

## **Cambridge International Examinations**

Cambridge International General Certificate of Secondary Education

PHYSICAL SCIENCE 0652/21

Paper 2 Multiple Choice October/November 2017

45 minutes

Additional Materials: Multiple Choice Answer Sheet

Soft clean eraser

Soft pencil (type B or HB is recommended)

## **READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

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

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

## Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.



International Examinations

CAMBRIDGE

1	Wh	at is the name o	f the	process by whi	ich g	as particle	s move	to	occupy all the available space?
	A	boiling							
	В	condensation							
	С	diffusion							
	D	evaporation							
2	An	atom of sodium	cont	ains 11 protons	, 11	electrons a	and 12 r	neu	trons.
	Wh	at is the nucleor	nur	mber of the aton	n?				
	Α	11	В	12	С	22	I	D	23
3	Wh	ich statement de	escri	bes the formation	on of	the bonds	in mag	nes	sium chloride?
	Α	Chlorine atoms	trar	nsfer electrons to	o ma	ignesium a	itoms fo	ormi	ing an ionic bond.
	В	Magnesium ato	ms	and chlorine atc	ms :	share a pa	ir of ele	ctro	ons forming a covalent bond.
	С	Magnesium ato	ms	transfer electror	ns to	chlorine a	toms fo	rmi	ng a covalent bond.
	D	Magnesium ato	ms	transfer electror	ns to	chlorine a	toms fo	rmi	ng an ionic bond.
4	Wh	ich statement ex	plai	ns why graphite	con	ducts elect	ricity?		
	Α	All of the electr	ons	in graphite are f	ree t	to move the	rough it	s st	tructure.
	В	Each carbon a structure.	itom	has three cov	alen	t bonds ai	nd one	ele	ectron free to move through the
	С	Graphite is a m	etal	and the outer s	hell (	electrons a	re free	to r	move.
	D	The electrons in	n the	e covalent bonds	s are	free to mo	ove thro	ougl	h the structure.
5	The	e formula of a ga	lliun	n ion is Ga <sup>3+</sup> .					
	The	e formula of a su	lfate	ion is $SO_4^{2-}$ .					
	Wh	at is the formula	of g	allium sulfate?					
	Α	GaSO <sub>4</sub>	В	Ga₂SO₃	С	Ga <sub>2</sub> (SO <sub>4</sub>	) <sub>3</sub>	D	$Ga_3(SO_4)_2$

**6** Chromium(III) oxide reacts with dilute nitric acid to give chromium(III) nitrate and water.

$$Cr_2O_3 \ + \ xHNO_3 \ \rightarrow \ yCr(NO_3)_3 \ + \ zH_2O$$

Which values of x, y and z balance the equation?

	х	у	Z
Α	3	1	3
В	3	2	6
С	6	2	3
D	6	2	6

- 7 Which compound has the largest relative molecular mass,  $M_r$ ?
  - $A CO_2$
- B NO<sub>2</sub>
- C SiO<sub>2</sub>
- D  $SO_2$

8 The diagram shows wood burning in air.



Which two words describe what happens to the wood and the type of reaction taking place?

	wood is	type of reaction
Α	oxidised	endothermic
В	oxidised	exothermic
С	reduced	endothermic
D	reduced	exothermic

**9** Hydrogen bromide gas reacts with water to produce an acidic solution.

The equation for the reaction is

$$HBr + H_2O \rightarrow H_3O^{\dagger} + Br^{-}$$

Which statement describes what happens during the reaction?

- A Bromine accepts an electron from the water.
- **B** Hydrogen bromide accepts a proton from the water.
- **C** Hydrogen bromide donates a proton to the water.
- **D** Hydrogen bromide loses an electron to the water.
- **10** Four methods of preparing salts are shown.
  - adding an excess of an insoluble carbonate to a dilute acid and removing the excess by filtration
  - 2 adding an excess of an insoluble metal oxide to a dilute acid and removing the excess by filtration
  - 3 precipitation
  - 4 titration using an acid and an alkali

The solubility of some lead compounds is shown.

compound	solubility
lead carbonate	insoluble
lead hydroxide	insoluble
lead oxide	insoluble
lead nitrate	soluble
lead sulfate	insoluble

Which methods could be used to make lead nitrate?

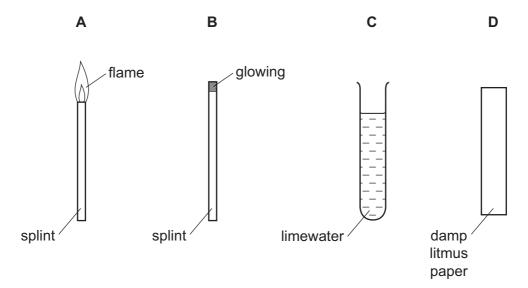
**A** 1 and 2

**B** 1 and 4

C 3 only

**D** 4 only

11 Which test is used to show that a gas is ammonia?



**12** An element Z has the electronic structure 2,8,5.

In which group in the Periodic Table is Z placed?

**A** 2

**B** 3

**C** 5

**D** 8

13 The elements in Group VI of the Periodic Table show the same trends as the elements in Group VII.

Which row describes the trend in melting point and density of the Group VI elements as the group is descended?

	melting point	density
Α	decrease	decrease
В	decrease	increase
С	increase	decrease
D	increase	increase

**14** Bauxite and haematite are important ores.

Which metals do the ores contain?

	bauxite	haematite
Α	Αl	Cu
В	Αl	Fe
С	Cu	Αl
D	Fe	Cu

15 One of the reactions that occurs in a blast furnace is shown.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Which substance is the reducing agent?

- A CO
- B CO<sub>2</sub>
- **C** Fe
- **D**  $Fe_2O_3$

16 Which property of a metal makes it **not** suitable for aircraft bodies?

- A high density
- B high malleability
- C high strength
- **D** low reactivity

17 Nitrogen oxides are produced in a car engine.

Which process describes how the nitrogen oxides are catalytically removed in the exhaust fumes?

- **A** combustion
- **B** oxidation
- **C** reduction
- **D** thermal decomposition

**18** Which row describes compounds in the same homologous series?

	chemical properties	functional group
Α	different	different
В	different	the same
С	similar	different
D	similar	the same

19 When decane is heated over a catalyst, it breaks down to make octane and ethene.

Which name is given to this process?

- A cracking
- **B** distilling
- **C** polymerising
- **D** reducing

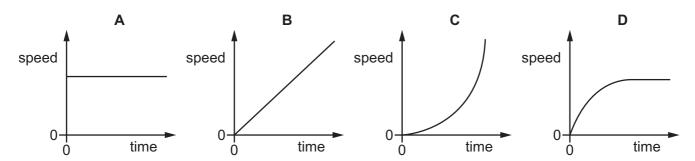
**20** Limonene is a colourless, unsaturated hydrocarbon found in lemons.

Which row describes the colour change when a few drops of limonene are shaken with bromine?

	colour of bromine at the start of experiment	colour of bromine after mixing with limonene
Α	colourless	colourless
В	colourless	orange
С	orange	colourless
D	orange	orange

21 An object falls vertically in air, from rest, through a large distance. Air resistance acts on the object.

Which speed-time graph represents the motion of the object?



**22** A student does work by pulling a case across a horizontal floor.

She now pulls a second case along the same floor.

Which row indicates that the student is now doing twice as much work?

	force used to pull case	distance the case is pulled
Α	is doubled	is doubled
В	is doubled	is halved
С	stays the same	is doubled
D	stays the same	is halved

23 A metal container has a mass of 200 kg.

The container is filled with 1.00 m<sup>3</sup> of a liquid. The total mass is now 1000 kg.

What is the density of the liquid?

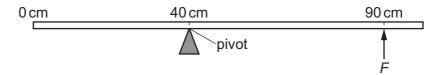
- **A**  $0.00125 \, \text{kg/m}^3$
- **B**  $0.00500 \, \text{kg/m}^3$
- $\mathbf{C}$  800 kg/m<sup>3</sup>
- **D**  $1000 \, \text{kg/m}^3$

24 Which row correctly describes iron and lead?

	iron	lead
Α	ferrous	ferrous
В	ferrous	non-ferrous
С	non-ferrous	ferrous
D	non-ferrous	non-ferrous

**25** A uniform metre rule of weight 2.0 N is pivoted at the 40 cm mark.

The rule is held in equilibrium by force *F* acting at the 90 cm mark.



What is F?

- **A** 0.22 N
- **B** 0.40 N
- C 0.89 N
- **D** 1.6 N

**26** An object of mass *m* moving with velocity *v* has kinetic energy *E*.

What is the kinetic energy of an object of mass 4.0 m moving with velocity 2.0 v?

- **A** 2.0 *E*
- **B** 4.0 *E*
- **C** 8.0 *E*
- **D** 16.0 *E*

27 A power station uses nuclear fission to obtain energy.

In this process, nuclear energy is first transferred to

- **A** chemical energy.
- **B** electrical energy.
- **C** gravitational energy.
- **D** thermal (heat) energy.

**28** A student has two mercury-in-glass thermometers P and Q. They contain equal volumes of mercury.

Thermometer Q has a longer stem and a wider capillary bore than thermometer P.

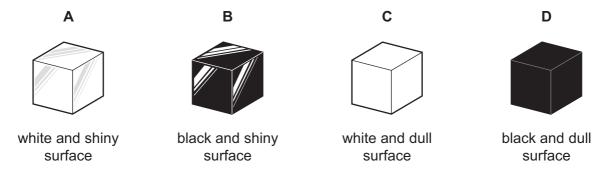
Which row compares the range and the sensitivity of thermometer Q with those of thermometer P?

	range of Q compared with P	sensitivity of Q compared with P
Α	greater	greater
В	greater	smaller
С	smaller	greater
D	smaller	smaller

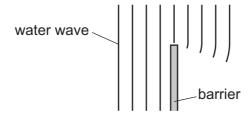
29 The diagram shows four identical copper blocks. The blocks have been painted so that their surfaces are different.

All four blocks are heated to the same temperature, in the same room.

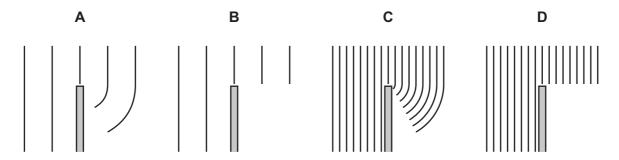
Which block cools the most slowly?



**30** The diagram shows a water wave being diffracted at the edge of a barrier.



Which diagram shows water waves of half the frequency being diffracted at the edge of the same barrier?

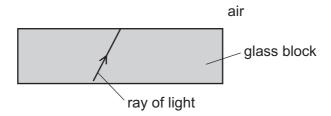


31 The table gives information about the approximate speed and range of wavelengths of waves.

Which row describes monochromatic microwaves in a vacuum?

	approximate speed	wavelengths
Α	300 m/s	all the same
В	300 m/s	a range of different values
С	300 000 km/s	all the same
D	300 000 km/s	a range of different values

**32** A ray of light in a glass block strikes the edge of the block. The angle of incidence is much smaller than the critical angle.

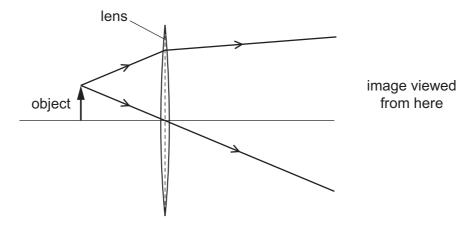


What happens to this ray?

- **A** It is completely reflected.
- **B** It is completely refracted.
- **C** It is partially reflected and partially refracted.
- **D** It is refracted at an angle of refraction of 90°.
- **33** The diagram shows the paths of two rays from the top of an object.

The rays pass through a thin converging lens.

The image produced is viewed from the position shown.



What type of image is seen?

- A a real image that is larger than the object
- **B** a real image that is smaller than the object
- **C** a virtual image that is larger than the object
- **D** a virtual image that is smaller than the object

**34** Three objects, P, Q and R, vibrate with the frequencies shown and produce longitudinal waves in the air.

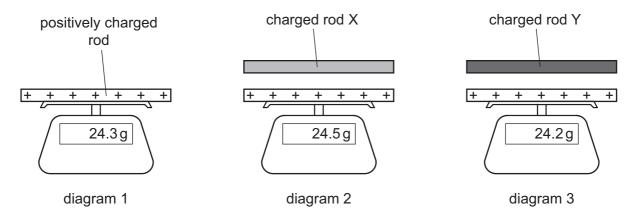
object	frequency/Hz
Р	25
Q	1000
R	15 000

Which of these waves can be heard by a human with normal hearing?

- A P, Q and R
- B P and Q only
- C P and R only
- **D** Q and R only
- **35** A positively charged insulating rod is placed on a balance. The reading on the balance is shown in diagram 1.

Two charged rods X and Y are now brought close to the positively charged rod in turn.

Diagram 2 and diagram 3 show the new reading on the balance in each case.



Which row gives the charges on rod X and rod Y?

	rod X	rod Y
Α	negative	negative
В	negative	positive
С	positive	negative
D	positive	positive

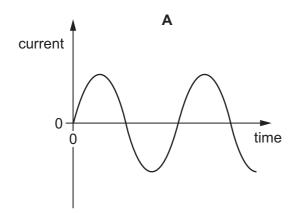
**36** A charger for a mobile phone (cell phone) supplies 50 mA of current to the phone battery for 30 minutes.

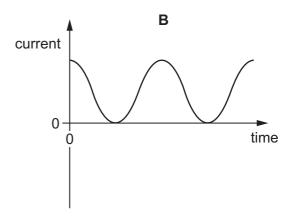
How much charge passes through the battery?

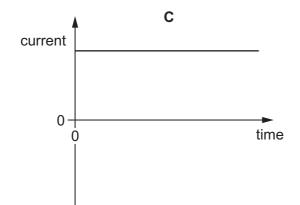
- **A** 1.5 C
- **B** 90 C
- **C** 1500 C
- **D** 90000 C
- 37 There is a current of 3.0 A in a resistor. The energy converted in the resistor is 540 J in 60 s.

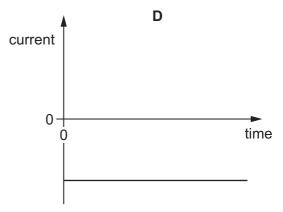
What is the potential difference across the resistor?

- **A** 1.0 V
- **B** 3.0 V
- **C** 9.0 V
- **D** 180 V
- 38 Which graph represents an alternating current?

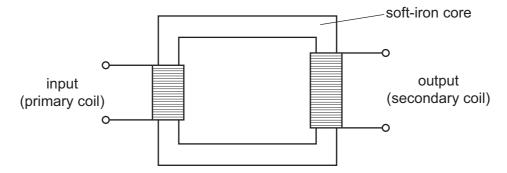








**39** The diagram represents a transformer.



Why is there an induced electromotive force (e.m.f.) across the secondary coil?

- **A** There is a changing magnetic field in the soft-iron core.
- **B** There is a direct current in the primary coil.
- **C** There is a direct current in the soft-iron core.
- **D** There is a steady magnetic field in the soft-iron core.
- **40** The emissions from a radioactive source pass through a sheet of lead, 10 mm thick.

Which row describes other properties of these emissions?

	ionising effect	deflection in an electric field
Α	strong	from positive to negative
В	strong	no deflection
С	weak	from positive to negative
D	weak	no deflection

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The Periodic Table of Elements

	III/	2 :	Не	helium 4	10	Ne	neon 20	18	Ā	argon 40	36	궃	krypton 84	54	Xe	xenon 131	98	R	radon				
	IIA				6	ш	fluorine 19	17	Cl	chlorine 35.5	35	ğ	bromine 80	53	Н	iodine 127	85	Αţ	astatine -				
	I				8	0	oxygen 16	16	ഗ	sulfur 32	34	Se	selenium 79	52	<u>e</u>	tellurium 128	84	Ъ	molod –	116	^	livermorium -	
	>				7	z	nitrogen 14	15	₾	phosphorus 31	33	As	arsenic 75	51	Sp	antimony 122	83	Ξ	bismuth 209				
	>				9	ပ	carbon 12	14	S	silicon 28	32	Ge	germanium 73	50	Sn	tin 119	82	Pb	lead 207	114	ŀΙ	flerovium	
	≡				2	М	boron 11	13	Αl	aluminium 27	31	Ga	gallium 70	49	In	indium 115	81	11	thallium 204				
											30	Zu	zinc 65	48	ပ	cadmium 112	80	Нg	mercury 201	112	S	copernicium -	
											29	Cn	copper 64	47	Ag	silver 108	62	Αn	gold 197	111	Rg	roentgenium -	
Group												28	z	nickel 59	46	Pd	palladium 106	78	చ	platinum 195	110	Ds	darmstadtium -
Gro											27	ဝိ	cobalt 59	45	牊	rhodium 103	77	Ir	iridium 192	109	Mt	meitnerium -	
		F :	I	hydrogen 1							26	Ьe	iron 56	44		-		SO	osmium 190	108	Hs	hassium –	
											25	M	manganese 55	43	ပ	technetium -	75	Re	rhenium 186			bohrium –	
					_	pol	ass				24	ပ်	chromium 52	42	Mo	molybdenum 96	74	≥	tungsten 184	106	Sg	seaborgium -	
				Key	atomic number	atomic symbo	name relative atomic mass				23	>	vanadium 51	41	g	niobium 93	73	<u>a</u>	tantalum 181	105	В	dubnium –	
						ato	rek				22	i=	titanium 48	40	Zr	zirconium 91	72	士	hafnium 178	104	꿆	rutherfordium —	
											21	လွ	scandium 45	39	>	yttrium 89	57–71	lanthanoids		89-103	actinoids		
	=				4	Be	beryllium 9	12	Mg	magnesium 24	20	Ca	calcium 40	38	ഗ്	strontium 88	99	Ba	barium 137	88	Ra	radium -	
	_				ဇ	=	lithium 7	1	Na	sodium 23	19	¥	potassium 39	37	В	rubidium 85	55	S	caesium 133	87	Ŧ	francium -	

71	Lu lutetium 175	103	۲	lawrencium	ı
	TD ytterbium 173				
69 <b>E</b>	thulium 169	101	Md	mendelevium	ı
88 1	erbium 167	100	Fm	fermium	I
29	holmium 165	66	Es	einsteinium	ı
99	dysprosium 163	86	ర్	califomium	ı
65 <b>A</b> F	terbium 159	26	益	berkelium	I
64	gadolinium 157	96	Cm	curium	I
63	Eu europium 152	98	Am	americium	I
62	Samarium 150	94	Pu	plutonium	ı
61	promethium	93	dN	neptunium	I
09	neodymium 144	92	$\supset$	uranium	730
59	praseodymium 141	91	Ра	protactinium	167
88 6	Cerium 140	06	T	thorium	707
22	lanthanum 139	68	Ac	actinium	I
( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	lanulanonus		actinoids		

The volume of one mole of any gas is  $24\,\mathrm{dm}^3$  at room temperature and pressure (r.t.p.).