Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/22**

Paper 2 Multiple Choice (Extended) **October/November 2023**

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

1 Which characteristics of living things are demonstrated by phototropism?

1 growth

2 nutrition

3 reproduction

4 sensitivity

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

2 What is osmosis?

A the diffusion of sugar molecules from a concentrated solution to a dilute solution through a partially permeable membrane

B the diffusion of sugar molecules from a dilute solution to a concentrated solution through a partially permeable membrane

C the diffusion of water molecules from a concentrated solution to a dilute solution through a partially permeable membrane

D the diffusion of water molecules from a dilute solution to a concentrated solution through a partially permeable membrane

3 A colourless liquid gives the test results shown.

test	colour obtained
Benedict's	blue
biuret	purple
iodine	blue / black

Which nutrients are in the colourless liquid?

A protein, reducing sugar and starch

B protein and reducing sugar only

C protein and starch only

D protein only

4 Which type of molecule are enzymes?

A carbohydrate

B fat

C protein

D starch

5 Which row shows the correct raw materials and products of photosynthesis?

	raw materials		products	
A	CO_2	H_2O	$C_6H_{12}O_6$	O_2
B	$C_6H_{12}O_6$	H_2O	CO_2	O_2
C	O_2	CO_2	$C_6H_{12}O_6$	H_2O
D	O_2	$C_6H_{12}O_6$	CO_2	H_2O

6 Which row provides the greatest amount of the nutrient needed to move food through the alimentary canal?

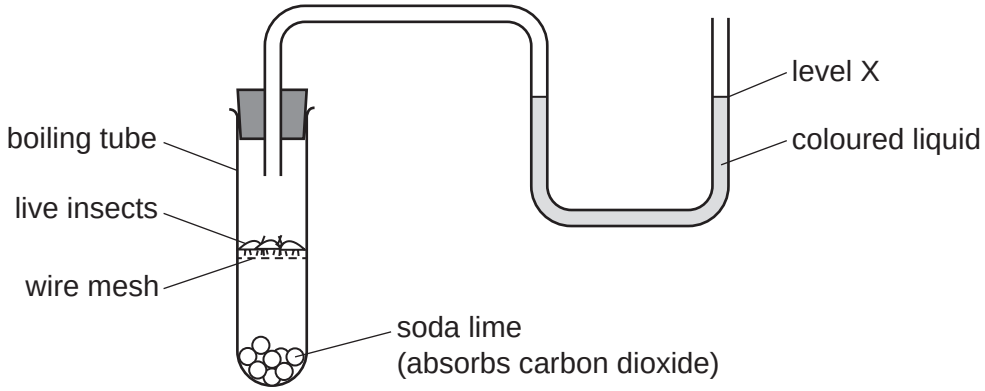
	nutrient content / 100 g			
	calcium / mg	fibre / g	protein / g	sugar / g
A	36.0	5.1	9.0	24.8
B	35.0	2.8	3.3	20.0
C	46.0	10.9	9.0	0.8
D	8.5	0.0	28.0	0.0

7 The rates of water uptake and loss are measured in four leaves. The results are shown in the table.

Which leaf is least likely to wilt?

	rate of water uptake / mm^3 per minute	rate of water loss / mm^3 per minute
A	8	15
B	9	11
C	12	13
D	15	10

8 An experiment is set up, as shown.



What will happen to the level of coloured liquid at X?

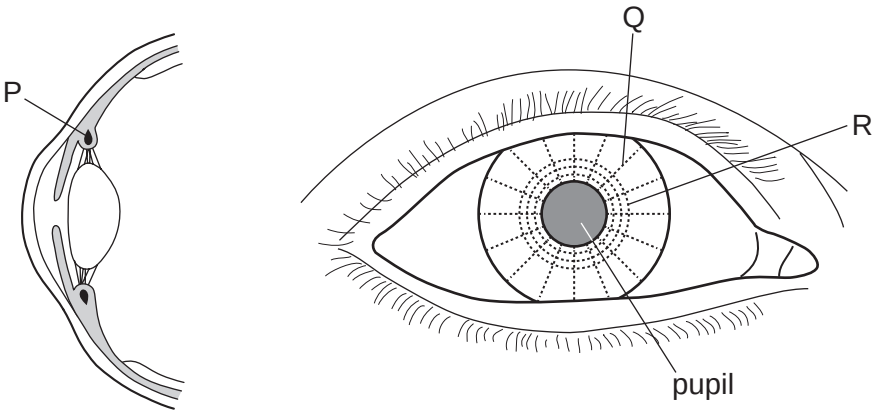
A It goes down.

B It goes up.

C It goes up and then down.

D It stays the same.

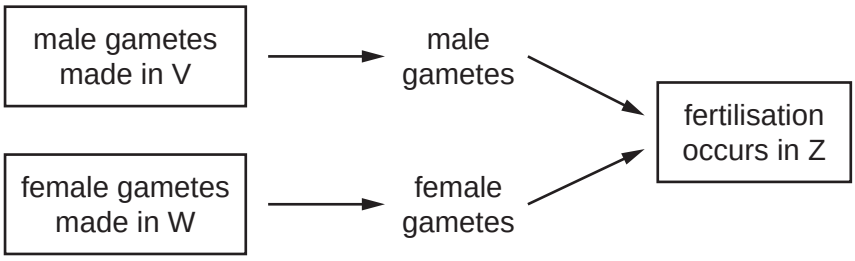
9 The diagram shows a section through the front of the eye and a front view of the eye.



Which muscles contract when viewing a distant object in dim light?

A P and R **B** P only **C** Q and R **D** Q only

10 The diagram shows human gamete formation and fertilisation.



Which row is correct?

	structure V	structure W	structure Z
A	scrotum	uterus	oviduct
B	testes	oviduct	ovary
C	testes	ovary	oviduct
D	scrotum	oviduct	uterus

11 Which statement about variation is correct?

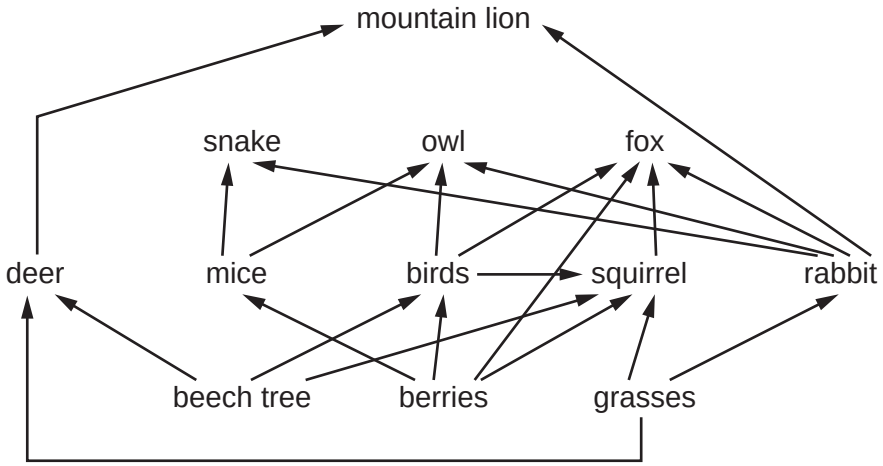
A Continuous variation results only from environmental differences.

B Continuous variation results only from genetic differences.

C Discontinuous variation results only from environmental differences.

D Discontinuous variation results only from genetic differences.

12 The diagram shows a North American food web.



Which organism is both a primary and secondary consumer?

A birds

B owl

C snake

D squirrel

13 The concentration of carbon dioxide in the atmosphere has increased during the last 200 years.

What has contributed to this increase?

A burning large areas of forest

B increasing use of pesticides

C planting more crops

D using fewer fossil fuels

14 A sample of water contains two useful substances, insoluble chalk and a soluble salt.

Which two processes are used to individually separate the insoluble chalk from the soluble salt and from the water?

A distillation and chromatography

B distillation and crystallisation

C filtration and chromatography

D filtration and crystallisation

15 Which statement about isotopes of the same element is correct?

A They have the same number of protons but different number of electrons.

B They have the same number of protons but different number of neutrons.

C They have the same number of neutrons but different number of electrons.

D They have the same number of neutrons but different number of protons.

16 When dilute sodium hydroxide is added to aqueous iron(II) sulfate, insoluble iron(II) hydroxide and aqueous sodium sulfate are formed.

What is the ionic equation for this reaction?

A $Fe^{2+}(aq) + 2OH^{-}(aq) \rightarrow Fe(OH)_2(s)$

B $Fe^{2+}(aq) + SO_4^{2-}(aq) + 2Na^{+}(aq) + 2OH^{-}(aq) \rightarrow Fe(OH)_2(s) + 2Na^{+}(aq) + SO_4^{2-}(aq)$

C $FeSO_4(aq) + 2NaOH(aq) \rightarrow Fe(OH)_2(s) + Na_2SO_4(aq)$

D $SO_4^{2-}(aq) + 2Na^{+}(aq) \rightarrow Na_2SO_4(aq)$

17 Concentrated aqueous sodium chloride is electrolysed using inert electrodes.

Which row describes how the number of sodium ions and the number of chloride ions changes during the electrolysis?

	number of sodium ions	number of chloride ions
A	decreases	decreases
B	decreases	no change
C	no change	decreases
D	no change	no change

18 Which change decreases the frequency of collisions between reactant particles?

A increasing the concentration of reactant solutions

B increasing the pressure on gaseous reactants

C increasing the temperature of the reaction mixture

D using larger pieces of a solid reactant

19 Iron displaces copper ions from its aqueous salts.

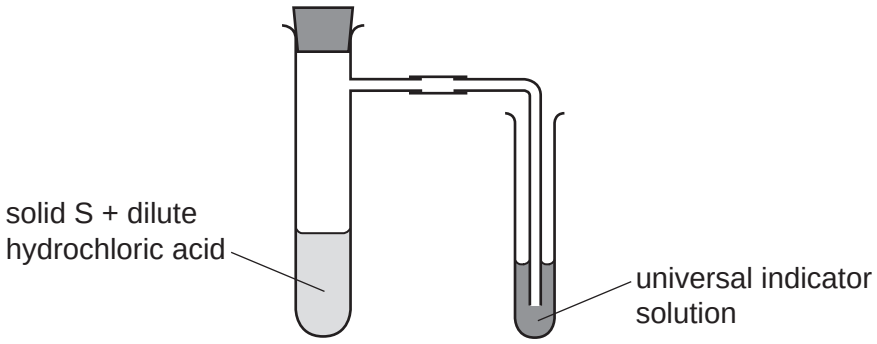
An equation for this reaction is shown.

$$Fe + Cu^{2+} \rightarrow Fe^{2+} + Cu$$

What is the reducing agent in this reaction?

A Cu **B** Cu^{2+} **C** Fe **D** Fe^{2+}

20 Solid S is added to dilute hydrochloric acid in the apparatus shown.



The universal indicator solution shows the pH decreases.

What is solid S?

A zinc

B zinc carbonate

C zinc hydroxide

D zinc oxide

21 Which statements about the halogens are correct?

1 They are diatomic metals.

2 Their atoms have seven outer-shell electrons.

3 Going down the group, they change from solid to liquid to gas.

4 Going down the group, they become darker in colour.

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

22 Which statement explains why argon is used to fill lamps?

A It is a gas.

B It is colourless.

C It is reactive.

D It is unreactive.

23 W, X, Y and Z are metals.

Three statements about these metals are listed.

1 Metal W reduces the oxide of X.

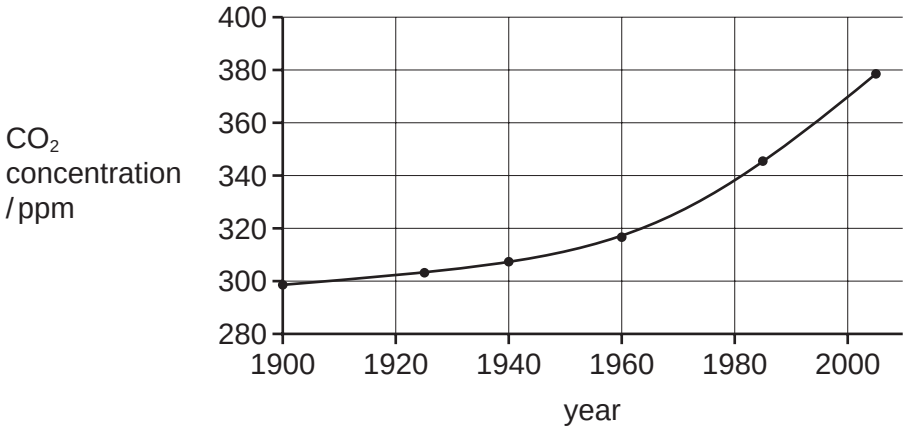
2 Metal Z is **not** able to reduce the oxide of W, but it does reduce the oxides of X and Y.

3 Metal X displaces Y from its aqueous solution.

Which row shows the order of reactivity?

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

24 The change in the concentration of carbon dioxide in the atmosphere over time is shown.



Which row identifies the cause of this change and an environmental problem caused by this change?

	cause	environmental problem
A	increased combustion of sulfur containing fossil fuels	acid rain
B	increased combustion of gasoline	climate change
C	increased fermentation of sugars	acid rain
D	increased cracking of crude oil	climate change

25 Which equation does **not** represent a reaction that occurs in the Contact process?

A $CaO + SO_2 \rightarrow CaSO_3$

B $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

C $2SO_2 + O_2 \rightarrow 2SO_3$

D $S + O_2 \rightarrow SO_2$

26 Which word equation describes the manufacture of lime from limestone?

A calcium carbonate → calcium hydroxide + carbon dioxide

B calcium carbonate → calcium oxide + carbon dioxide

C calcium hydroxide → calcium oxide + water

D calcium oxide + carbon dioxide → calcium carbonate

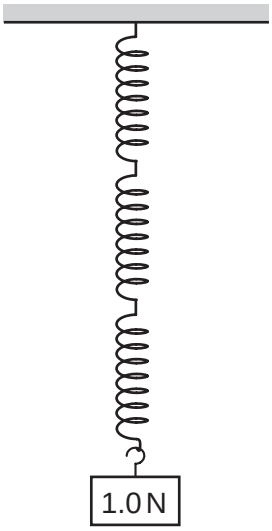
27 Which row about the formation of condensation polymers is correct?

	monomer description	product formation
A	contains C=C double bond	the condensation polymer only
B	contains C=C double bond	the condensation polymer and a small molecule
C	two different monomers used	the condensation polymer only
D	two different monomers used	the condensation polymer and a small molecule

28 A student tests three identical springs that obey Hooke's Law. Each spring stretches by 3.0 cm when a 3.0 N load is attached to one end of it.

The three springs are connected together as shown.

A 1.0 N load is placed on the end of the springs. The mass of the springs can be ignored.



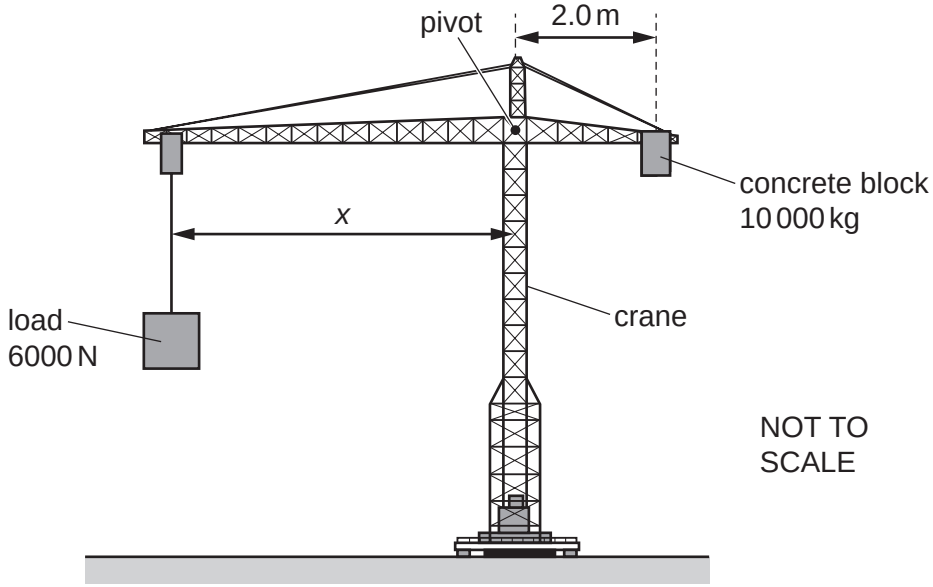
What is the total extension of all the springs together?

A 1.0 cm **B** 3.0 cm **C** 6.0 cm **D** 9.0 cm

29 The diagram shows a crane supporting a load of 6000 N. The horizontal distance between the load and the pivot is *x*.

The load is balanced about the pivot by a concrete block of mass 10 000 kg. The horizontal distance of the concrete block from the pivot is 2.0 m.

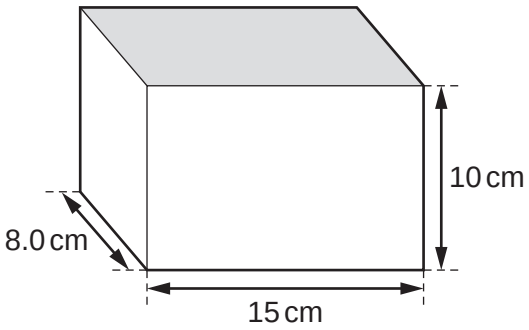
Gravitational field strength *g* is 10 N / kg.



What is the distance of *x*?

A 1.2 m **B** 3.3 m **C** 12 m **D** 33 m

30 A rectangular block weighs 1200 N and has the dimensions shown.



What is the minimum pressure that the block can exert on the ground by standing on one of its faces?

A 1.0 N / cm^2 **B** 8.0 N / cm^2 **C** 10 N / cm^2 **D** 15 N / cm^2

31 A brick falls from rest at a height of 45 m above the ground.

The acceleration of free fall *g* is 10 m / s^2. There is no air resistance.

What is the speed of the brick as it hits the ground?

A 9.5 m / s **B** 21 m / s **C** 30 m / s **D** 450 m / s

32 For which energy resource is the Sun the source of **all** the energy stored?

A geothermal

B nuclear fission

C tidal

D wind

33 Which change on its own increases the sensitivity of a liquid-in-glass thermometer?

A decreasing the internal diameter of the tube

B increasing the internal diameter of the tube

C making the thermometer longer

D making the thermometer shorter

34 The amplitude of a sound wave increases, and the frequency of the wave decreases.

What is the effect on the loudness of the sound and on the pitch of the sound?

	loudness	pitch
A	greater	higher
B	greater	lower
C	less	higher
D	less	lower

35 A plastic rod is rubbed with a cloth. The rod becomes positively charged.

Which statement describes why this happens?

A Electrons move from the cloth to the rod.

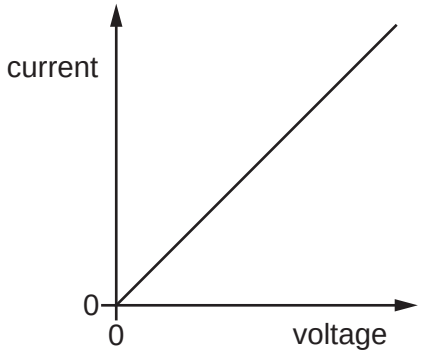
B Electrons move from the rod to the cloth.

C Protons move from the cloth to the rod.

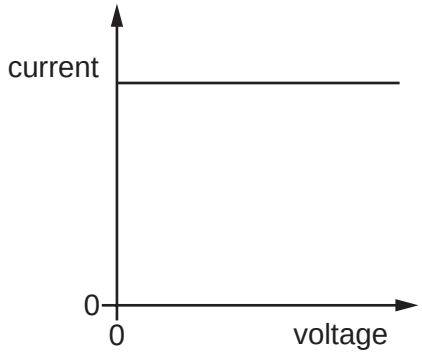
D Protons move from the rod to the cloth.

36 Which graph is the current–voltage characteristic of a filament lamp?

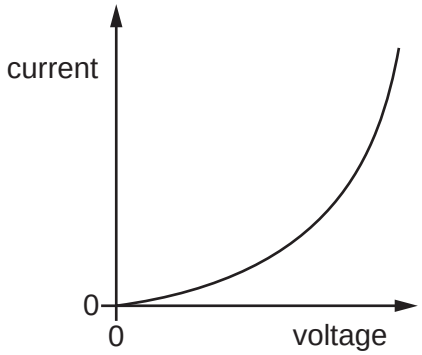
A



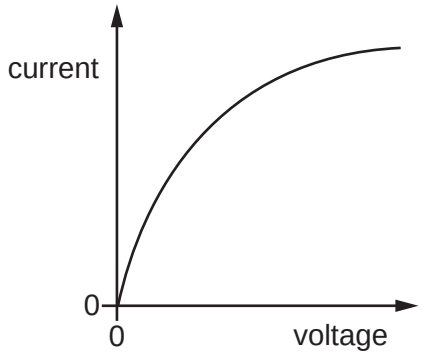
B



C



D

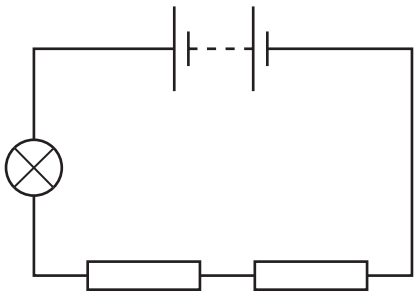


37 A lamp is connected in four circuits in turn.

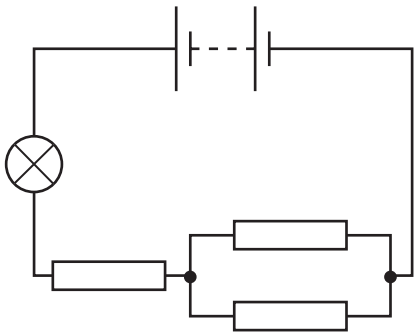
The batteries are identical and the resistors are identical.

In which circuit is the lamp the brightest?

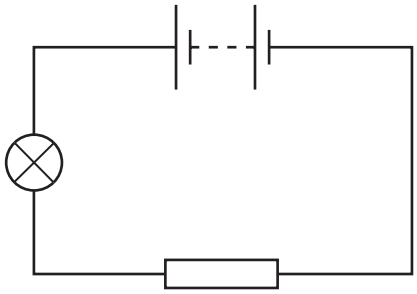
A



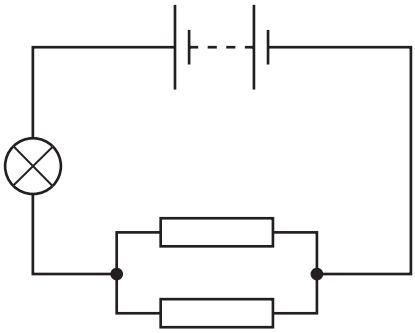
B



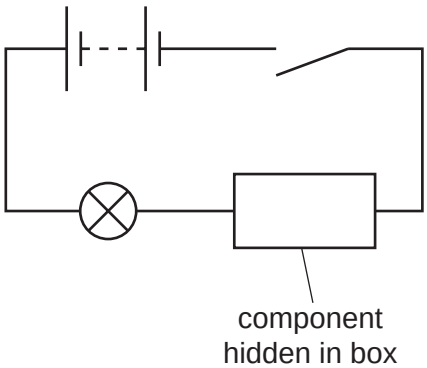
C



D



38 The series circuit shown includes a single component hidden in a box. The switch is open.

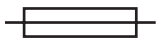


The switch is now closed and the lamp lights briefly before going off.

The switch is now opened, and then closed again. This time the lamp does **not** light.

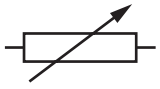
Which symbol represents the component in the box?

A

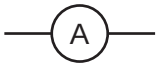


B

C



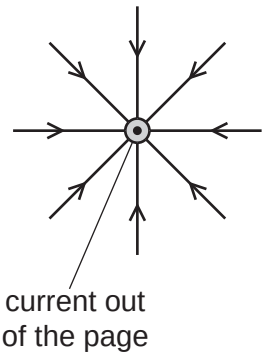
D



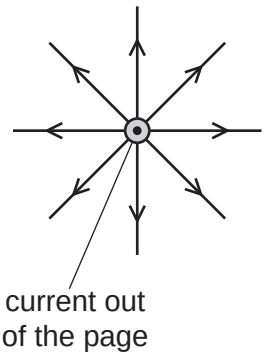
39 The diagrams show a wire carrying a current out of the page.

Which diagram shows the pattern of magnetic field lines near the wire?

A



B



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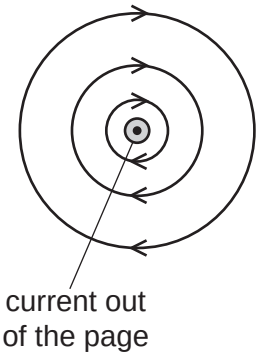

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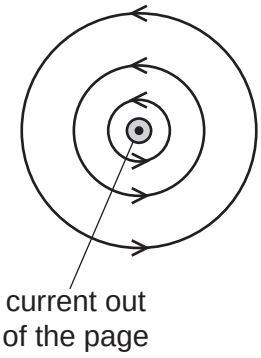

40 Electric and magnetic fields can cause deflection of ionising radiation.

Which statements about the deflection are correct?

1 In an electric field, α-particles and β-particles are deflected in opposite directions.

2 In a magnetic field, α-particles and β-particles are deflected in the same direction.

3 γ-rays are not deflected by electric fields or by magnetic fields.

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

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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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).