Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/21**

Paper 2 Multiple Choice (Extended) **October/November 2024**

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 Which term describes the ability to detect and respond to changes in the environment?

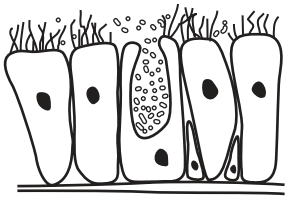
A excretion

B growth

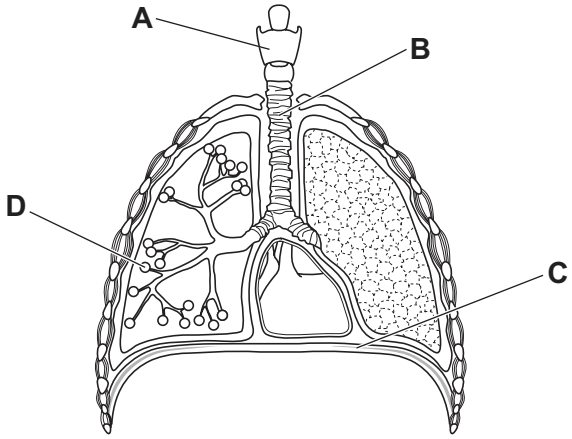
C movement

D sensitivity

2 The diagram shows some cells in the gas exchange system.



Which label shows the part of the gas exchange system where these cells are found?



3 Which biological molecule contains the elements carbon, hydrogen, nitrogen and oxygen?

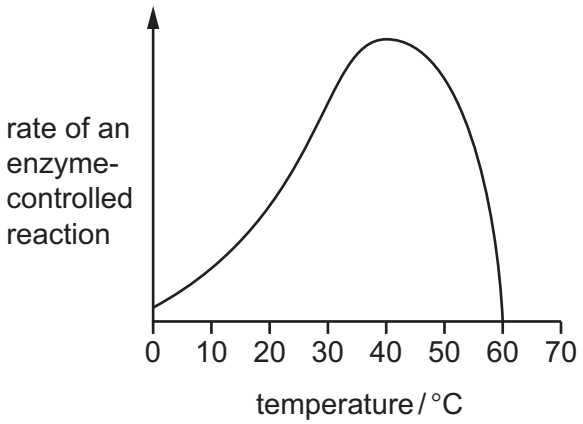
A carbohydrate

B fat

C oil

D protein

4 The graph shows the effect of temperature on the rate of an enzyme-controlled reaction.



Which statements are correct?

1 Enzyme molecules denature above 50 °C and below 20 °C.

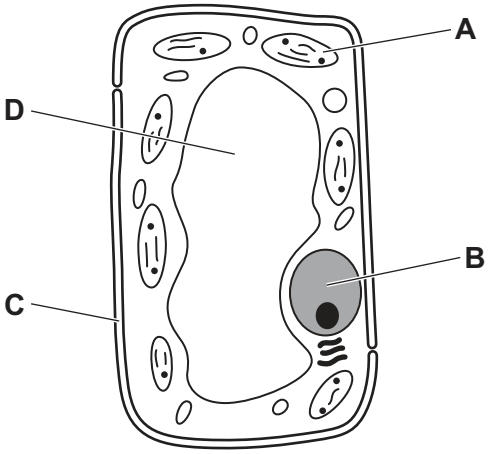
2 Increasing the temperature between 10 °C and 40 °C increases the kinetic energy of enzyme molecules.

3 The shape of the active site changes between 40 °C and 60 °C.

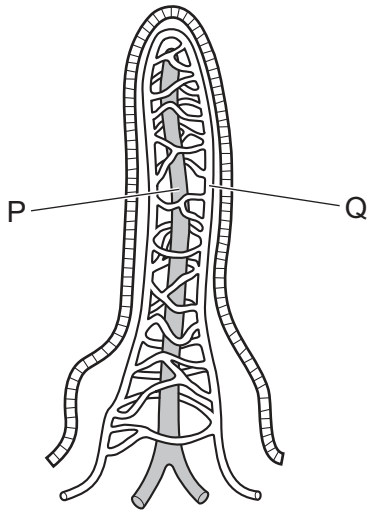
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

5 The diagram shows a mesophyll cell.

In which structure does photosynthesis take place?



6 The diagram shows a villus.



What are structures P and Q and which substances do they absorb?

	structure		substance absorbed	
	capillary	lacteal	amino acids	fatty acids
A	P	Q	P	Q
B	P	Q	Q	P
C	Q	P	P	Q
D	Q	P	Q	P

7 In which weather conditions is the rate of transpiration fastest?

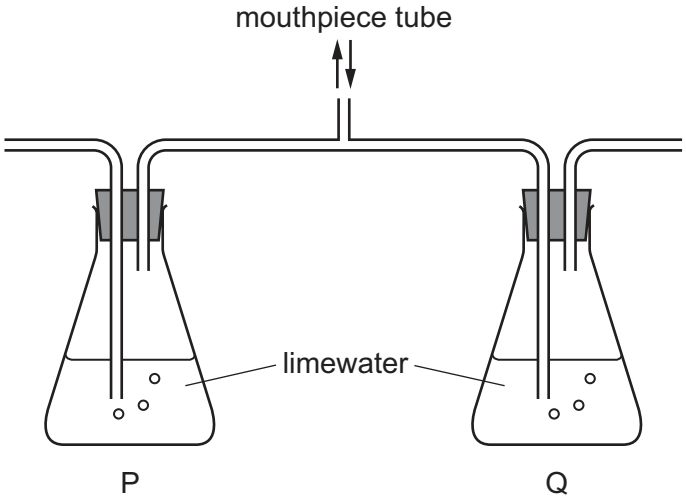
A cold and dry

B cold and wet

C warm and dry

D warm and wet

8 A student breathed gently in and out of the mouthpiece of the apparatus shown.



What were the results after 10 breaths?

	P	Q
A	colourless	colourless
B	colourless	milky
C	milky	colourless
D	milky	milky

9 A student looks at an object at a distance and then looks at an object close by. This ability to focus on both objects is brought about by changing the shape of the lens.

What is this called?

A accommodation

B coordination

C pupil reflex

D transmission

10 Which statement describes one similarity between asexual and sexual reproduction?

A They both involve gametes.

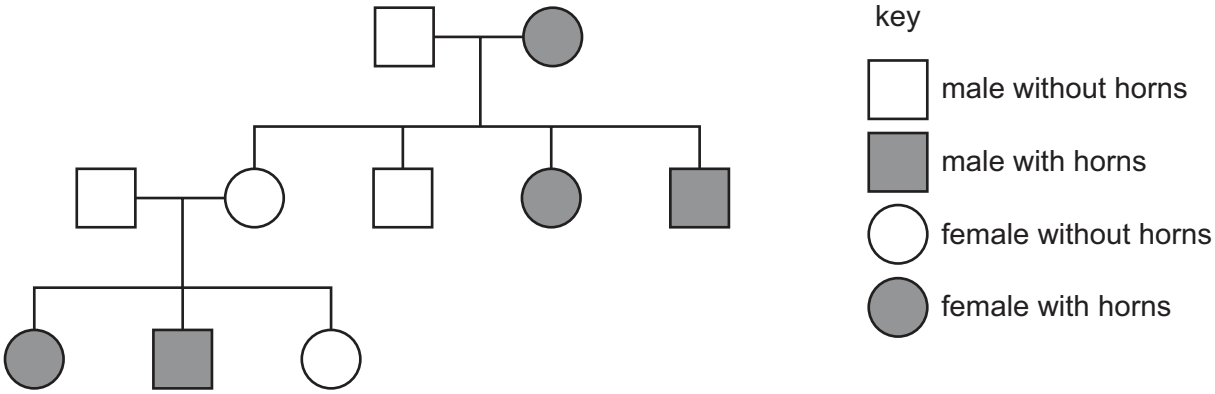
B They both involve parent and offspring.

C They both produce genetically identical individuals.

D They both require fertilisation to take place.

11 Horn development in some cattle is controlled by a pair of alleles. The allele for not developing horns is dominant to the allele for developing horns.

The pedigree diagram shows cattle with and without horns.



How many of the cattle are definitely heterozygous?

A 2 **B** 3 **C** 4 **D** 5

12 What is an example of an ecosystem?

A a decomposing log and the organisms in it

B a food chain

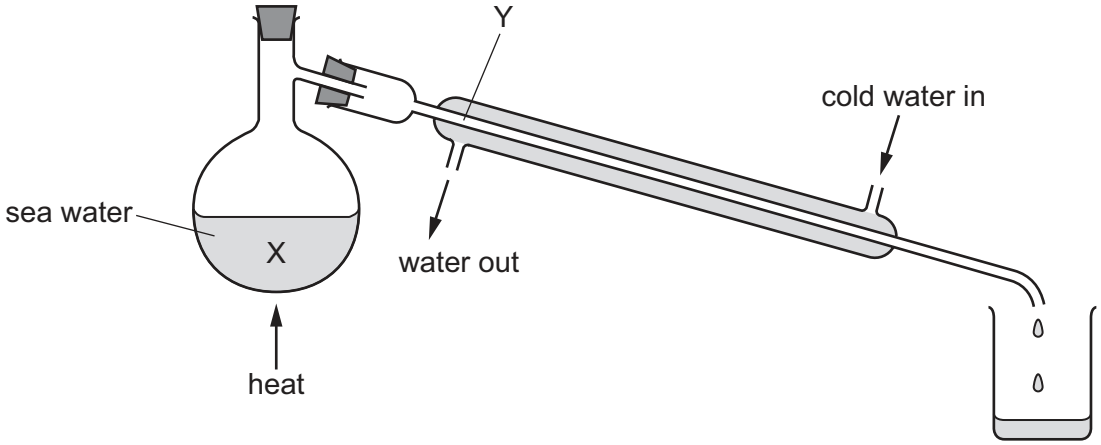
C the network of burrows in which some rabbits live

D the oak trees in a forest

13 Which processes change the amount of carbon dioxide in the air?

	process causing increase in carbon dioxide	process causing decrease in carbon dioxide
A	burning fossil fuels	photosynthesis in plants
B	photosynthesis in plants	respiration in animals
C	respiration in animals	respiration in plants
D	respiration in plants	burning fossil fuels

14 Sea water is heated in the apparatus shown.



Which row describes changes at positions X and Y?

	at X	at Y
A	concentration of solution decreases	solvent condenses
B	concentration of solution decreases	solute condenses
C	concentration of solution increases	solvent condenses
D	concentration of solution increases	solute condenses

15 An experiment is assembled to measure the rate of reaction between limestone and hydrochloric acid.

In the experiment a gas is released. The volume of gas produced is measured every five seconds.

Which piece of apparatus **cannot** be used to measure the volume of gas?

A burette

B measuring cylinder

C pipette

D gas syringe

16 What is a property of a typical covalent compound?

A low electrical conductivity

B high melting point

C low volatility

D soluble in water

[Turn over

17 The formula of an ammonium ion is NH_4^+.

The formula of a phosphate ion is PO_4^{3-}.

What is the formula of ammonium phosphate?

A $(NH_4)_3PO_4$ **B** $(NH_4)_2PO_4$ **C** NH_4PO_4 **D** $NH_4(PO_4)_3$

18 Which statement describes what happens during electrolysis?

A Covalent compounds produce more complex substances.

B Covalent compounds produce simpler substances.

C Ionic compounds produce more complex substances.

D Ionic compounds produce simpler substances.

19 When a match burns, heat and light energy are produced.

Which row describes the type of change and the type of reaction taking place?

	type of change	type of reaction
A	chemical	endothermic
B	chemical	exothermic
C	physical	endothermic
D	physical	exothermic

20 The equation for the reaction between sulfur dioxide and oxygen is shown.

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

Which statements explain why the rate of this reaction increases at higher temperatures?

1 The molecules move closer together so they collide more frequently.

2 The molecules move more quickly so they collide more frequently.

3 The activation energy is decreased.

4 More colliding particles possess the activation energy.

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

21 All Group I metal compounds and all Group II metal chlorides are soluble in water.

All Group II metal carbonates and barium sulfate are insoluble.

Which method is used to prepare barium sulfate using barium carbonate?

A direct combination of solid barium carbonate and dilute sulfuric acid

B reaction of solid barium carbonate and hydrogen chloride gas, followed by reaction with dilute sulfuric acid

C reaction of aqueous barium carbonate with dilute hydrochloric acid, followed by reaction with aqueous sodium sulfate

D reaction of solid barium carbonate with dilute hydrochloric acid, followed by reaction with aqueous sodium sulfate

22 Which electronic structure belongs to a non-metallic element?

A 2 **B** 2,2 **C** 2,8,2 **D** 2,8,8,2

23 Tennessine is a newly discovered halogen and is below astatine in Group VII of the Periodic Table.

Which row predicts the appearance of tennessine and the effect of adding aqueous potassium iodide?

	appearance of tennessine	effect of adding aqueous potassium iodide to tennessine
A	black solid	iodine is formed
B	black solid	no reaction
C	brown liquid	iodine is formed
D	brown liquid	no reaction

24 Which statement about the extraction of metals is correct?

A Aluminium ore is called hematite.

B Aluminium is extracted from its ore by heating with carbon.

C Iron oxide is reduced to iron by heating with carbon monoxide.

D Limestone is used to remove basic impurities in a blast furnace.

25 In a test for water, water turns anhydrous copper(II) .....1..... from .....2..... to .....3..... .

Which words complete gaps 1, 2 and 3?

	1	2	3
A	chloride	blue	white
B	chloride	white	blue
C	sulfate	blue	white
D	sulfate	white	blue

26 What is a general formula for unsaturated hydrocarbons?

A C_nH_{n+2} **B** $C_{2n}H_{2n+2}$ **C** C_nH_{2n} **D** C_nH_{2n+2}

27 Poly(ethene) and nylon are two different types of polymer.

Which statement about these polymers is correct?

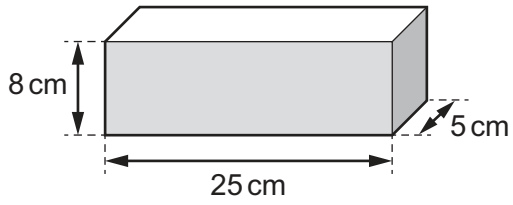
A Nylon is an addition polymer.

B The linkage between monomers in nylon is –CONH–.

C Poly(ethene) and nylon are made from the same monomers.

D Poly(ethene) and nylon have the same linkages between their monomers.

28 A solid, rectangular metal block has the dimensions shown.



The mass of the block is 2700 g.

What is the density of the metal?

A $\frac{25 \times 5}{2700}\ g/cm^3$

B $\frac{25 \times 5 \times 8}{2700}\ g/cm^3$

C $\frac{2700}{25 \times 5}\ g/cm^3$

D $\frac{2700}{25 \times 5 \times 8}\ g/cm^3$

29 The length of a spring changes when a force is applied to stretch the spring.

The table shows how the length of the spring depends on the force.

force / N	0	1.0	2.0	3.0	4.0	5.0
length of spring / cm	22	25	28	31	35	45

What is the length of the spring when the limit of proportionality is reached?

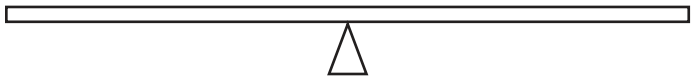
A exactly 22 cm

B between 31 cm and 35 cm

C exactly 35 cm

D between 35 cm and 45 cm

30 A see-saw (teeter-totter) rests on a pivot at its centre.



NOT TO SCALE

A child of weight 250 N sits on one side of the see-saw at a distance of 1.6 m from the pivot.

A second child balances the see-saw by sitting on the other side of the pivot at a distance of 1.2 m from the pivot.

What is the weight of the second child?

A 190 N **B** 250 N **C** 330 N **D** 400 N

31 The Sun is the source of energy for most energy resources.

In which group of resources is energy input from the Sun the **only** source of energy?

A coal, geothermal, gasoline

B hydroelectric, tidal, waves

C natural gas, solar, wind

D nuclear, solar, wood

32 A student observes that a substance X does **not** flow.

Which statement about substance X is correct?

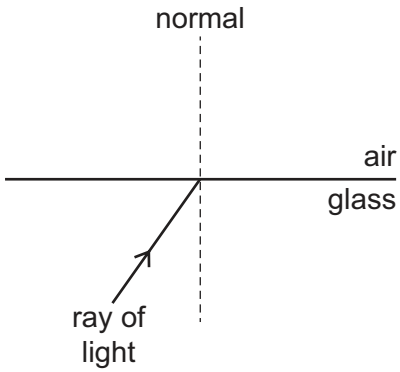
A It can be either a gas or a liquid.

B It can only be a gas.

C It can only be a liquid.

D It can only be a solid.

33 A ray of light travels from glass into air.



In which direction is the light refracted and how does the speed of the light change?

	direction of refracted light	speed of light
A	bends away from the normal	decreases
B	bends away from the normal	increases
C	bends towards the normal	decreases
D	bends towards the normal	increases

34 Gamma rays and microwaves are both electromagnetic radiations.

Which statement about their frequencies and speeds in a vacuum is correct?

A Gamma rays have greater frequencies than microwaves and travel at a greater speed.

B Gamma rays have greater frequencies than microwaves and travel at the same speed.

C Gamma rays have smaller frequencies than microwaves and travel at a greater speed.

D Gamma rays have smaller frequencies than microwaves and travel at the same speed.

35 Which statement about the core of an electromagnet is correct?

A It is made of soft iron because soft iron is easy to magnetise.

B It is made of soft iron because soft iron does not lose its magnetism easily.

C It is made of steel because steel is easy to magnetise.

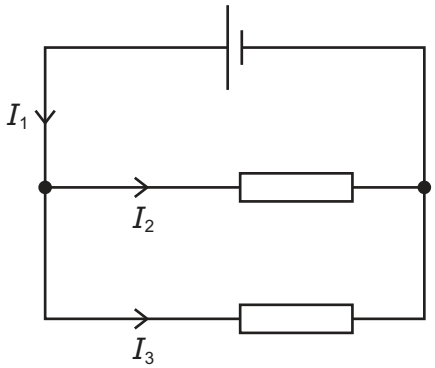
D It is made of steel because steel loses its magnetism easily.

36 A wire of a certain length has a resistance of 8.0 Ω. A second wire made of the same material has double the length and double the cross-sectional area of the first wire.

What is the resistance of the second wire?

A 4.0 Ω **B** 8.0 Ω **C** 16 Ω **D** 32 Ω

37 A circuit contains a cell and two resistors connected in parallel. The currents in each part of the circuit are labelled I_1, I_2 and I_3.



What is the relationship between the currents?

A $I_1 = I_2$ **B** $I_1 = I_3$ **C** $I_1 > I_2 + I_3$ **D** $I_1 = I_2 + I_3$

38 The instructions for a household lamp state that the plug must be fitted with a 3 A fuse.

What happens if a 13 A fuse is fitted by mistake?

A The fuse blows too easily.

B The lamp lights less brightly.

C The wires connecting the lamp to the plug overheat if a fault develops.

D Too much voltage is supplied to the lamp.

39 A transformer with an efficiency of 100% has an input current of 10 A. The input voltage is 100 V and the output voltage is 20 V.

What is the output current?

A 2.0 A **B** 10 A **C** 50 A **D** 200 A

40 A uranium nucleus decays into a thorium nucleus. The thorium nucleus then decays into a protactinium nucleus.

$$^{238}_{92}\text{U} \rightarrow {}^{234}_{90}\text{Th} \rightarrow {}^{234}_{91}\text{Pa}$$

Which emissions take place during the decays?

A an alpha-particle followed by a beta-particle

B an alpha-particle followed by another alpha-particle

C a beta-particle followed by an alpha-particle

D a beta-particle followed by another beta-particle

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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.).