UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4305067619

PHYSICAL SCIENCE **0652/32**

Paper 3 (Extended) **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 20.

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	
4	
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6	
7	
8	
9	
Total	

This document consists of **19** printed pages and **1** blank page.

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UNIVERSITY *of* CAMBRIDGE
International Examinations

1 Two cars are being tested on a straight level track.

Fig. 1.1 shows the speed-time graphs for the two cars, each of mass 1500 kg.

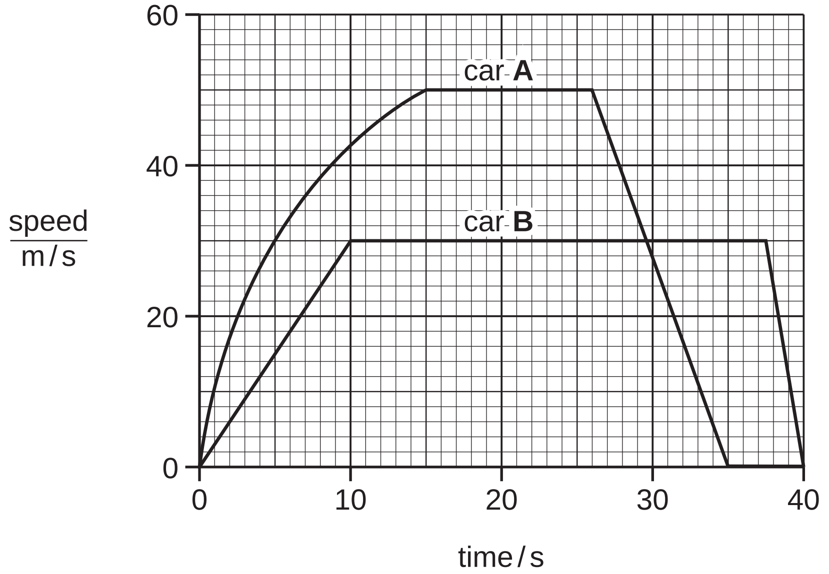

Fig. 1.1

(a) Determine the maximum velocity of car **A**.

velocity = ... m / s [1]

(b) Describe the motion of car **A** after 26 s.

....

....

.... [2]

For Examiner's Use

For Examiner's Use

(c) **(i)** Use the graph to calculate the acceleration of car **B** during the first 10 s of the test.

acceleration = ... [2]

(ii) Calculate the resultant force on car **B** during this period.

force = ... [2]

(iii) Explain why the engine must provide a greater force than that given in your answer to **(c)(ii)**.

....

....

.... [2]

(d) As the two cars approach the end of the track they brake and come to rest.

Explain which car produces the greater braking force.

....

....

.... [2]

For Examiner's Use

2 Fig. 2.1 shows a catalytic converter, which is part of a car exhaust system.

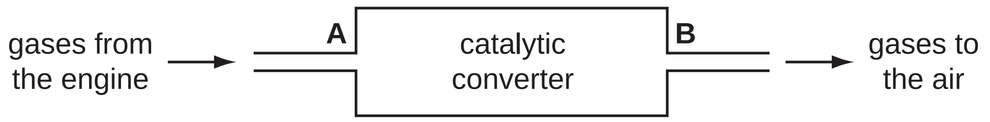

Fig. 2.1

Scientists analyse the gases at **A** and at **B**. Their results are shown in Table 2.1.

Table 2.1

gas	percentage at A	percentage at B
carbon dioxide	8.0	9.2
carbon monoxide	5.0	3.8
hydrogen	2.0	0.8
nitrogen	71.0	71.3
nitrogen monoxide	0.3	0.0
oxygen	4.0	2.8
water vapour	9.0	10.7

(a) The scientists conclude that in the catalytic converter nitrogen monoxide is converted to nitrogen by reaction with carbon monoxide.

(i) Write a balanced equation for this reaction. Use the data in Table 2.1 to help you.

.... [2]

(ii) Use this reaction to explain the meaning of the terms *reduced* and *oxidised*.

....

....

.... [2]

(iii) Explain how the results in Table 2.1 support the conclusion that this reaction takes place in the catalytic converter.

....

....

.... [2]

For Examiner's Use

(iv) Use data from Table 2.1 to suggest another reaction that takes place in the catalytic converter.

....

.... [1]

(b) Parts of the car exhaust system are made from galvanised steel.

(i) Explain how galvanising prevents steel from rusting.

....

....

....

.... [3]

(ii) Suggest why galvanising is a better method of rust prevention than painting.

....

.... [1]

3 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. 3.1.

For Examiner's Use

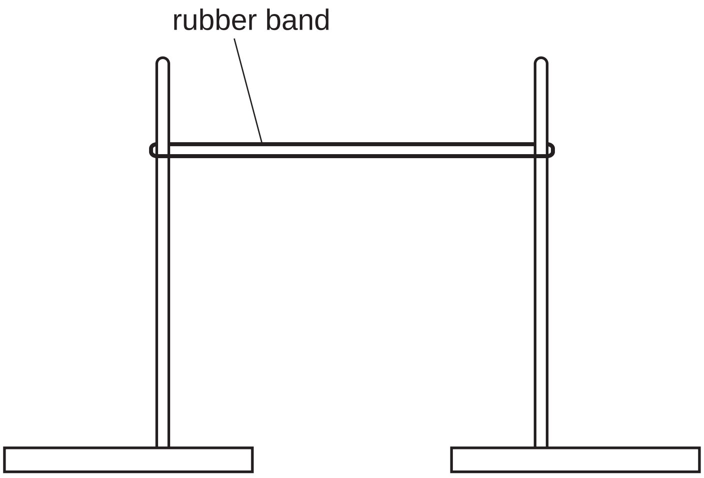

Fig. 3.1

(a) Explain why the sound is produced.

....

....

.... [2]

(b) The student sets up a cathode ray oscilloscope and a microphone, as shown in Fig. 3.2, to display the sound trace produced by the apparatus in Fig. 3.1.

For Examiner's Use

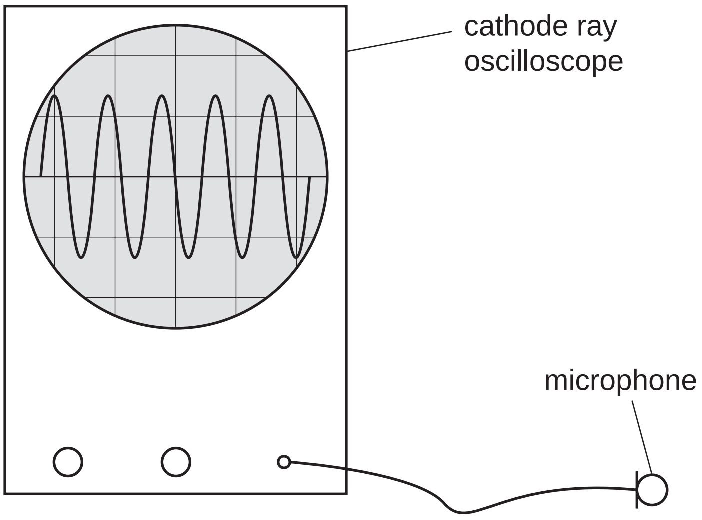

Fig. 3.2

The time base is set to 2.5 ms / division.

Calculate the frequency of the sound wave.

Show your working in the box.

frequency = ... Hz [3]

For Examiner's Use

4 Silver salts are used in photography.

(a) The action of light on silver bromide releases an electron.

$$Ag^{+}Br^{-} \longrightarrow Ag^{+} + Br + e^{-}$$

(i) How does light enable this reaction to take place?

.... [1]

(ii) The silver ion is converted into a silver atom.

Why is this said to be a reduction reaction?

.... [1]

(iii) Write an ionic equation to show this reduction of a silver ion.

.... [1]

(b) Silver bromide can be made from the reaction between silver nitrate and potassium bromide.

$$AgNO_3(aq) + KBr(aq) \longrightarrow AgBr(s) + KNO_3(aq)$$

(i) Describe how you would prepare a pure, dry sample of silver bromide from solutions of silver nitrate and potassium bromide.

....

....

....

....

....

.... [4]

For Examiner's Use

(ii) What mass of silver bromide could be made from 5.0 g of silver nitrate?

[relative atomic masses, A_r : Ag,108; Br,80; N,14; O,16]

Show your working in the box.

mass of silver bromide = ... g [3]

5 Fig. 5.1 shows an electric circuit. The e.m.f. of the battery is 6.0 V. The total resistance of the variable resistor 48 Ω.

For Examiner's Use

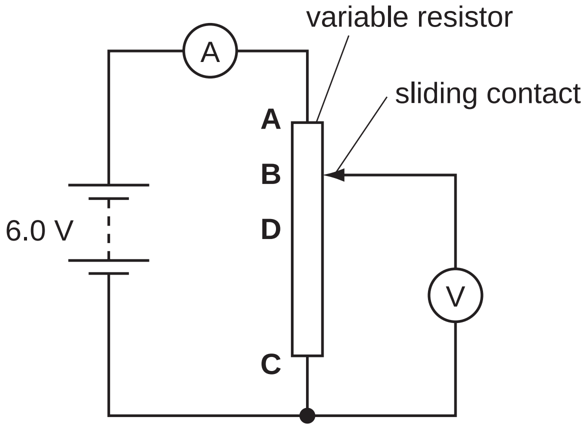

Fig. 5.1

(a) (i) Calculate the current measured by the ammeter.

current = ... [2]

(ii) When the sliding contact is at point **B** the voltmeter reading is 4.5 V.

Calculate the value of the resistance of the section of the variable resistor **BC**.

resistance = ... [2]

(b) The sliding contact is moved to point **D**. The reading on the voltmeter is now 3.0 V.

Show that the resistance of the section **CD** of the variable resistor is 24 Ω. You may assume that the current through the circuit remains the same.

[1]

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(c) The student realises that he could use this circuit as a variable voltage supply. He leaves the sliding contact at point **D** and connects a 3.0 V bulb of resistance 8 Ω in place of the voltmeter.

(i) Show that the resistance of the parallel combination of the bulb and the section **CD** of the variable resistor is 6 Ω.

[2]

(ii) Calculate the total resistance in the circuit.

resistance = ... [1]

(iii) Calculate the potential drop across the section **CD** of the variable resistor.

p.d. = ... [2]

(iv) Comment on the brightness of the bulb.

....

.... [1]

For Examiner's Use

6 When calcium carbonate is heated strongly it decomposes to form calcium oxide and carbon dioxide.

$$CaCO_3 \longrightarrow CaO + CO_2$$

(a) Calculate the volume of carbon dioxide, measured at room temperature and pressure, produced when 2.5 g of calcium carbonate is decomposed.

[The volume of one mole of any gas is 24 dm^3 at room temperature and pressure.]

Show your working in the box.

volume of carbon dioxide = ... dm^3 [3]

(b) Calcium oxide reacts with hydrochloric acid to form a salt.

$$CaO + 2HCl \longrightarrow CaCl_2 + H_2O$$

In this reaction calcium oxide is acting as a base.

(i) Use this reaction to define the terms *acid* and *base* in terms of proton transfer.

acid ....

....

base ....

.... [2]

(ii) Calcium oxide reacts with acids but not with alkalis. It is classified as a basic oxide.

Complete Table 6.1 to classify three other oxides.

For Examiner's Use

Table 6.1

name	**formula**	**property**	**type of oxide**
calcium oxide	CaO	reacts with acids but not alkalis	basic
aluminium oxide	Al_2O_3	reacts with both acids and alkalis	
carbon dioxide	CO_2	reacts with alkalis but not acids	
nitrogen monoxide	NO	reacts with neither acids nor alkalis	

[3]

7 Fig. 7.1 shows a magnet and a coil which is connected to a sensitive voltmeter.

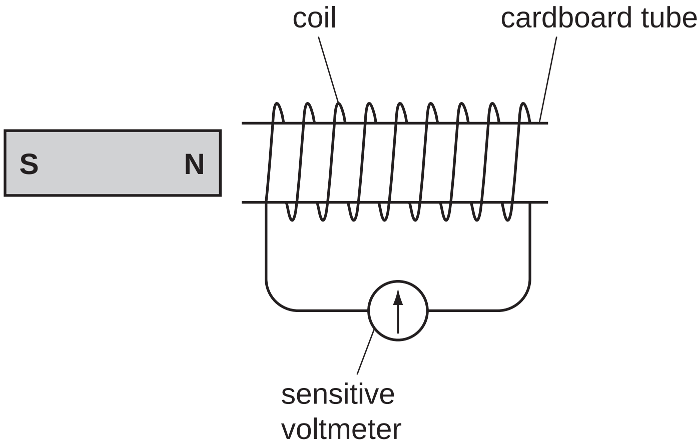

Fig. 7.1

(a) **(i)** Describe what you would observe as the magnet is moved away from the coil.

....

....

.... [2]

(ii) Explain this observation using the theory of electromagnetic induction.

....

....

.... [2]

(b) The magnet is now moved towards the coil.

Describe what you would observe.

....

.... [1]

For Examiner's Use

(c) The magnet is now replaced with a similar coil connected to an alternating supply. The original coil is connected to a cathode ray oscilloscope. This is shown in Fig. 7.2.

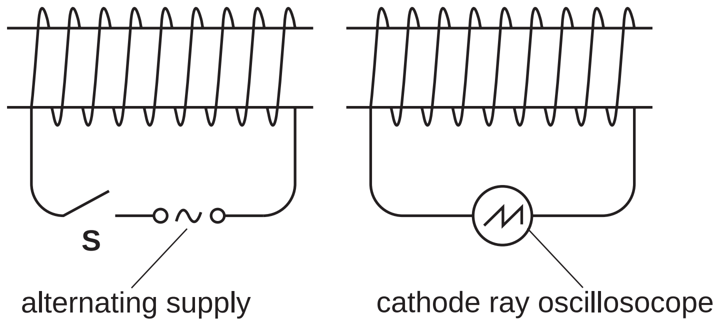

Fig. 7.2

State and explain what is observed when the switch **S** is closed.

....

....

.... [2]

8 Table 8.1 contains data about elements in Group 0 of the Periodic Table.

For Examiner's Use

Table 8.1

element	**symbol**	**proton number**	**boiling point / °C**	**density of gas in kg / m^3**
helium	He	2	−269	0.17
neon	Ne	10	−246	0.84
argon	Ar	18	−186	1.67
krypton	Kr	36	−152	3.50

(a) (i) What name is given to the elements in Group 0?

.... [1]

(ii) Use information from Table 8.1 to describe a trend in **one** physical property shown by this group of elements.

....

....

.... [2]

(iii) Describe a chemical property common to all elements in this group.

.... [1]

(iv) Xenon is the next member of Group 0 after krypton.

Predict the density of xenon.

density = ... kg / m^3 [1]

For Examiner's Use

(b) (i) Draw a diagram to show the electron arrangement in an atom of argon.

[2]

(ii) A calcium ion has the same electron arrangement as an argon atom.

Give the **name** of, and the **charge** on, another ion apart from calcium that has the same electron arrangement as an argon atom.

name .... charge .... [2]

(iii) State how a calcium ion is formed from a calcium atom.

....

....

.... [2]

9 A student is investigating the cooling of a cup of tea.

She makes the tea using water first boiled in a kettle. As the tea cools she notices that some of it evaporates.

(a) **(i)** State **one** similarity between evaporation and boiling.

....

.... [1]

(ii) Explain the difference between evaporation and boiling.

....

....

.... [2]

(b) The graph in Fig. 9.1 shows how the temperature of the tea changes with time.

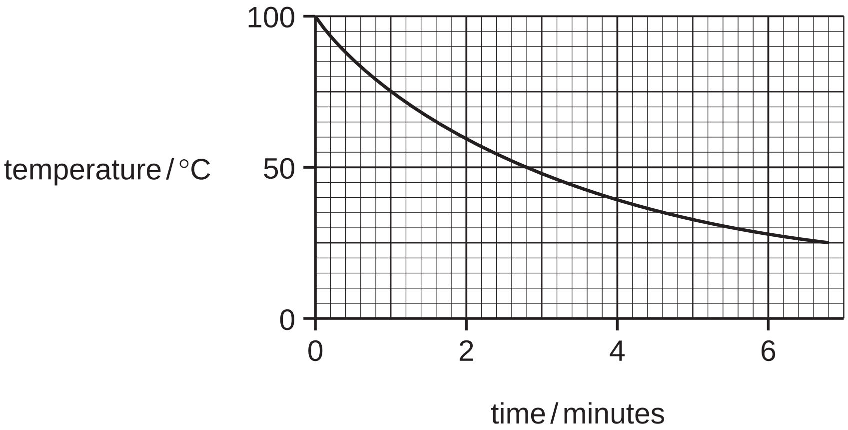

Fig. 9.1

Use the graph to estimate room temperature.

room temperature = ... °C [1]

(c) Explain, in terms of the molecular kinetic theory, what happens to the tea as it cools.

....

....

.... [2]

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DATA SHEET
The Periodic Table of the Elements

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.).