy conversion from kinetic to gravitational potential has been done efficiently.

.....

.....

.....[2]

3 Many substances need to be kept under carefully controlled conditions. Use your kno of the reactions of the substances involved to explain each of the following.

(a) Silver nitrate is stored in dark brown bottles.

.....

.....

.....[2]

(b) Sodium metal is stored immersed in liquid paraffin.

.....

.....

.....[2]

(c) Anhydrous copper(II) sulphate is stored in a desiccator.

.....

.....

.....[2]

(d) Bromine should be kept cold and in a fume cupboard.

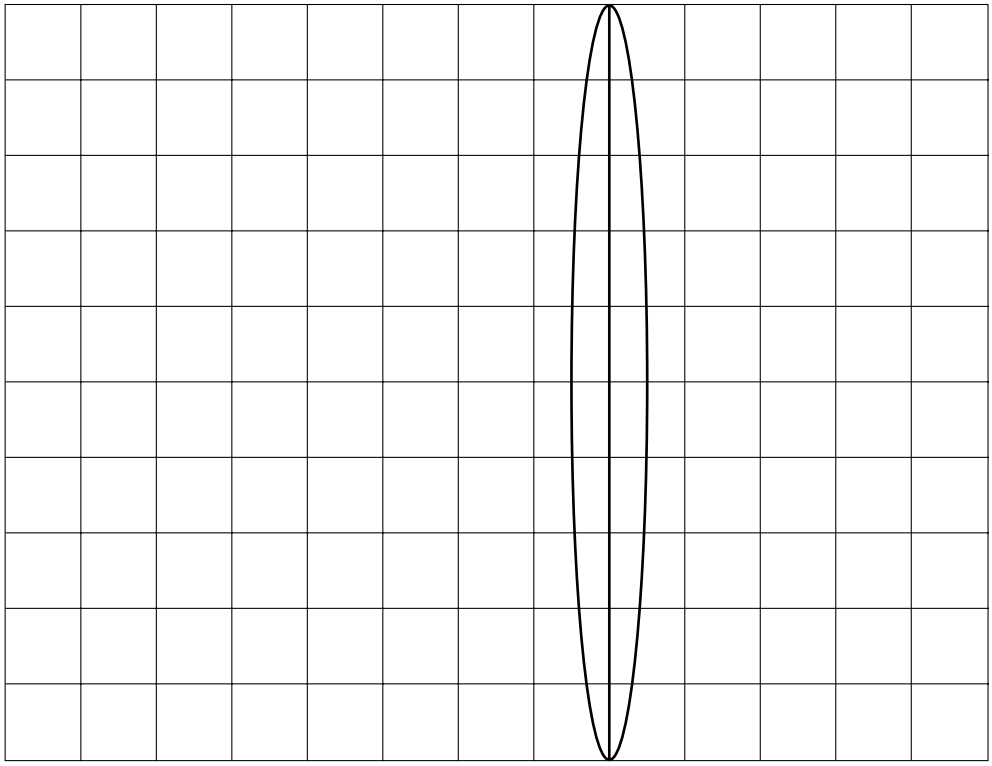
.....

.....

.....[2]

4 An object of height 2.0 cm is placed 3.0 cm to the left of a converging (convex) lens of focal length 5.0 cm.

(a) On the grid below draw a ray diagram to show the formation of the image by the lens. The central line shows the centre of the lens.



[3]

(b) Write down **three** properties of the image.

.....

.....

.....[3]

(c) Suggest a use for a lens forming an image in this way.

.....

.....[1]

5 The two diagrams in Fig. 5.1 represent the structures of a pure metal and one of its a

metal alloy

Fig. 5.1

(a) State what holds the positive metal ions together.

.....

.....[1]

(b) By referring to the diagrams, explain why pure metals are more malleable than alloys.

.....

.....

.....

.....

.....

.....[4]

(c) Both the metals in the alloy belong to Group II in the Periodic Table. The smaller circles represent magnesium ions.

(i) Suggest what ions the larger circles represent. ..... [1]

(ii) Describe **two** changes that you would expect to observe if a sample of the pure metal were placed in cold water.

.....

.....

.....

.....[2]

For Examiner's Use

6 Fig. 6.1 shows a coil of copper wire wound on a cardboard tube. The ends of the
connected to a cathode ray oscilloscope (c.r.o.) and a magnet is released so that it
vertically down the tube.

Fig. 6.2 shows the trace seen on the c.r.o., along with its y-gain and time-base settings.

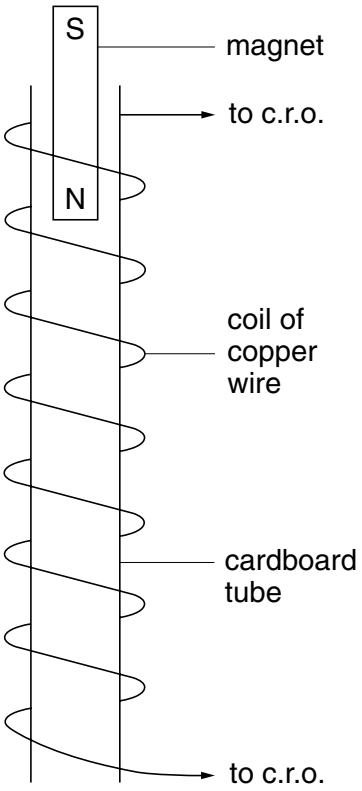
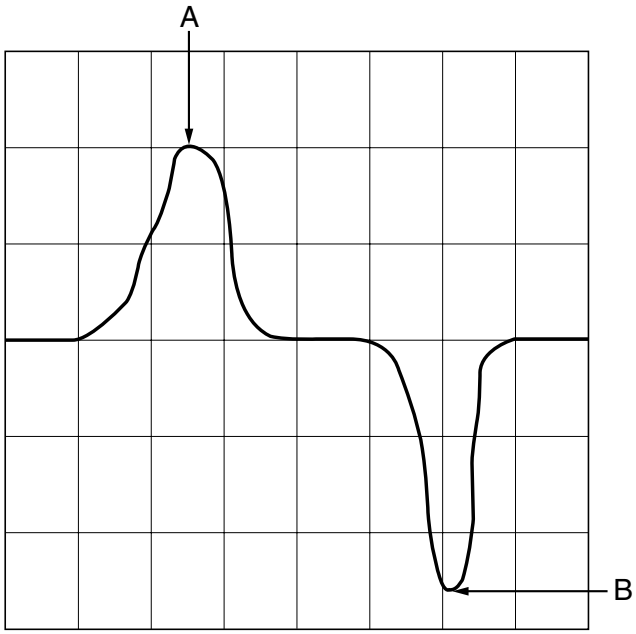


Fig. 6.1



voltage (y-gain): 0.2V/division
time-base: 20ms/division

Fig. 6.2

(a) Write down the voltages at **A** and **B.**

voltage at **A** = ...V

voltage at **B** = ...V
[2]

(b) Explain why these voltages are produced.

.....

.....

.....

.....[2]

(c) State and explain **two** things about the shape of the trace.

.....

.....

.....

.....

.....

.....

.....

.....[4]

7 The equation for the reaction between copper(II) carbonate and dilute hydrochloric a be written as shown below.

$$CuCO_3(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l) + CO_2(g)$$

(a) (i) What do you understand by the symbol (II) after the word copper?

.....

.....[1]

(ii) Why is it **not** necessary to write this symbol after calcium in the name calcium carbonate?

.....

.....[1]

(b) In an experiment copper(II) carbonate is added to 50 cm^3 of hydrochloric acid of concentration 1 mol/dm^3, until no more will react.

(i) Calculate the number of moles of HCl in the 50 cm^3 of acid.

number of moles of HCl ..... [1]

(ii) Calculate the number of moles of copper(II) carbonate that will react with this acid.

number of moles of copper(II) carbonate .....[1]

(iii) Calculate the relative formula mass, M_r, of copper(II) carbonate.
[A_r: C, 12; O, 16; Cu, 64]

M_r of copper(II) carbonate .....[2]

(iv) Calculate the mass of copper(II) carbonate that will react with this acid.

mass of copper(II) carbonate .....[2]

8 Fig. 8.1 shows a circuit with a high-resistance voltmeter being used to measure the e
a cell.

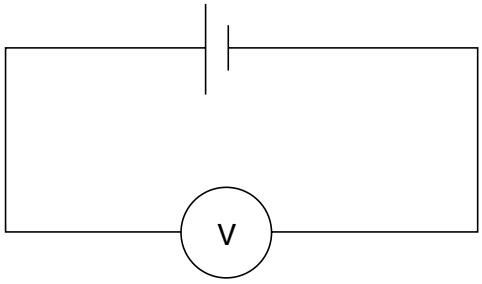


Fig. 8.1

(a) Explain the meaning of the term *e.m.f.*

.....

.....

.....[2]

(b) Explain why the voltmeter must have a high resistance if it is to measure an accurate value of the e.m.f.

.....

.....

.....[2]

(c) Fig. 8.2 shows a cell with an internal resistance of 2 Ω.

A voltmeter which has a resistance of 100 Ω is connected across the cell. The e.m.f. of the cell is 1.50 V.

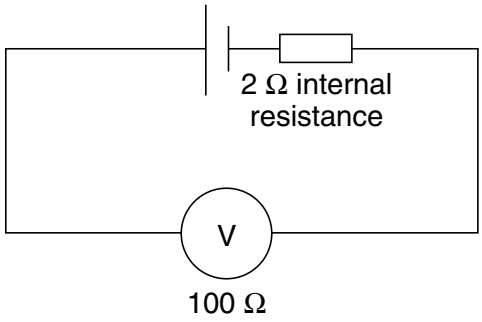


Fig. 8.2

(i) Calculate the current in the circuit.

current = ... [3]

(ii) Calculate the potential difference across the voltmeter.

potential difference = ... [2]

(iii) The potential difference in **(ii)** is **not** equal to the e.m.f. of the cell. Explain why this is the case and state what change you would make in order to give a value much closer to the e.m.f. of the cell.

.....

.....

.....

.....

.....[3]

9 Ethene, C_2H_4, is the first member of the homologous series of alkenes.

(a) Draw a diagram to show the arrangement of the outer shell electrons in a molecule of ethene.

[2]

(b) In most homologous series the first member contains only one carbon atom. Explain why this is not the case with alkenes.

.....

.....

.....

.....[2]

(c) Ethene and hydrogen can be produced from saturated hydrocarbons by cracking.

(i) Write an equation for the cracking of butane, C_4H_{10}, to produce ethene and hydrogen.

.....[2]

(ii) State **two** essential conditions for cracking to occur.

.....

.....[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	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 1	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 9	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 7	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

8-71 Lanthanoid series
90-103 Actinoid series

ey

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.).