Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICAL SCIENCE **0652/21**

Paper 2 Multiple Choice (Extended) **October/November 2021**

45 minutes

You must answer on the multiple choice answer sheet.

2755820608

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.

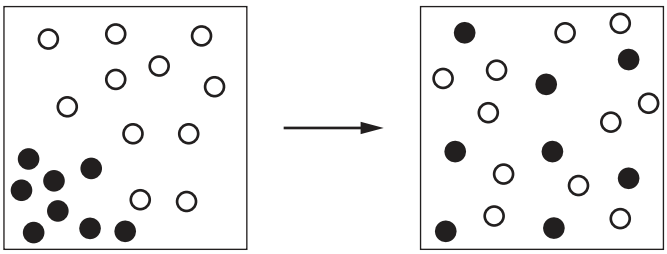
INFORMATION

- 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 **20** pages. Any blank pages are indicated.

[Turn over

1 The diagram shows the movement of particles during a physical change.



Which process is represented by the diagram?

A condensation

B diffusion

C melting

D precipitation

2 When ammonium chloride is added to water, the mixture becomes cooler.

Which piece of apparatus is used to measure this change?

A balance

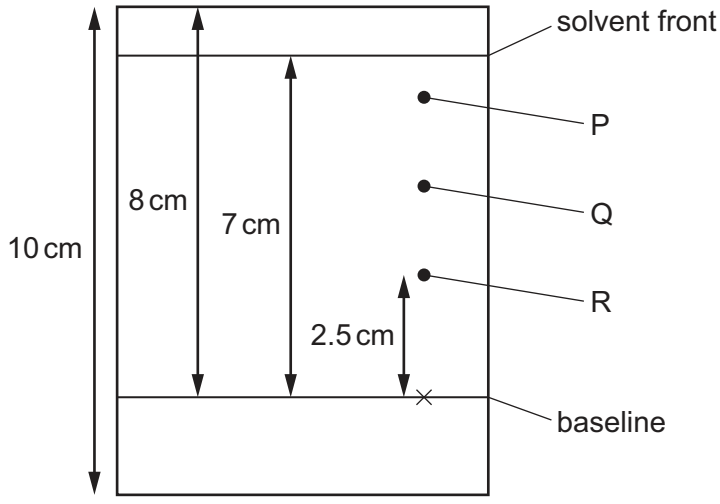
B burette

C stop-clock

D thermometer

3 The chromatogram obtained from an ink is shown.

The ink contains three different colours P, Q and R.



What is the R_f value of colour R?

A 0.25 **B** 0.3 **C** 0.36 **D** 2.5

4 The table shows the electronic structure of four atoms from four different elements.

The letters shown are not the symbols of the elements.

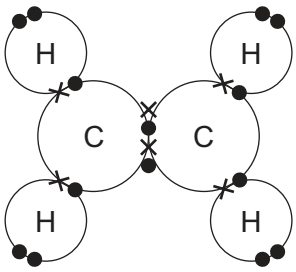
atom	J	K	L	M
electronic structure	2,8,1	2,7	2,8	2,1

Which atoms combine with chlorine to form an ionic compound?

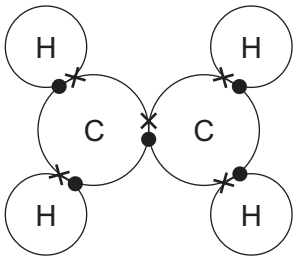
A J and M **B** J only **C** K only **D** L and M

5 What is the outer electron arrangement in a molecule of ethene?

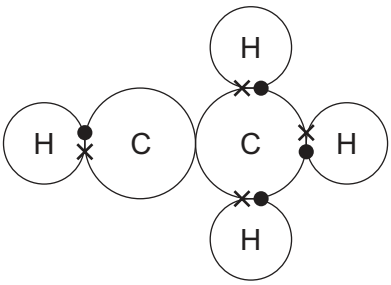
A



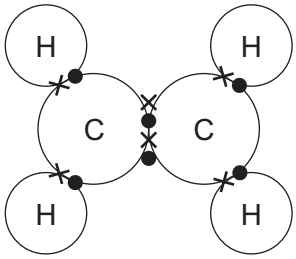
B



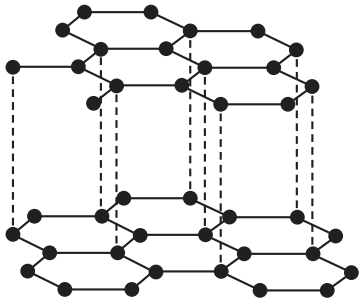
C



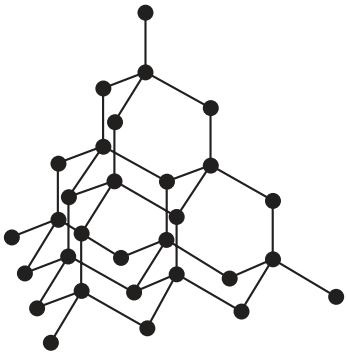
D



6 Two structures X and Y are shown.



X



Y

Which row is correct?

	identity of X	identity of Y	hardness	conductivity
A	diamond	graphite	X greater than Y	X less than Y
B	diamond	graphite	X less than Y	X greater than Y
C	graphite	diamond	X greater than Y	X less than Y
D	graphite	diamond	X less than Y	X greater than Y

7 Butane gas is used as the fuel in camping stoves.

Butane burns in air to produce carbon dioxide and water. The equation is shown.

$$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$$

What are the volumes of oxygen used and carbon dioxide produced by burning 40 cm^3 of butane?

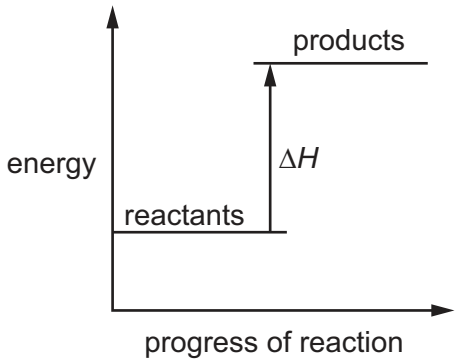
	oxygen / cm^3	carbon dioxide / cm^3
A	40	80
B	40	160
C	260	160
D	260	240

8 Molten lead(II) bromide is electrolysed using inert electrodes.

Which row identifies the product and the reaction occurring at the cathode?

	product	reaction at the cathode
A	bromine	bromide ions gain electrons
B	bromine	bromide ions lose electrons
C	lead	lead ions gain electrons
D	lead	lead ions lose electrons

9 An energy level diagram is shown.



Which change does this energy level diagram represent?

A $C(g) + 4H(g) \rightarrow CH_4(g)$

B $H_2(g) \rightarrow 2H(g)$

C $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

D $H_2O(g) \rightarrow H_2O(l)$

10 Which change decreases the rate of reaction between lumps of zinc and dilute sulfuric acid?

A Add a suitable catalyst.

B Add water to the acid.

C Break the lumps of zinc into smaller pieces.

D Use a higher temperature.

11 Which type of substance accepts protons?

A acid

B base

C oxidising agent

D reducing agent

12 Substances P and Q are oxides.

Substance P reacts with carbon dioxide, but it does not react with sodium oxide.

Substance Q reacts with both carbon dioxide and sodium oxide.

Which row identifies the two types of oxide?

	P	Q
A	acidic	amphoteric
B	acidic	neutral
C	basic	amphoteric
D	basic	neutral

13 A gas is tested as shown.

test	observation
lighted splint is placed in the gas	lighted splint goes out
damp red litmus paper is placed in the gas	red litmus paper turns blue
gas is passed through limewater	limewater is colourless

What is the gas?

A ammonia

B carbon dioxide

C chlorine

D hydrogen

14 Which statement about the Periodic Table is correct?

A Elements with the highest number of electrons in their outer shell are the most non-metallic.

B Non-metallic elements react by losing their outer shell electrons.

C The elements with the largest group number are the best electrical conductors.

D The group number is the total number of electron shells.

15 Which row describes the properties of a transition element?

	melting point / °C	density / g / cm^3	colour of compounds
A	–210	0.0011	one oxide is brown, but most compounds are colourless
B	98	0.97	all the compounds are white
C	328	11.34	the iodide is yellow, but most compounds are white
D	1535	7.86	most compounds are either green or brown

16 Four different metals W, X, Y and Z are added to solutions of their metal nitrates.

The results are shown.

	solution of metal nitrate			
metal added	W nitrate	X nitrate	Y nitrate	Z nitrate
W		✓	✗	✗
X	✗		✗	✗
Y	✓	✓		✗
Z	✓	✓	✓	

key

✓ = reacts

✗ = no reaction

What is the order of reaction?

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

17 Which equation represents a reaction where pollutant gases are removed by a catalytic converter?

A $CO_2 + C \rightarrow 2CO$

B $2CO + 2NO \rightarrow 2CO_2 + N_2$

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

D $2CO_2 + N_2 \rightarrow 2CO + 2NO$

18 Which process does **not** produce carbon dioxide?

A an acid reacting with a carbonate

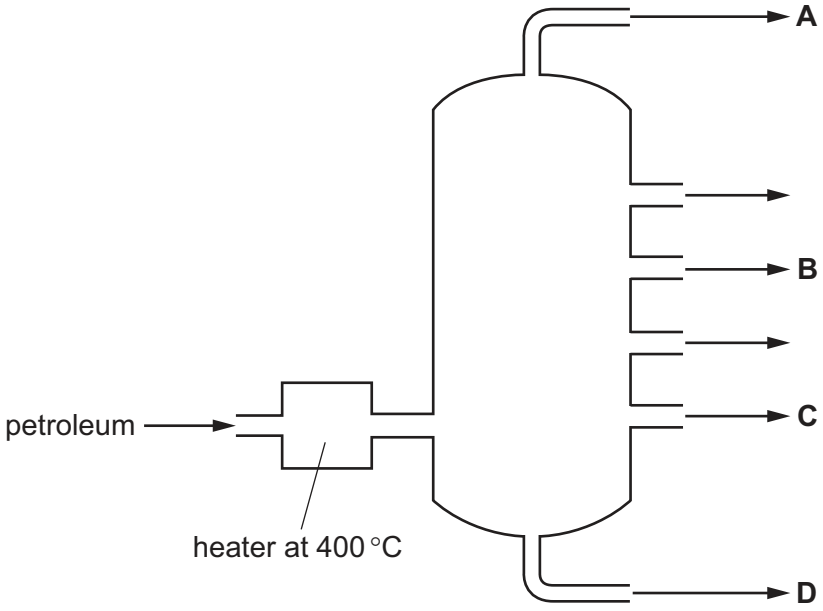
B burning coal

C burning hydrogen

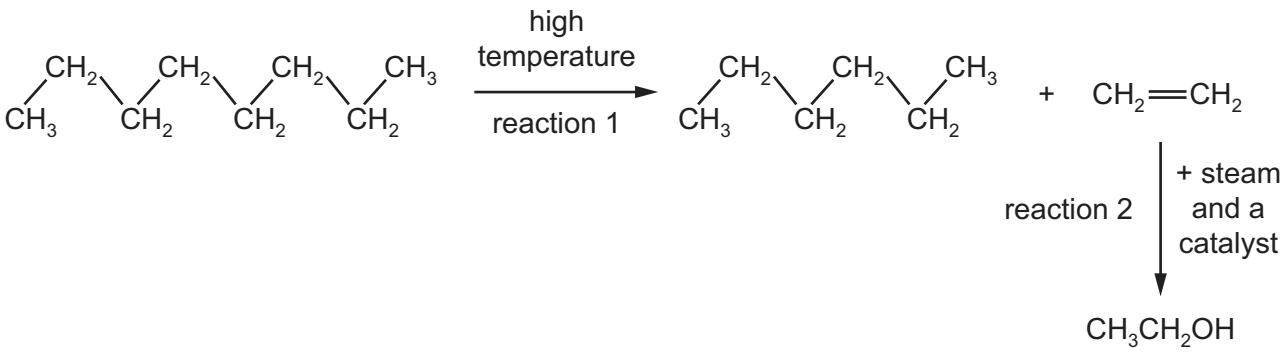
D respiration

19 The fractional distillation of petroleum is shown.

From which position is methane obtained?



20 The diagram shows a two-step reaction scheme.



What are the names given to reaction 1 and reaction 2?

	reaction 1	reaction 2
A	cracking	addition
B	cracking	fermentation
C	polymerisation	addition
D	polymerisation	fermentation

21 How is the velocity of a moving object related to its speed?

A Its speed has the same magnitude as its velocity but its speed also has direction.

B Speed is equal to the rate of change of velocity.

C Its velocity has the same magnitude as its speed but its velocity also has direction.

D Velocity is equal to the rate of change of speed.

22 An object falls vertically at a constant speed in air.

Which statement about the forces on the object is correct?

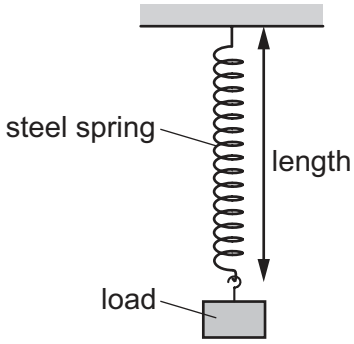
A Air resistance is the only force acting on the object.

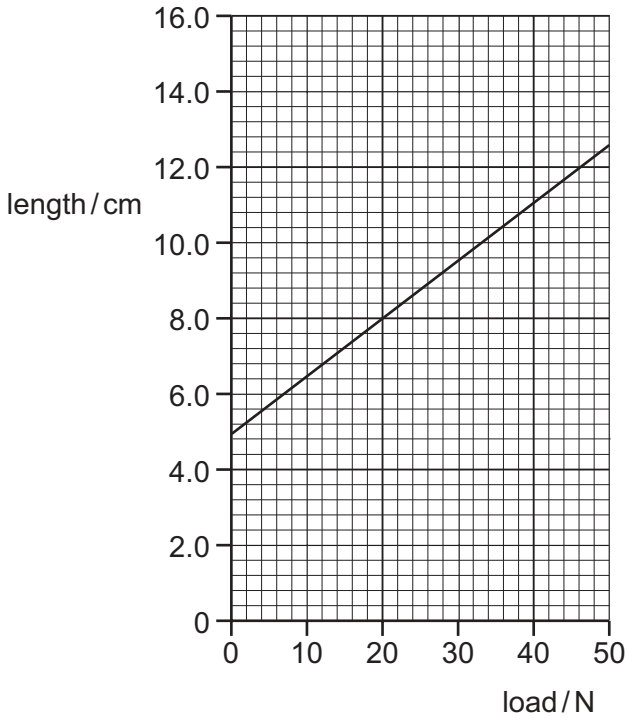
B The magnitude of the air resistance acting on the object is equal to the weight of the object.

C The magnitude of the air resistance acting on the object is greater than the weight of the object.

D The magnitude of the air resistance acting on the object is less than the weight of the object.

23 The diagrams show a steel spring and a graph of its length against the load applied to it.

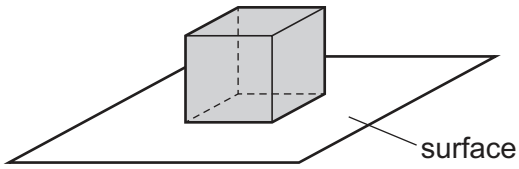




What is the extension of the spring when a load of 20 N is applied to it?

A 3.0 cm **B** 3.5 cm **C** 5.0 cm **D** 8.0 cm

24 The diagram shows one of four cubes resting on a horizontal surface.



The weight and length of side of each of the four cubes are shown in the table.

Which cube exerts the greatest pressure on the surface?

	weight / N	length of side / cm
A	2.0	4.0
B	4.0	2.0
C	6.0	10.0
D	8.0	8.0

25 Which energy does an object possess due to its motion?

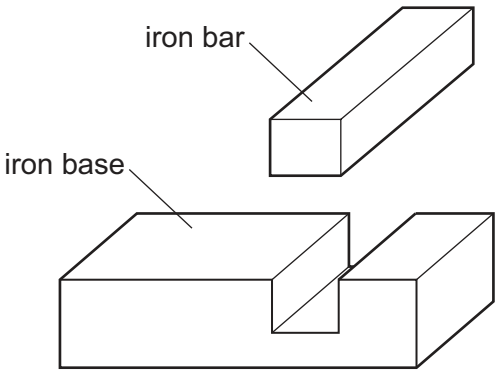
A elastic (strain)

B gravitational potential

C kinetic

D thermal

26 An engineer needs to fit an iron bar into a gap in an iron base.



At room temperature, the bar is slightly too big to fit into the gap.

How can the engineer make the bar fit into the gap?

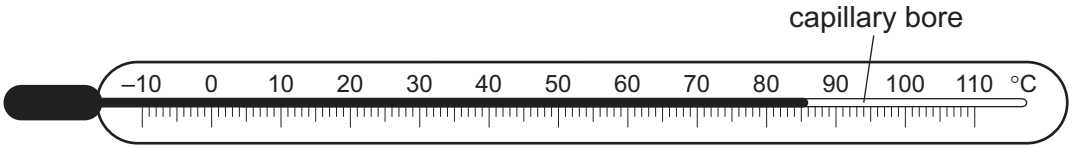
A Cool the bar and heat the base.

B Cool the base and cool the bar to the same temperature.

C Cool the base and heat the bar.

D Heat the base and heat the bar to the same temperature.

27 The diagram shows a liquid-in-glass thermometer.



A second thermometer has a narrower capillary bore and a different scale, but contains the same volume of liquid and is the same length.

Which row compares the second thermometer with the first thermometer?

	range of second thermometer	sensitivity of second thermometer
A	greater	greater
B	greater	less
C	less	greater
D	less	less

28 Four copper plates of the same size and shape are placed in bright sunshine.

The plates have different surfaces and different colours.

Which plate absorbs radiation from the Sun at the lowest rate?

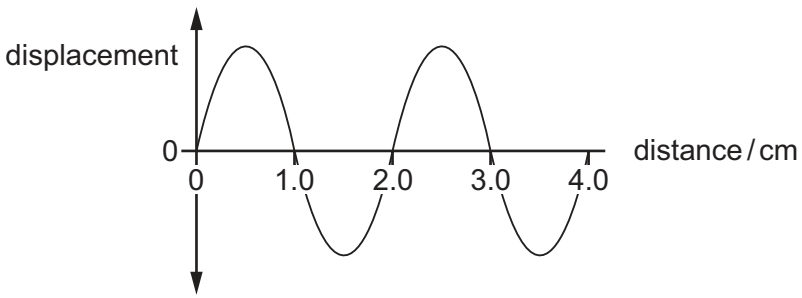
A dull, black surface

B dull, white surface

C shiny, black surface

D shiny, white surface

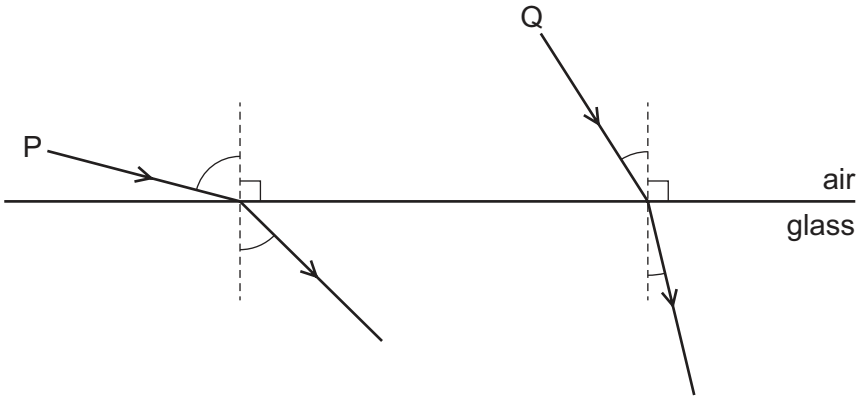
29 The diagram represents a wave. The wave travels at a speed of 20 cm / s.



What is the frequency of the wave?

A 5.0 Hz **B** 10 Hz **C** 40 Hz **D** 80 Hz

30 The diagram shows two rays of light P and Q passing from air into glass.



The angles of incidence of P and Q are i_P and i_Q.

The angles of refraction of P and Q are r_P and r_Q.

Which row compares the angles of incidence and compares the angles of refraction of rays P and Q?

	angles of incidence	angles of refraction
A	i_P bigger than i_Q	r_P bigger than r_Q
B	i_P bigger than i_Q	r_P smaller than r_Q
C	i_P smaller than i_Q	r_P bigger than r_Q
D	i_P smaller than i_Q	r_P smaller than r_Q

31 A converging lens of focal length 15 cm is used as a magnifying glass to produce a virtual, magnified image.

What is a possible position of the object?

A 8.0 cm from the lens

B 16 cm from the lens

C 32 cm from the lens

D 64 cm from the lens

32 Which row shows how, in a vacuum, the speed of radio waves and the speed of X-rays compare with the speed of light?

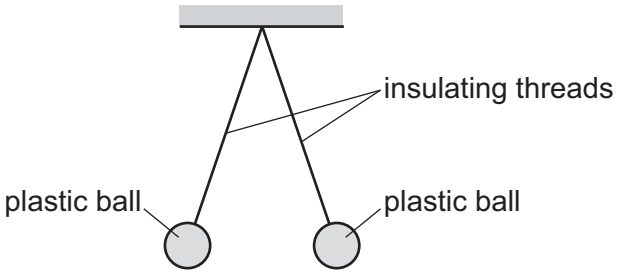
	speed of radio waves	speed of X-rays
A	greater than light	less than light
B	the same as light	greater than light
C	less than light	greater than light
D	the same as light	the same as light

[Turn over

33 Which frequency is outside the range of audible frequencies for a healthy human ear?

A 30 Hz **B** 300 Hz **C** 3000 Hz **D** 30 000 Hz

34 The diagram shows two light plastic balls suspended by insulating threads from a support.



Which statement is an explanation of why the plastic balls hang apart from each other?

A The balls have like charges.

B One ball is charged; the other is uncharged.

C The balls have unlike charges.

D Both balls are uncharged.

35 A charger for a mobile phone (cell phone) produces a current of 50 mA for 30 minutes.

How much charge passes through the charger?

A 1.5 C **B** 90 C **C** 1500 C **D** 90 000 C

36 A copper wire has resistance of 8.0 Ω.

The wire is melted and made into a new wire with twice the original length and half the original cross-sectional area.

What is the resistance of the new wire?

A 4.0 Ω **B** 8.0 Ω **C** 16 Ω **D** 32 Ω

37 An electric kettle is connected to a 240 V supply.

It takes 5.0 minutes to transfer 580 kJ of energy.

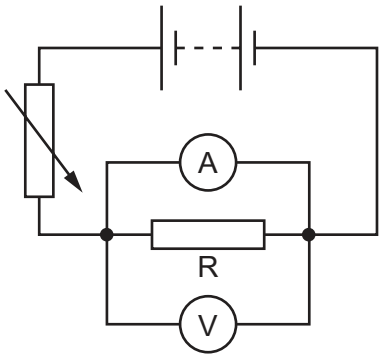
What is the current in the kettle?

A 0.48 A **B** 2.1 A **C** 8.1 A **D** 12 A

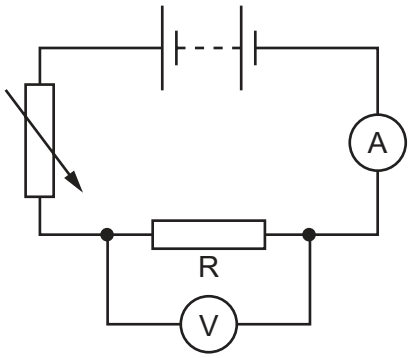
38 A student investigates how the current in a resistor R varies with the voltage across it.

Which circuit does the student use?

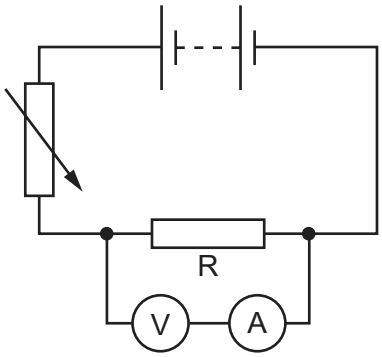
A



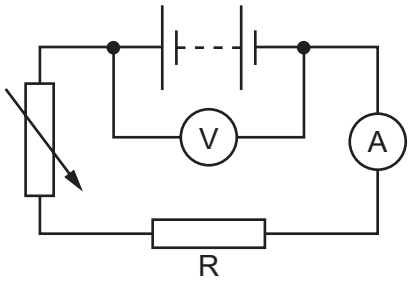
B



C



D



39 What is the difference between alternating current (a.c.) and direct current (d.c.)?

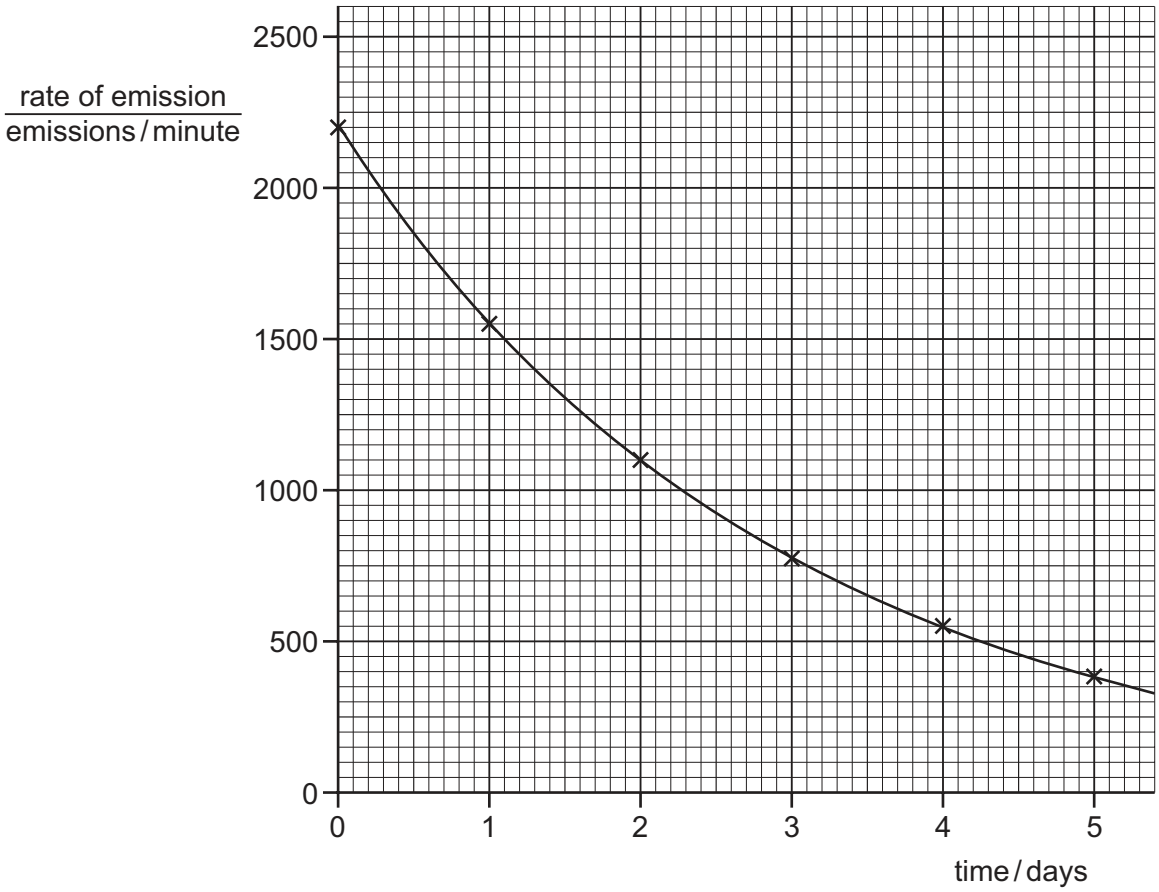
A a.c. changes direction but d.c. does not.

B a.c. causes a magnetic field but d.c. does not.

C a.c. transfers energy in a resistor but d.c. does not.

D a.c. has a constant magnitude but d.c. does not.

40 The graph shows the decay curve for one particular radioactive isotope.



What is the half-life of this isotope?

A 1.0 day **B** 1.5 days **C** 2.0 days **D** 2.5 days

BLANK PAGE

BLANK PAGE

BLANK PAGE

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											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
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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).