



Cambridge IGCSE™

CO-ORDINATED SCIENCES

0654/23

Paper 2 Multiple Choice (Extended)

May/June 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. Any blank pages are indicated.



- 1 During a sunny day, stomata are open to allow gas exchange. Oxygen moves out of the plant through the stomata.

Which characteristic of living things is described?

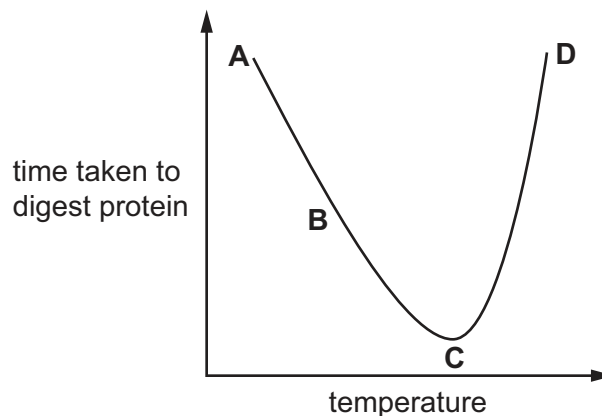
- A** excretion
B movement
C reproduction
D respiration
- 2 Which statement about cells is correct?
- A** Cell membranes are found only in animal cells.
B Cell membranes are found only in plant cells.
C Cell walls are found only in animal cells.
D Cell walls are found only in plant cells.
- 3 Large biological molecules are made from smaller molecules joined together.

Which large molecule is correctly matched with its smaller molecule?

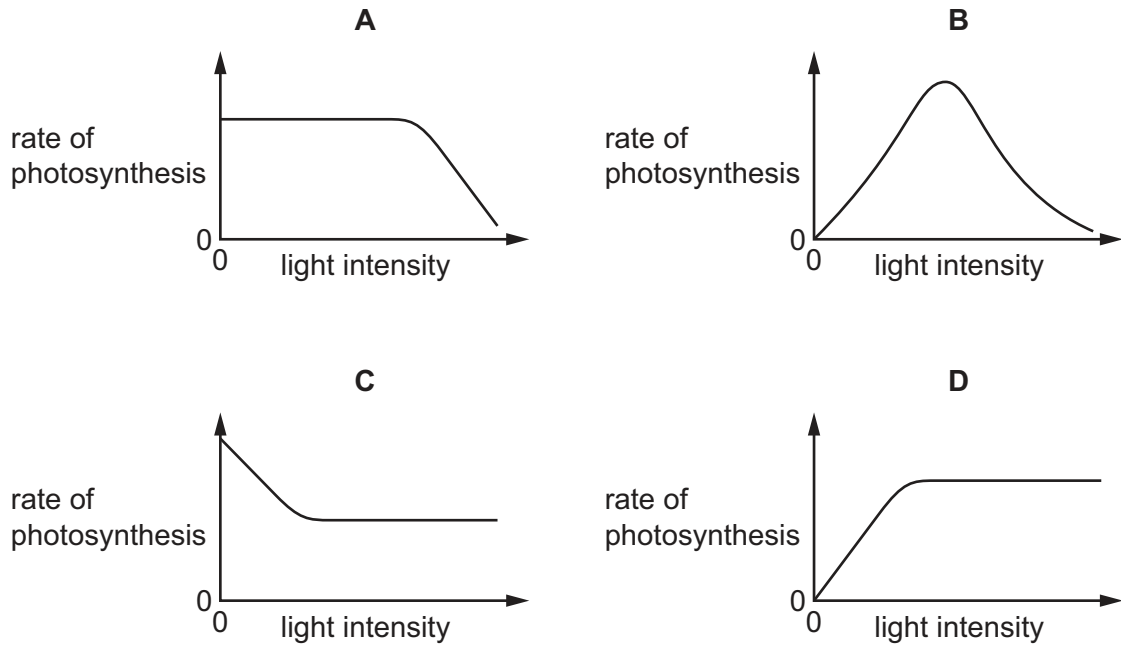
	large molecule	smaller molecule
A	fat	amino acid
B	glycogen	glucose
C	starch	fatty acid
D	protein	glycerol

- 4 The graph shows the effect of temperature on the time taken for a protease to digest protein.

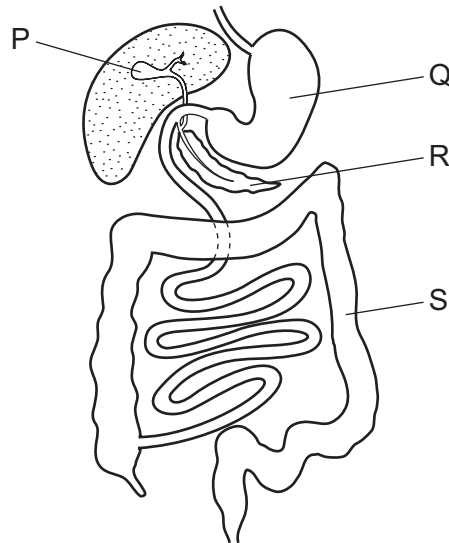
At which point on the graph is the greatest frequency of effective collisions between enzyme and substrate?



- 5 Which graph shows the effect of light intensity on the rate of photosynthesis, if all other factors are kept constant?



- 6 The diagram shows part of the digestive system.

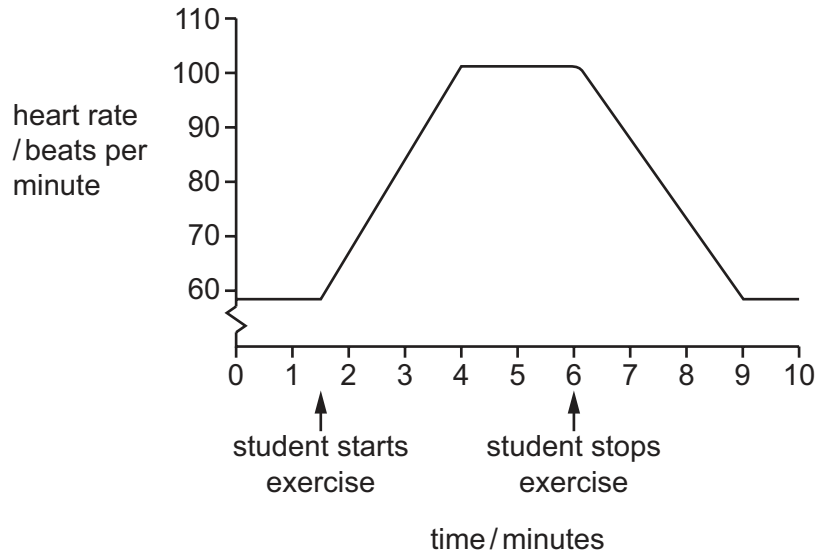


Which labelled parts produce digestive enzymes, absorb water and store bile?

	produce digestive enzymes	absorb water	store bile
A	P	Q	R
B	Q	R	P
C	R	S	P
D	S	P	R

- 7 Students investigate the effect of exercise on heart rate.

The graph shows the results.



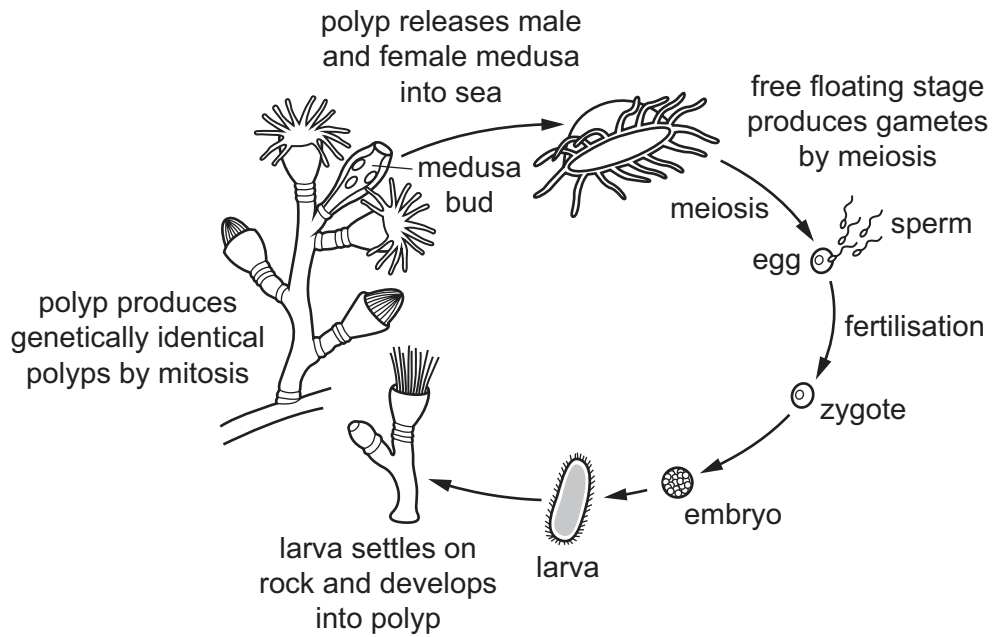
How long does it take for the heart rate to decrease to the resting rate after the student stops exercising?

- A** 3 minutes
B 5 minutes
C 7.5 minutes
D 9 minutes
- 8 What is the relative concentration of glucose, lactic acid and oxygen in the muscles immediately after extreme exercise?

	glucose	lactic acid	oxygen
A	high	high	low
B	high	low	high
C	low	high	low
D	low	low	high

- 9 Which statement about temperature control is correct?
- A** Vasoconstriction near the skin surface and shivering will cool the body down.
B Vasoconstriction near the skin surface and sweating will warm the body up.
C Vasodilation near the skin surface and shivering will warm the body up.
D Vasodilation near the skin surface and sweating will cool the body down.

10 The diagram shows the life cycle of a marine organism called a hydrozoan.

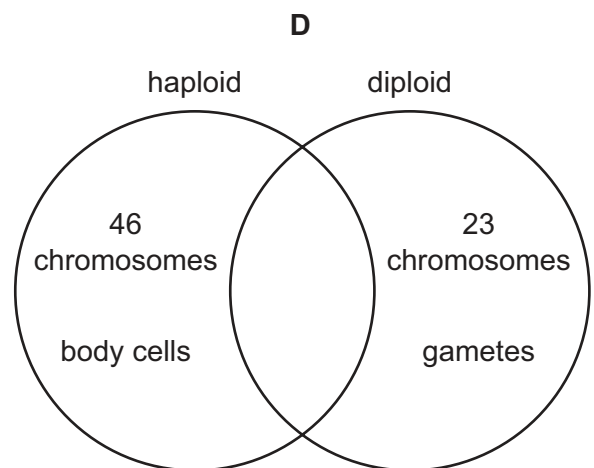
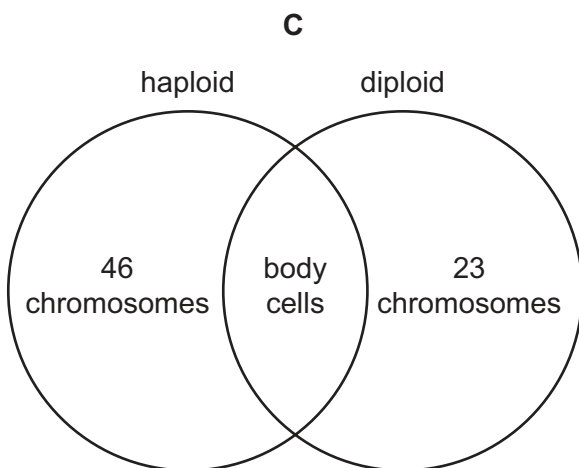
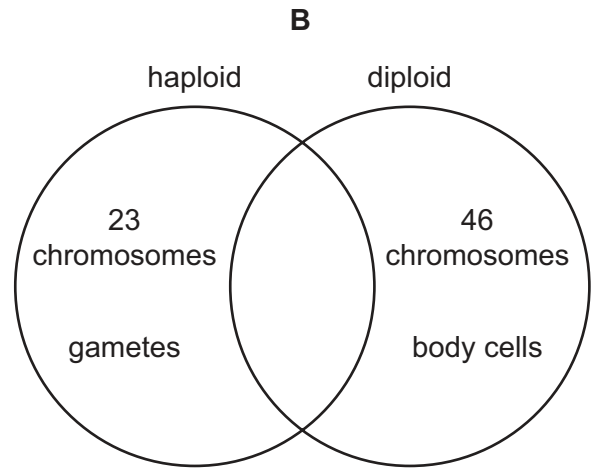
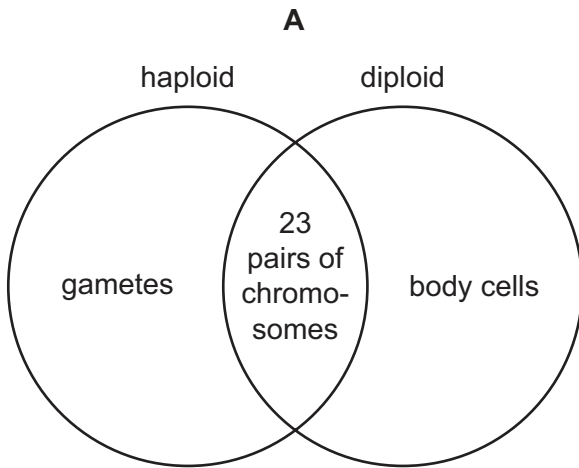


Which statements about the life cycle of hydrozoa are correct?

- 1 Hydrozoa reproduce asexually.
- 2 Hydrozoa reproduce sexually.
- 3 Fusion of haploid gametes produces a diploid zygote.

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

11 Which diagram about haploid and diploid cells in humans is correct?



12 Which organisms obtain energy directly from every trophic level?

- A carnivores
- B decomposers
- C herbivores
- D producers

13 How does deforestation change the concentrations of carbon dioxide and oxygen in the atmosphere?

	carbon dioxide	oxygen
A	rise	fall
B	rise	rise
C	fall	rise
D	fall	fall

14 Information about the solubility in water of some calcium compounds is listed.

- Calcium hydroxide is soluble.
- Calcium carbonate is insoluble.
- Calcium chloride is soluble.

Which method is used to prepare pure calcium chloride?

- A** Add excess calcium hydroxide to dilute hydrochloric acid, filter, then crystallise.
B Add excess calcium carbonate to dilute hydrochloric acid, filter, then crystallise.
C Add excess dilute hydrochloric acid to calcium hydroxide, filter, then crystallise.
D Add excess dilute hydrochloric acid to calcium carbonate, filter, then crystallise.

15 Which process is a chemical change?

- A** boiling
B dissolving
C melting
D neutralisation

16 Sodium phosphate, Na_3PO_4 , contains sodium ions, Na^+ .

Aluminium sulfate, $\text{Al}_2(\text{SO}_4)_3$, contains sulfate ions, SO_4^{2-} .

What is the formula of aluminium phosphate?

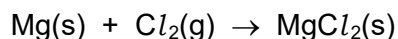
- A** AlPO_4 **B** $\text{Al}(\text{PO}_4)_2$ **C** $\text{Al}_2(\text{PO}_4)_3$ **D** $\text{Al}_3(\text{PO}_4)_2$

17 Aqueous copper(II) sulfate is electrolysed using carbon electrodes.

Which row describes the observations and products at each electrode during this process?

	cathode observation	cathode product	anode observation	anode product
A	bubbles	hydrogen	anode decreases in size	copper(II) ions
B	bubbles	hydrogen	bubbles	oxygen
C	orange-brown solid	copper	bubbles	oxygen
D	orange-brown solid	copper	anode decreases in size	copper(II) ions

18 Magnesium reacts with chlorine to form magnesium chloride.



Which statement about this reaction is correct?

- A The magnesium is being reduced.
- B The oxidising agent is chlorine.
- C The reaction involves oxidation but not reduction.
- D There is no oxygen involved so there is no oxidation.

19 Which substance changes the colour of damp red litmus?

- A CO₂ B Cl₂ C H₂ D SO₂

20 A gas is used in welding metals together at high temperatures.

The gas is used to provide an inert atmosphere.

What is the gas?

- A argon
- B carbon dioxide
- C fluorine
- D oxygen

21 Which row does **not** link a general physical property to the type of element?

	type of element	general physical property
A	metal	malleable
B	metal	thermal conductor
C	non-metal	electrical conductor
D	non-metal	low melting point

22 Which metal oxide is reduced when heated with magnesium powder?

- A calcium oxide
- B copper oxide
- C magnesium oxide
- D sodium oxide

23 Zinc is used to galvanise iron.

Which statements about galvanising are correct?

- 1 Iron is more reactive than zinc.
- 2 Zinc oxidises instead of iron.
- 3 Galvanised iron rusts if the zinc coating is scratched.
- 4 Galvanising iron is an example of sacrificial protection.

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

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

- A** $2\text{S} + 3\text{O}_2 \rightarrow 2\text{SO}_3$
- B** $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$
- C** $\text{H}_2\text{SO}_4 + \text{SO}_3 \rightarrow \text{H}_2\text{S}_2\text{O}_7$
- D** $\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$

25 Why do farmers add limestone to soil?

- A** It acts as a fertiliser.
- B** It adds nitrogen to the soil.
- C** It decreases the pH of the soil.
- D** It increases the pH of the soil.

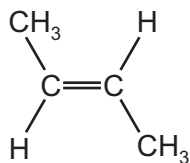
26 Petroleum is a mixture of hydrocarbons which is separated into fractions by fractional distillation.

Which statements describe the fraction collected at the bottom of the fractionating column?

- 1 It contains the smallest molecules.
- 2 It has the weakest forces between molecules.
- 3 It is the most viscous.
- 4 It is the least flammable.

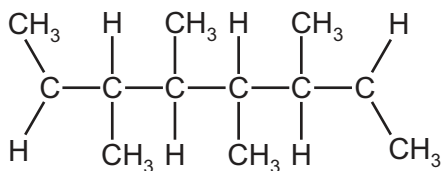
A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

27 The structure of a monomer is shown.

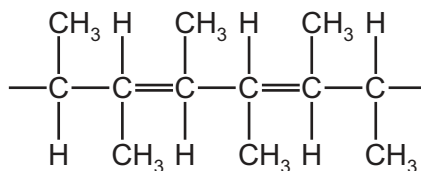


Which structure represents the addition polymer formed by this monomer?

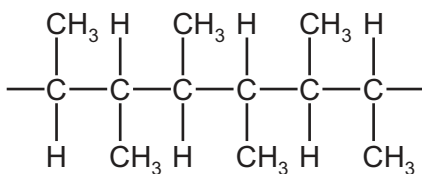
A



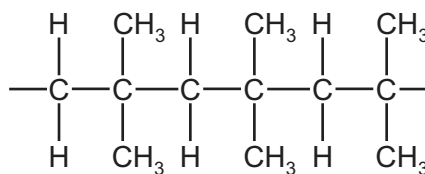
B



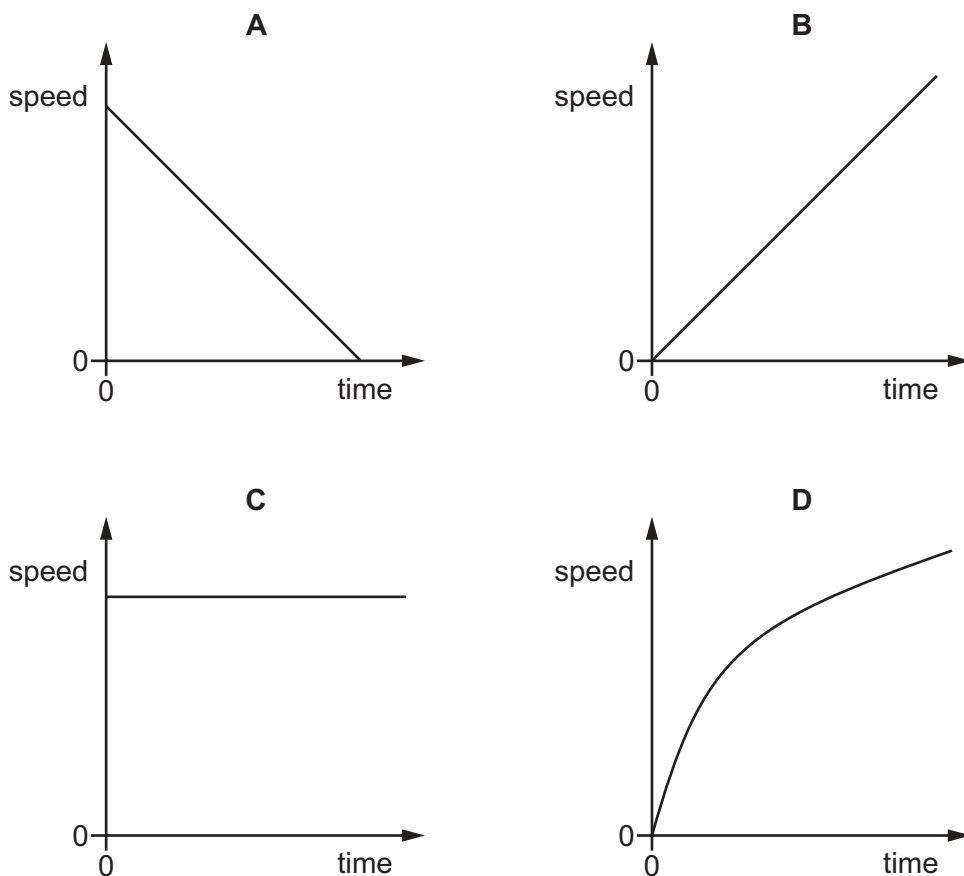
C



D



28 Which speed–time graph represents an object travelling at constant speed?



29 A parachutist falls vertically at constant speed.

Which statement about the resultant force on the parachutist is correct?

- A** The resultant force on the parachutist acts vertically downwards.
- B** The resultant force on the parachutist acts vertically upwards.
- C** The resultant force on the parachutist is equal to his weight.
- D** The resultant force on the parachutist is equal to zero.

30 An object moving at speed v has kinetic energy E .

What is the speed of the object when its kinetic energy is $4.0E$?

- A** $0.25v$
- B** $2.0v$
- C** $4.0v$
- D** $16v$

31 What is the name of the process by which energy is released in the Sun?

- A background radiation
- B chemical reaction
- C nuclear fission
- D nuclear fusion

32 What happens to the temperature of a substance as it is melting and as it is boiling?

	melting	boiling
A	decreases	increases
B	decreases	no change
C	increases	increases
D	no change	no change

33 A loudspeaker produces a sound wave that has a frequency of 3300 Hz. The speed of sound in air is 330 m/s.

What is the wavelength of the sound wave?

- A 0.10 m
- B 1.0 m
- C 11 m
- D 1.1×10^6 m

34 A lens is used as a magnifying glass to form a magnified image of some writing on a page.

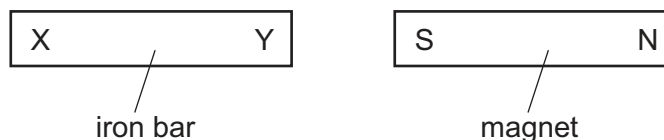


Which statements are correct?

- 1 The lens is a converging lens.
- 2 The writing is closer to the lens than one focal length of the lens.
- 3 The magnified image is a virtual image.

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

- 35 An iron bar XY is brought near to a magnet. Magnetic poles are induced in the iron bar.



What are the magnetic poles induced at X and Y?

	pole at X	pole at Y
A	N	N
B	N	S
C	S	N
D	S	S

- 36 A battery with an electromotive force (e.m.f.) of 6.0 V is connected to a $30\ \Omega$ resistor.

How much charge flows through the battery in 5.0 s?

- A** 1.0 C **B** 25 C **C** 36 C **D** 900 C

- 37 Which row shows how lamps are connected in a lighting circuit in a house and gives an advantage of connecting them in this way?

	how lamps are connected	advantage of connecting them in this way
A	in parallel	they can be switched separately
B	in parallel	they share the voltage
C	in series	they can be switched separately
D	in series	they share the voltage

- 38 A transformer increases the voltage from a power station in order to transfer electricity along transmission cables.

How does increasing the voltage affect the current in the cables and how does it affect the efficiency of energy transfer?

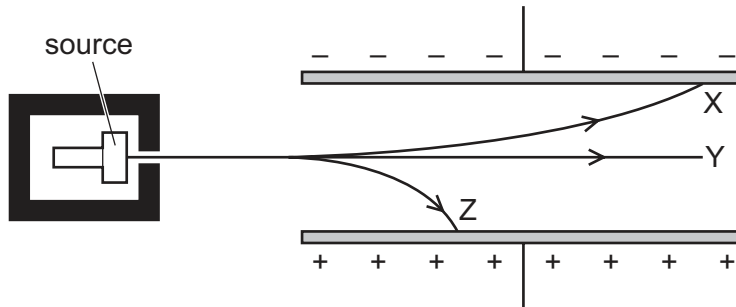
	current	efficiency
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

39 An atom of beryllium is represented by ${}^9_4\text{Be}$.

How many neutrons are in the nucleus of this type of beryllium atom?

- A** 4 **B** 5 **C** 9 **D** 13

40 Three different types of ionising radiation X, Y and Z pass between two charged plates.



NOT TO SCALE

Which row identifies X, Y and Z?

	X	Y	Z
A	alpha	beta	gamma
B	alpha	gamma	beta
C	beta	alpha	gamma
D	beta	gamma	alpha

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The Periodic Table of Elements

		Group																	
I	II	III	IV	V	VI	VII	VIII					VIII							
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	<table border="1"> <thead> <tr> <th colspan="2">Key</th> </tr> <tr> <th>atomic number</th> <th>atomic symbol name relative atomic mass</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>H hydrogen 1</td> </tr> </tbody> </table>				Key		atomic number	atomic symbol name relative atomic mass	1	H hydrogen 1	2 He helium 4	
Key																			
atomic number	atomic symbol name relative atomic mass																		
1	H hydrogen 1																		
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					36 Kr krypton 84							
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	
87 Fr francium —	88 Ra radium —	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 —	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.).