



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

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**PHYSICAL SCIENCE**

**0652/21**

Paper 2 (Core)

**October/November 2011**

**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.

**DO NOT WRITE IN ANY BARCODES.**

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	
3	
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7	
8	
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10	
11	
12	
13	
<b>Total</b>	

This document consists of **16** printed pages.



- 1 A list of apparatus commonly found in the laboratory is shown below.

**balance                  beaker                  burette                  spatula                  thermometer**

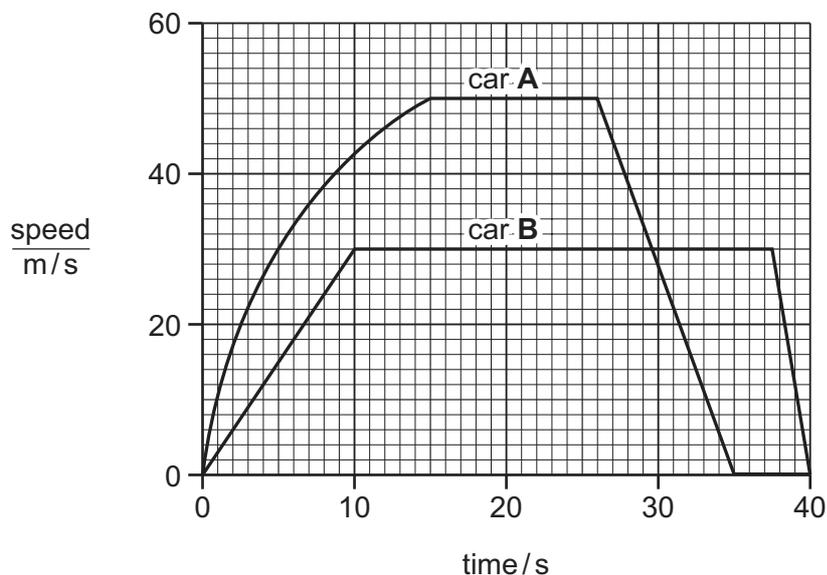
Choose the item from the list which you would use to carry out each of the following actions.

- (a) weigh 0.5 g of copper(II) carbonate .....
- (b) measure 25.0 cm<sup>3</sup> of water .....
- (c) find the temperature of boiling ethanol .....
- (d) react together an acid and an alkali .....

[4]

- 2 Two cars are being tested on a straight level track.

Fig. 2.1 shows the speed-time graphs for the two cars, each of mass 1500 kg.



**Fig. 2.1**

- (a) Determine the maximum speed of car A.

maximum speed = ..... m/s [1]

(b) Describe the motion of car **B** during the last 2.5 s of the test.

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

(c) Use the graph to determine the distance travelled by car **B** during the first 10 s of the test.

distance = ..... m [2]

(d) From 10.0 s to 37.5 s car **B** is travelling at constant speed in a straight line.

(i) State the resultant force on the car during this time.

force = ..... [1]

(ii) Explain why the car engine must continue to do work during this period.

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

(e) At the beginning of the test both cars accelerate from rest.

Explain which car produces the greater accelerating force.

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

- 3 (a) Give an example of an ionic compound and an example of a covalent compound.

ionic compound .....

covalent compound ..... [2]

- (b) Describe **two** differences in the properties of ionic and covalent compounds.

1 .....

.....

2 .....

..... [2]

- (c) Draw a dot and cross diagram to show the electron arrangement in an atom of magnesium.

[2]

4 (a) Name the main ore of aluminium.

..... [1]

(b) Explain why aluminium is not extracted from its ore by heating with carbon.

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

- 5 A student is investigating the melting of fruit flavoured crushed ice. Initially, the temperature of the ice is  $-10^{\circ}\text{C}$ . He measures the temperature every 30 s.

For  
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Fig. 5.1 shows the apparatus he uses.

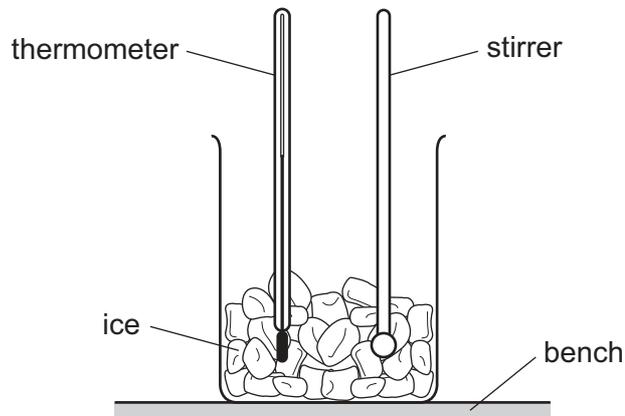


Fig. 5.1

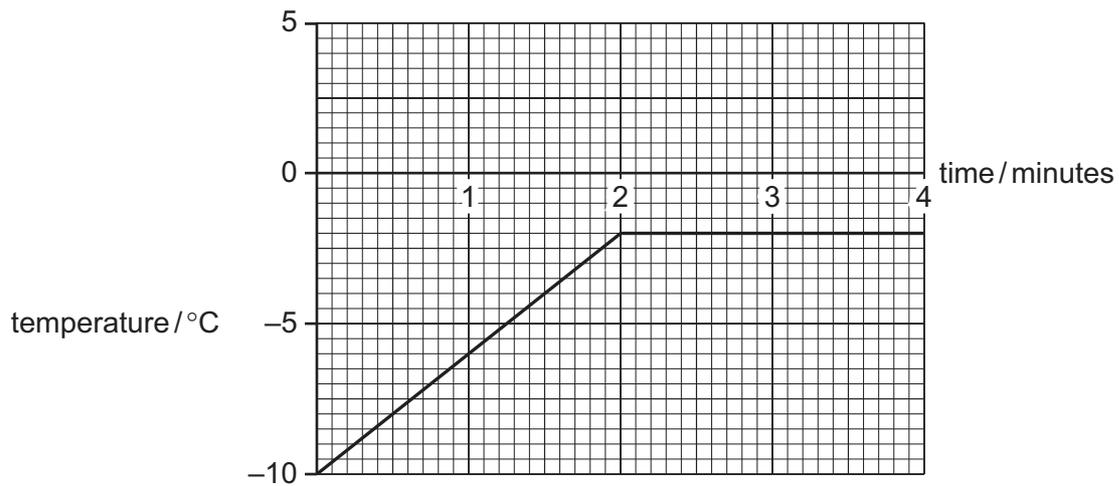
- (a) (i) Explain why the student stirs the crushed ice just before taking each temperature reading.

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

- (ii) Suggest why, in the first two minutes of the experiment, the temperature of the ice rises, even though there is no apparent heat source.

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

The graph in Fig. 5.2 shows how the temperature of the ice changes with time.



**Fig. 5.2**

**(b)** Determine the temperature at which this sample of ice melts.

temperature = ..... °C [1]

**(c)** Explain in terms of the kinetic theory what is happening to the sample from two minutes to four minutes.

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

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- 6 (a) Complete Table 6.1 by putting in the missing names, formulae and molar masses.

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Table 6.1

name	formula	mass of 1 mole / g
.....	H <sub>2</sub> O	.....
hydrogen chloride	.....	36.5
sodium fluoride	.....	42
.....	N <sub>2</sub>	.....

[4]

- (b) Give the symbols for the ions in sodium fluoride and the number of protons present in each ion.

sodium ion ..... number of protons .....

fluoride ion ..... number of protons ..... [2]

- 7 The radioactive isotope  $^{105}_{45}\text{Rh}$  decays by emitting a beta-particle ( $\beta$ -particle).

- (a) (i) State the number of protons in the nucleus of this isotope.

number of protons = ..... [1]

- (ii) Calculate the number of neutrons in the nucleus.

number of neutrons = ..... [1]

**(b) (i)** What is a beta-particle?

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

**(ii)** Describe the changes in the nucleus when a beta-particle is emitted.

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

**8 (a)** Give an advantage and a disadvantage of using hydrogen as a fuel for motor vehicles.

advantage .....

disadvantage ..... [2]

**(b)** Write a balanced equation for the burning of hydrogen in air.

..... [2]

**(c)** Describe a test for hydrogen and state the expected result.

test .....

result ..... [2]

**(d)** The reaction between hydrogen and nitrogen is an important industrial process.

**(i)** Name the gas formed.

..... [1]

**(ii)** Name this industrial process.

..... [1]

- 9 A student experiments with a rubber band. She stretches it between two retort stands and notices that it produces a sound when she plucks it. The apparatus is shown in Fig. 9.1.

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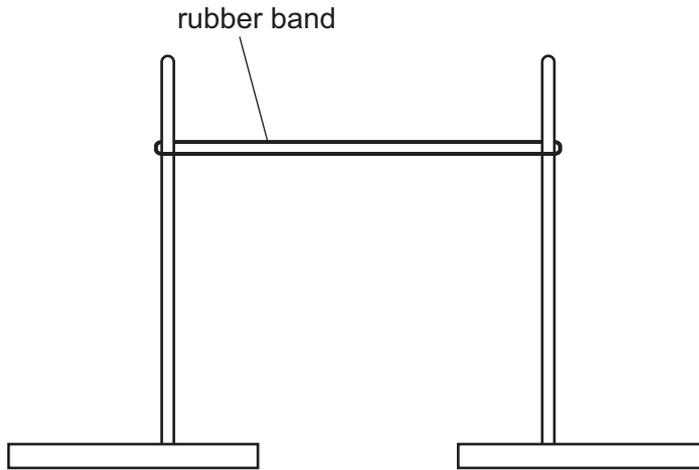


Fig. 9.1

- (a) Explain why the sound is produced.

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

- (b) The student sets up a cathode ray oscilloscope and a microphone as shown in Fig. 9.2 to display the sound trace produced by the apparatus in Fig. 9.1.

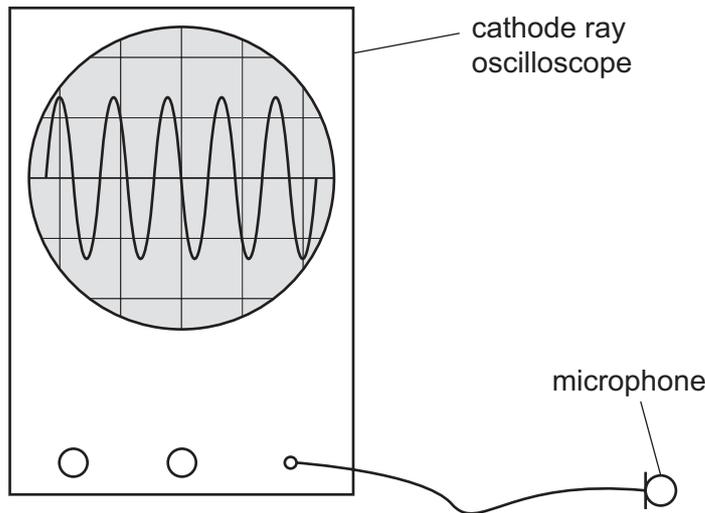
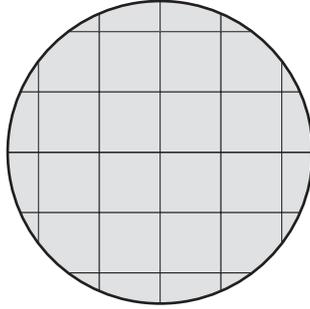


Fig. 9.2

- (i) She now plucks the rubber band so that a quieter note of the same frequency is heard.

For  
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Use

Draw, on Fig. 9.3, the trace that is now seen.



[2]

Fig. 9.3

- (ii) She moves the stands further apart. She plucks the band again. The frequency of the sound now heard is greater than before.

Explain what is meant by the term *frequency* and state the unit used to measure it.

.....

.....

unit ..... [2]

10 Chlorine is in Group VII of the Periodic Table.

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(a) Name this Group.

..... [1]

(b) Name another element in this Group.

..... [1]

(c) State **one** use of chlorine.

..... [1]

(d) Name the Group II element which is in the same period as chlorine.

..... [1]

(e) Describe how, using chlorine, you can show that a solution contains bromide ions.

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

(f) Write down the number of electrons in a bromine atom and in a bromide ion.

bromine atom .....

bromide ion ..... [2]

11 Fig. 11.1 shows an electric circuit. The e.m.f. of the battery is 9.0 V.

For  
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Use

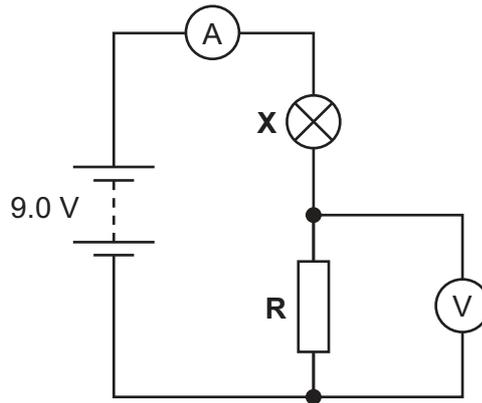


Fig. 11.1

(a) Name component **X**. ..... [1]

(b) The resistance of resistor **R** is  $12\ \Omega$  and the resistance of component **X** is  $8.0\ \Omega$ .

(i) Calculate the combined resistance of **R** and **X**.

resistance = .....  $\Omega$  [1]

(ii) Calculate the current measured by the ammeter.

current = ..... [2]

(iii) Calculate the reading on the voltmeter.

reading = ..... V [2]

12 Methane and ethane are hydrocarbons. They are members of the same homologous series.

For  
Examiner's  
Use

(a) Name this homologous series.

..... [1]

(b) Give the name and formula of the next member of this series.

name .....

formula ..... [2]

(c) Explain why ethanol,  $C_2H_5OH$ , is not a hydrocarbon.

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

- 13 (a) Fig. 13.1 shows a stiff copper rod suspended between two magnetic poles. The copper rod is freely hinged at the top.

For  
Examiner's  
Use

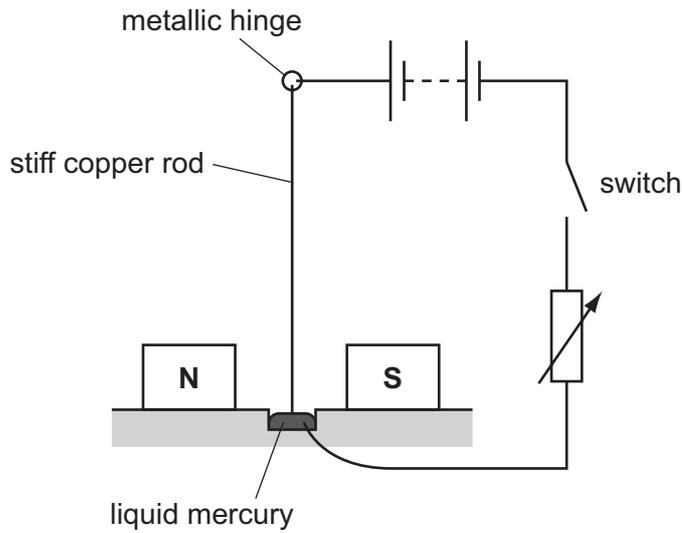


Fig. 13.1

- (a) Draw, on Fig. 13.1, the magnetic field between the poles. [3]

- (b) Explain why a current passes through the circuit when the switch is closed.  
 .....  
 .....  
 ..... [2]

- (c) State what will be observed when switch is closed.  
 .....  
 .....  
 ..... [2]

- (d) The connections to the battery are reversed so that the current in the circuit is in the opposite direction.  
 State how the observations change.  
 .....  
 ..... [1]

**DATA SHEET**  
**The Periodic Table of the Elements**

		Group																		
I	II	III	IV	V	VI	VII	0					0								
		1 <b>H</b> Hydrogen 1											4 <b>He</b> Helium 2							
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											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> Sulfur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18					84 <b>Kr</b> Krypton 36								
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	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					131 <b>Xe</b> Xenon 54								
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	128 <b>Te</b> Tellurium 52	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54					86 <b>Rn</b> Radon 86								
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	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					86 <b>Rn</b> Radon 86								
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89											227 <b>Ac</b> Actinium 89								
*58-71 Lanthanoid series †90-103 Actinoid series																				
<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">a</td> <td style="padding: 2px;"><b>X</b></td> <td style="padding: 2px;">= relative atomic mass</td> </tr> <tr> <td style="padding: 2px;">b</td> <td style="padding: 2px;"><b>X</b></td> <td style="padding: 2px;">= atomic symbol</td> </tr> <tr> <td style="padding: 2px;"></td> <td style="padding: 2px;"><b>X</b></td> <td style="padding: 2px;">= proton (atomic) number</td> </tr> </table>												a	<b>X</b>	= relative atomic mass	b	<b>X</b>	= atomic symbol		<b>X</b>	= proton (atomic) number
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	<b>X</b>	= proton (atomic) number																		
140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	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	103 <b>Lr</b> Lawrencium 103								
232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	238 <b>U</b> Uranium 92	94 <b>Pu</b> Plutonium 94	95 <b>Am</b> Americium 95	96 <b>Cm</b> Curium 96	98 <b>Cf</b> Californium 98	99 <b>Es</b> Einsteinium 99	100 <b>Fm</b> Fermium 100	101 <b>Md</b> Mendelevium 101	102 <b>No</b> Nobelium 102	103 <b>Lr</b> Lawrencium 103	103 <b>Lr</b> Lawrencium 103								

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

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