

Centre Number	Candidate Number	Name
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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	
2	
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4	
5	
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7	
8	
9	
10	
11	
<b>Total</b>	

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



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

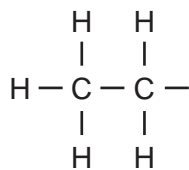


Fig. 1.1

[1]

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

Show your working.

$$M_r = \dots\dots\dots [2]$$

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

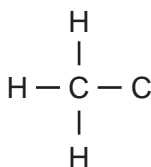


Fig. 1.2

[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.



[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 solution of 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.

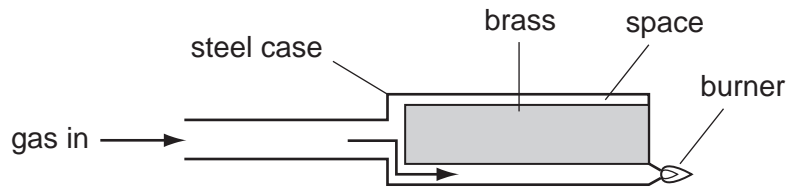


Fig. 3.1

(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.

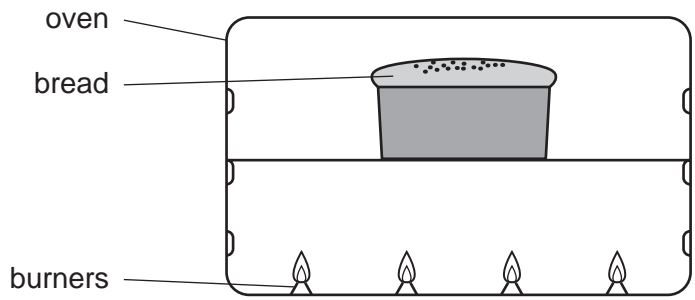


Fig. 3.2

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*, .....

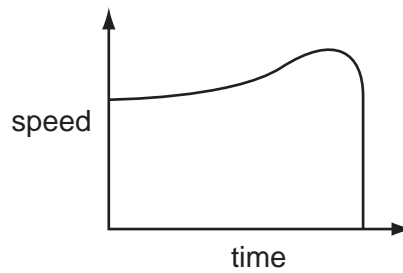
.....

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

..... [4]

- 4 A meteorite is a piece of rock which comes from the outer part of the solar system and 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.

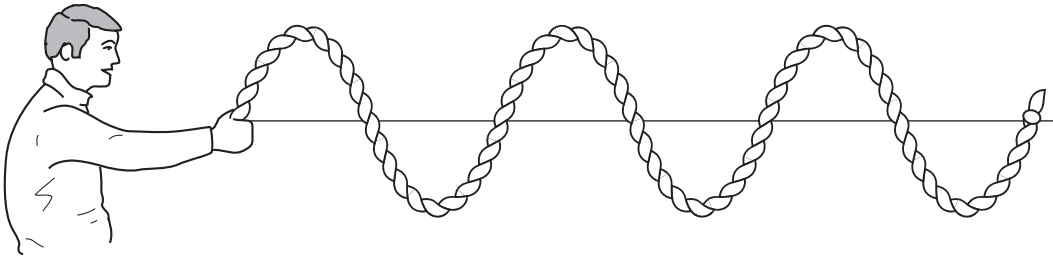


Fig. 5.1

- (a) Mark on the diagram

(i) the wavelength of the wave and label it  $\lambda$ ,

(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 pressure, 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
<b>arrangement</b> of electrons in shells in the atom	2	

Fig. 6.1

[3]



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

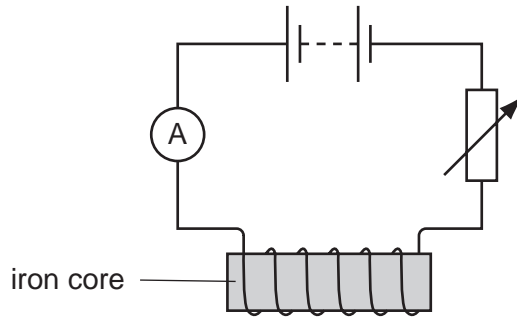


Fig. 7.1

(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.

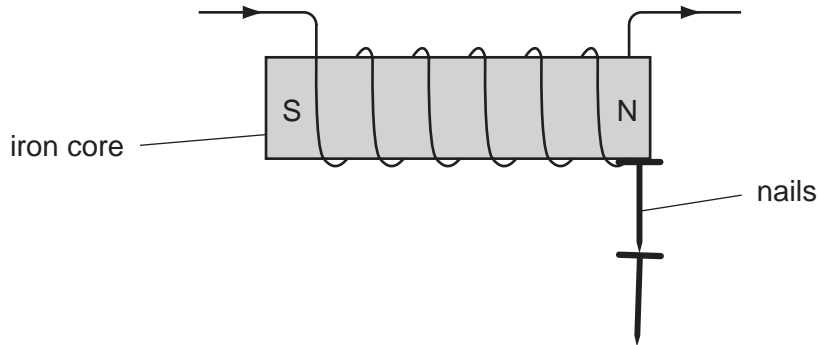


Fig. 7.2

(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.



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 shown 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.

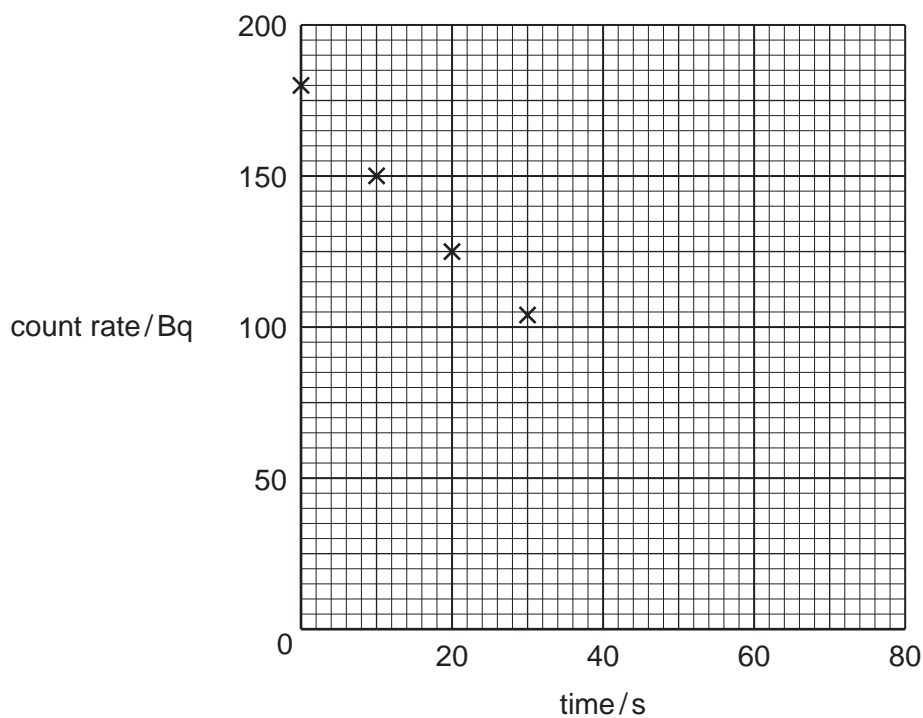


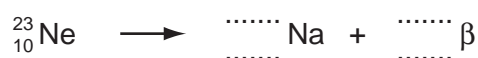
Fig. 9.2

[3]

- (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 ( $\beta$ -particle). Complete the equation to show the decay.



[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.

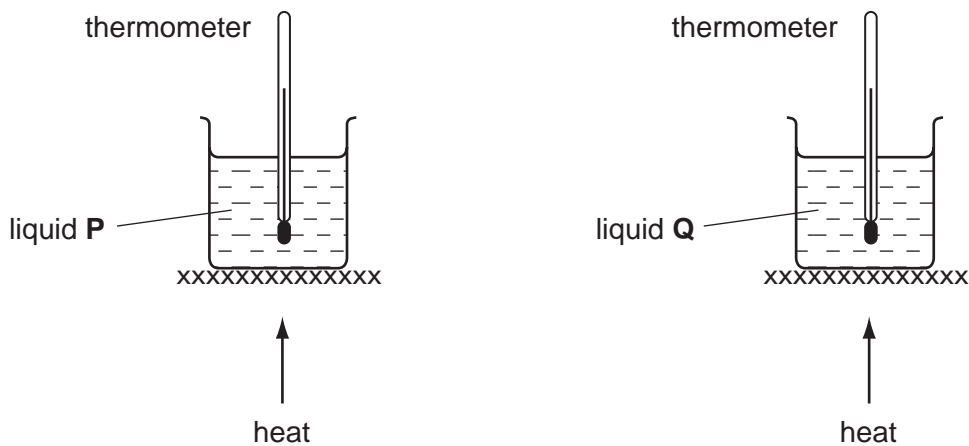


Fig. 10.1

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.

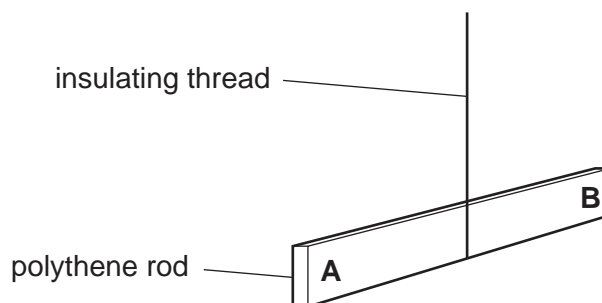


Fig. 11.1

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	VIII	IX	X	XI	XII	0																	
		1 <b>H</b> Hydrogen 1																											
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10												
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12											27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulphur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18												
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36												
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	106 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	128 <b>Te</b> Tellurium 52	131 <b>Xe</b> Xenon 54													
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	190 <b>Os</b> Osmium 76	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	210 <b>Rn</b> Radon 86														
87 <b>Fr</b> Francium	88 <b>Ra</b> Radium	89 <b>Ac</b> Actinium											87 <b>La</b> Lanthanum	88 <b>Ce</b> Cerium	89 <b>Pr</b> Praseodymium	90 <b>Th</b> Thorium	91 <b>Pa</b> Protactinium	92 <b>U</b> Uranium	93 <b>Np</b> Neptunium	94 <b>Pu</b> Plutonium	95 <b>Am</b> Americium	96 <b>Cm</b> Curium	97 <b>Bk</b> Berkelium	98 <b>Cf</b> Californium	99 <b>Es</b> Einsteinium	100 <b>Fm</b> Fermium	101 <b>Md</b> Mendelevium	102 <b>No</b> Nobelium	103 <b>Lr</b> Lawrencium
												159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71											

\*58-71 Lanthanoid series  
†90-103 Actinoid series

a	<b>X</b>	b
Key		

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).