



Cambridge IGCSE™

COMBINED SCIENCE

Paper 2 Multiple Choice (Extended)

0653/21

May/June 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

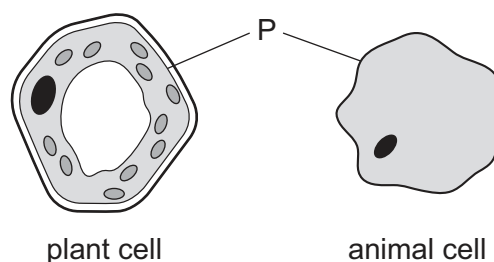
- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the 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.

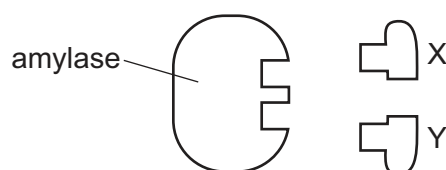
- 1 The diagram shows a plant cell and an animal cell as seen under a light microscope.



What is structure P and what is one of its functions?

	structure P	function
A	cell membrane	controls the entry of substances into the cell
B	cell membrane	supports the cell
C	cell wall	controls the entry of substances into the cell
D	cell wall	supports the cell

- 2 The diagram represents the enzyme amylase and the products of digestion by amylase.



What are products X and Y?

	X	Y
A	amino acid	amino acid
B	fatty acid	glycerol
C	glycerol	fatty acid
D	simple sugar	simple sugar

- 3 Which type of cell needs a supply of magnesium ions to carry out its main function?

- A** a ciliated cell
- B** palisade mesophyll cell
- C** a red blood cell
- D** a root hair cell

4 Which process produces food molecules that are small enough to be absorbed?

- A chemical digestion
- B egestion
- C ingestion
- D mechanical digestion

5 Which statement about the structure and function of blood vessels is correct?

- A Arteries have valves and always carry oxygenated blood.
- B Arteries have a thick muscular wall to maintain a high blood pressure.
- C Veins have a narrow lumen to allow the blood to flow quickly.
- D Veins have a thin wall so that they can exchange molecules with tissue cells.

6 Which processes use the energy released by respiration?

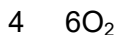
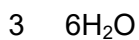
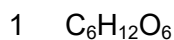
	diffusion	growth	osmosis	protein synthesis
A	✓	✓	x	x
B	✓	x	x	✓
C	x	✓	x	✓
D	x	x	✓	x

key

✓ = yes

x = no

7 Molecules from the balanced chemical equation for aerobic respiration are listed.



What represents the correct equation for aerobic respiration using these molecules?

- A $1 + 2 \rightarrow 3 + 4$
- B $2 + 3 \rightarrow 1 + 4$
- C $1 + 4 \rightarrow 2 + 3$
- D $3 + 4 \rightarrow 1 + 2$

8 Which statement about adrenaline is correct?

- A It is produced by a gland.
- B It is transported in the red blood cells.
- C It only has one target organ.
- D It reduces the size of the pupils.

9 Auxin stimulates cell elongation.

If a light shines onto a shoot, why does it grow towards the direction of the light?

- A Auxin spreads evenly through the shoot.
- B Auxin stays in the shoot tip.
- C More auxin collects on the side of the shoot furthest from the light.
- D More auxin collects on the side of the shoot nearest the light.

10 Which statement about sexual reproduction is **always** correct?

- A It involves only one parent.
- B It involves the fusion of nuclei.
- C It produces genetically identical offspring.
- D It takes place only in animals.

11 Which row describes adaptations of a wind-pollinated flower?

	anthers inside flower	large petals	stigma outside flower
A	✓	✓	✗
B	✗	✓	✓
C	✓	✗	✗
D	✗	✗	✓

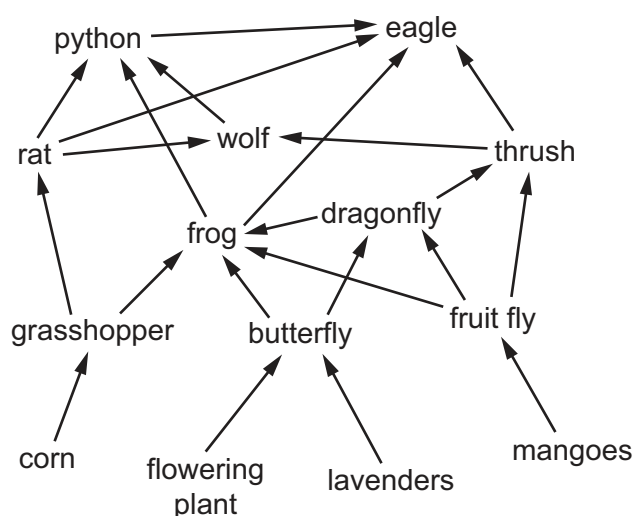
12 The list shows the adaptive features of some gametes.

- 1 a flagellum
- 2 a jelly coat
- 3 a sac of enzymes at one end
- 4 a store of energy

Which features are present in a human male gamete?

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

13 The diagram shows a food web.



How many of the food chains in this food web support the wolf?

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

14 50g of a liquid alkane at 20 °C is left in an open, insulated beaker for 30 minutes.

After this time, the mass of the liquid is 42 g and its temperature is 18 °C.

Which statement is correct?

- A** Some of the liquid evaporates in an exothermic process.
- B** The evaporation is an endothermic process because covalent bonds in the alkane molecules are broken.
- C** The temperature decreases because energy is used to overcome attractive forces between the liquid molecules.
- D** There are fewer molecules in the remaining liquid so they move further apart.

15 What is an example of a physical change?

- A carbon dioxide turning limewater milky
- B the crystallisation of copper(II) sulfate from solution
- C the electrolysis of molten lead(II) bromide
- D the thermal decomposition of calcium carbonate

16 Which statement defines the nucleon number of an atom?

- A It is the total number of neutrons and protons in the atom.
- B It is the total number of neutrons and electrons in the atom.
- C It is the total number of neutrons, protons and electrons in the atom.
- D It is the total number of neutrons in the atom.

17 The formula of magnesium nitrate is $\text{Mg}(\text{NO}_3)_2$.

Which symbols represent the ions in magnesium nitrate?

	magnesium	nitrate
A	Mg^+	NO_3^-
B	Mg^+	NO_3^{2-}
C	Mg^{2+}	NO_3^{2-}
D	Mg^{2+}	NO_3^-

18 Which rows identify the electrode products for the named electrolyte?

	electrolyte	product at anode	product at cathode
1	dilute sulfuric acid	oxygen	hydrogen
2	dilute sulfuric acid	sulfur dioxide	hydrogen
3	concentrated aqueous sodium chloride	chlorine	hydrogen
4	molten lead(II) bromide	lead	bromine

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

- 19 Hydrogen reacts with oxygen to produce water as shown.



The reaction causes the surroundings to heat up.

Which row identifies the type of reaction and explains why it is endothermic or exothermic?

	type of reaction	explanation
A	endothermic	the bonds formed are stronger than the bonds broken
B	endothermic	the bonds formed are weaker than the bonds broken
C	exothermic	the bonds formed are stronger than the bonds broken
D	exothermic	the bonds formed are weaker than the bonds broken

- 20 An experiment is set up to investigate the rate of reaction between calcium carbonate and dilute hydrochloric acid.

A fixed mass of solid calcium carbonate is placed in a conical flask, and an excess of the acid is added using a measuring cylinder. Carbon dioxide is produced in the reaction.

Which other pieces of apparatus are used to find the rate of reaction?

- 1 a balance
- 2 a thermometer
- 3 a stop-watch

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

- 21 Which aqueous substances form a white precipitate when they are mixed?

- A** barium chloride and hydrochloric acid
- B** barium chloride and nitric acid
- C** silver nitrate and nitric acid
- D** silver nitrate and hydrochloric acid

- 22** All sodium compounds are soluble. Magnesium hydroxide is insoluble.

An excess of a solid is added to dilute nitric acid, mixed, filtered and then the filtrate is left to crystallise.

Which solids react with dilute nitric acid and can be used separately to prepare crystals of magnesium nitrate?

- A** magnesium hydroxide and sodium carbonate only
- B** magnesium and magnesium hydroxide only
- C** magnesium and sodium carbonate only
- D** magnesium, magnesium hydroxide and sodium carbonate

- 23** Astatine is an element near the bottom of Group VII in the Periodic Table.

Which row shows properties of astatine?

	physical state at room temperature	reacts with iodide ions
A	gas	no
B	solid	no
C	gas	yes
D	solid	yes

- 24** Which statement about the properties of the elements in Period 3 of the Periodic Table is correct?

- A** The elements on the left lose electrons more readily.
- B** The elements on the left are less malleable.
- C** The elements on the right are metallic.
- D** The elements on the right form cations.

- 25** Iron is extracted from its ore in a blast furnace.

Which statement about this process is correct?

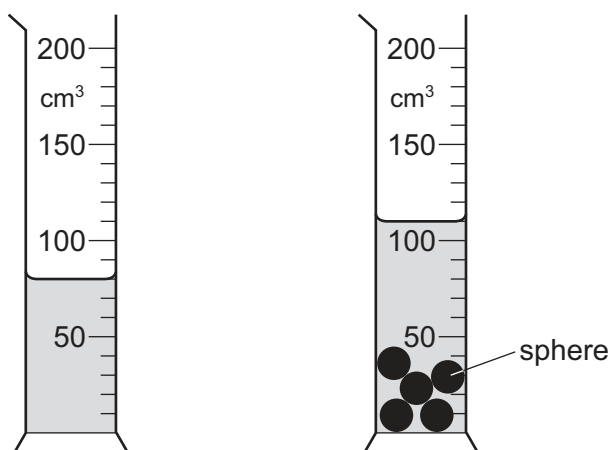
- A** Carbon dioxide reduces iron(III) oxide.
- B** Iron(III) oxide reduces carbon monoxide.
- C** Carbon oxidises iron(III) oxide.
- D** Carbon dioxide oxidises carbon.

- 26 A water supply contains small insoluble impurities. It also contains bacteria.

Which statement describes how the insoluble impurities are removed and how the bacteria are killed?

- A The water supply is filtered.
 - B The water supply is filtered and treated with chloride ions.
 - C The water supply is filtered and treated with chlorine.
 - D The water supply is treated with chlorine and chloride ions.
- 27 Which products are obtained by the cracking of larger alkane molecules?
- A smaller alkane molecules, smaller alkene molecules and hydrogen
 - B smaller alkane molecules only
 - C smaller alkene molecules and hydrogen only
 - D smaller alkene molecules only

- 28 Five identical solid spheres are placed in a measuring cylinder containing a liquid. The diagrams show the measuring cylinder before and after the spheres are placed inside.



The mass of one sphere is 12 g.

What is the density of the material used to make the spheres?

- A 0.40 g/cm^3 B 0.50 g/cm^3 C 2.0 g/cm^3 D 2.5 g/cm^3

29 A book rests on a table.

Which two quantities are needed to calculate the pressure exerted by the book on the table?

- A the density of the book and the volume of the book
- B the density of the book and the area of contact between the book and the table
- C the weight of the book and the volume of the book
- D the weight of the book and the area of contact between the book and the table

30 Which row shows the expressions for the gravitational potential energy (GPE) and the kinetic energy (KE) of an object?

	GPE	KE
A	$\frac{mg}{h}$	$\frac{1}{2}mv^2$
B	$\frac{mg}{h}$	$\frac{1}{2}(mv)^2$
C	mgh	$\frac{1}{2}mv^2$
D	mgh	$\frac{1}{2}(mv)^2$

31 Which row compares the distances between the molecules and the forces between the molecules in a solid and in a gas?

	distances between the molecules	forces between the molecules
A	larger in a gas	larger in a gas
B	larger in a gas	larger in a solid
C	larger in a solid	larger in a gas
D	larger in a solid	larger in a solid

32 Which statement is correct for evaporation?

- A Evaporation occurs only at the boiling point of the liquid.
- B Evaporation occurs only at the surface of a liquid.
- C Evaporation involves a vapour changing into a liquid.
- D Evaporation increases the temperature of the remaining liquid.

- 33** A sea wave reaches the shore at a rate of three wavelengths every 60 s.

What is the frequency of the wave?

- A** 0.050 Hz **B** 1.0 Hz **C** 3.0 Hz **D** 20 Hz

- 34** A sound wave moves from a solid into a liquid.

The frequency of the sound does not change.

What happens to the speed and what happens to the wavelength of the sound wave?

	speed	wavelength
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 35** A thin converging lens has a focal length of 5.0 cm.

The lens is placed at different distances from the object.

At which distance does the lens act as a magnifying glass?

- A** 15 cm **B** 10 cm **C** 6.0 cm **D** 3.0 cm

- 36** A plastic rod becomes negatively charged when rubbed with a cloth.

The cloth becomes positively charged.

Which statement describes the charging process?

- A** The rod and the cloth both gain electrons.
B The rod and the cloth both lose electrons.
C The rod gains electrons and the cloth loses electrons.
D The rod loses electrons and the cloth gains electrons.

- 37** Which list contains a material that prevents electrical charge from flowing through it?

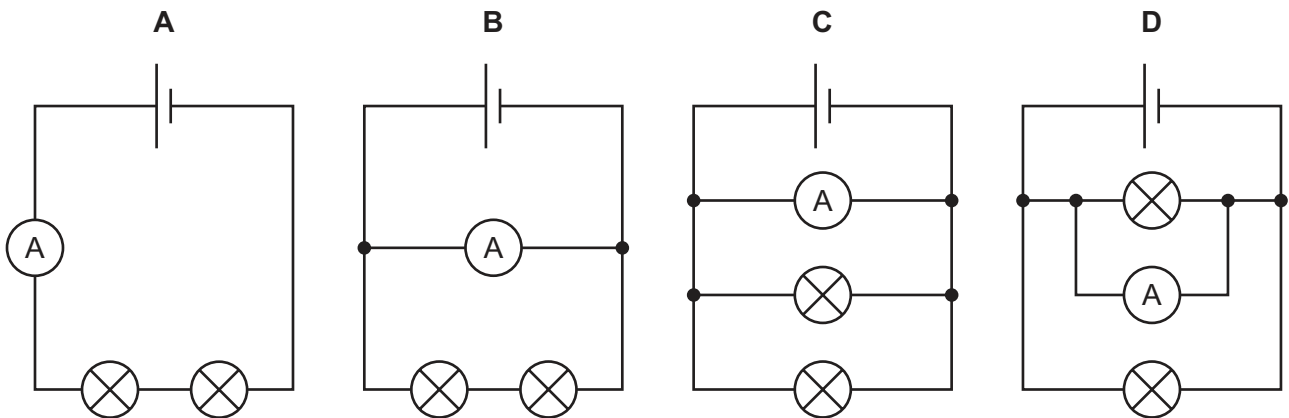
- A** aluminium, copper, mercury
B brass, nickel, steel
C glass, gold, zinc
D silver, iron, lead

38 Which expression is equal to current?

- A charge $\times$ time
- B $\frac{\text{charge}}{\text{time}}$
- C resistance $\times$ potential difference (p.d.)
- D $\frac{\text{resistance}}{\text{potential difference (p.d.)}}$

39 The diagrams show four circuits, each containing an ammeter and two lamps of different resistances.

Which circuit shows an ammeter with a reading equal to the current in each lamp?



40 There is a current of 20 mA in an electrical component when there is a potential difference (p.d.) of 10 V across it.

How much energy is transferred by the component in 30 minutes?

- A 6.0 J
- B 360 J
- C 6000 J
- D 360 000 J

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The Periodic Table of Elements

Group																			
I	II	Key										III	IV	V	VI	VII	VIII		
		1Hhydrogen1																	
3Li lithium 7	4Be beryllium 9	atomic number atomic symbol name relative atomic mass												5B boron 11	6C carbon 12	7N nitrogen 14	8O oxygen 16	9F fluorine 19	10Ne neon 20
11Na sodium 23	12Mg magnesium 24													13Al aluminium 27	14Si silicon 28	15P phosphorus 31	16S sulfur 32	17Cl chlorine 35.5	18Ar argon 40
19K potassium 39	20Ca calcium 40	21Sc scandium 45	22Ti titanium 48	23V vanadium 51	24Cr chromium 52	25Mn manganese 55	26Fe iron 56	27Co cobalt 59	28Ni nickel 59	29Cu copper 64	30Zn zinc 65	31Ga gallium 70	32Ge germanium 73	33As arsenic 75	34Se selenium 79	35Br bromine 80	36Kr krypton 84		
37Rb rubidium 85	38Sr strontium 88	39Y yttrium 89	40Zr zirconium 91	41Nb niobium 93	42Mo molybdenum 96	43Tc technetium —	44Ru ruthenium 101	45Rh rhodium 103	46Pd palladium 106	47Ag silver 108	48Cd cadmium 112	49In indium 115	50Sn tin 119	51Sb antimony 122	52Te tellurium 128	53I iodine 127	54Xe xenon 131		
55Cs caesium 133	56Ba barium 137	57–71 lanthanoids		72Hf hafnium 178	73Ta tantalum 181	74W tungsten 184	75Re rhenium 186	76Os osmium 190	77Ir iridium 192	78Pt platinum 195	79Au gold 197	80Hg mercury 201	81Tl thallium 204	82Pb lead 207	83Bi bismuth 209	84Po polonium —	85At astatine —	86Rn radon —	
87Fr francium —	88Ra radium —	89–103 actinoids		104Rf rutherfordium —	105Db dubnium —	106Sg seaborgium —	107Bh bohrium —	108Hs hassium —	109Mt meitnerium —	110Ds darmstadtium —	111Rg roentgenium —	112Cn copernicium —	113Nh nihonium —	114Fl flerovium —	115Mc moscovium —	116Lv livermorium —	117Ts tennessine —	118Og oganesson —	

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	euporium	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.).