Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/22**

Paper 2 Multiple Choice (Extended) **October/November 2025**

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

1 The length of an insect in a photograph is measured as 17 mm.

The actual length of the insect is 12 mm.

What is the magnification of the insect in the photograph?

A ×0.7 **B** ×0.8 **C** ×1.4 **D** ×1.5

2 The mass of a potato cylinder is recorded. The potato cylinder is then placed into concentrated sucrose solution.

After 2 hours, the potato cylinder is removed from the solution and the mass recorded.

The results are shown.

time / hours	mass / g
0	2.50
2	1.65

Which statement explains the change in mass of the potato?

A Sucrose moves out of the potato cells because the solution has a higher water potential than the cells.

B Sucrose moves out of the potato cells because the solution has a lower water potential than the cells.

C Water moves out of the potato cells because the solution has a higher water potential than the cells.

D Water moves out of the potato cells because the solution has a lower water potential than the cells.

3 Which molecule is a component of proteins?

A $C_2H_5NO_2$ **B** $C_3H_8O_3$ **C** $C_6H_{12}O_6$ **D** $C_{10}H_{20}O_2$

4 Which molecule in this reaction has an active site?

$$\text{fat} \xrightarrow{\text{lipase}} \text{fatty acid + glycerol}$$

A fat

B fatty acid

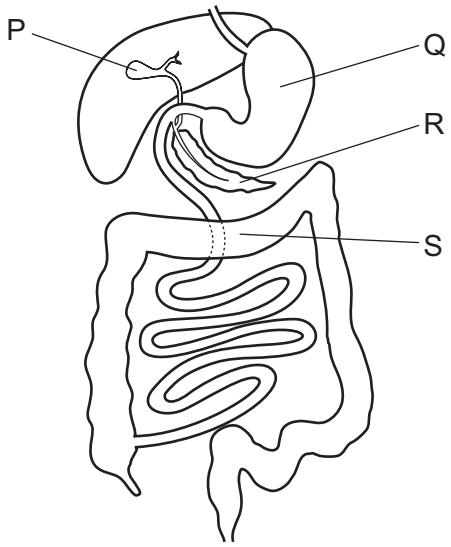
C glycerol

D lipase

5 Which row shows the effect of magnesium ion deficiency on plants?

	leaf colour	growth
A	green	good
B	green	poor
C	yellow	good
D	yellow	poor

6 The diagram shows part of the human digestive system.



Which organs produce digestive enzymes?

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

7 Which statement about the human circulatory system is correct?

A Blood flows through the aorta towards the heart.

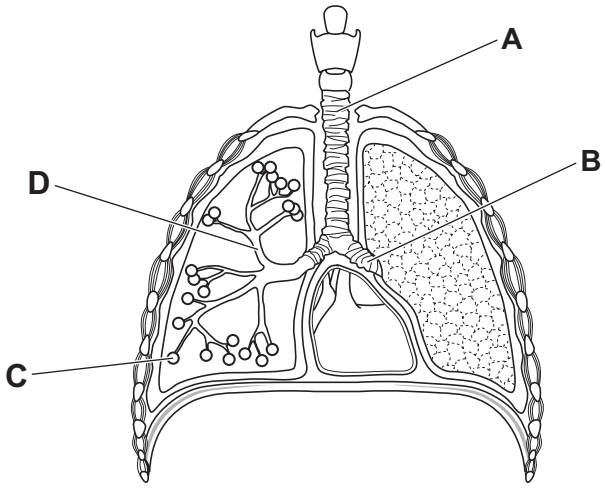
B Blood flows through the pulmonary artery towards the lungs.

C Blood flows through the pulmonary vein away from the heart.

D Blood flows through the vena cava away from the lungs.

8 The diagram shows part of the breathing system in humans.

Which labelled part is the trachea?



9 The word equation for aerobic respiration is shown.

glucose + oxygen → carbon dioxide + water

How many molecules of carbon dioxide will be produced from the breakdown of four molecules of glucose?

A 4 **B** 8 **C** 16 **D** 24

10 Which statement about blood flow to the skin in the maintenance of a constant internal body temperature is correct?

A If the internal body temperature is too high then vasoconstriction of skin arterioles occurs.

B If the internal body temperature is too low then vasoconstriction of skin capillaries occurs.

C If the internal body temperature is too high then vasodilation of skin arterioles occurs.

D If the internal body temperature is too low then vasodilation of skin capillaries occurs.

11 Which statement is correct?

A Asexual reproduction produces offspring which can adapt quickly to changes in the environment.

B Asexual reproduction produces genetically different offspring much faster than sexual reproduction.

C Sexual reproduction produces genetically different offspring enabling natural selection to occur.

D Sexual reproduction produces genetically identical offspring by the production of gametes.

12 Which combination of chromosomes produces a male in humans?

A XO **B** XY **C** YY **D** XX

13 Rabbits are herbivores.

Which trophic levels can the rabbit occupy?

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

14 Which row shows the electronic configuration of a calcium atom and of a fluoride ion?

	calcium atom	fluoride ion
A	2,8,8	2,7
B	2,8,8	2,8
C	2,8,8,2	2,7
D	2,8,8,2	2,8

15 Which statement explains why isotopes of an element have the same chemical properties?

A They have the same atomic mass.

B They have the same number of neutrons.

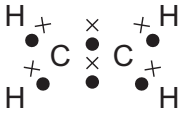
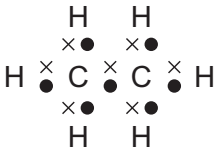
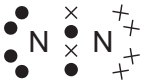
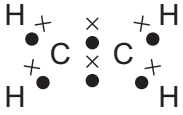
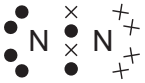
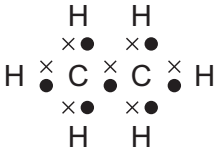
C They have the same electronic configuration.

D They have the same density.

16 Which changes take place at the electrodes during electrolysis?

	anode	cathode
A	negatively charged ions gain electrons	positively charged ions lose electrons
B	negatively charged ions lose electrons	positively charged ions gain electrons
C	positively charged ions gain electrons	negatively charged ions lose electrons
D	positively charged ions lose electrons	negatively charged ions gain electrons

17 Which row shows the dot-and-cross diagrams for nitrogen and ethene?

	nitrogen	ethene
A		
B		
C		
D		

18 Which particles are free to move in a giant metallic lattice?

	positive ions	negative ions	electrons
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

19 P is in Group II of the Periodic Table.

Q is a non-metallic element.

P reacts with Q to form an ionic compound, P_3Q_2.

What is the charge on the element Q ion in P_3Q_2?

A 1– **B** 2– **C** 3– **D** 4–

20 Which statement about the Avogadro constant is correct?

A It is the volume of 1 mole of a gas at room temperature and pressure.

B It is the mass of 1 mole of a substance.

C It is the number of particles in 1 mole of a substance.

D It has a value of 24 dm^3.

21 Lead sulfate, $PbSO_4$, is prepared by reacting lead oxide, PbO, with excess dilute sulfuric acid.

The equation for the reaction is shown.

$$PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$$

What is the mass of lead oxide required to produce 22.6 g of lead sulfate?

A 15.4 g **B** 16.6 g **C** 17.6 g **D** 17.8 g

22 When magnesium reacts with dilute hydrochloric acid, the temperature of the mixture increases.

Which statement about this reaction is correct?

A It is endothermic as thermal energy is taken in from the surroundings.

B It is endothermic as thermal energy is transferred to the surroundings.

C It is exothermic as thermal energy is taken in from the surroundings.

D It is exothermic as thermal energy is transferred to the surroundings.

23 Which change to the conditions of a reaction can produce the same number of successful collisions between reacting particles per second?

	temperature	reactant concentration
A	higher	lower
B	higher	unchanged
C	lower	lower
D	lower	unchanged

24 Which statements about oxidation and reduction are correct?

1 Oxidation is the gain of oxygen.

2 Oxidation is the loss of oxygen.

3 Reduction is the gain of oxygen.

4 Reduction is the loss of oxygen.

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

25 The word equation shown is incomplete.

$$\text{acid} + \text{alkali} \rightarrow \text{X} + \text{water}$$

What is X?

A base

B carbon dioxide

C hydrogen

D salt

26 Which type of reaction occurs when ethene reacts with steam?

A addition

B cracking

C displacement

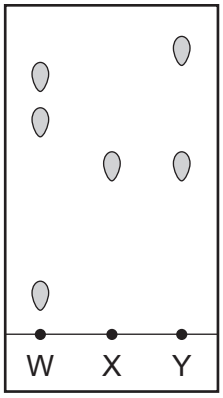
D polymerisation

27 The boiling points of three substances, W, X and Y, are shown.

	W	X	Y
boiling point / °C	116–118	132	141–145

The substances are tested using chromatography.

The chromatogram is shown.



Which statement is correct?

A One of the components of Y has a boiling point of 132 °C.

B Substance Y has a smaller boiling point range than substance W.

C Substance W produces the largest R_f value.

D Substance X is an impure mixture.

28 An object of mass *m* falls through a vacuum. The speed of the object at one instant is *v*.

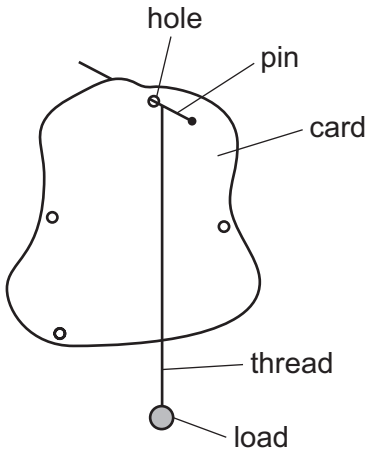
Which row shows the quantities that affect the acceleration of free fall of the object?

	m	*v*
A	no	no
B	no	yes
C	yes	no
D	yes	yes

29 The diagram shows the apparatus that a student uses to determine the centre of gravity of a piece of card.

The student:

- makes several holes in the card
- suspends the card from a pin placed through one of the holes
- hangs a load from a thread attached to the pin
- marks the line of the thread on the card.



The student repeats the steps using a different hole each time.

What is the smallest number of lines that the student needs to draw to determine the position of the centre of gravity of the card?

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

30 A 60 W lamp is switched on and 30 J of energy is transferred by the lamp.

How long is the lamp switched on for?

A 0.50 s **B** 2.0 s **C** 90 s **D** 1800 s

31 The temperature of a liquid in a beaker decreases because particles escape from the surface of the liquid.

Which row gives the name of this process and shows which particles escape from the liquid?

	name of process	particles that escape
A	condensation	less energetic
B	condensation	more energetic
C	evaporation	less energetic
D	evaporation	more energetic

32 What is the main method of thermal energy transfer in liquid water?

A boiling

B conduction

C convection

D radiation

33 Which row contains an example of a longitudinal wave and an example of a transverse wave?

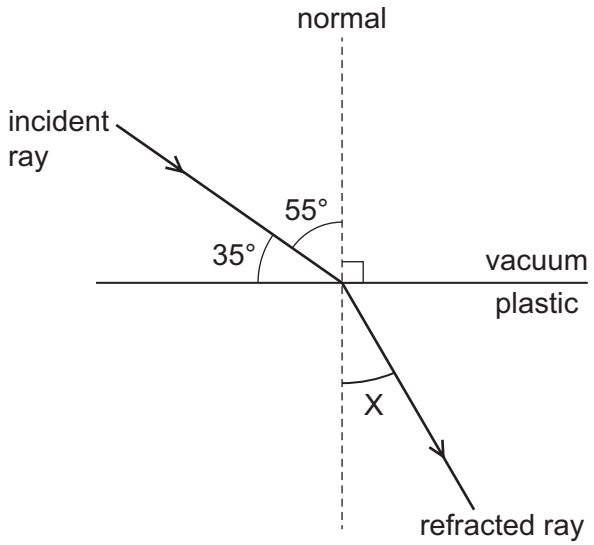
	longitudinal wave	transverse wave
A	radio wave	water wave
B	sound wave	radio wave
C	water wave	radio wave
D	water wave	sound wave

[Turn over

34 The diagram shows a ray of light that passes from a vacuum into plastic.

The plastic has a refractive index of 1.5.

An angle X is labelled on the diagram.



What is angle X?

A 22° **B** 23° **C** 33° **D** 37°

35 Sound travels at different speeds in water, in steel and in air.

Each row in the table gives the three speeds at room temperature.

Which row gives the correct speeds?

	speed of sound in water / m/s	speed of sound in steel / m/s	speed of sound in air / m/s
A	300	1500	4500
B	300	4500	1500
C	1500	4500	300
D	4500	1500	300

36 An electric heater operates at 220 V.

The current in the heater is 15 A.

Which expression gives the time for the heater to transfer 1.0×10^4 J of energy?

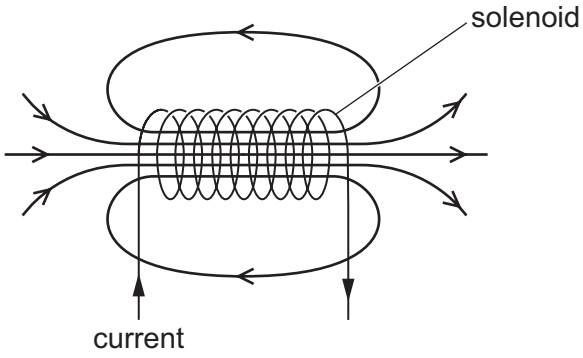
A $\dfrac{1.0 \times 10^4 \times 220}{15}$ s

B $\dfrac{1.0 \times 10^4 \times 15}{220}$ s

C $\dfrac{1.0 \times 10^4}{220 \times 15}$ s

D $1.0 \times 10^4 \times 220 \times 15$ s

37 The diagram shows the magnetic field due to a current in a solenoid.



Which change reverses the direction of the magnetic field?

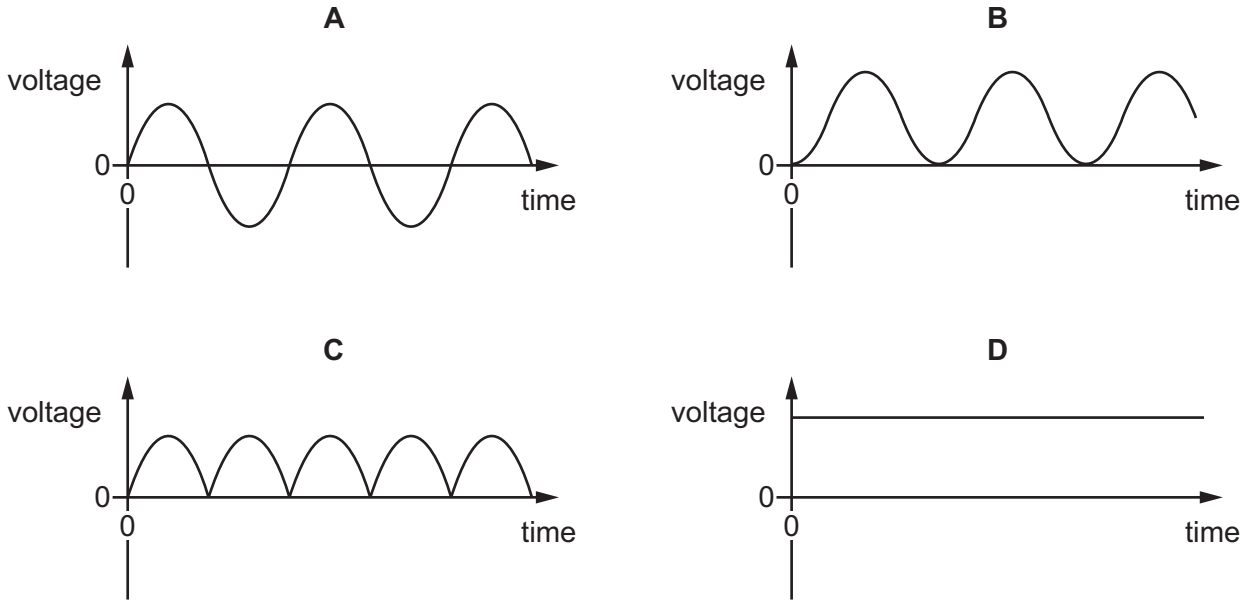
A Change the current direction.

B Decrease the current.

C Increase the current.

D Switch off the current.

38 Which graph shows how the output electromotive force (e.m.f.) of an a.c. generator varies with time?



39 A carbon-14 nucleus decays to form a nitrogen-14 nucleus and one particle X of ionising radiation.

The decay equation is shown.

$$^{14}_{6}\mathrm{C} \rightarrow {}^{14}_{Z}\mathrm{N} + {}^{0}_{-1}\mathrm{X}$$

Which row gives the value of Z and the identity of particle X?

	Z	particle X
A	5	β
B	7	α
C	7	β
D	8	α

40 A moon that orbits a planet has an orbit radius of $9.4 \times 10^{6}\,\mathrm{m}$ and an orbital period of 7.7 hours.

What is the orbital speed of this moon?

A $6.8 \times 10^{2}\,\mathrm{m/s}$

B $2.1 \times 10^{3}\,\mathrm{m/s}$

C $1.3 \times 10^{5}\,\mathrm{m/s}$

D $1.6 \times 10^{12}\,\mathrm{m/s}$

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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.).