



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**PHYSICAL SCIENCE**

**0652/21**

Paper 2 Multiple Choice

**October/November 2018**

**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.

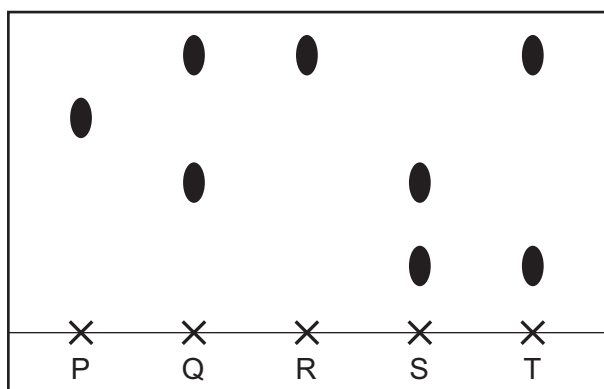
Electronic calculators may be used.

This document consists of **16** printed pages.

- 1 When smoke particles collide with molecules in the air, the smoke particles move randomly.

How is the movement of the smoke particles described?

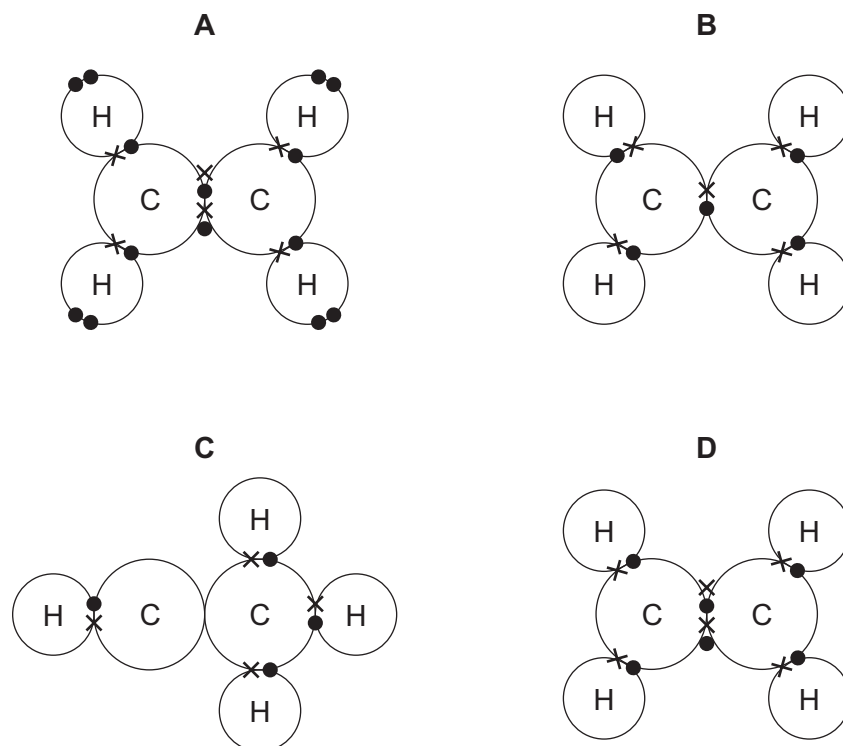
- A Brownian motion  
 B condensation  
 C diffusion  
 D evaporation
- 2 The diagram shows a chromatogram obtained using five felt-tip pens.



Which statement about the pens is **not** correct?

- A One of the dyes is found in three pens.  
 B Pen R contains a mixture of dyes.  
 C Three pens contain two dyes.  
 D Two pens contain only one dye.
- 3 Which statement describes how an ionic compound is formed from two elements?
- A A pair of electrons is shared between a metal and a non-metal.  
 B A pair of electrons is shared between two non-metals.  
 C Electrons are transferred from a metal to a non-metal.  
 D Electrons are transferred from a non-metal to a metal.

4 What is the electron arrangement in a molecule of ethene?



5 Which statement about the properties and structures of diamond and graphite is correct?

- A** Diamond has a high melting point as it has a giant structure with each carbon atom connected to three others.
- B** Diamond is a good conductor of electricity as it has a large number of shared pairs of electrons.
- C** Graphite has a low melting point as it has a layered structure with weak bonds between the layers.
- D** Graphite is a good conductor of electricity as it has delocalised electrons between layers.

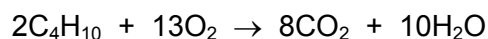
6 An ionic compound has the formula  $\text{Ga}_2\text{S}_3$ .

What are the formulae of the ions?

- A**  $\text{Ga}^{2-}$  and  $\text{S}^{3+}$
- B**  $\text{Ga}^{3-}$  and  $\text{S}^{2+}$
- C**  $\text{Ga}^{2+}$  and  $\text{S}^{2-}$
- D**  $\text{Ga}^{3+}$  and  $\text{S}^{2-}$

- 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.



What are the volumes of oxygen used and carbon dioxide produced by burning 40 cm<sup>3</sup> of butane?

	oxygen /cm <sup>3</sup>	carbon dioxide /cm <sup>3</sup>
<b>A</b>	40	80
<b>B</b>	40	160
<b>C</b>	260	160
<b>D</b>	260	240

- 8 Anhydrous copper(II) sulfate is placed in a test-tube.

When water is added to the test-tube, the temperature changes from 17 °C to 27 °C.

Which type of reaction takes place?

- A** addition
  - B** endothermic
  - C** exothermic
  - D** oxidation
- 9 Photographic film is coated with a layer of silver salts that contain silver ions.

Some photographic film is exposed to light.

Which row describes the colour change and the reaction of the silver ions?

	colour change	reaction of silver ions
<b>A</b>	turns black	oxidised to silver
<b>B</b>	turns black	reduced to silver
<b>C</b>	turns white	oxidised to silver
<b>D</b>	turns white	reduced to silver

10 Which reaction is an oxidation?

- A  $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$   
 B  $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$   
 C  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$   
 D  $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$

11 Hydrochloric acid reacts with aqueous sodium hydroxide to form a salt and compound Y.

Which row shows the action of sodium hydroxide and the name of compound Y?

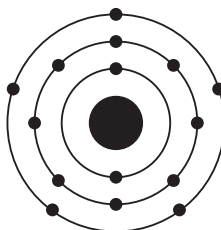
	action of sodium hydroxide	compound Y
<b>A</b>	as a proton acceptor	hydrogen
<b>B</b>	as a proton acceptor	water
<b>C</b>	as a proton donor	hydrogen
<b>D</b>	as a proton donor	water

12 Aluminium, magnesium and phosphorus are elements in Period III of the Periodic Table.

Which row describes the oxides of the elements?

	aluminium oxide	magnesium oxide	phosphorus oxide
<b>A</b>	amphoteric	acidic	basic
<b>B</b>	amphoteric	basic	acidic
<b>C</b>	basic	amphoteric	acidic
<b>D</b>	basic	basic	amphoteric

13 The diagram shows the electronic structure of an atom of an element.



In which group of the Periodic Table is this element?

- A Group II
- B Group III
- C Group V
- D Group VIII

14 The noble gases make up a group in the Periodic Table.

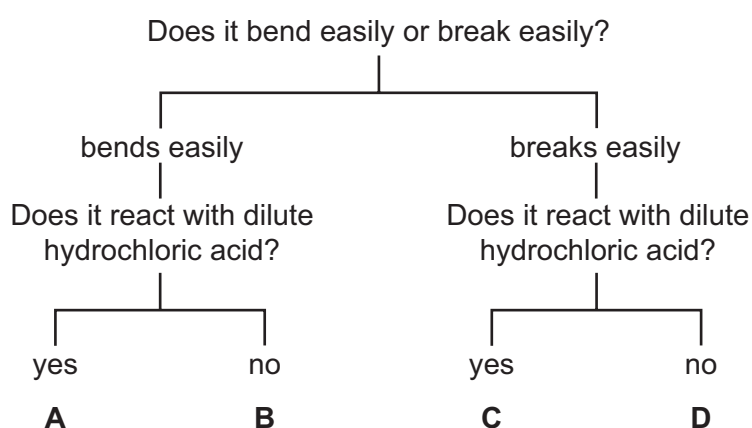
Which statements describe the properties of noble gases?

- 1 They have full outer shells.
- 2 They are diatomic.
- 3 They are very unreactive.

- A 1, 2 and 3
- B 1 and 2 only
- C 1 and 3 only
- D 2 and 3 only

15 The diagram shows the properties of four substances.

Which one is magnesium?



16 Iron is extracted from its ore, hematite, in the Blast Furnace.

Which equation does **not** represent a reaction that occurs in the Blast Furnace?

- A  $C + O_2 \rightarrow CO_2$   
 B  $CaO + SiO_2 \rightarrow CaSiO_3$   
 C  $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$   
 D  $Mg + FeSO_4 \rightarrow Fe + MgSO_4$

17 Which row describes the correct use for a fraction obtained from petroleum by fractional distillation?

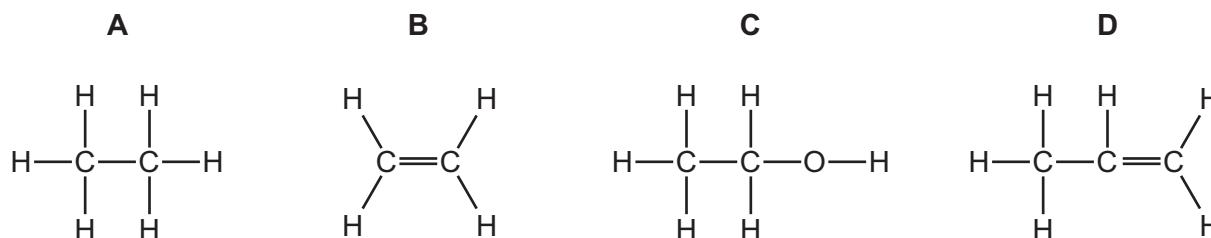
	fraction	use
<b>A</b>	bitumen	making waxes and polishes
<b>B</b>	diesel	fuel for oil stoves
<b>C</b>	lubricating	making roads
<b>D</b>	paraffin	aircraft fuel

18 Long-chain alkanes are broken down into shorter-chain compounds and an element.

Which statement about the process is correct?

- A Alkenes are formed during the reaction.  
 B The element is nitrogen.  
 C The process is polymerisation.  
 D The reaction occurs at room temperature.

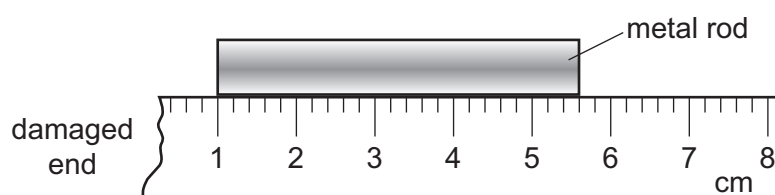
19 Which compound is the monomer used to make poly(ethene)?



20 Which row describes the starting material and conditions used to make ethanol?

	starting material	conditions
<b>A</b>	ethene	high temperature, low pressure and a catalyst
<b>B</b>	ethene	yeast and low temperature
<b>C</b>	glucose	high temperature, low pressure and a catalyst
<b>D</b>	glucose	yeast and low temperature

21 A girl uses a rule to measure the length of a metal rod. The end of the rule is damaged so she places one end of the rod at the 1 cm mark as shown.



How long is the metal rod?

- A** 43 mm      **B** 46 mm      **C** 53 mm      **D** 56 mm

22 A steel ball is dropped from a window.

Air resistance can be ignored.

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

	speed	acceleration
<b>A</b>	constant	constant
<b>B</b>	constant	increasing
<b>C</b>	increasing	constant
<b>D</b>	increasing	increasing



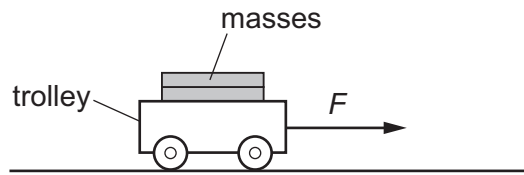
23 The diagram shows a man in a small boat.



Why does the boat become less stable when the man stands up?

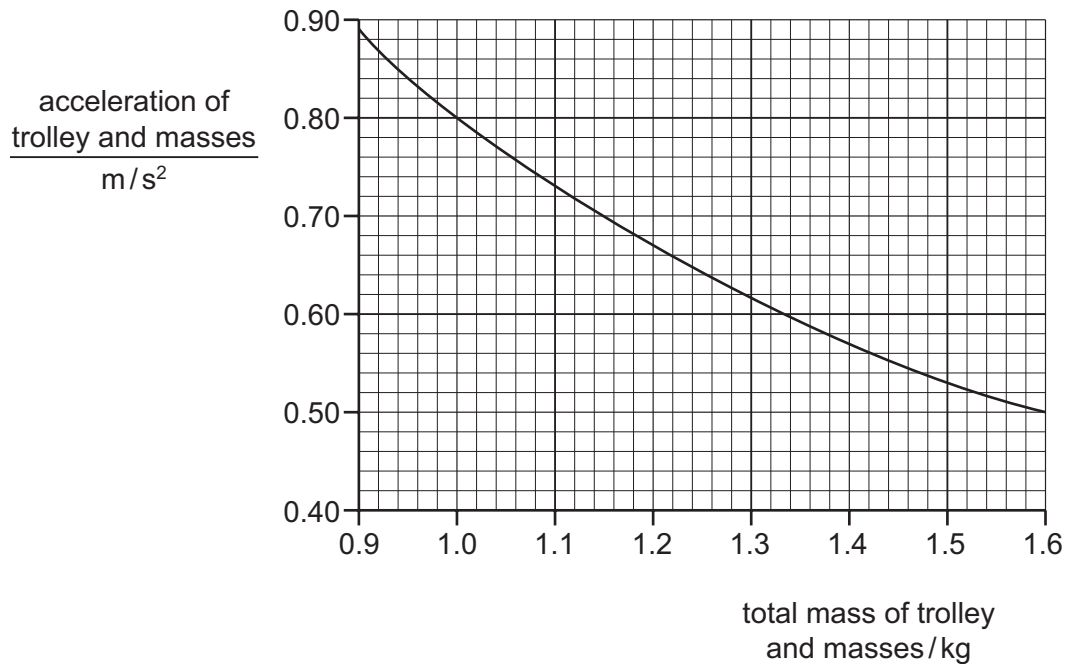
- A The centre of mass of the man and the boat is higher.
- B The centre of mass of the man and the boat is lower.
- C The total mass of the man and the boat is greater.
- D The total mass of the man and the boat is less.

- 24 A student wishes to investigate how the mass of a trolley affects its acceleration. She applies a constant horizontal force  $F$  to the trolley.



Different masses are placed on the trolley, and acceleration is measured.

The graph shows the student's results.



What is the value of  $F$ ?

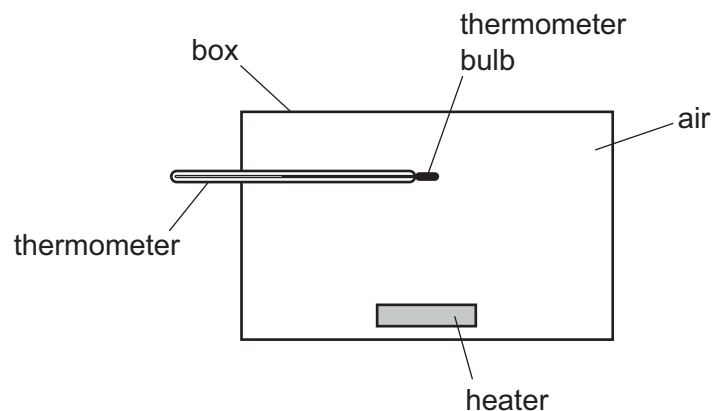
- A** 0.28 N      **B** 0.66 N      **C** 0.80 N      **D** 1.51 N
- 25 A stone is at rest at a height of 3.2 m above the ground. It is released and falls to the ground. The acceleration of free fall  $g$  is  $10 \text{ m/s}^2$ . Air resistance can be ignored. At what speed does the stone hit the ground?
- A** 3.2 m/s      **B** 8.0 m/s      **C** 32 m/s      **D** 64 m/s
- 26 In a nuclear reaction, the total mass decreases by 1.0 g. How much energy is released?
- A**  $3.0 \times 10^5 \text{ J}$       **B**  $3.0 \times 10^8 \text{ J}$       **C**  $9.0 \times 10^{13} \text{ J}$       **D**  $9.0 \times 10^{16} \text{ J}$

27 A chemical process causes energy to be released.

Which type of power station makes use of this type of process?

- A a gas-fired power station
- B a geothermal power station
- C a hydroelectric power station
- D a nuclear power station

28 The diagram shows a heater in a box that contains air. A thermometer is fixed in the box. The thermometer bulb is in the position shown.



Which row shows how thermal energy from the heater reaches the thermometer bulb?

	conduction	convection	radiation
<b>A</b>	✓	✓	x
<b>B</b>	✓	x	✓
<b>C</b>	x	✓	✓
<b>D</b>	x	x	✓

29 Water waves are refracted as they pass from deep water into shallow water.

Which property of the waves must stay the same when this happens?

- A direction
- B frequency
- C wavelength
- D velocity

30 A convex lens of focal length 15 cm is used as a magnifying glass.

Which position of the object gives a virtual, magnified image?

- A object 8.0 cm from the lens
- B object 16 cm from the lens
- C object 32 cm from the lens
- D object 64 cm from the lens

31 A vibrating object produces waves of different frequencies in air.

Which frequency is a sound wave that someone with normal hearing is able to hear?

- A 2.5 Hz
- B 1000 Hz
- C 25 000 Hz
- D 100 000 Hz

32 Why is iron a suitable material for the core of an electromagnet?

- A It is a good conductor of electricity.
- B It is a poor conductor of electricity.
- C It loses its magnetism when the current is switched off.
- D It stays magnetised when the current is switched off.

33 Which combination of units can be used to measure current?

- A coulomb per joule
- B coulomb per second
- C joule per coulomb
- D joule per second

34 Four wires are made from copper. The table gives information about the wires.

wire	length / cm	cross-sectional area / mm <sup>2</sup>
1	20	3.0
2	30	2.0
3	40	6.0
4	40	1.5

Which two wires have the same resistance?

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

35 Two resistors, each of resistance  $R$ , are connected in parallel.

What is their combined resistance?

- A  $R$                       B  $R^2$                       C  $\frac{R}{2}$                       D  $2R$

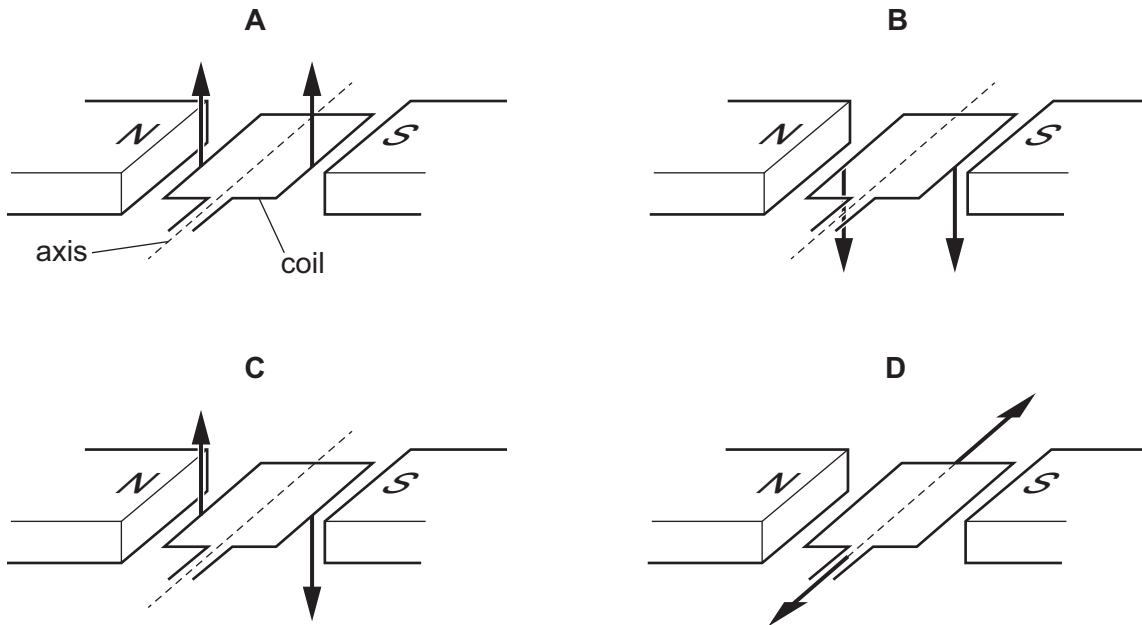
36 A 12V power supply produces a current of 2.0A in a resistor.

How much energy is transferred in the resistor in 2.0 minutes?

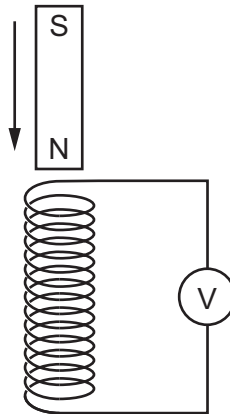
- A 12J                      B 48J                      C 720J                      D 2880J

37 The diagrams show two forces acting on the coil of an electric motor.

In which diagram do the two forces cause the coil to rotate?



- 38 The diagram shows a magnet being moved slowly downwards into a stationary coil to induce an e.m.f. across a voltmeter.



Which change does **not** induce a larger e.m.f.?

- A keeping the magnet stationary and moving the coil upwards quickly
  - B moving both the magnet and the coil downwards at the same speed
  - C using a stationary coil with a larger number of turns and moving the magnet at the same speed
  - D using a stronger magnet and moving it more quickly
- 39 A cathode-ray oscilloscope is used to display a waveform.

The time-base is set at  $5.0 \text{ ms/cm}$ .

The Y-gain is set at  $2.0 \text{ V/cm}$ .

The amplitude of the waveform is too large to fit on the screen.

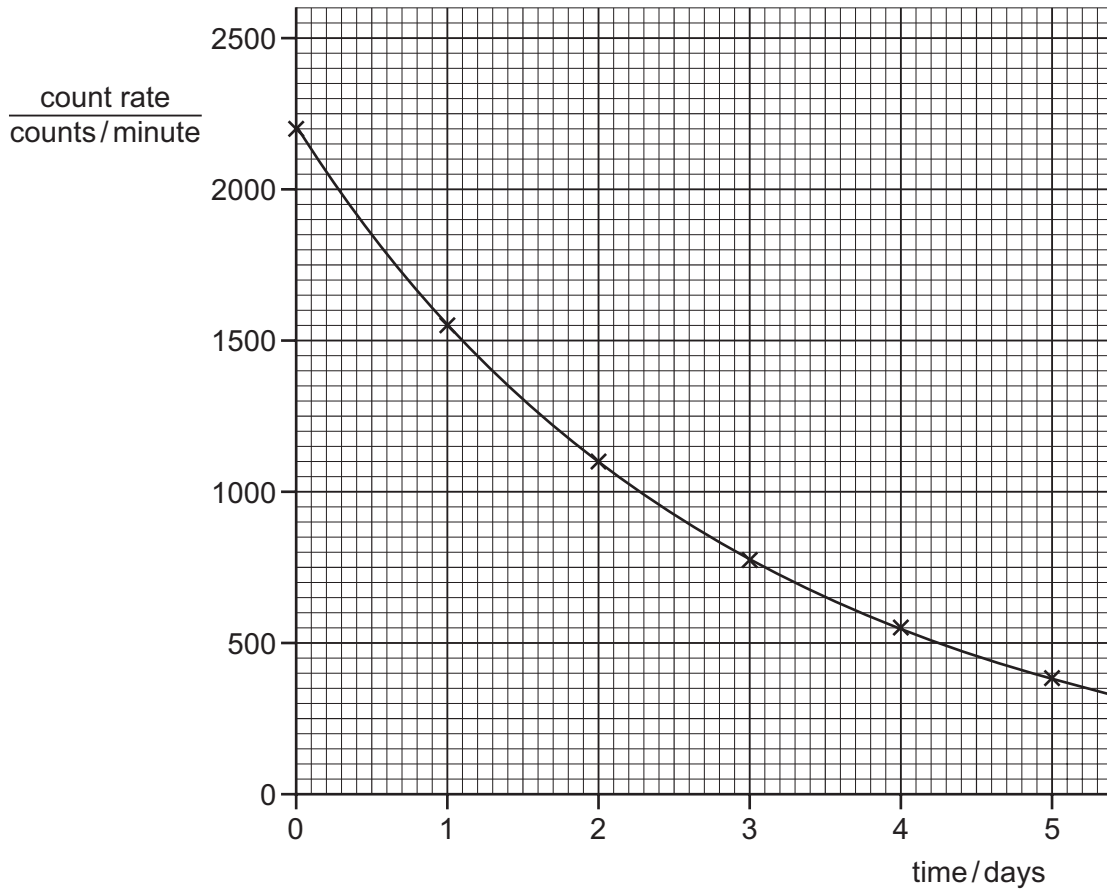
The oscilloscope is adjusted so that the waveform fits on the screen.

Which adjustment is made?

- A The time-base is adjusted to  $2.0 \text{ ms/cm}$ .
- B The time-base is adjusted to  $10 \text{ ms/cm}$ .
- C The Y-gain is adjusted to  $1.0 \text{ V/cm}$ .
- D The Y-gain is adjusted to  $5.0 \text{ V/cm}$ .

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

The count rate is corrected to remove the effect of background radiation.



What is the half-life of this isotope?

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

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## The Periodic Table of Elements

		Group															
I	II											III	IV	V	VI	VII	VIII
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>Key</b>            atomic number            atomic symbol            name            relative atomic mass         </div>										5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24											1 <b>H</b> hydrogen 1	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —	—	—	—	—

lanthanoids	57 <b>La</b> lanthanum 139	58 <b>Ce</b> cerium 140	59 <b>Pr</b> praseodymium 141	60 <b>Nd</b> neodymium 144	61 <b>Pm</b> promethium —	62 <b>Sm</b> samarium 150	63 <b>Eu</b> europium 152	64 <b>Gd</b> gadolinium 157	65 <b>Tb</b> terbium 159	66 <b>Dy</b> dysprosium 163	67 <b>Ho</b> holmium 165	68 <b>Er</b> erbium 167	69 <b>Tm</b> thulium 169	70 <b>Yb</b> ytterbium 173	71 <b>Lu</b> lutetium 175
actinoids	89 <b>Ac</b> actinium —	90 <b>Th</b> thorium 232	91 <b>Pa</b> protactinium 231	92 <b>U</b> uranium 238	93 <b>Np</b> neptunium —	94 <b>Pu</b> plutonium —	95 <b>Am</b> americium —	96 <b>Cm</b> curium —	97 <b>Bk</b> berkelium —	98 <b>Cf</b> californium —	99 <b>Es</b> einsteinium —	100 <b>Fm</b> fermium —	101 <b>Md</b> mendelevium —	102 <b>No</b> nobelium —	103 <b>Lr</b> lawrencium —

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).