

Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

PHYSICAL SCIENCE

0652/21

Paper 2 (Core)

October/November 2015

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 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 Carbon-12 and carbon-14 are isotope	es oi	carbon.
---------------------------------------	-------	---------

(a)

(b)

Explain what is meant by the term <i>isotope</i> .
[2
Carbon-14 can be represented by $^{14}_{6}$ C.
State what the numbers 6 and 14 stand for.

(c) Complete Fig. 1.1 to show the electron arrangement in an atom of carbon-14.

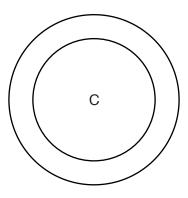


Fig. 1.1

[1]

2 Fig. 2.1 shows a beam fixed into a wall at one end. **C** marks the centre of mass of the beam. Point **X** acts as the pivot.

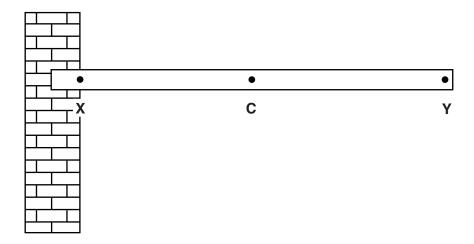


Fig. 2.1

(a)	Draw an arrow to show where the weight of the beam acts and the direction in wh	nich it acts.
	·	[2]

- (b) A man of mass 80 kg stands on the beam at point Y.
 - (i) Calculate the weight of the man and give the unit. Use $g = 10 \,\mathrm{m/s^2}$.

weight		unit		[2]	
--------	--	------	--	-----	--

(ii) The distance from **X** to **Y** is 6.0 m.

Calculate the moment at point **X** produced by the man when he is at point **Y**.

moment =		Ν	lm	[2	2
----------	--	---	----	----	---

(iii) State and explain how the moment produced at **X** changes as the man walks towards the wall.

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3 Use words from the list below to complete Table 3.1.

Each word may be used once, more than once, or not at all.

air brass bromine chlorine graphite nitrogen steel sulfur

Table 3.1

description	substance
an alloy containing zinc	
a solid non-metallic element	
a gaseous mixture	
an element which is a good conductor of electricity	
a gaseous element used in water purification	

[5]

4 Fig. 4.1 shows a piece of apparatus, viewed from above. Four different metal strips are fixed to a wooden ring.

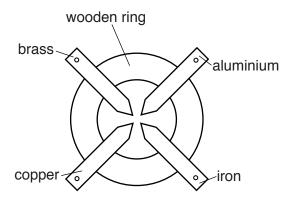


Fig. 4.1

Fig. 4.2 shows an experiment using the apparatus.

A match head is placed on the end of each metal strip. The strips are then heated at the centre.

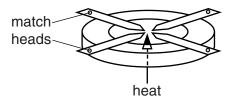


Fig. 4.2

Each of the match heads ignites after a different length of time. This is shown in Table 4.1.

Table 4.1

metal strip	time for match head to ignite/minutes
aluminium	4
brass	3
copper	1
iron	8

(a)	Name th	ne form of thermal energy transfer which causes the match to ignite.	
			. [1]
(b)	List the	metals in order of the speed at which they transfer thermal energy.	
	fastest		
	slowest		[2

Soc	lium	chloride, $NaCl$, is an ionic compound containing sodium ions and chloride ions.	
(a)	(i)	Explain how a sodium ion is formed from a sodium atom.	
	(ii)	Give the symbol for a chloride ion and the total number of electrons it contains.	
		symbol	
		number of electrons	[2]
(b)		he box, draw a dot and cross diagram to show the electrons in a molecule of hybride, $HC\mathit{l}$.	/drogen
	Incl	ude outer electrons only.	
			[2]
(c)	Soc	dium chloride can be made by reacting hydrogen chloride with an alkali.	
	Nar	me a suitable alkali and the other product or products of the reaction with this alkali	i.
	alka	ali	
	othe	er product(s)	
			[2]

6 Fig. 6.1 shows an illuminated object **O** in front of a plane mirror. Two rays of light are shown leaving object **O**.

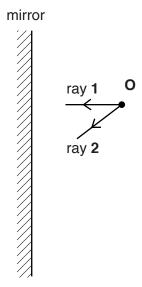


Fig. 6.1

(a)	(1)	On Fig. 6.1, mark the position of the image of object O formed by the mirror and label	IT 1.
	(ii)	Complete ray 1 showing how it is reflected from the mirror.	[1]
	(iii)	Complete ray 2 showing how it is reflected from the mirror.	[1]
	(iv)	Identify and label, with the letter ${\bf r}$, the angle of reflection that ray ${\bf 2}$ makes with the mi	rror. [1]
	(v)	Complete the diagram to show how the image ${f I}$ is formed.	[2]
	(vi)	Mark the position of an eye for the image to be seen and label it E .	[1]
(b)	Sta	te the relationship between the angle of incidence and the angle of reflection.	
			. [1]
(c)		e image formed in a plane mirror is upright and the same size as the original object.	
			. [1]

- Calcium carbonate, CaCO₃, and ammonium sulfate, (NH₄)₂SO₄, may be used by farmers to 7 improve crop yields.
 - (a) Complete Table 7.1 by writing the names of the three other elements present in ammonium sulfate and the relative numbers of atoms of each in the compound. One element is done for you.

Table 7.1

element	relative number of atoms
sulfur	1

ı	٠,	כ	
•			٠

- (c) Many crops grow best in neutral or weakly alkaline soils. Calcium carbonate is added to acidic soils to increase their pH.
 - Suggest the pH number of a weakly acidic soil.

.....[1]

State the pH number of neutral soil. (ii)

.....[1]

8 A student hangs two balloons from the ceiling as shown in Fig. 8.1a.

The student then rubs the two balloons on his jumper. The balloons now hang as shown in Fig. 8.1b.

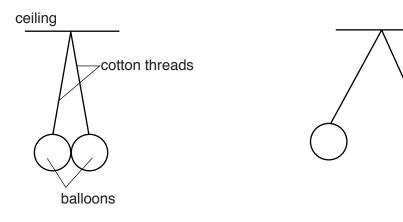


Fig. 8.1a Fig. 8.1b

(a)	Explain why the balloons are no longer touching.
	Į:

(b) A fine mist of water is sprayed near the balloons. The balloons move back so that they are touching each other as shown in Fig. 8.2.

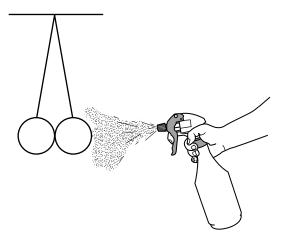


Fig. 8.2

Explain why the balloons move back to this position.

9

Cop	oper i	s a transition element.	
(a)	Trar	nsition elements are metals.	
	Stat	e one other characteristic of transition elements.	
			[1]
(b)	Nan	ne a non-metallic element in the same period as copper.	F4 1
			[1]
(c)	Сор	per is found in the Earth's crust, either as an ore or 'native'.	
	(i)	Name an ore of copper.	
			[1]
	(ii)	Name another metal which is also found 'native' in the Earth's crust.	
			[1]
	(iii)	Give a reason why these metals are found 'native'.	
			[4]

(d) A student sets up the apparatus as shown in Fig. 9.1.

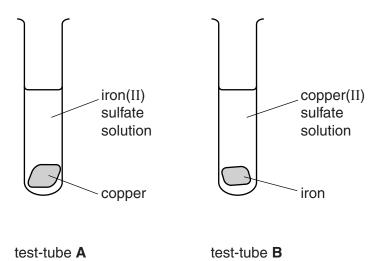


Fig. 9.1

She observes the apparatus after one hour.

(i)	State what she sees in each test-tube after one hour.	
	test-tube A	
	test-tube B	
		[2
		ےا
(ii)	Explain these observations.	
		[1

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10	0 Ethyne (acetylene), C ₂ H ₂ , is used as a fuel when metals are welded together.												
	Eth	ourns in oxygen to form carbon dioxide and water in an exothermic reaction.											
	(a)	(i)	State what is meant by exothermic.										
				[1]									
		(ii)	Write a balanced equation for the burning of ethyne underneath the word equation.										
			ethyne + oxygen $ ightarrow$ carbon dioxide + water										
				[2]									
	(b)	(i)	Name the harmful gas that is formed when ethyne burns in a limited supply of oxygen	١.									
				[1]									
		(ii)	Explain why this gas is harmful.										
				[1]									
	(c)	Eth	yne is a member of a homologous series.										
		(i)	State one characteristic of a homologous series.										
				[1]									
		(ii)	Ethene, C_2H_4 , and ethane, C_2H_6 , are members of different homologous series.										
			Explain how ethene and ethane are different in terms of their bonding.										
				[2]									

11 A student draws the circuit diagram shown in Fig. 11.1.

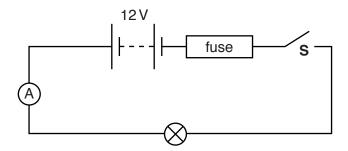


Fig. 11.1

(a) He has drawn the wrong symbol for a fuse.

Draw the correct symbol for a fuse in the space below.

[1]

(b) The student constructs the circuit shown in his diagram.

He closes switch **S** and the reading on the ammeter is 3.2 A.

Calculate the resistance of the lamp. Give the unit.

resistance = unit [3]

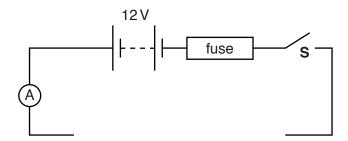
(c) Fuses of the following ratings are available: 3A, 5A, and 13A.

State which fuse would be most suitable to use in the circuit shown in Fig. 11.1 and give an explanation for your choice.

fuse rating

explanation

- (d) The student adds an identical second lamp, in parallel with the original lamp.
 - (i) Complete Fig. 11.2 to show the two lamps connected in parallel in the circuit.



[1]

(ii)	When switch S in the second circuit is closed the fuse blows.
	Explain why the fuse blows.
	[2

12 The graph in Fig. 12.1 shows the results from an experiment to measure the half life of a radioactive isotope.

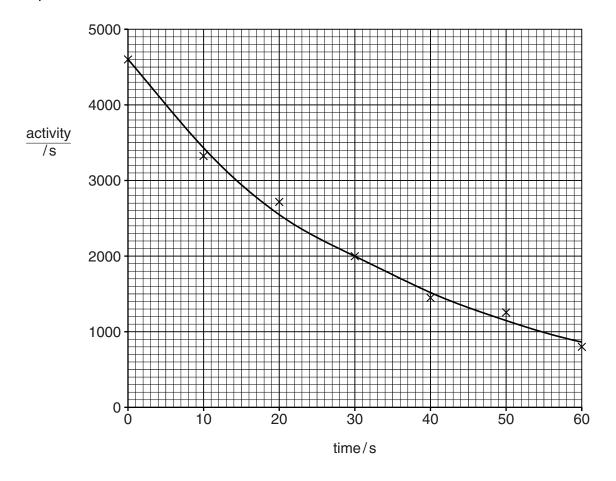


Fig. 12.1

(a) Suggest why the points do not lie precisely on the drawn curve.

		[1]
(b)	(i)	Determine the initial activity of the sample.
		[1]
	(ii)	Use your graph to calculate the half life of the isotope. Show on your graph how you determined your answer.

half life =s [2]

(c)	Radioactive isotopes can be dangerous to health.
	Give one precaution that should be taken when using radioactive isotopes.
	[1

DATA SHEET
The Periodic Table of the Elements

		0	4	£	Helium 2	20	Ne	Neon 10	40	Ā	Argon 18	84	궃	Krypton 36	131	Xe	Xenon 54	222	R	Radon 86				175	3	Lutetium 71	260	ئ	Lawrencium 103												
		=>				19	ш	Fluorine 9	35.5	CI	Chlorine 17	80	Ŗ	Bromine 35			lodine 53	210	Αţ	Astatine 85				173		=		8	Nobelium 102												
		5				16	0	Oxygen 8	32	တ		62	Se	Selenium 34	128	<u>е</u>	Tellurium 52	509	Ъ	Polonium 84				169	Ę		258	Md	Mendelevium 101												
		>				14	z	Nitrogen 7	31	Δ.	Phosphorus 15	75	As	Arsenic 33	122	Sb	Antimony 51	509	Ξ	Bismuth 83				167	ш	Erbium 68	257	Fm	_												
		≥																12	ပ	Carbon 6	28	S	Silicon 14	73	Ge	Germanium 32			Tin 50	207	Pb	Lead 82				165		Holmium 67		Es	E
		=					11	В	Boron 5	27	Ν	Aluminium 13	20	Ga	Gallium 31	115	In	Indium 49	204	11	Thallium 81				162		Ę	251	ర	Californium 98											
S													Zu	Zinc 30	112	ဦ	Cadmium 48	201	Hg	Mercury 80				159		Terbium 65	247		Berkelium 97												
The Periodic Table of the Elements												64	Cn	Copper 29	108	Ag		197	Αn	Gold 79			•			Gadolinium 64		Cm	Curium 96												
e or tne	Group											69	Z	Nickel 28	106	Pd	Palladium 46	195	퐙	Platinum 78					П	E	243	Am	Americium 95												
alc labi	Gro											59	ဝိ	Cobalt 27	103		Rhodium 45	192	Ä	Iridium 77				150	Sm	Samarium 62		Pu	Plutonium 94												
ne Perio			- :	I	Hydrogen 1							56	Fe	Iron 26	101		Ruthenium 44		SO	Osmium 76				147	Pm	Promethium 61	237	dΝ	Neptunium 93												
												55	Mn	Manganese 25		ဍ	Technetium 43	186		Rhenium 75				144	Nd	um Neodymium 60	238	-	Uranium 92												
												52	ပ်	Chromium 24		Mo	Molybdenum 42		>	Tungsten 74			•		Ā	Praseodymium 59		Ра	Protactinium 91												
												51	>	Vanadium 23	93	QN	Niobium 41	181	Та	Tantalum 73			•	140	ဝီ	Cerium 58	232	드	Thorium 90												
												48	F	Titanium 22	91		Zirconium 40	178	Ξ	Hafnium 72							ic mass	loc	on) number												
												45	လွ	Scandium 21	88	>	Yttrium 39	139	Ľa	Lanthanum 57 *	227	Ac	Actinium 89 †	d sprips	Sprips	5	a = relative atomic mass	X = atomic symbol	b = atomic (proton) number												
		=				6	Be	Beryllium 4	24	Mg	Magnesium 12	40	Ca	Calcium 20	88	S	Strontium 38	137	Ва	Barium 56	226	Ва	Kadium 88	anthanoi	Actinoid		a	×	= q												
		_				7	=	Lithium	23	Na		39	¥	Potassium 19	85		Rubidium 37	133	S	Caesium 55	223	Ľ,	Francium 87	* 58–71 Lanthanoid series	+ 90-103 Actinoid series	8		Key	a												
of	disclo	osure	of a	nsw	/er-re	elate	ed ir	nform	atio	n to		lida			ppyr			owl			nts a	re re					in t		Cambi												

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

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