UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5239055396

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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10	
11	
12	
13	
Total	

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

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

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^3 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.

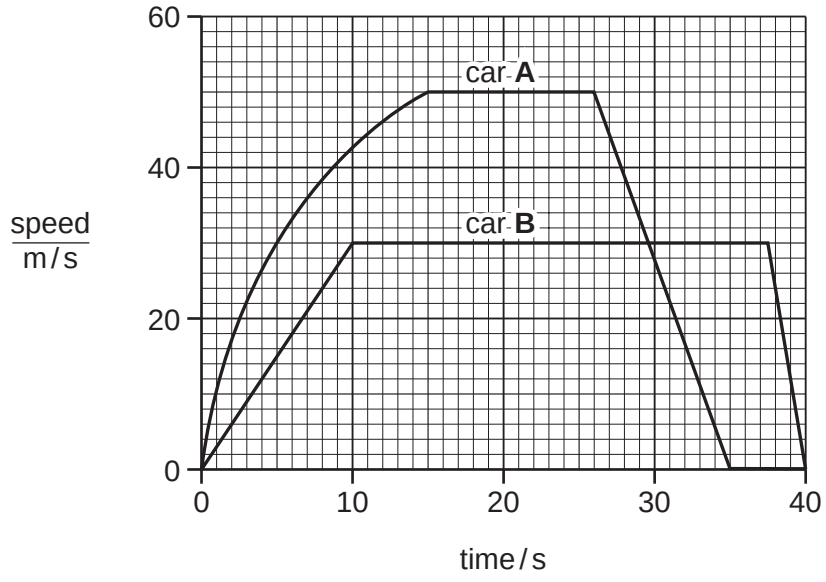


Fig. 2.1

(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]

[Turn over

For Examiner's Use

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]

For Examiner's Use

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 °C. He measures the temperature every 30 s.

Fig. 5.1 shows the apparatus he uses.

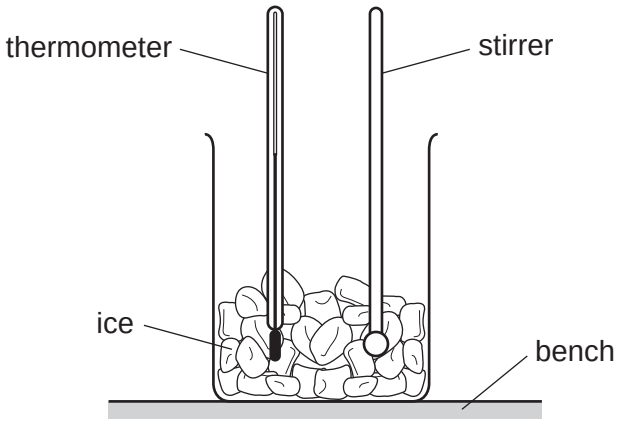


Fig. 5.1

(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.

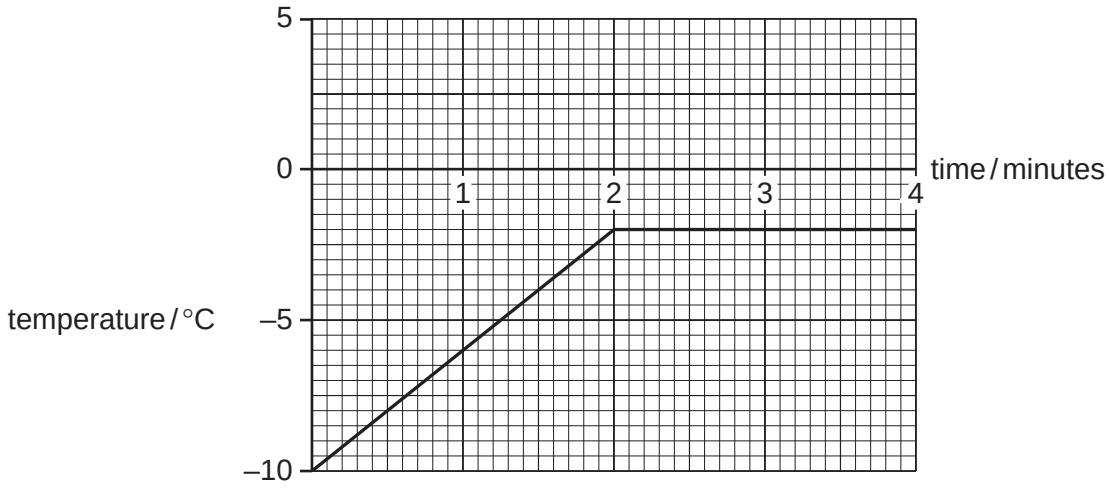


Fig. 5.2

(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]

For Examiner's Use

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

Table 6.1

name	formula	mass of 1 mole / g
.....	H_2O	.....
hydrogen chloride	.....	36.5
sodium fluoride	.....	42
.....	N_2	.....

[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 $^{105}_{45}Rh$ decays by emitting a beta-particle (β-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]

[Turn over

For Examiner's Use

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.

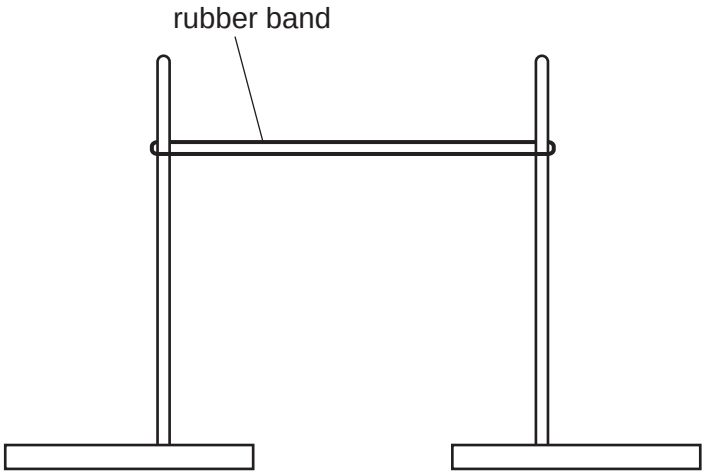


Fig. 9.1

(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.

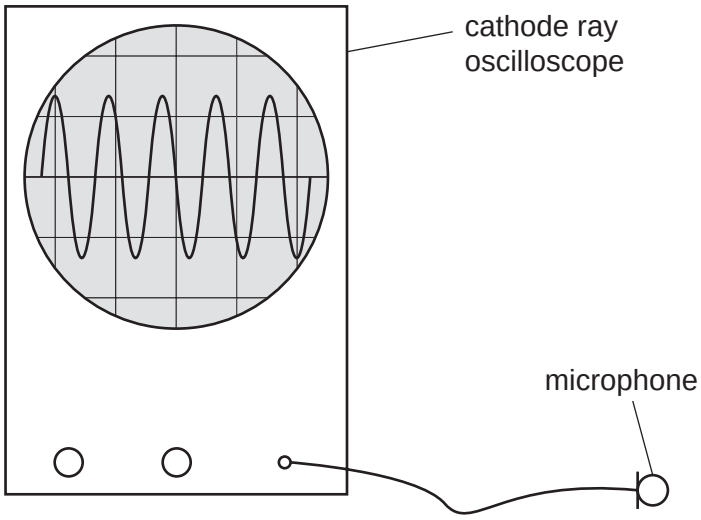
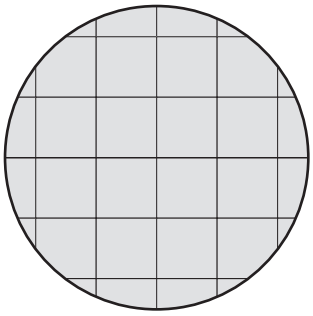


Fig. 9.2

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

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.

For Examiner's Use

(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 Examiner's Use

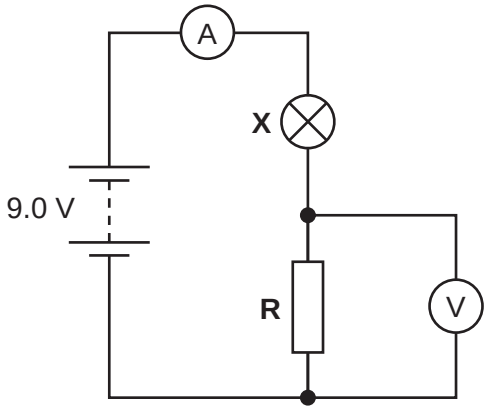


Fig. 11.1

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

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

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

resistance = ... Ω [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]

For Examiner's Use

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

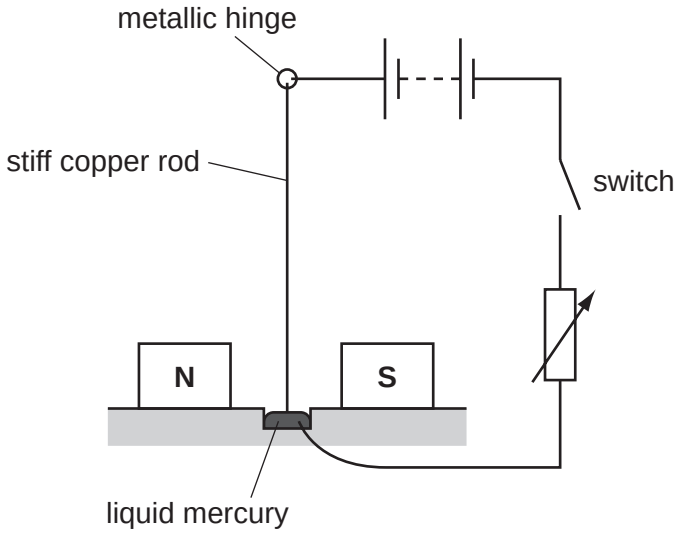


Fig. 13.1

(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
							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** Sulfur 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 †															

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

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

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.).