Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/02**

Paper 2

October/November 2003

1 hour

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, 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 12.

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 **12** printed pages.

University of Cambridge
Local Examinations Syndicate

[Turn over

1 **(a)** **(i)** Describe how a sodium atom, Na, forms a sodium ion, Na^+.

.....

.....[1]

(ii) Describe how a chlorine atom, C*l*, forms a chloride ion, Cl^-.

.....

.....[1]

(iii) Hence describe how sodium chloride is formed from sodium and chlorine.

.....

.....

.....[2]

(b) In terms of covalent bonding, explain how chlorine forms diatomic molecules, Cl_2.

.....

.....

.....[2]

2 A scientist is studying the electromagnetic radiation received from a star. The graph in Fig. 2.1 shows the intensity of the radiation of different wavelengths.

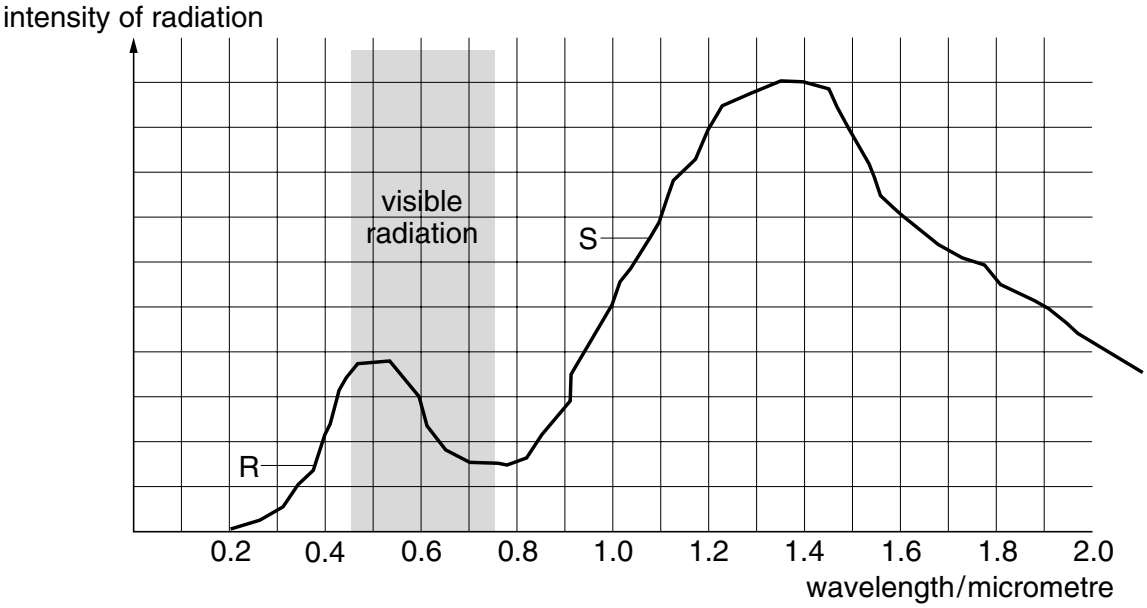

Fig. 2.1

The wavelength of visible light ranges from 0.45 to 0.75 micrometres, the shaded region on the graph.

(a) In what regions of the electromagnetic spectrum are the points **R** and **S**?

R .....

S .....[2]

(b) How does the speed in a vacuum of the radiation at **R** and at **S** compare?

.....[1]

(c) At what wavelength is the intensity of the radiation greatest?

..... micrometres [1]

3 A small child has mixed together the salt and the pepper in the kitchen.
Salt is soluble in water. Pepper is not soluble in water.
Describe how to obtain salt and pepper separately from this mixture.

.....

.....

.....

.....

.....

.....[4]

4 Complete the table in Fig. 4.1 for the relative charge and approximate relative mass of a proton, a neutron and an electron.

particle	relative charge	approximate relative mass
proton	+1	
neutron		1
electron		$\frac{1}{2000}$

Fig. 4.1

[3]

5 **(a)** An athlete wins a trophy for completing a 200 m race in a time of 25 s. Calculate the average speed of the athlete. Show your working and state the unit.

speed = ... [3]

(b) Fig. 5.1 shows four designs for the trophy, **P**, **Q**, **R** and **S**. The position of the centre of mass of each trophy is marked with an **X**.

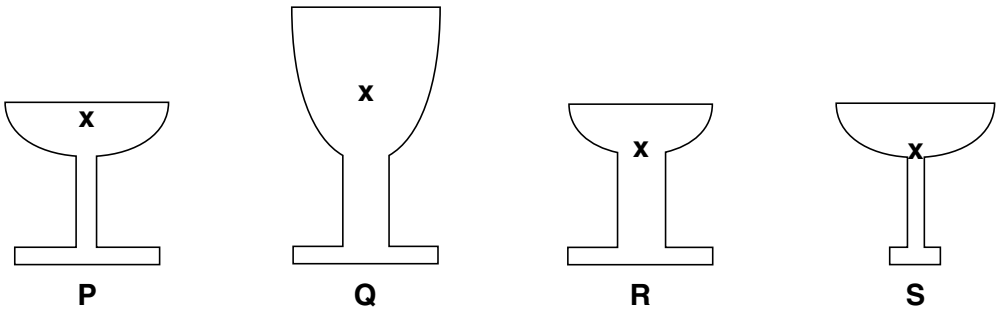

Fig. 5.1

State and explain which trophy would be the most stable.

.....

.....

.....[3]

6 **(a)** State **two** properties of iron which explain why this metal is described as a *transition* element.

property 1 .....

property 2 .....

[2]

(b) State **two** methods used to prevent iron rusting.

method 1 .....

method 2 .....

[2]

[Turn over

7 Fig. 7.1 shows an experiment to measure the half-life of an isotope of protactinium which decays by emission of beta-particles.

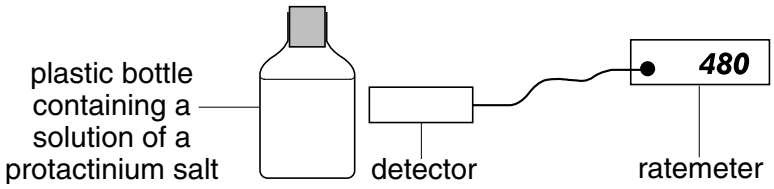

Fig. 7.1

(a) (i) Explain what is meant by the term *isotope*.

.....

.....[2]

(ii) Name a suitable detector.

.....[1]

(iii) Explain why this method could not be used for a liquid that emits alpha-particles.

.....

.....

.....[2]

(b) Protactinium has a half-life of 1 minute.
In the experiment the initial count rate was 480 Bq.
Calculate the count rate after 3 minutes. Show your working.

count rate = ... Bq. [3]

(c) In a further experiment the background count rate was considered.

Explain what is meant by the term *background count rate*.

.....

.....

.....[2]

8 Two students investigate the speed of reaction of zinc with dilute hydrochloric acid.

(a) One student finds that adding water to dilute the acid makes the reaction slower.

Use the kinetic particle theory of matter to explain why the reaction is slower when the acid is more dilute.

.....

.....

.....[2]

(b) The other student finds that warming the acid makes the reaction faster.

Use the kinetic particle theory of matter to explain why the reaction is faster when the acid is warmer.

.....

.....

.....[2]

[Turn over

9 **(a)** In terms of molecular structure, explain why butane is described as a *saturated* hydrocarbon.

.....

.....

.....[1]

(b) The main use of butane is a fuel in the form of liquefied petroleum gas.

(i) When butane is burnt completely in excess air, only two substances are formed.

Name these two substances.

substance 1 .....

substance 2 .....

[2]

(ii) Explain why butane can be described as a *clean* fuel when burnt completely.

.....

.....

.....[2]

10 Fig 10.1 shows a bimetal strip before and after being heated.

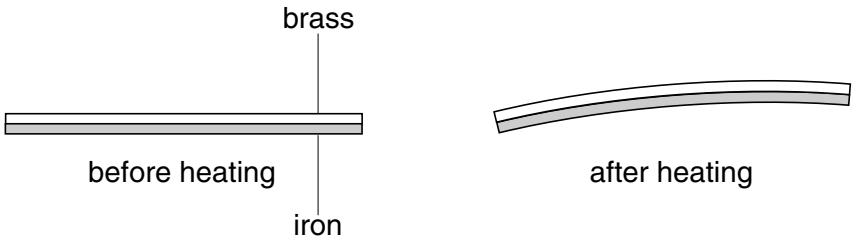

Fig. 10.1

(a) Explain why the strip bends when it is heated.

.....

.....

.....[2]

(b) Fig. 10.2 shows a similar strip in a circuit.

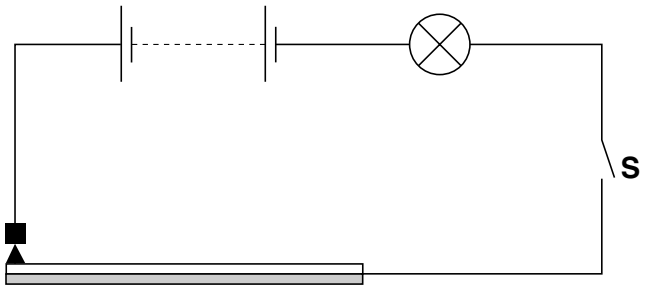

Fig. 10.2

(i) Explain why the lamp flashes on and off when switch **S** is closed.

.....

.....

.....[3]

(ii) Suggest a use for such a circuit.

.....[1]

11 (a) Use the following words to complete the table in Fig. 11.1.

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

conductor **high** **insulator** **low**

	density at room temperature	conduction of electricity
metals		
non-metals		

Fig. 11.1

[2]

(b) Gold occurs naturally as an element.

Iron is obtained from its ore by heating with carbon.

Aluminium must be obtained from its ore by electrolysis which requires considerable energy.

In terms of the reactivity of these metals, explain these facts.

.....

.....

.....[2]

12 Fig. 12.1 shows a circuit designed to determine the resistance of a wire. However, the voltmeter has been omitted.

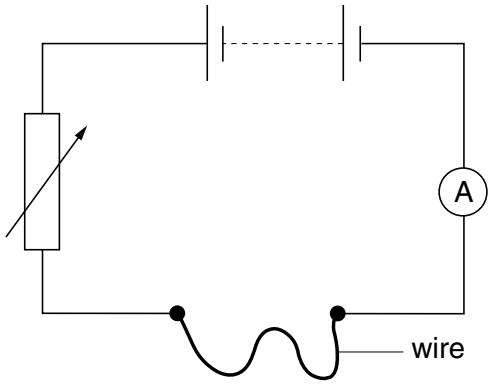

Fig. 12.1

(a) **(i)** Complete the diagram to show how the voltmeter should be connected.

(ii) Explain why the variable resistor is included in the circuit.

.....

.....[3]

(b) The wire is replaced by a wire made from the same material and of the same length, but of twice the diameter.

State how the resistance of the wires would compare.

.....[1]

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 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.).