

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

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
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.

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

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

(ii) Describe how a chlorine atom, Cl, 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, Cl₂.

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

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

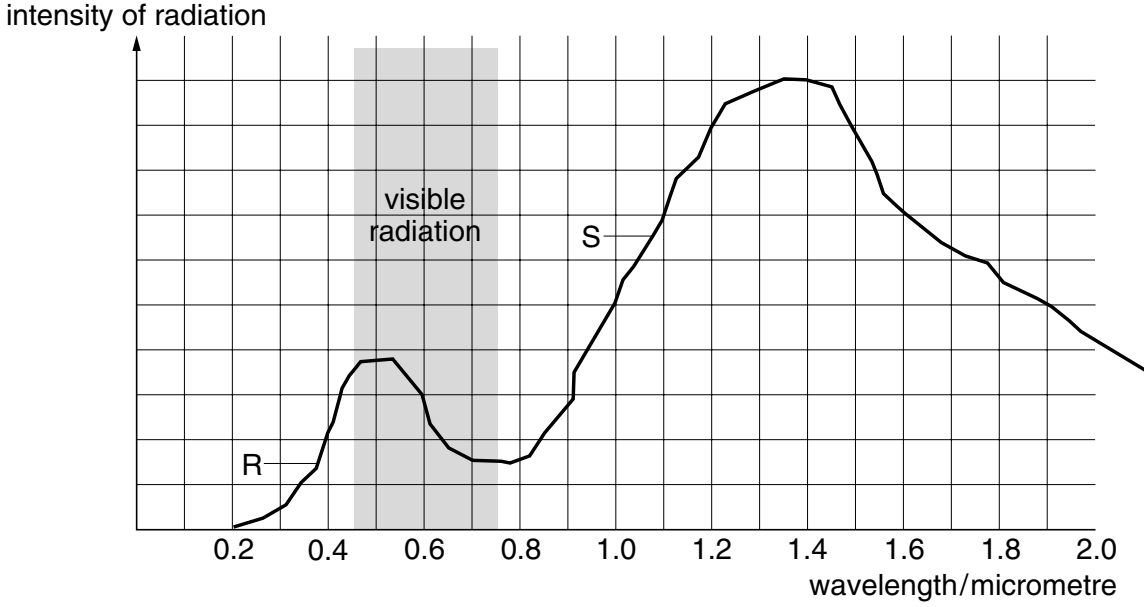


Fig. 2.1

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]

4

- 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.

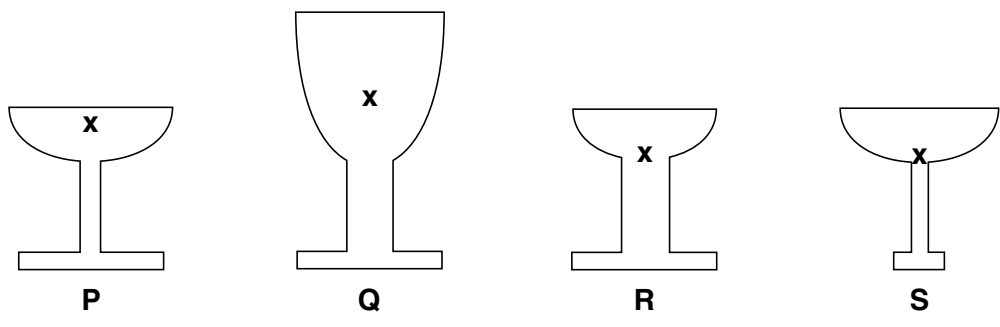


Fig. 5.1

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]

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

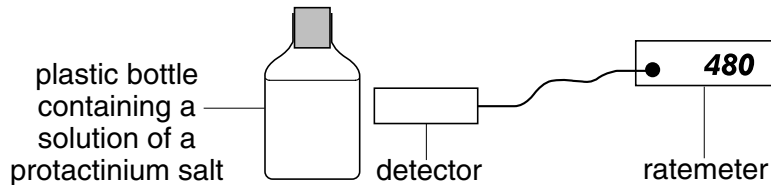


Fig. 7.1

(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]

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.

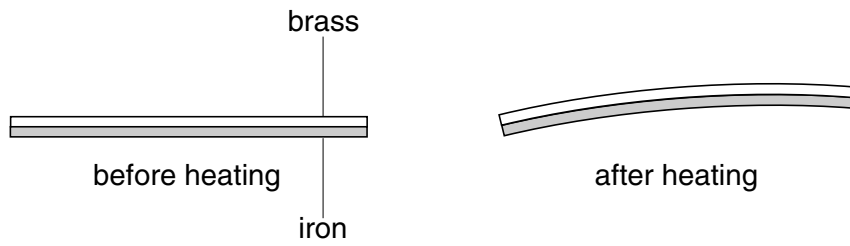


Fig. 10.1

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

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

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

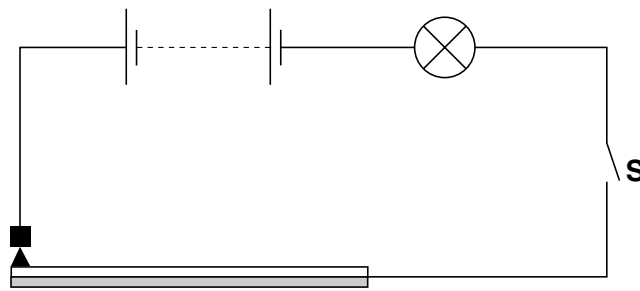


Fig. 10.2

(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.

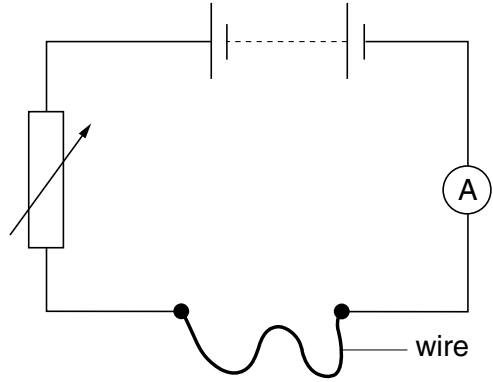


Fig. 12.1

- (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				
7 Li Lithium	9 Be Beryllium	1 H Hydrogen	12 C Carbon	14 N Nitrogen	16 O Oxygen	19 F Fluorine	4 He Helium				
23 Na Sodium	24 Mg Magnesium	11 B Boron	28 Si Silicon	31 P Phosphorus	32 S Sulphur	35.5 Cl Chlorine	20 Ne Neon				
39 K Potassium	40 Ca Calcium	27 Al Aluminium	73 Ge Germanium	75 As Arsenic	79 Se Selenium	80 Br Bromine	40 Ar Argon				
85 Rb Rubidium	88 Sr Strontium	70 Ga Gallium	112 Cd Cadmium	115 In Indium	119 Sn Tin	127 I Iodine	84 Kr Krypton				
133 Cs Caesium	137 Ba Barium	65 Zn Zinc	207 Pb Lead	209 Bi Bismuth	210 Po Polonium	210 At Astatine	131 Xe Xenon				
226 Ra Radium	227 Ac Actinium	59 Ni Nickel	197 Au Gold	195 Pt Platinum	201 Hg Mercury	210 Rn Radon	86 Rn Radon				
		56 Fe Iron	79 Cu Copper	78 Pd Palladium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		55 Mn Manganese	29 Cu Copper	46 Pd Palladium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		52 Cr Chromium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		48 Ti Titanium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		45 Sc Scandium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		91 Zr Zirconium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		91 Zr Zirconium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		178 Hf Hafnium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		181 Ta Tantalum	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		184 W Tungsten	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		226 Ra Radium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				
		227 Ac Actinium	27 Co Cobalt	45 Rh Rhodium	80 Hg Mercury	85 At Astatine	86 Rn Radon				

140 Ce Cerium	141 Pr Praseodymium	144 Nd Neodymium	150 Sm Samarium	152 Eu Europium	157 Gd Gadolinium	162 Dy Dysprosium	165 Ho Holmium	167 Er Erbium	169 Tm Thulium	173 Yb Ytterbium	175 Lu Lutetium
232 Th Thorium	232 Pa Protactinium	238 U Uranium	238 Pu Plutonium	238 Am Americium	238 Cm Curium	238 Bk Berkelium	238 Es Einsteinium	238 Fm Fermium	238 Md Mendelevium	238 No Nobelium	238 Lr Lawrencium

8-71 Lanthanoid series
90-103 Actinoid series

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

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