Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/02**

Paper 2 (Core)

October/November 2006

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.
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.
A copy of the Periodic Table is printed on page 16.
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.

For Examiner's Use	
1	
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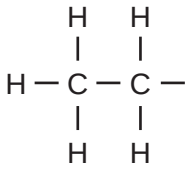
11	
Total	

This document consists of **14** printed pages and **2** blank pages.

1 **(a)** **(i)** Complete the diagram in Fig. 1.1 for **ethanol**, C_2H_6O.



[1]

Fig. 1.1

(ii) Calculate the relative molecular mass, M_r, of **ethanol**, C_2H_6O.

Show your working.

M_r = ... [2]

(iii) Complete the diagram in Fig.1.2 for **ethanoic acid**, $C_2H_4O_2$.

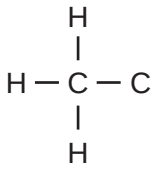


Fig. 1.2 [2]

(b) Ethanol, C_2H_6O, can be used as a fuel.

(i) Balance the following chemical equation for the products of the complete combustion of ethanol.

$$C_2H_6O + 3O_2 \longrightarrow \text{.....}CO_2 + \text{.....}H_2O$$

[1]

(ii) Describe a chemical test for the carbon dioxide produced.

test .....

result ..... [2]

(iii) Describe a chemical test for the water produced.

test .....

result ..... [2]

(c) A student adds dilute aqueous sodium hydroxide in **excess** to an aqueous sol ethanoic acid in a beaker.

Suggest how the pH number of the liquid in the beaker changes.

.....

.....

..... [2]

2 **(a)** Look at the Periodic Table on page 16.

State the number of electrons in the **outer shell** of an atom of

(i) the alkali metal caesium, Cs, ... [1]

(ii) the halogen astatine, At. ..... [1]

(b) Describe the formation of each of the ions in caesium astatide, CsAt, from the atoms of caesium and of astatine.

[2]

(c) A molecule of chlorine, Cl_2, has a single covalent bond between the two atoms.
A molecule of astatine, At_2, has similar bonding.

Draw a diagram to show the bonding in a molecule of astatine, At_2.

Show only the **outer** electrons.

[2]

3 Fig. 3. 1 shows part of a gas thermostat used in an oven.

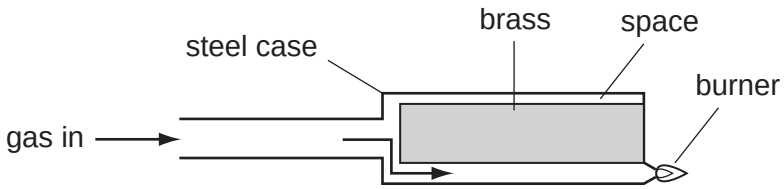


Fig. 3.1

(a) Explain why less gas enters the burner as the temperature in the oven gets higher.

.....

.....

..... [2]

(b) Fig. 3.2 shows a loaf of bread cooking in the oven.

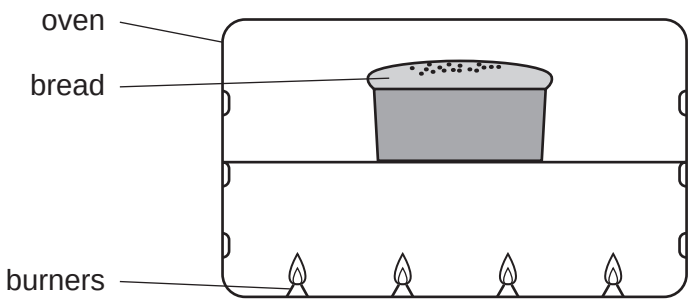


Fig. 3.2

Thermal energy is transferred from the burning gas to the bread by conduction, convection and radiation.

Explain, with reference to this example, what is meant by

(i) *conduction,* .....

.....

(ii) *convection,* .....

.....

(iii) *radiation.* .....

..... [4]

4 A meteorite is a piece of rock which comes from the outer part of the solar syste enters the Earth's atmosphere.

Fig. 4.1 shows the speed of the meteorite as it approaches and finally strikes the Earth.

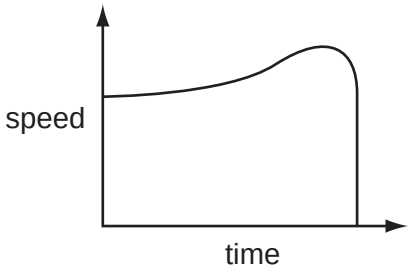


Fig. 4.1

(a) As the meteorite approaches the Earth it is travelling at a high speed and accelerates further.

(i) Name the type of energy it has due to its motion. ..... [1]

(ii) Suggest why it accelerates as it approaches the Earth.

.....

.....

..... [2]

(b) When the meteorite enters the Earth's atmosphere it slows down rapidly.

(i) Mark, with an **X**, the point on the graph at which the meteorite enters the Earth's atmosphere. [1]

(ii) Using scientific terms explain why the meteorite slows down.

.....

.....

..... [2]

(iii) State into what form the energy is converted.

..... [1]

5 A boy holds a long rope at one end and moves it sharply up and down to send waves along the rope. Fig. 5.1 shows the waves moving along the rope.

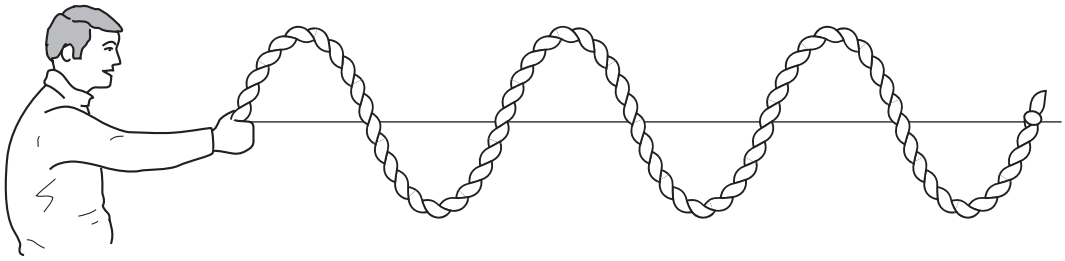


Fig. 5.1

(a) Mark on the diagram

(i) the wavelength of the wave and label it λ,

(ii) the amplitude of the wave and label it **A**. [2]

(b) Explain how the boy changes the movement of his hand to

(i) increase the amplitude of the wave,

.....

.....

(ii) increase the frequency of the wave.

.....

..... [3]

(c) When a guitar string is plucked a sound is heard.

Explain how the sound is produced.

.....

.....

..... [2]

6 **(a)** Balloons are used to lift radio equipment high in the atmosphere to measure pr... temperature and ozone levels.

Explain why helium, **not** hydrogen, is used to fill these balloons.

.....

.....

..... [2]

(b) Filament lamps have a thin wire of tungsten that glows white hot when connected to the electrical supply.

Explain why argon, **not** air, is used to fill these lamps.

.....

.....

..... [2]

(c) An atom of helium has the notation $^{4}_{2}\text{He}$.

An atom of argon has the notation $^{40}_{18}\text{Ar}$.

Complete Fig. 6.1 for these atoms.

notation of atom	$^{4}_{2}\text{He}$	$^{40}_{18}\text{Ar}$
number of protons in nucleus	2	
number of neutrons in nucleus		22
arrangement of electrons in shells in the atom	2	

[3]

Fig. 6.1

7 Fig. 7.1 shows a circuit. The e.m.f. of the battery is 12V.

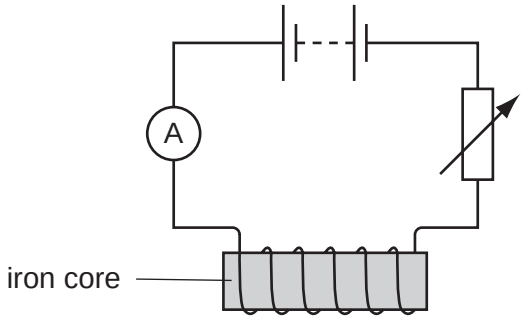


Fig. 7.1

(a) What is the total resistance in the circuit when the ammeter reads 2 A?

Show your working and state the unit.

resistance = ... [3]

(b) Two soft iron nails are attracted to the core as shown in Fig. 7.2.

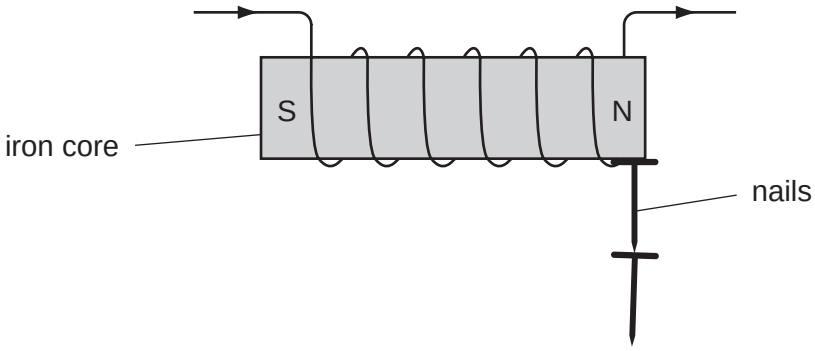


Fig. 7.2

(i) Complete Fig. 7.2 to show the poles induced on the nails. [2]

(ii) Explain what happens to the nails when the current is gradually reduced to zero.

.....

.....

..... [3]

8 **(a)** Iron, Fe, is described as a *transition* element.

State two properties of iron that are common to transition elements.

1. .....

2. ..... [2]

(b) Iron reacts with dilute hydrochloric acid.

$$Fe(s) + 2HCl(aq) \longrightarrow FeCl_2(aq) + H_2(g)$$

State two ways of increasing the speed of this reaction.

1. .....

2. ..... [2]

(c) Iron goes rusty in damp air.

State two ways to prevent iron from rusting.

1. .....

2. ..... [2]

(d) Rust is a form of iron oxide. When this is heated in carbon monoxide, iron and carbon dioxide are formed.

Explain this reaction in terms of *oxidation* and *reduction*.

oxidation .....

.....

reduction .....

..... [2]

9 An experiment is done to measure the half-life of an isotope of neon. The results are in Fig. 9.1

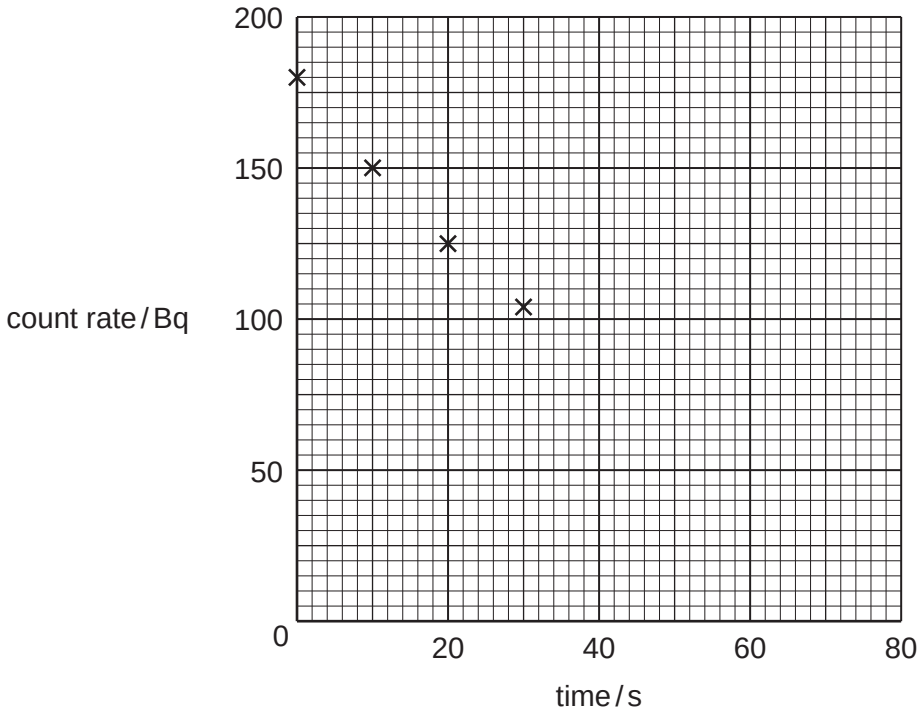
count rate/Bq	180	150	125	104	85	70	60	51	42
time/s	0	10	20	30	40	50	60	70	80

Fig. 9.1

(a) The first four points are already plotted on the grid in Fig. 9.2.

(i) Plot the remaining points.

(ii) Draw a smooth curve through the points.



[3]

Fig. 9.2

(b) Use the graph to find the half-life of the isotope.

half-life = ... s [2]

(c) The isotope decays by emission of a beta-particle (β-particle). Complete the equation to show the decay.

$$^{23}_{10}\text{Ne} \longrightarrow \text{.....}^{\text{.....}}_{\text{.....}}\text{Na} + \text{.....}^{\text{.....}}_{\text{.....}}\beta$$

[2]

10 **(a)** Energy is needed to convert a boiling liquid, at constant temperature, into a gas.

Use the kinetic particle theory of matter to explain this fact.

.....

.....

.....

..... [2]

(b) Explain why evaporation from the surface of a liquid causes the temperature of the remaining liquid to cool.

.....

.....

.....

..... [2]

(c) **(i)** Fig. 10.1 shows two liquids being boiled for several minutes.

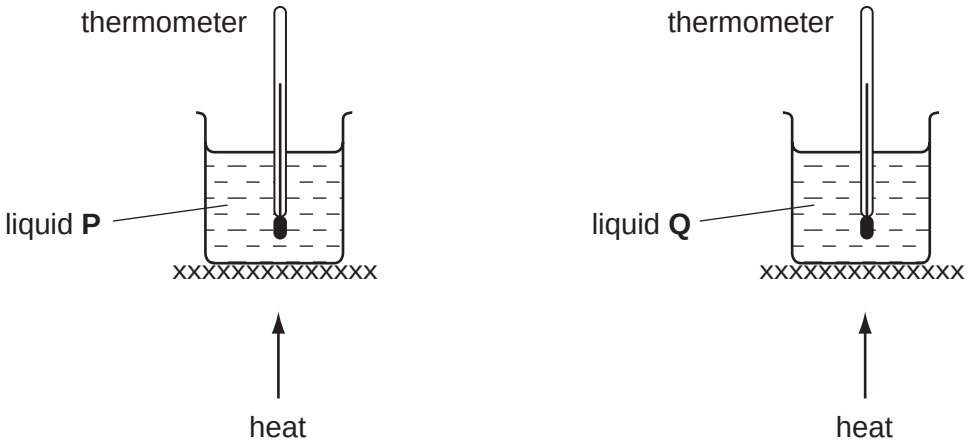


Fig. 10.1

Liquid **P** continues to boil at a **constant** temperature.

Liquid **Q** continues to boil at a temperature that **increases** with time.

Explain these observations.

.....

.....

..... [2]

(ii) Name **one** example of a liquid that behaves like liquid **Q**.

..... [1]

11 **(a)** Describe how a polythene rod can be charged.

.....

..... [1]

(b) Fig. 11.1 shows a negatively charged polythene rod suspended by an insulating thread.

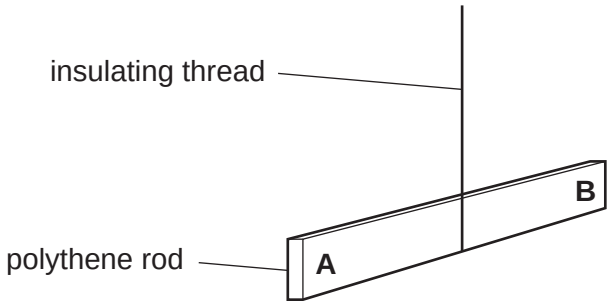


Fig. 11.1

State what happens when

(i) a negatively charged rod is brought up to end **A**,

.....

(ii) a positively charged acetate rod is brought up to end **A**,

.....

(iii) a positively charged acetate rod is brought up to end **B**,

.....

(iv) an uncharged glass rod is brought up to end **A**.

.....

[4]

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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 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.).