

Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

PHYSICAL SCI	ENCE		0652/21
CENTRE NUMBER		CANDIDATE NUMBER	
CANDIDATE NAME			

Paper 2 (Core)

October/November 2014

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 an HB soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

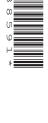
Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.



1 A student is investigating the stretching of a spring.

She sets up the apparatus as shown in Fig. 1.1 and measures the length of the spring with different loads.

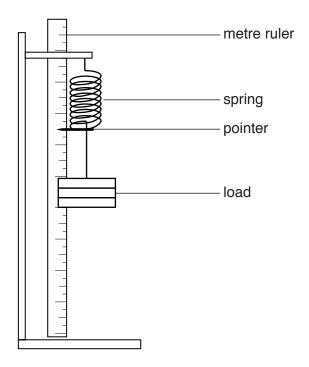


Fig. 1.1

(a) Table 1.1 shows some of the student's results.

Table 1.1

load / N	length of spring / cm	extension / cm
0	12.0	0
1.0	13.3	1.3
2.0	14.8	

[1]

Calculate the extension when the load is 2.0 N and complete the table.

(b) The student takes three more sets of readings and draws the best-fit line in Fig. 1.2.

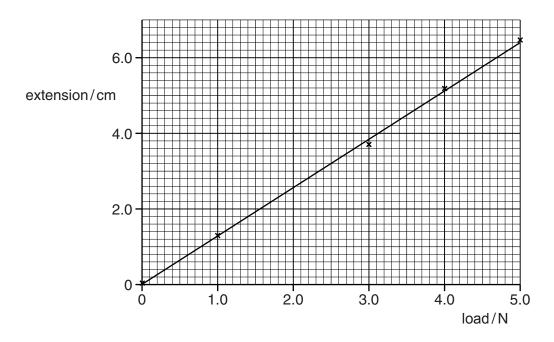


Fig. 1.2

- (i) Using your answer to part (a), plot the point on the graph for a load of 2.0 N. [1]
- (ii) State the relationship between the load and the extension shown by the best-fit line.

.....[1]

(c) Fig. 1.3 shows a rectangular block of mass 63 g and dimensions 3.0 cm by 6.0 cm by 2.5 cm.

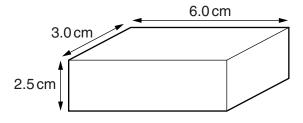


Fig. 1.3

(i) Calculate the volume of the block.

volume = cm³ [1]

(ii) Calculate the density of the block and state the unit.

2

Cop	oper(II) oxide is added to dilute sulfuric acid until there is no further reaction.	
The	e mixture is filtered to obtain a blue solution (filtrate).	
(a)	Describe how the positive metal ions in this blue solution can be identified.	
	reagent	
	result	
		[2]
(b)	Explain how dry crystals of a blue solid can be obtained from this blue solution.	
		[3]
(c)	Name this blue solid.	

3

٦	Γhe	burr	ning of hydrogen is a reaction which gives out heat energy.
(a)	Sta	te the term used to describe reactions which give out heat energy.
			[1]
(b)	Wri	te a balanced equation for the burning of hydrogen in air.
			[2]
(c)	(i)	State which bonds are broken and which are formed during this reaction.
			bonds broken
			bonds formed
			[3]
		(ii)	Energy is taken in to break chemical bonds. Energy is released when chemical bonds are formed.
			Suggest how a chemical reaction can result in an overall release of energy.
			[1]

4 Fig. 4.1 shows a bimetallic strip made from copper and an alloy called invar.



Fig. 4.1

(a)	Explain what is meant by <i>an alloy</i> .
(b)	When the strip is heated it bends as shown in Fig. 4.2.
	invar
	Fig. 4.2
	Explain why the strip bends in the direction shown in Fig. 4.2.

(c) Fig. 4.3 shows the bimetallic strip used as part of a thermostat switch in an electric oven.

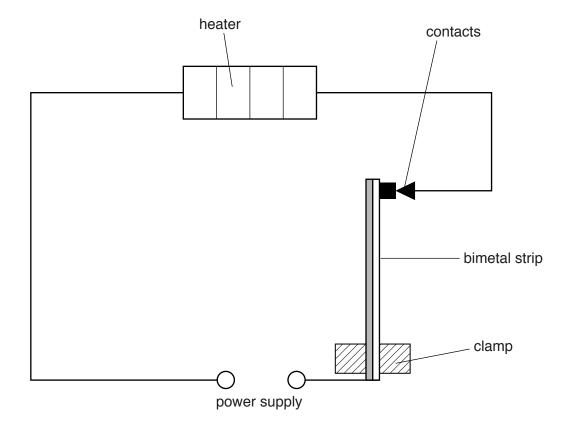


Fig. 4.3

Explain what happens when the temperature reaches the level set.
[2

- **5** Reacting limestone with hydrochloric acid produces carbon dioxide.
 - (a) Complete Fig. 5.1 to show how the carbon dioxide could be collected and its volume measured. [2]

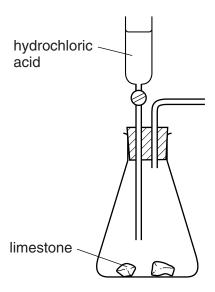
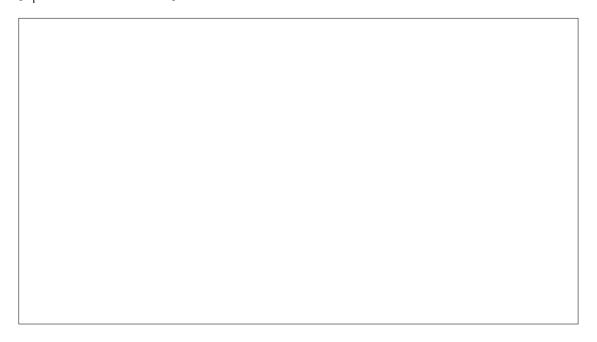


Fig. 5.1

(b) The main component of limestone is calcium carbonate, CaCO₃.

Use its formula to show that calcium carbonate contains 12% of carbon by mass.

[A_r: Ca, 40; C, 12; O, 16]



[2]

6 A teacher demonstrates the properties of waves using a ripple tank.

A barrier is placed in the ripple tank.

Fig. 6.1 shows a view of the ripple tank from above.

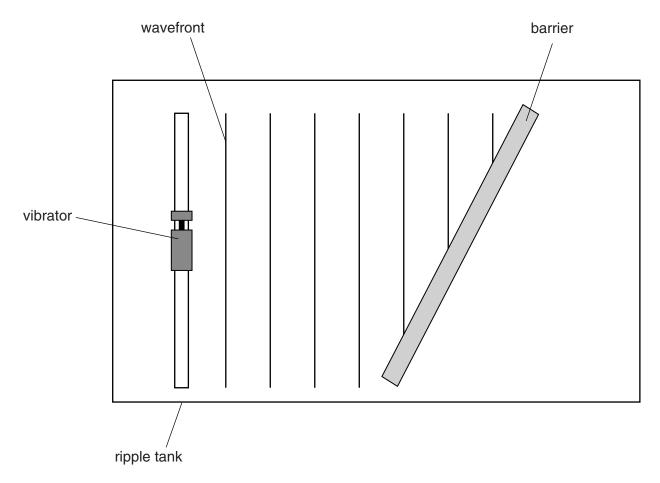


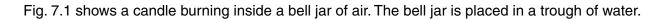
Fig. 6.1

The vibrator produces a series of waves of constant frequency. These waves move towards the barrier.

- (a) On the diagram, draw an arrow (\leftrightarrow) to show **one** wavelength. [1]
- (b) (i) Draw on Fig. 6.1 three wavefronts after they hit the barrier. [3]
 - (ii) Name the property of waves shown by the change in direction of these wavefronts.

......[1]

7 Carbon dioxide gas is much more soluble in water than oxygen gas.



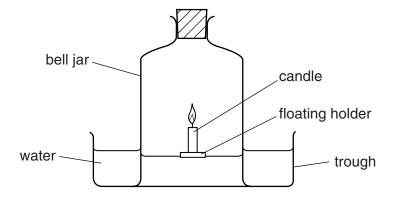


Fig. 7.1

As the candle burns the water level rises up inside the bell jar.

(a)	Explain how burning the candle causes the water level to rise.	
(b)	After several minutes the candle stops burning.	
	Name the main gas in the bell jar after the candle has stopped burning.	
		[1]
(c)	Candles are made from wax which is a compound of carbon.	
	Explain why it can be dangerous to burn wax in a limited supply of air.	
		[2]

Soc	lium is a member of Group I of the Periodic Table.
(a)	State two observations made when sodium reacts with water.
	1
	2[2]
(b)	Name two other members of Group I, one which is more reactive than sodium and one which is less reactive than sodium.
	one which is more reactive than sodium
	one which is less reactive than sodium
	[2]
(c)	Name a metal and a non-metal in the same period as sodium.
	metal
	non-metal[2]
(d)	Sodium reacts with chlorine to form sodium chloride, an ionic compound.
	Draw a diagram to show the electron arrangement of the ions present in sodium chloride. Show all of the electrons in each ion. Label your diagram with the names of the ions.

9 Fig. 9.1 shows a circuit with a lamp and a cell in series.

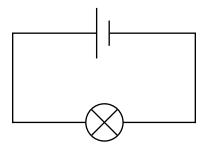


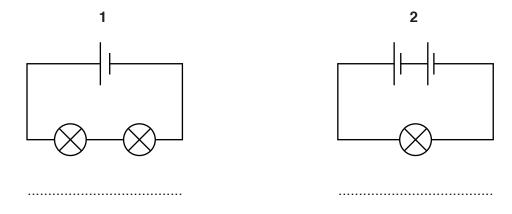
Fig. 9.1

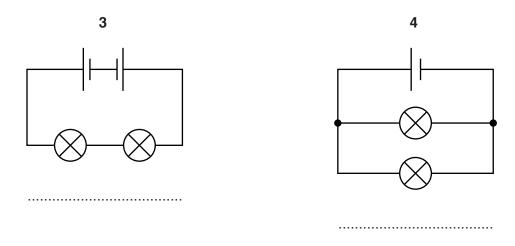
(a) Fig. 9.2 shows four more circuits.

The cells and lamps are identical to those in Fig. 9.1.

(i) Compared with the lamp in Fig. 9.1, state under each diagram whether each lamp in the circuit is

brighter, less bright, as bright, not lit.





[4]

Fig. 9.2

	(ii)	State in which circuit in Fig. 9.2 the cell(s) stop working the most quickly.	
		Explain your answer.	
		circuit	
		explanation	
		[2	ː]
(b)	A st	udent wishes to measure the current from the cell in circuit 4 .	
	(i)	Name the instrument used to measure current.	
		[1]
	(ii)	In the box below, redraw circuit 4 to include the measuring instrument.	
		[3	3]

10 Fig. 10.1 shows an iron rod with a coil of wire wrapped around it.

The coil is attached to a power supply.

A mixture of small pieces of different types of metal are on the bench near the iron rod.

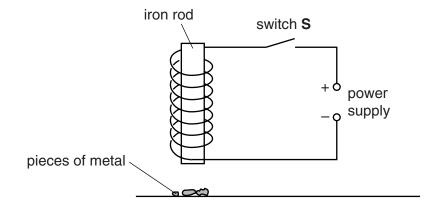


Fig. 10.1

(a)	(i)	State what happens to the iron rod when switch S is closed.
		[1]
		When switch S is closed, some of the pieces of metal are attracted to the iron rod and stick to it. The other pieces of metal stay on the bench.
	(ii)	Explain why some of the pieces of metal are attracted to the iron rod and some are not attracted.
		[2]

(b) In a separate experiment, a magnet is used to pick up two metal pins as shown in Fig. 10.2.

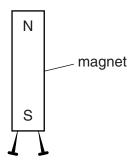


Fig. 10.2

The pins hang at an angle to each other.	
Explain why the pins do not hang vertically.	
	.[3

- 11 Carbon-12, ${}^{12}_{6}$ C, and carbon-14, ${}^{14}_{6}$ C, are isotopes of carbon.
 - (a) Complete Table 11.1 to show the number of protons, electrons and neutrons in atoms of carbon-12 and carbon-14.

Table 11.1

isotope		protons	electrons	neutrons
carbon-12	¹² ₆ C			
carbon-14	¹⁴ ₆ C			

[2]

- (b) Ethane and ethene are hydrocarbons. They each contain two carbon atoms per molecule.
 - (i) Complete Fig. 11.1 to show the structural formulae of ethane and ethene.

C C C

ethane ethene [3]

Fig. 11.1

12 Fig. 12.1 shows a cathode ray tube.

There is an electric field between the charged plates.

The cathode rays are deflected by this electric field.

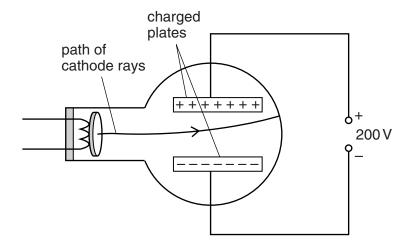


Fig. 12.1

(a)	Describe the evidence which suggests that the particles which make up cathode ra negatively charged.	
(b)	Name the type of particle which forms cathode rays.	
		[1]

13 A student measures the half-life of a radioactive isotope.

She records the results and draws the graph in Fig. 13.1.

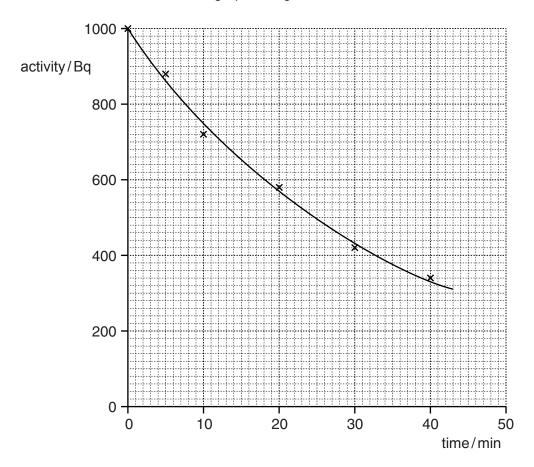


Fig. 13.1

(a)	The	points	are	not	exactly	on/	а	smooth	curve.
-----	-----	--------	-----	-----	---------	-----	---	--------	--------

State the property of radioactive decay which causes this scatter.

(b) Use the graph to determine the half life of the isotope.

Show clearly on the graph in Fig. 13.1, how you obtained this value.

half-life = min [2]

(c)	The isotope decays by emitting an α -particle (alpha-particle).	
	Describe the nature of an α -particle.	
		••••
		ſΩ

DATA SHEET
The Periodic Table of the Elements

	0	4 He Helium	20 Neon 10 40 Arrgon	84 Krypton 36	131 Xe Xenon	Radon 86		175 Lu Lutetium 71	Lr Lawrencium 103
	II/		19 Fluorine 9 35.5 C 1	80 Br Bromine	127 T lodine	At Astatine 85		Yb Ytterbium 70	Nobelium 102
	N		16 Oxygen 8 32 S Sulfur	79 Selenium 34	128 Te Tellurium	Po Polonium 84		169 Tm Thulium 69	Md Mendelevium 101
	>		14 Nitrogen 7 31 Phosphorus 15	75 As Arsenic 33	Sb Antimony 51	1		167 Er Erbium 68	Fm Fermium 100
	2		12 Carbon 6 Si Si	73 Ge Germanium 32	Sn Tin 50	207 Pb Lead 82		165 Ho Holmium 67	Es Einsteinium 99
	=		11 Bann 5 27 Aluminium 13	70 Ga Gallium 31	115 In Indium 49	204 T 1 Thallium		162 Dy Dysprosium 66	Cf Californium 98
				65 Zn Zinc 30	Cd Cadmium 48	1		159 Tb Terbium 65	Bk Berkelium 97
				64 Copper 29	108 Ag Silver 47	197 Au Gold		Gd Gadolinium 64	Cm Curium
Group				59 X Nickel 28	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu Europium 63	Am Americium 95
Gr				59 Cob	Rhodium 45	192 Ir Indium		Samarium 62	Pu Plutonium 94
		1 Hydrogen		56 Fe Iron	Ru Ruthenium 44	190 Os Osmium 76		Pm Promethium 61	Neptunium
				Manganese	Tc Technetium 43	186 Re Rhenium 75		Neodymium 60	238 U Uranium 92
				52 Cr Chromium 24	96 Moybdenum 42	184 W Tungsten 74		Pr Pr Praseodymium 59	Pa Protactinium 91
				51 Vanadium 23	Nobium 41	181 Ta Tantalum		140 Ce	232 Th Thorium 90
				48 T iTitanium 22	2r Zirconium 40	178 Hf Hafnium * 72			nic mass Ibol nic) number
				Scandium 21	89 ×	139 La Lanthanum 57 *	227 Ac Actinium 89	d series series	 a = relative atomic mass X = atomic symbol b = proton (atomic) number
	=		Be Beryllium 4 24 Mg Magnesium 12	40 Calcium	Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series †90-103 Actinoid series	<i>a</i> × <i>∞</i>
	_		7 Lithium 3 23 Na Sodium 11	39 K	Rb Rubidium	Cs Caesium 55	Fr Francium 87	*58-711 †90-103	Key

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

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