



Cambridge IGCSE™

PHYSICAL SCIENCE

0652/21

Paper 2 Multiple Choice (Extended)

October/November 2022

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

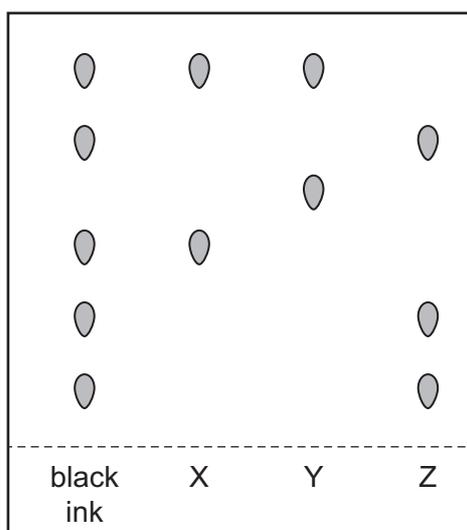
This document has **16** pages.



- 1 Which row describes the direction of movement and the speed of the particles of a gas during diffusion?

	direction of movement	speed of particles
A	high to low concentration	faster for smaller molecular masses
B	high to low concentration	slower for smaller molecular masses
C	low to high concentration	faster for smaller molecular masses
D	low to high concentration	slower for smaller molecular masses

- 2 The chromatogram of a black ink and three coloured dyes, X, Y and Z, is shown.

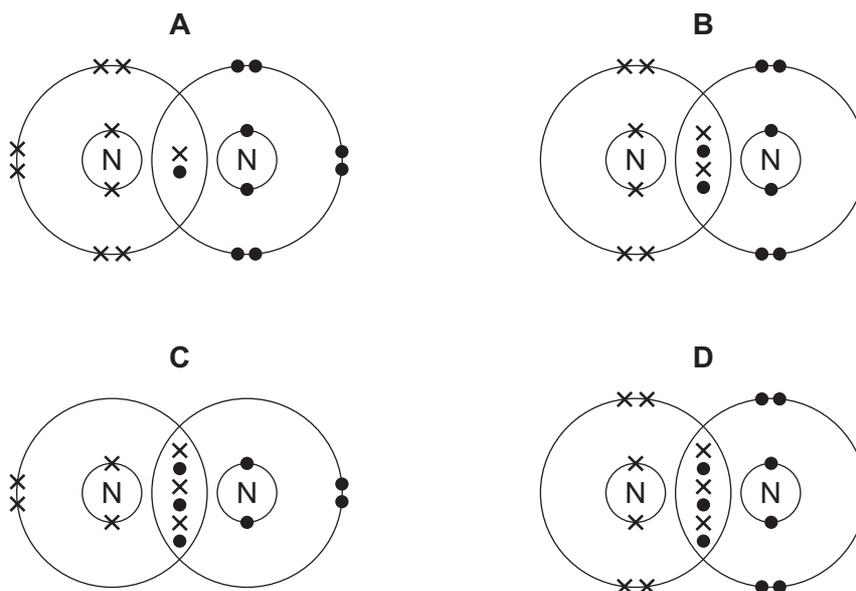


Which colours make up the black ink?

- A** X and Y only **B** X and Z only **C** X, Y and Z **D** Z only
- 3 Which row about isotopes of the same element is correct?

	nucleon number	reason for same chemical properties
A	different	same number of electron shells
B	different	same number of electrons in the outer shell
C	same	same number of electron shells
D	same	same number of electrons in the outer shell

4 Which dot-and-cross diagram represents a nitrogen, N₂, molecule?

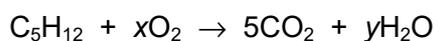


5 Silicon(IV) oxide has a giant covalent structure, very similar to the structure of diamond.

Silicon(IV) oxide is a very hard substance with a high melting point and does not conduct electricity, just like diamond.

Which statement about the structure of silicon(IV) oxide is correct?

- A** All the covalent bonds between silicon atoms and oxygen atoms are in the same plane.
 - B** No outer shell electrons from silicon atoms or oxygen atoms are free to move.
 - C** Layers of silicon atoms and oxygen atoms can slide over one another.
 - D** There are weak forces of attraction between atoms of silicon and atoms of oxygen.
- 6 Pentane, C₅H₁₂, burns in oxygen.

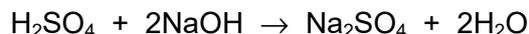


Which values of x and y balance the equation?

	x	y
A	4	6
B	4	12
C	8	6
D	8	12

- 7 Sulfuric acid is titrated with 25.0 cm³ of 0.05 mol/dm³ aqueous sodium hydroxide.

The equation for this reaction is shown.



Which volume of 0.1 mol/dm³ sulfuric acid is required to neutralise this volume of aqueous sodium hydroxide?

- A** 6.25 cm³ **B** 12.5 cm³ **C** 25.0 cm³ **D** 100.0 cm³

- 8 Which row identifies the electrode products when molten sodium chloride is electrolysed?

	anode	cathode
A	chlorine	sodium
B	chlorine	hydrogen
C	hydrogen	chlorine
D	sodium	chlorine

- 9 When the temperature of a reaction is increased the reaction gets faster.

Which statements explain why this happens?

- 1 The activation energy increases.
- 2 The activation energy decreases.
- 3 The number of collisions per second increases.
- 4 The number of particles with energy greater than the activation energy increases.

- A** 1 and 3 **B** 2 and 3 **C** 2 and 4 **D** 3 and 4

- 10 The chart shows the colour of universal indicator at different pH values.

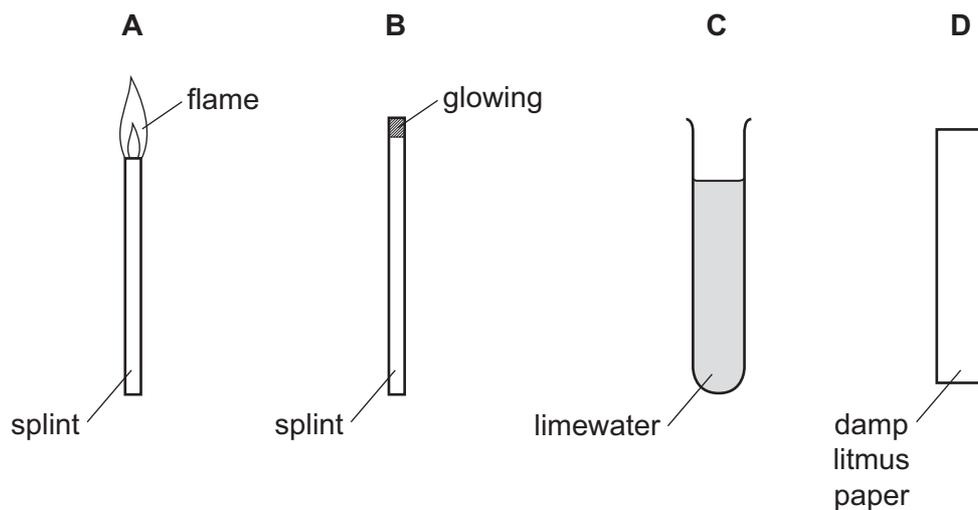
colour	red		orange			green				blue		violet		
pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14

A solution of lemon juice is only slightly acidic.

Which colour does universal indicator give with this solution?

- A** blue
B orange
C red
D violet

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



12 A student mixes aqueous solutions of four halogens with four aqueous solutions of halides.

- 1 chlorine and potassium iodide
- 2 bromine and potassium chloride
- 3 iodine and potassium chloride
- 4 bromine and potassium iodide

In which mixtures is a halogen displaced?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

13 Some properties of an element are listed.

- high density
- high melting point
- forms coloured compounds
- can act as a catalyst

Where in the Periodic Table is the element placed?

- A** Group VIII
B Group I
C Group VII
D transition elements

14 An element, Q, reacts with aqueous copper sulfate and copper is produced.

The same element does not react with aqueous zinc sulfate.

What is the position of Q in the reactivity series?

- A more reactive than zinc and more reactive than copper
- B more reactive than zinc and less reactive than copper
- C less reactive than zinc and more reactive than copper
- D less reactive than zinc and less reactive than copper

15 Some reactions of four metals, W, X, Y and Z, and their oxides are shown.

The letters are not the chemical symbols of the metals.

metal	reaction of metal with dilute hydrochloric acid	reaction of metal oxide with carbon
W	reacts	not readily reduced
X	no reaction	readily reduced
Y	reacts	reduced
Z	fast reaction	not reduced

What is the order of reactivity of these metals?

	most reactive	→		least reactive
A	Z	W	Y	X
B	Z	Y	W	X
C	X	W	Y	Z
D	X	Y	W	Z

16 Which row identifies the gases that are removed from car exhaust fumes by a catalytic converter?

	carbon dioxide	carbon monoxide	nitrogen	nitrogen monoxide
A	x	✓	x	✓
B	✓	x	✓	x
C	✓	✓	x	✓
D	x	✓	✓	x

key

✓ = gas is removed

x = gas is not removed

17 Which statements about carbon dioxide are correct?

- 1 It is produced by the reaction between an acid and a metal oxide.
- 2 It is produced by the reaction of a metal with an acid.
- 3 It is a greenhouse gas.
- 4 It is a product of respiration.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

18 Which type of reaction occurs when calcium carbonate is converted into calcium oxide?

- A** cracking
- B** displacement
- C** neutralisation
- D** thermal decomposition

19 Which row describes compounds in the same homologous series?

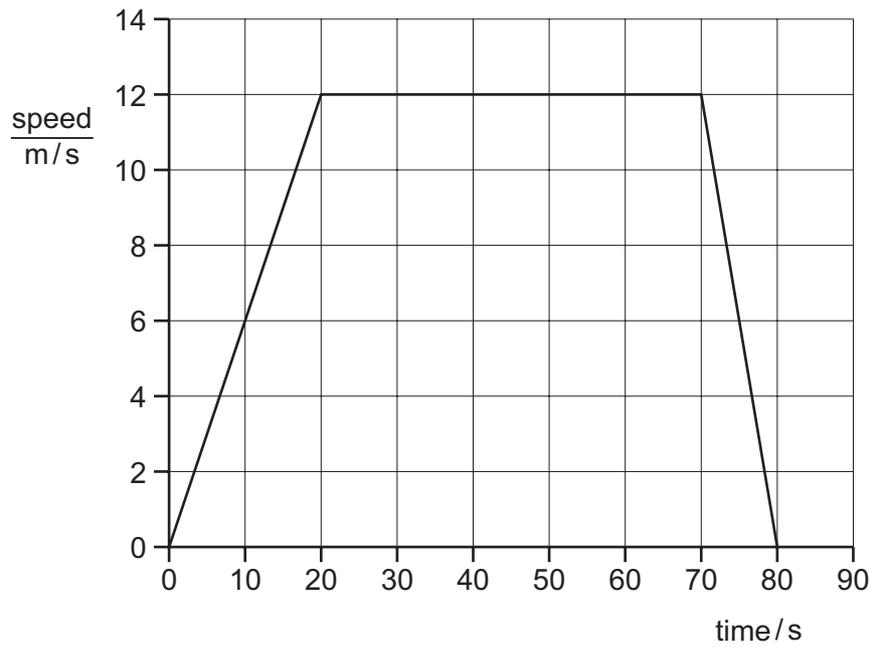
	chemical properties	functional group
A	different	different
B	different	same
C	similar	different
D	similar	same

20 Propene is an alkene.

Which statement about propene is correct?

- A** It reacts with hydrogen to form a polymer.
- B** It turns bromine orange.
- C** It undergoes addition reactions.
- D** It will not react with steam.

21 The speed–time graph shown is for a bus as it travels from one bus stop to the next.



What is the distance between the two bus stops?

- A** 120 m **B** 600 m **C** 780 m **D** 960 m

22 A steel ball is dropped from a table.

Air resistance can be ignored.

Which row describes the speed and the acceleration of the ball as it is falling?

	speed	acceleration
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

23 A measuring cylinder containing water rests on a balance, as shown in diagram 1.

A stone is now lowered carefully into the water, as shown in diagram 2.

The readings on the measuring cylinder and the balance are shown in the diagrams.

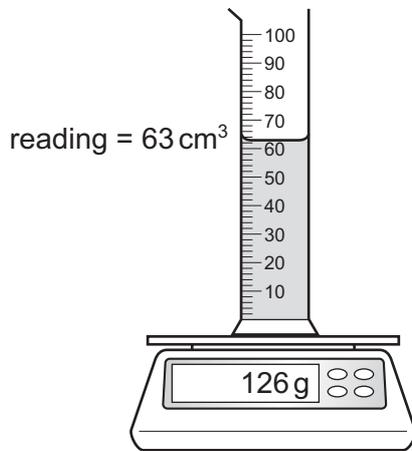


diagram 1

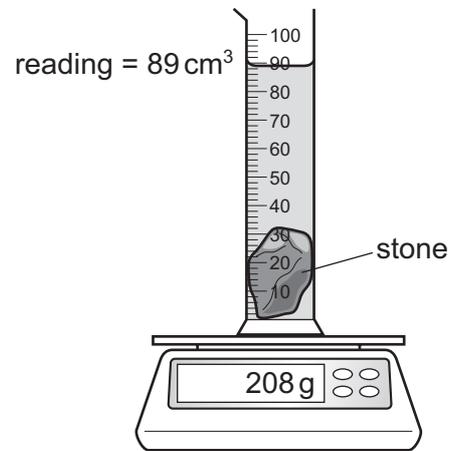


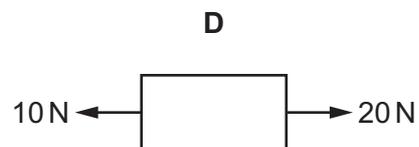
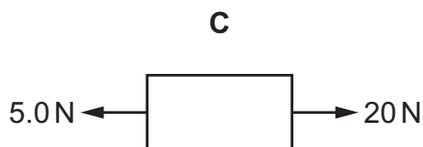
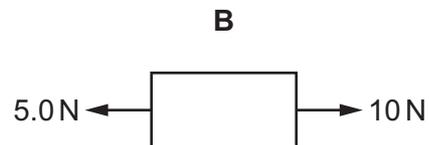
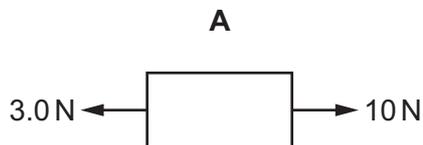
diagram 2

What is the density of the stone?

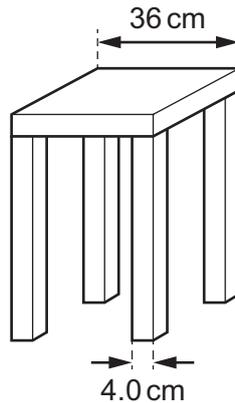
- A** 2.3 g/cm³ **B** 3.2 g/cm³ **C** 3.8 g/cm³ **D** 8.0 g/cm³

24 An object of mass 2.5 kg is acted upon by two forces.

Which arrangement of forces causes the object to accelerate at 4.0 m/s²?



- 25 A stool of weight 620 N has four legs. The legs all have a square cross-section of side length 4.0 cm. The seat of the stool is a square of side length 36 cm, as shown.



What is the pressure exerted on the floor by the legs of the stool?

- A 0.48 N/cm² B 9.7 N/cm² C 39 N/cm² D 155 N/cm²
- 26 A box with initial kinetic energy 48 J is sliding along a horizontal floor.

A constant frictional force of 9.0 N acts on the box.

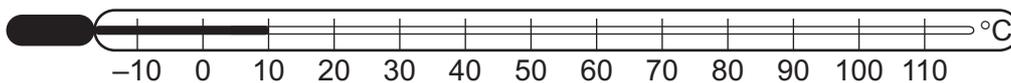
What is the kinetic energy of the box after it has moved a distance of 3.0 m?

- A 21 J B 27 J C 45 J D 75 J
- 27 Different energy resources are used to produce electricity.

Which resource is the least reliable?

- A geothermal
B hydroelectric
C nuclear
D wind

- 28 A liquid-in-glass thermometer is marked with a scale in °C.



What are the fixed points for this thermometer?

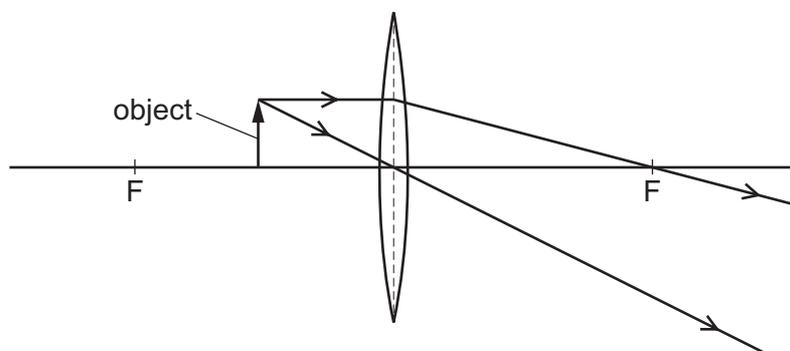
- A -10 °C and 10 °C
B -10 °C and 110 °C
C 0 °C and 100 °C
D 10 °C and 110 °C

- 29 Light travelling in medium 1 strikes a boundary with medium 2 and undergoes total internal reflection.

Which row compares the speed of the light in each medium, and compares the angle of incidence of the ray with the critical angle?

	speed of light in medium 1	angle of incidence
A	greater than in medium 2	greater than the critical angle
B	greater than in medium 2	less than the critical angle
C	less than in medium 2	greater than the critical angle
D	less than in medium 2	less than the critical angle

- 30 The diagram shows an object in front of a converging lens. The principal focus on each side of the lens is labelled F.



Which statement describes the image produced?

- A** It is real and closer to the lens than the object is to the lens.
- B** It is real and further away from the lens than the object is from the lens.
- C** It is virtual and closer to the lens than the object is to the lens.
- D** It is virtual and further away from the lens than the object is from the lens.
- 31 Which electromagnetic radiation is used to show what is inside closed suitcases in airports?
- A** infrared
- B** microwaves
- C** radio waves
- D** X-rays

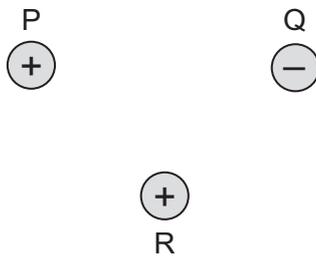
- 32 Three objects, P, Q and R, vibrate with the frequencies shown, producing longitudinal waves in the air.

object	frequency/Hz
P	25
Q	1 000
R	15 000

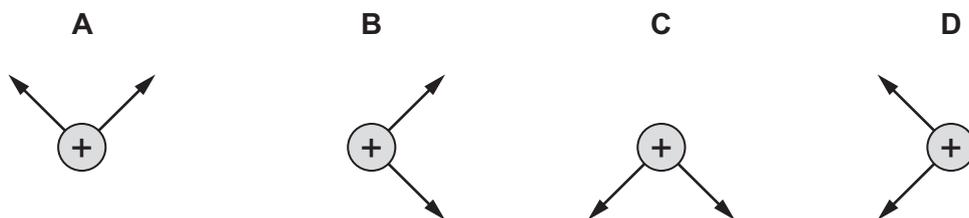
Which objects produce waves that can be heard by a healthy human ear?

- A** P, Q and R **B** P and Q only **C** P and R only **D** Q and R only
- 33 Which metal is used to make the core of an electromagnet?
- A** aluminium
B copper
C iron
D steel

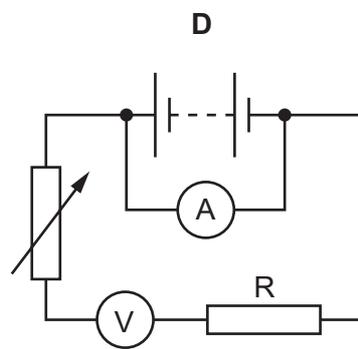
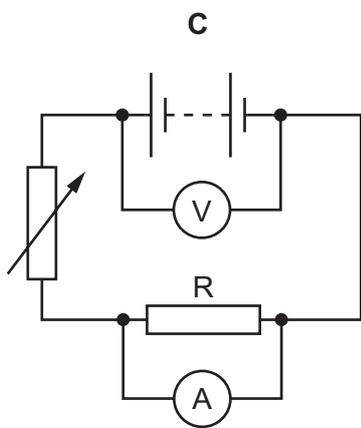
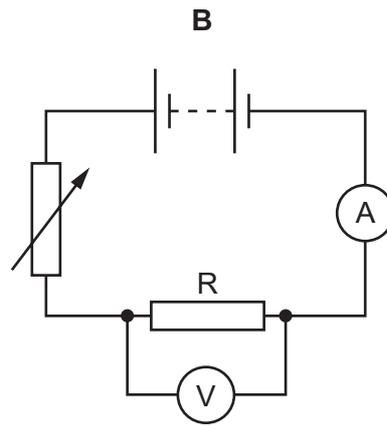
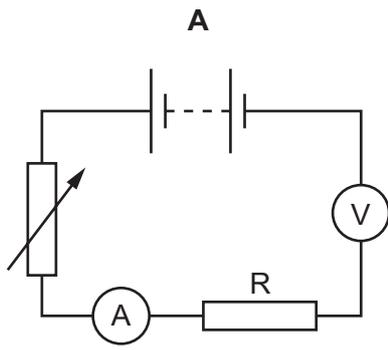
- 34 The diagram shows the charges on three objects, P, Q and R.



Which diagram shows the directions of the forces that act on object R?



35 Which circuit is used when determining the resistance of the resistor R?



36 An electric charge of 30 C flows through a conductor in 1.0 minute.

What is the current in the conductor?

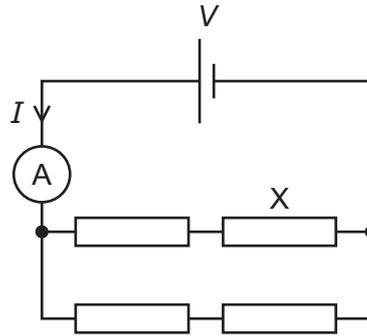
A 0.033 A

B 0.50 A

C 2.0 A

D 30 A

- 37 The diagram shows an ammeter and four identical resistors connected to a cell. One resistor is labelled X.



The potential difference (p.d.) across the cell is V , and the current in the ammeter is I .

What is the current in resistor X, and what is the p.d. across resistor X?

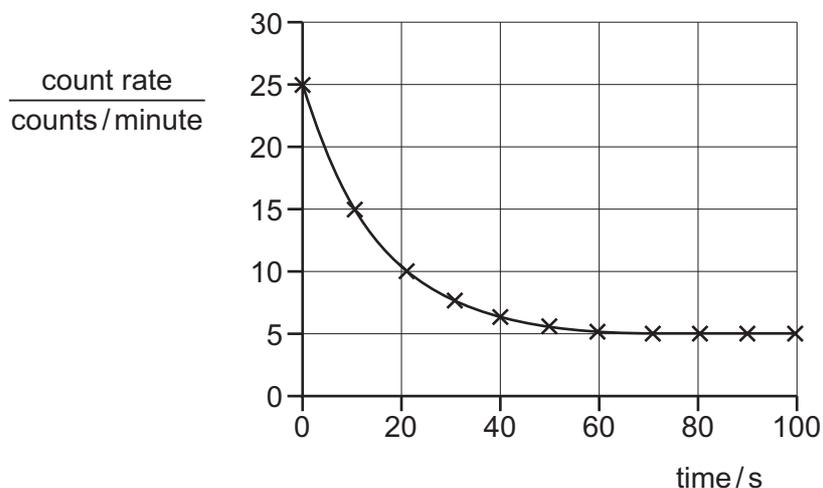
	current in X	p.d. across X
A	$\frac{I}{2}$	$\frac{V}{2}$
B	$\frac{I}{2}$	V
C	I	$\frac{V}{2}$
D	I	V

- 38 What is the benefit of earthing the metal case of an electric kettle?
- A** It prevents an electric shock if the live wire touches the metal case.
 - B** It prevents the insulation of the cable from becoming damaged.
 - C** It prevents overheating of the cable.
 - D** It prevents overheating of the kettle.
- 39 Which radioactive emissions are **not** deflected by electric fields and are also **not** deflected by magnetic fields?
- A** alpha and beta
 - B** alpha only
 - C** beta only
 - D** gamma only

40 A teacher investigates the radiation emitted by a radioactive source.

She places a detector near the source and records how the count rate changes with time.

The results are shown on the graph.



Which row gives the count rate due to the source only at the start of the experiment, and the count rate due to background radiation only?

	<u>count rate due to the source only at start</u> counts/minute	<u>count rate due to background radiation only</u> counts/minute
A	20	5
B	20	20
C	25	5
D	25	20

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The Periodic Table of Elements

		Group																																				
I	II	III	IV	V	VI	VII	VIII																															
3 Li lithium 7	4 Be beryllium 9	<table border="1"> <tr> <td>1 H hydrogen 1</td> <td colspan="10"> <table border="1"> <tr> <td colspan="2"> Key atomic number atomic symbol name relative atomic mass </td> </tr> </table> </td> </tr> <tr> <td>11 Na sodium 23</td> <td>12 Mg magnesium 24</td> <td>5 B boron 11</td> <td>6 C carbon 12</td> <td>7 N nitrogen 14</td> <td>8 O oxygen 16</td> <td>9 F fluorine 19</td> <td>10 Ne neon 20</td> <td>13 Al aluminium 27</td> <td>14 Si silicon 28</td> <td>15 P phosphorus 31</td> <td>16 S sulfur 32</td> <td>17 Cl chlorine 35.5</td> <td>18 Ar argon 40</td> </tr> </table>										1 H hydrogen 1	<table border="1"> <tr> <td colspan="2"> Key atomic number atomic symbol name relative atomic mass </td> </tr> </table>										Key atomic number atomic symbol name relative atomic mass		11 Na sodium 23	12 Mg magnesium 24	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
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19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —	—	—	—	—
lanthanoids		57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175	
actinoids		89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —	

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