

## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

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 Exam	iner'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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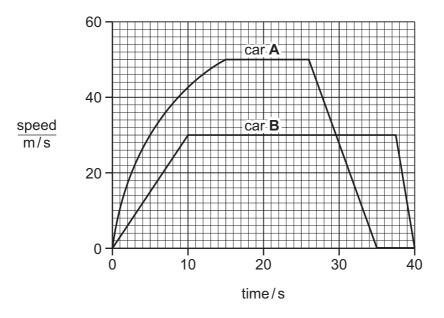


Fig. 1.1

(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>B</b> during the first 10 s of the tes	st.
			ro1
		acceleration =	[2]
	(ii)	Calculate the resultant force on car <b>B</b> during this period.	
		force =	[2]
	(iii)	Explain why the engine must provide a greater force than that given in your answ to (c)(ii).	/er
			[2]
(d)	As	the two cars approach the end of the track they brake and come to rest.	
	Exp	plain which car produces the greater braking force.	
			[2]

[2]

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

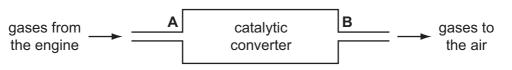


Fig. 2.1

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.

(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.

	(iv)	Use data from Table 2.1 to suggest another reaction that takes place in catalytic converter.	the For Examiner Use
			 [1]
(b)	Dor	to of the car exhaust system are made from galvanised steel	1.1
(D)	rai	rts 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.	

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.

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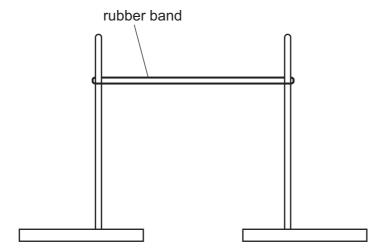


Fig. 3.1

		 [2]
(a)	Explain why the sound is produced.	

**(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.

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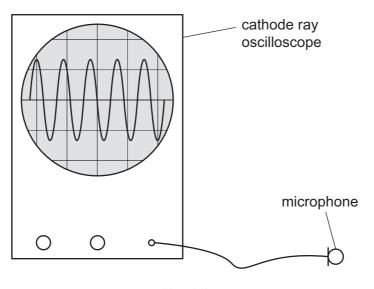
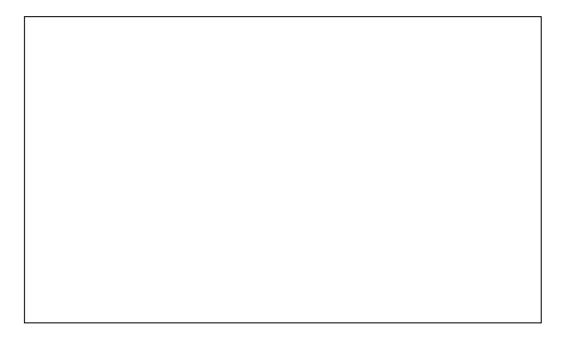


Fig. 3.2

The time base is set to 2.5 ms/division.

Calculate the frequency of the sound wave.

Show your working in the box.



		8
4	Silver s	salts are used in photography.
	(a) Th	e action of light on silver bromide releases an electron.
		$Ag^{\dagger}Br^{-} \longrightarrow Ag^{\dagger} + Br + e^{-}$
	(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
		ver bromide can be made from the reaction between silver nitrate and potassium omide.
	Д	$AgNO_3(aq) + KBr(aq) \longrightarrow AgBr(s) + KNO_3(aq)$
	(i)	Describe how you would prepare a pure, dry sample of silver bromide from solutions of silver nitrate and potassium bromide.

[4]

(ii)	What mass of silver bromide could be made from 5.0 g of silver nitrate?
	[relative atomic masses, A <sub>r</sub> : Ag,108; Br,80; N,14; O,16]
	Show your working in the box.

mass of silver bromide = \_\_\_\_\_ g

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[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  $48 \Omega$ .

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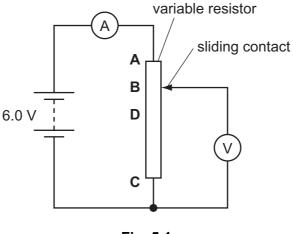


Fig. 5.1

(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**.

**(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  ${\bf CD}$  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. leaves the sliding contact at point ${\bf D}$ and connects a 3.0 V bulb of resistance $8\Omega$ in pla of the voltmeter.			
	(i)	Show that the resistance of the parallel combination of the bulb and the section of the variable resistor is $6\Omega.$	CD	
	(ii)	Calculate the total resistance in the circuit.	[2]	
(	(iii)	resistance =Calculate the potential drop across the section <b>CD</b> of the variable resistor.	[1]	
(	(iv)	p.d. = Comment on the brightness of the bulb.	[2]	
			[1]	

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 dm³ at room temperature and pressure.]		
		Show your working in the box.		
		volume of carbon dioxide = dm <sup>3</sup> [3]		
	(b)	Calcium oxide reacts with hydrochloric acid to form a salt.		
		CaO + 2HC $l$ — CaC $l_2$ + H <sub>2</sub> O		
		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.

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Table 6.1

name	formula	property	type of oxide
calcium oxide	CaO	reacts with acids but not alkalis	basic
aluminium oxide	Al <sub>2</sub> O <sub>3</sub>	reacts with both acids and alkalis	
carbon dioxide	CO <sub>2</sub>	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.

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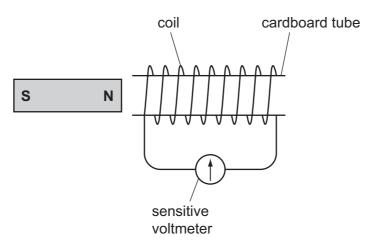


Fig. 7.1

(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	e magnet is now moved towards the coil.	
	Des	scribe 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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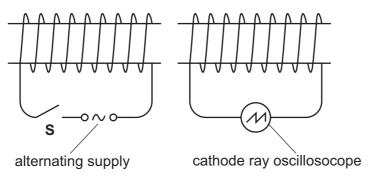


Fig. 7.2

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	ement symbol		boiling point /°C	density of gas in kg/m³
helium	helium He		-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 <b>one</b> physical pr by this group of elements.	operty sho	own
			[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 =	ka/m³	[1]

(b)	(i)	Draw a diagram to show the electron arrangement in an atom of argon.	For Examiner's Use
		[2]	
	(ii)	A calcium ion has the same electron arrangement as an argon atom.	
		Give the <b>name</b> of, and the <b>charge</b> 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]	

18 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. (ii) Explain the difference between evaporation and boiling. **(b)** The graph in Fig. 9.1 shows how the temperature of the tea changes with time. 100 temperature / °C 50 2 6 4 0 time/minutes Fig. 9.1 Use the graph to estimate room temperature. room temperature = [1]

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

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DATA SHEET
The Periodic Table of the Elements

	0	4 <b>He</b> Helium	Neon 10 Neon 10 Argon 18	84 Krypton 36	131 <b>Xe</b> Xenon Xenon 54	<b>Rn</b> Radon 86		175 <b>Lu</b> Lutetium 71	<b>Lr</b> Lawrencium 103
	IIA		19 Fluorine 9 35.5 <b>C1</b>	80 <b>Br</b> Bromine 35	127 <b>I</b> lodine 53	At Astatine 85		173 <b>Yb</b> Ytterbium 70	Nobelium 102
	IN		16 Oxygen 8 32 <b>S</b> Suffur 16	Selenium	128 Te	Po Polonium 84		169 <b>Tm</b> Thulium 69	Md Mendelevium 101
	^		14 Nitrogen 7 31 97 Phosphorus 15	75 <b>As</b> Arsenic 33	Sb Antimony 51	209 <b>Bi</b> Bismuth 83		167 <b>Er</b> Erbium 68	Fm Fermium
	//		12 Carbon 6 Silicon 14	73 <b>Ge</b> Germanium 32	Sn Tin 50	207 <b>Pb</b> Lead 82		165 <b>Ho</b> Holmium 67	<b>ES</b> Einsteinium 99
	Ш		11 <b>B</b> 80000 5 27 <b>A1</b> Auminium	70 <b>Ga</b> Gallium 31	115 <b>I n</b> Indium 49	204 <b>T t</b> Thallium 81		162 <b>Dy</b> Dysprosium 66	<b>Cf</b> Californium 98
				65 <b>Zn</b> Zinc 30	112 <b>Cd</b> Cadmium 48	201 <b>Hg</b> Mercury 80		159 <b>Tb</b> Terbium 65	<b>BK</b> Berkelium 97
				64 <b>C</b> Copper 29	108 <b>Ag</b> Silver 47	197 <b>Au</b> Gold		157 <b>Gd</b> Gadolinium 64	Carium Ourium
Group				59 Nickel 28	106 Pd Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	Am Americium 95
ອັ			1	59 <b>Cobalt</b>	Rhodium 45	192 <b>I r</b> Iridium		Sm Samarium 62	<b>Pu</b> Plutonium
		T Hydrogen		56 <b>Fe</b> Iron	Ru Ruthenium 44	190 <b>Os</b> Osmium 76		Pm Promethium 61	Neptunium 93
				Manganese	Tc Technetium 43	186 <b>Re</b> Rhenium 75		Neodymium 60	238 <b>U</b> Uranium 92
				52 <b>Cr</b> Chromium 24	96 <b>Mo</b> Molybdenum 42	184 <b>W</b> Tungsten 74		Pr Praseodymium 59	Pa Protactinium 91
				51 Vanadium 23	93 <b>Nb</b> Niobium	181 <b>Ta</b> Tantalum 73		140 <b>Ce</b>	232 <b>Th</b> Thorium 90
			_	48 <b>T</b> Titanium	2r Zirconium 40	178 <b>Hf</b> Hafnium * 72			mic mass nbol nic) number
				Scandium 21	89 <b>×</b> Yttrium	139 <b>La</b> Lanthanum 57 ,	AC Actinium 89	d series series	a = relative atomic mass  X = atomic symbol b = proton (atomic) number
	=		9 Be Beryllium 4 24 Mg Magnesium 12	40 <b>Ca</b> Calcium	Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	<i>a</i> × <i>a</i>
	_		7	39 Fotassium	Rb Rubidium	133 <b>Cs</b> Caesium 55	<b>Fr</b> Francium 87	*58-71 L	Key

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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