



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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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	
5	
6	
7	
8	
9	
Total	

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



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.

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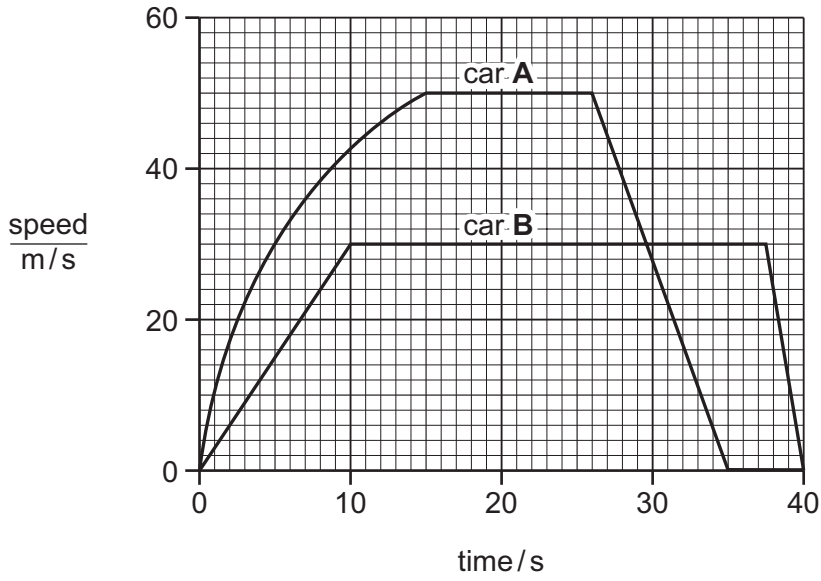


Fig. 1.1

(a) Determine the maximum velocity of car A.

velocity = m/s [1]

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

.....

 [2]

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

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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]

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

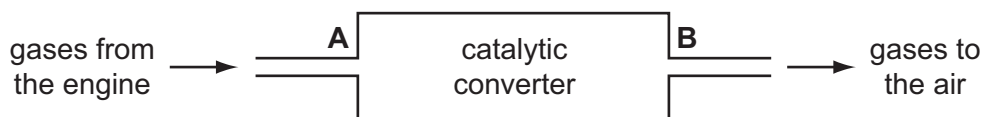


Fig. 2.1

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]

(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]

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- 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
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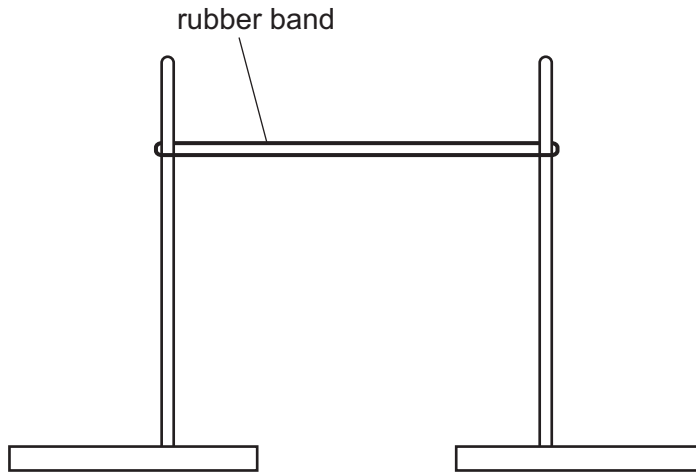


Fig. 3.1

- (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
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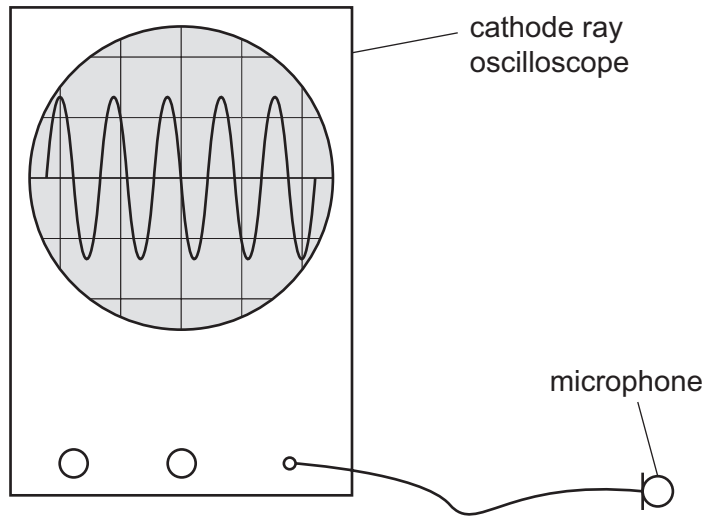


Fig. 3.2

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]

4 Silver salts are used in photography.

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



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

..... [1]

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

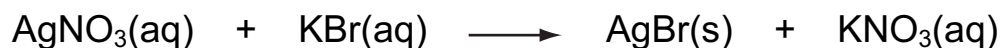
Why is this said to be a reduction reaction?

..... [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.



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

.....

 [4]

(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]

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- 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 is $48\ \Omega$.

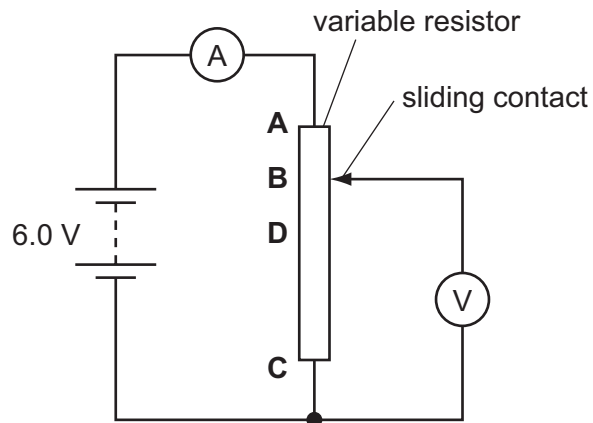


Fig. 5.1

- (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 $24\ \Omega$. You may assume that the current through the circuit remains the same.

[1]

(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 $8\ \Omega$ 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 $6\ \Omega$.

[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]

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

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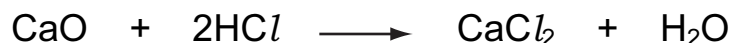
- (a) Calculate the volume of carbon dioxide, measured at room temperature and pressure, produced when 2.5 g of calcium carbonate is decomposed.

[The volume of one mole of any gas is 24 dm³ at room temperature and pressure.]

Show your working in the box.

volume of carbon dioxide = dm³ [3]

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



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.

Table 6.1

name	formula	property	type of oxide
calcium oxide	CaO	reacts with acids but not alkalis	basic
aluminium oxide	Al ₂ O 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]

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

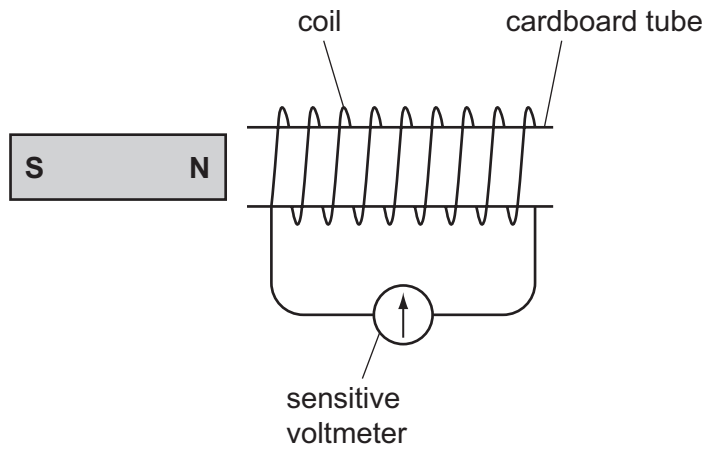


Fig. 7.1

(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]

(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.

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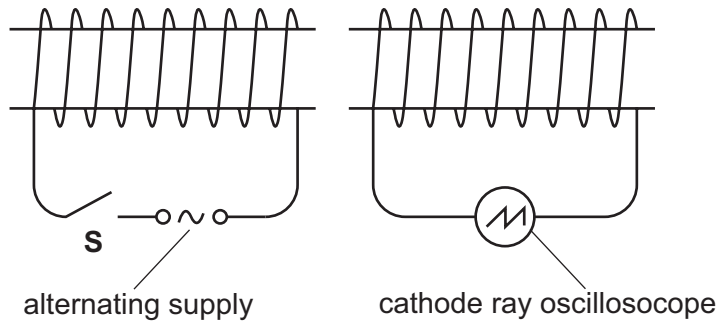


Fig. 7.2

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.

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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/ m³ [1]

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

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[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.

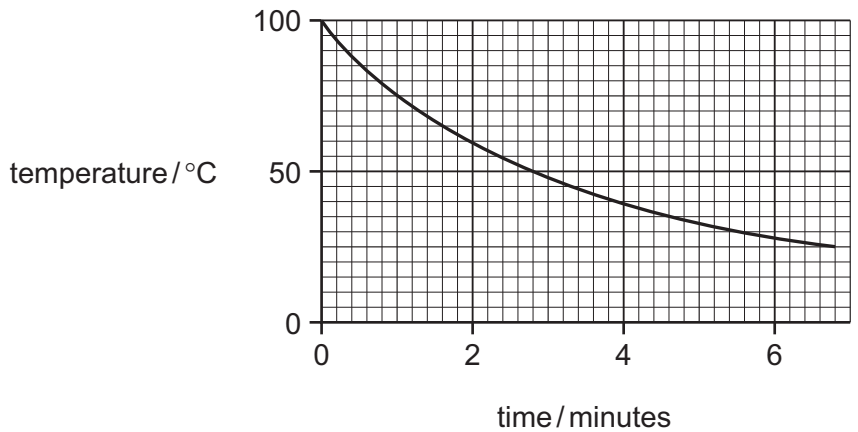


Fig. 9.1

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]

DATA SHEET
The Periodic Table of the Elements

		Group											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	
		1 H Hydrogen 1										4 He Helium 2	
7 Li Lithium 3	9 Be Beryllium 4											19 F Fluorine 9	
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	36 Ar Argon 18						40 Ne Neon 10
39 K Potassium 19	40 Ca Calcium 20	51 V Vanadium 23	48 Ti Titanium 22	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	84 Kr Krypton 36	
85 Rb Rubidium 37	88 Sr Strontium 38	93 Nb Niobium 41	91 Zr Zirconium 40	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	131 Xe Xenon 54	
133 Cs Caesium 55	137 Ba Barium 56	181 Ta Tantalum 73	178 Hf Hafnium 72	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 Rn Radon 86	
226 Ra Radium 88	227 Ac Actinium 89											210 Rn Radon 86	
*58-71 Lanthanoid series †90-103 Actinoid series													
140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71	103 Lr Lawrencium 103	
232 Th Thorium 90	238 U Uranium 92	91 Pa Protactinium 91	93 Np Neptunium 93	95 Am Americium 95	96 Cm Curium 96	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	103 Lr Lawrencium 103	

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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

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