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CO-ORDINATED SCIENCES **0654/21**

Paper 2 Multiple Choice (Extended) **May/June 2026**

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 or tape.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / s^2).

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.

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[Turn over

1 Which row describes the uptake of mineral ions from the soil?

	relative concentration of mineral ions in soil	relative concentration of mineral ions in root hair cell	method of transport into root hair cell	requires energy from respiration
A	low	high	active transport	yes
B	low	high	diffusion	no
C	high	low	active transport	no
D	high	low	diffusion	yes

2 Which statement correctly describes enzyme activity as the temperature increases up to an optimum temperature?

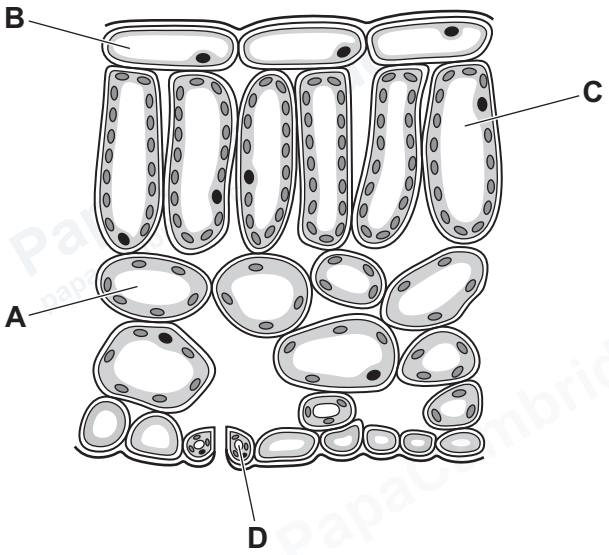
A The enzyme has less frequent effective collisions with the product.

B The enzyme has less frequent effective collisions with the substrate.

C The enzyme has more frequent effective collisions with the product.

D The enzyme has more frequent effective collisions with the substrate.

3 Which cell in a plant leaf controls gas exchange?



4 Which component of a balanced diet is a source of energy?

A carbohydrates

B minerals

C vitamins

D water

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5 What is a function of bile?

A assimilation of proteins

B chemical digestion of carbohydrates

C emulsification of fats

D lubrication of ingested food

6 What happens to plant cells when a plant wilts?

A They gain water, decrease in turgor pressure and become flaccid.

B They gain water, increase in turgor pressure and become turgid.

C They lose water, increase in turgor pressure and become turgid.

D They lose water, decrease in turgor pressure and become flaccid.

7 Platelets are a component of blood.

What is a function of platelets?

A antibody production

B clotting

C transport of nutrients

D transport of oxygen

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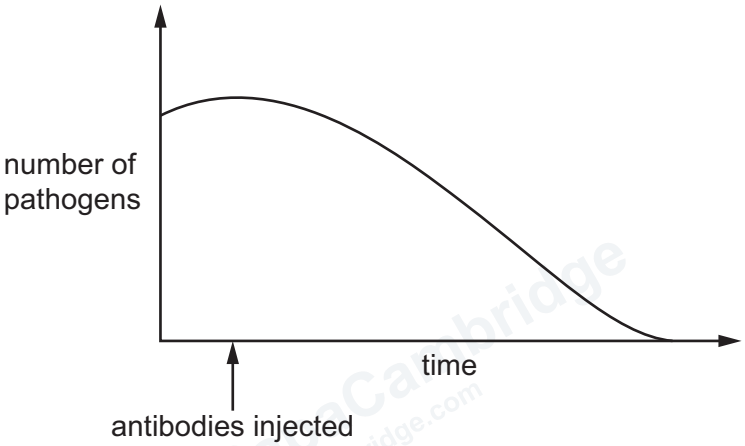
8 A person is infected with a pathogen.

Antibodies are injected into the person to treat the infection.

The graph shows the number of pathogens present in the blood of this person.



What is a possible explanation for the shape of the graph?

A The antibodies bind to antigens on the pathogens directly destroying the pathogens.

B The antibodies bind to the pathogens making it easier for lymphocytes to engulf and destroy them.

C The antibodies cause the production of memory cells so the patient becomes immune.

D The antibodies have the same antigens as the pathogen and stimulate an immune response.

9 Which statement about diffusion of gases in the lungs is correct?

A Carbon dioxide diffuses from alveoli into blood capillaries.

B Carbon dioxide diffuses from bronchi into blood capillaries.

C Oxygen diffuses from alveoli into blood capillaries.

D Oxygen diffuses from bronchi into blood capillaries.

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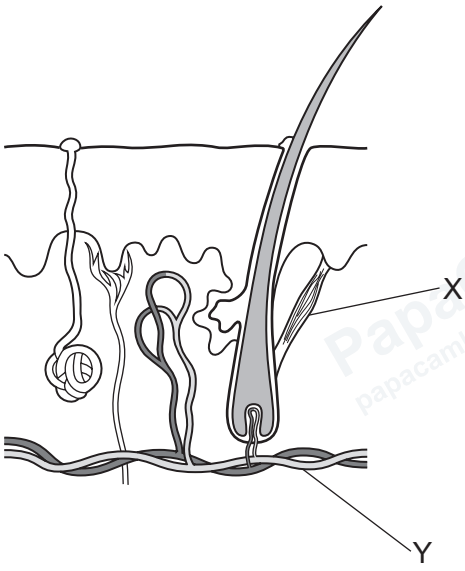
10 The diagram shows a cross-section of skin in a mammal.



Which row shows the responses of parts X and Y when the environmental temperature increases?

	X	Y
A	contracts	constricts
B	contracts	dilates
C	relaxes	constricts
D	relaxes	dilates

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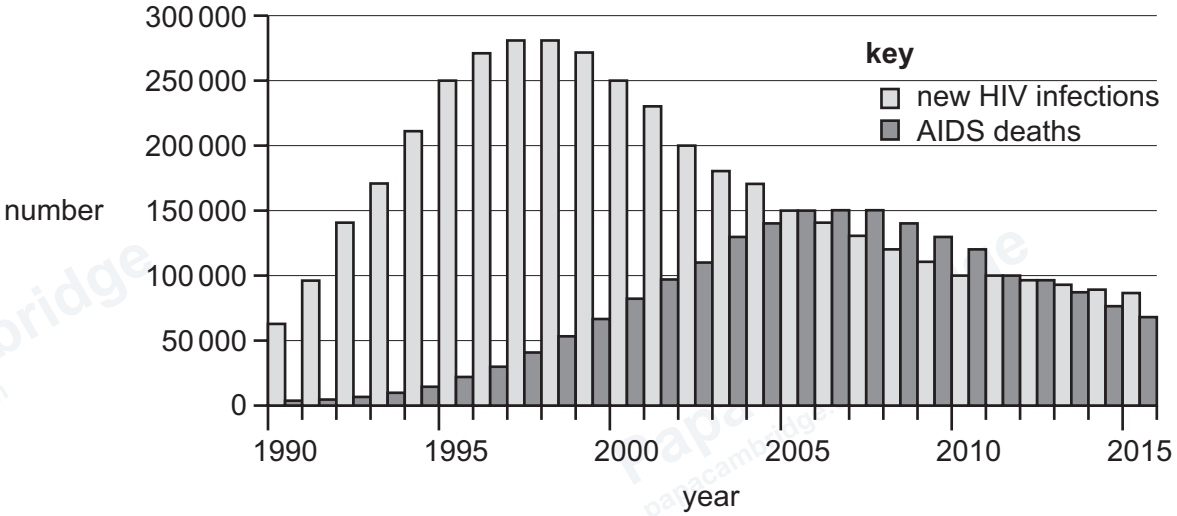
11 The graph shows the number of new HIV infections and AIDS deaths in a country.



Which statements can be concluded from the graph?

1 The number of AIDS deaths peaks in 2006–2008.

2 The number of AIDS deaths peaks at 150 000.

3 The number of new HIV infections peaks in 1997–1998.

4 The number of new HIV infections is always greater than the number of AIDS deaths.

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

12 The diagrams show some crosses between mice.

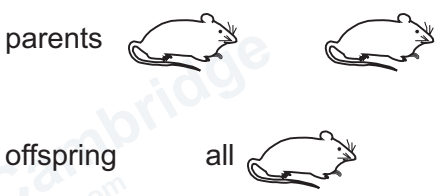
Which cross indicates that the allele for grey fur **must** be dominant to the allele for white fur?

A

B

C

D



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13 What are undesirable effects of deforestation?

1 increase of carbon dioxide in the atmosphere

2 extinction of species

3 flooding

4 increased number of habitats

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 3 and 4 only

14 Which statement describes what happens to the particles in a solid when it melts?

A They are no longer in fixed positions because the forces between them are completely overcome.

B They are no longer in fixed positions because the forces between them are partially overcome.

C They move further apart and do **not** touch because the forces between them are completely overcome.

D They move further apart and do **not** touch because the forces between them are partially overcome.

15 The equation for the complete combustion of methane is shown.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

What is the volume of oxygen, at room temperature and pressure, that is required for the complete combustion of 16 g of methane?

A 12 dm^3 **B** 24 dm^3 **C** 32 dm^3 **D** 48 dm^3

16 Hexane is a simple molecular compound.

Sodium phosphate is an ionic compound.

Which row describes the properties of hexane and sodium phosphate?

	hexane	**sodium phosphate**
A	high melting point	insoluble in water
B	low melting point	soluble in water
C	poor electrical conductivity	low boiling point
D	good electrical conductivity	high boiling point

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17 Which substance produces hydrogen at the cathode during electrolysis?

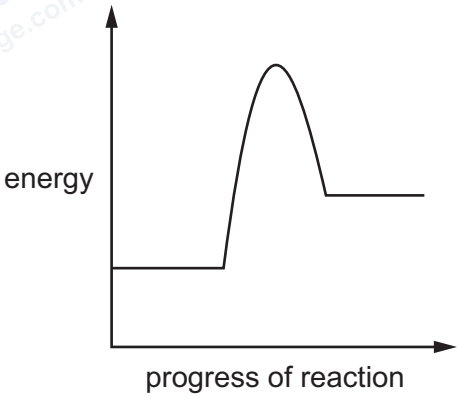
A aqueous copper(II) sulfate using copper electrodes

B molten sodium chloride using carbon electrodes

C dilute sulfuric acid using carbon electrodes

D molten sodium hydroxide using platinum electrodes

18 An unlabelled reaction pathway diagram is shown.



Which row describes the reaction and gives a correct explanation?

	description of reaction	explanation
A	endothermic	the reactants contain less energy than the products
B	endothermic	the reactants contain more energy than the products
C	exothermic	the reactants contain less energy than the products
D	exothermic	the reactants contain more energy than the products

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19 A student adds excess zinc to a fixed volume of dilute sulfuric acid of concentration 1.0 mol / dm^3 at different temperatures.

Hydrogen gas is produced.

The results are shown.

experiment	temperature of sulfuric acid / °C	time for effervescence to end / s
1	30	240
2	40	120

Which statement about the rate of reaction in these experiments is correct?

A Experiment 1 has a higher rate because more collisions have an energy exceeding the activation energy and the frequency of collisions between particles is smaller.

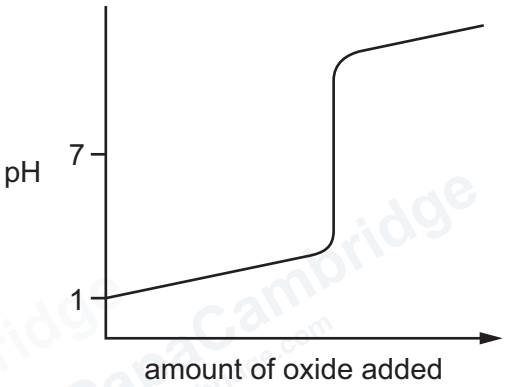
B Experiment 2 has a higher rate because more collisions have an energy exceeding the activation energy and the frequency of collisions between particles is greater.

C Experiment 1 has a higher rate because the activation energy is lower at lower temperatures and the frequency of collisions between particles is greater.

D Experiment 2 has a higher rate because the activation energy is lower at higher temperatures and the frequency of collisions between particles is smaller.

20 An excess of an oxide of element Q is added to hydrochloric acid.

The graph shows how the pH changes during the addition of the oxide.



Which row describes the type of oxide and element Q?

	type of oxide	element Q
A	acidic	metal
B	acidic	non-metal
C	basic	metal
D	basic	non-metal

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21 The halogen in Period 4 of the Periodic Table is a red-brown liquid at room temperature and pressure.

Which row describes the appearance of the halogens in Period 3 and Period 5?

	halogen in Period 3	halogen in Period 5
A	pale yellow-green gas	grey-black solid
B	pale yellow-green solid	grey-black solid
C	grey-black solid	pale yellow-green solid
D	grey-black solid	pale yellow-green gas

22 Which metal is used to galvanise steel?

A aluminium

B copper

C iron

D zinc

23 Which colour change is observed when water is added to anhydrous cobalt(II) chloride?

A blue to pink

B blue to white

C pink to blue

D white to blue

24 Which statements about carbon dioxide are correct?

1 Carbon dioxide in the atmosphere reduces the loss of thermal energy to space.

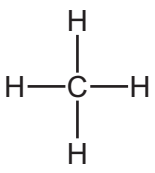
2 Carbon dioxide gas in the atmosphere causes acid rain.

3 Carbon dioxide is removed from car engine emissions using a catalytic convertor.

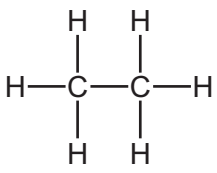
A 1, 2 and 3 **B** 1 and 2 only **C** 1 only **D** 2 and 3 only

25 Which diagram represents a molecule of ethane?

A



B



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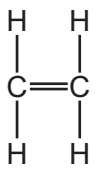

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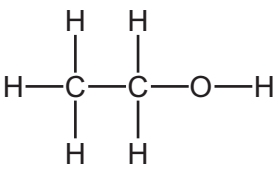

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26 Which statements about addition polymers and condensation polymers are correct?

1 Alkanes and alkenes form addition polymers.

2 Addition polymerisation forms only one product.

3 Condensation polymerisation forms a polymer and a small molecule.

4 Poly(ethene) is a condensation polymer.

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

27 The results of two tests on aqueous M are shown.

- When aqueous sodium hydroxide is added to M, a red-brown precipitate is produced.
- When acidified aqueous barium nitrate is added to M, a white precipitate is produced.

What is M?

A copper(II) chloride

B copper(II) sulfate

C iron(III) chloride

D iron(III) sulfate

28 An object near the surface of the Earth is in free fall. The gravitational field strength is constant.

Which statement about the acceleration of the object is correct?

A The acceleration is constant, but **not** zero.

B The acceleration is decreasing.

C The acceleration is increasing.

D The acceleration is zero.

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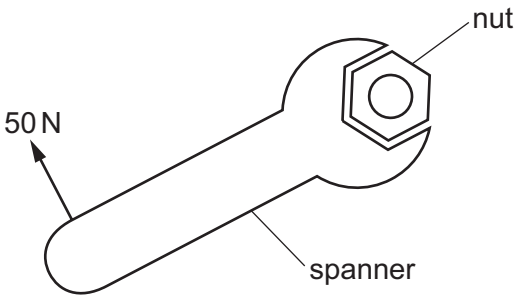
29 A force is applied to the end of the handle of a spanner to turn a nut.

The minimum force needed to turn the nut with this spanner is 50 N.



What is an advantage of using a spanner with a longer handle to turn the nut?

A It decreases the minimum force needed to turn the nut.

B It increases the minimum force needed to turn the nut.

C It decreases the moment needed to turn the nut.

D It increases the moment needed to turn the nut.

30 Which type of energy does an object store due to its motion?

A elastic

B gravitational potential

C kinetic

D nuclear

31 Which statement about boiling or evaporation of a liquid is correct?

A Boiling occurs at any temperature.

B Boiling occurs only at the surface of the liquid.

C Evaporation occurs only at a specific temperature.

D Evaporation occurs only at the surface of the liquid.

32 A solid metal transfers energy by thermal conduction.

What causes this transfer?

A atomic lattice vibrations and movement of delocalised electrons

B atomic lattice vibrations only

C movement of delocalised electrons only

D change in density of the metal

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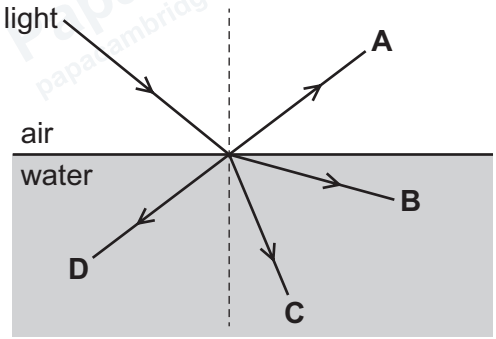
33 A ray of light in air is incident on the surface of water. The ray of light is refracted.

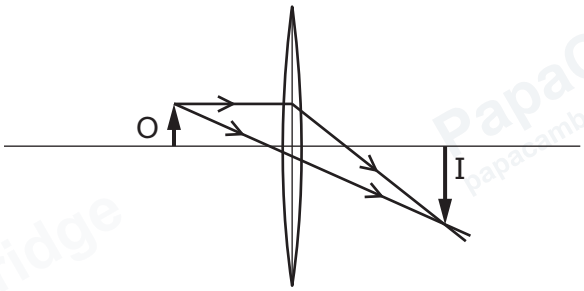
Light travels more slowly in water than in air.

In which labelled direction is the light refracted?

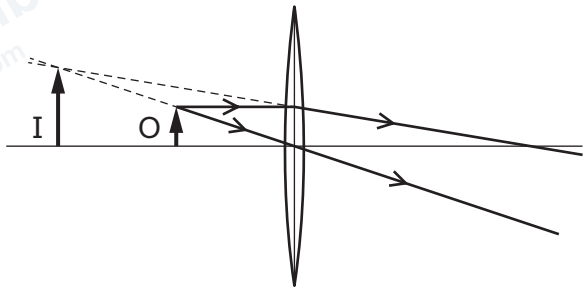


34 Which ray diagram represents the formation of a virtual image I of an object O by a thin converging lens?

A



B



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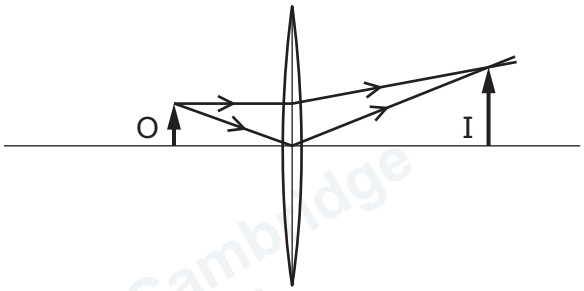

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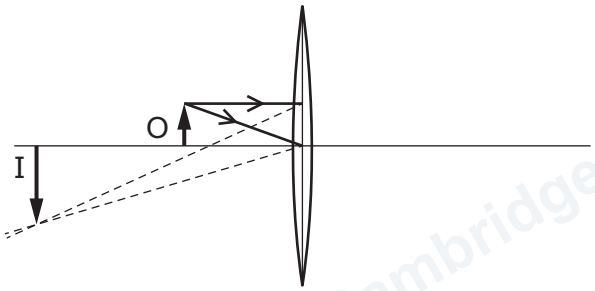

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35 A sound wave travels through air.

Which statement describes the behaviour of air particles as the sound wave travels?

A Air particles move backwards and forwards in a rarefaction, but up and down in a compression.

B Air particles move more slowly in a rarefaction than in a compression.

C Air particles are further apart in a rarefaction than in a compression.

D Air particles are in a region of higher pressure in a rarefaction than in a compression.

36 An electrician has a voltmeter that can be switched to different voltage ranges.

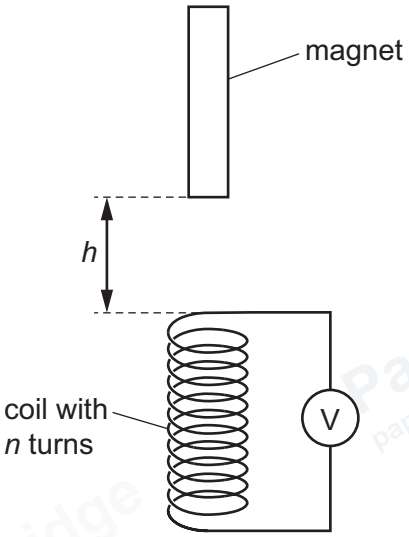
The voltmeter needs to measure a voltage of 240 V.

Which voltage range is the most suitable?

A 0–1000 mV **B** 0–200 V **C** 0–500 V **D** 5–250 kV

37 A magnet is dropped through a coil from a height of *h* cm.

The coil has *n* turns and is connected to a voltmeter.



Which row gives the values of *h* and *n* that produce the greatest induced electromotive force (e.m.f.)?

	h **/ cm**	***n***
A	5	200
B	5	400
C	10	200
D	10	400

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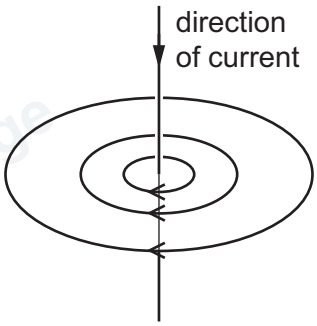
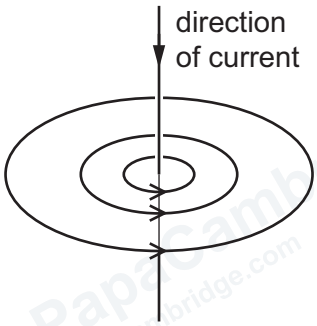
38 A straight wire carries a current. The direction of the current is shown.

Which diagram shows the pattern and direction of the magnetic field due to the current?

A



B



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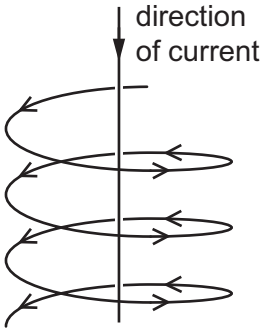

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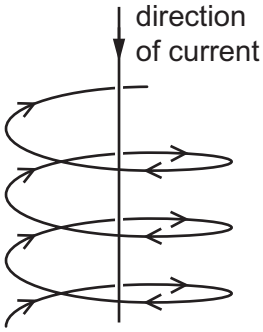

39 The decay equation for thorium-232 is shown.

$$^{232}_{90}\text{Th} \rightarrow {}^{228}_{88}\text{Ra} + {}^{x}_{y}Z$$

What are the values of x and y and what is the identity of particle Z?

	x	***y***	***Z***
A	1	2	beta
B	2	1	beta
C	2	4	alpha
D	4	2	alpha

40 A planet orbits the Sun once every 225 days. The radius of the orbit of the planet is 110 million km.

What is the orbital speed of the planet?

A 36 m / s **B** 85 m / s **C** 36 000 m / s **D** 85 000 m / s

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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.).

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