Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/21**

Paper 2 Multiple Choice (Extended) **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.

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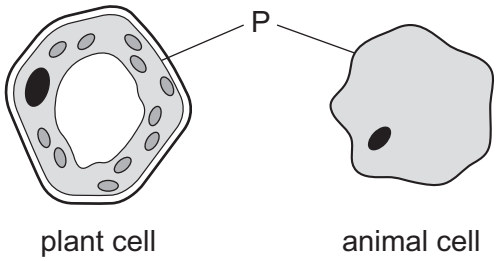
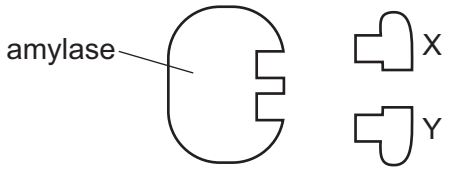
1 The diagram shows a plant cell and an animal cell as seen under a light microscope.



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	✓	✓	✗	✗
B	✓	✗	✗	✓
C	✗	✓	✗	✓
D	✗	✗	✓	✗

key

✓ = yes

✗ = no

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

1 $C_6H_{12}O_6$

2 $6CO_2$

3 $6H_2O$

4 $6O_2$

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

A 1 + 2 → 3 + 4

B 2 + 3 → 1 + 4

C 1 + 4 → 2 + 3

D 3 + 4 → 1 + 2

[Turn over

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

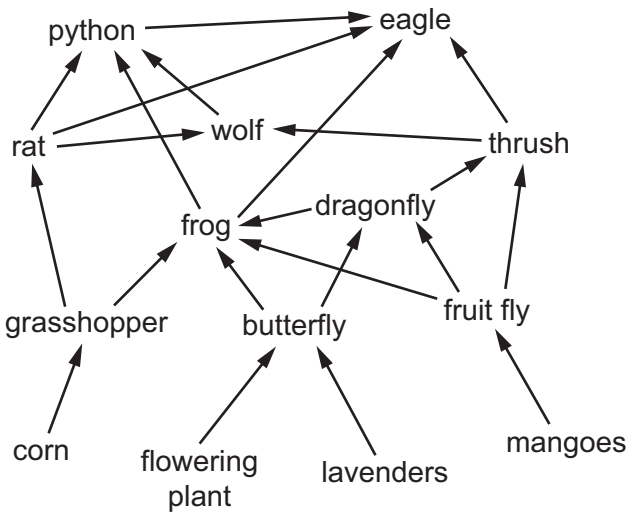
3 a sac of enzymes at one end

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 50 g 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 $Mg(NO_3)_2$.

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.

$$2H{-}H + O{=}O \rightarrow 2H{-}O{-}H$$

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?

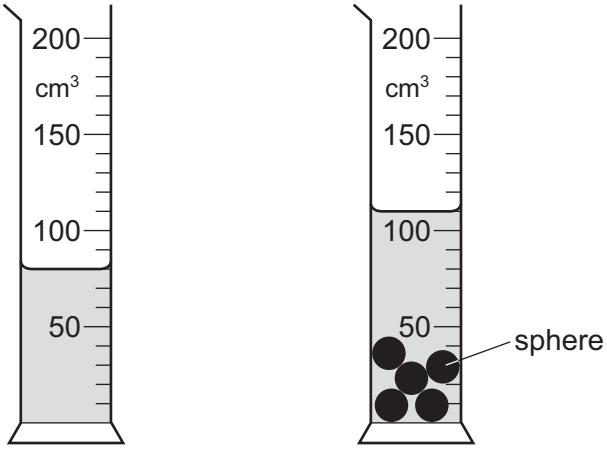
A smaller alkane molecules, smaller alkene molecules and hydrogen

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 × time

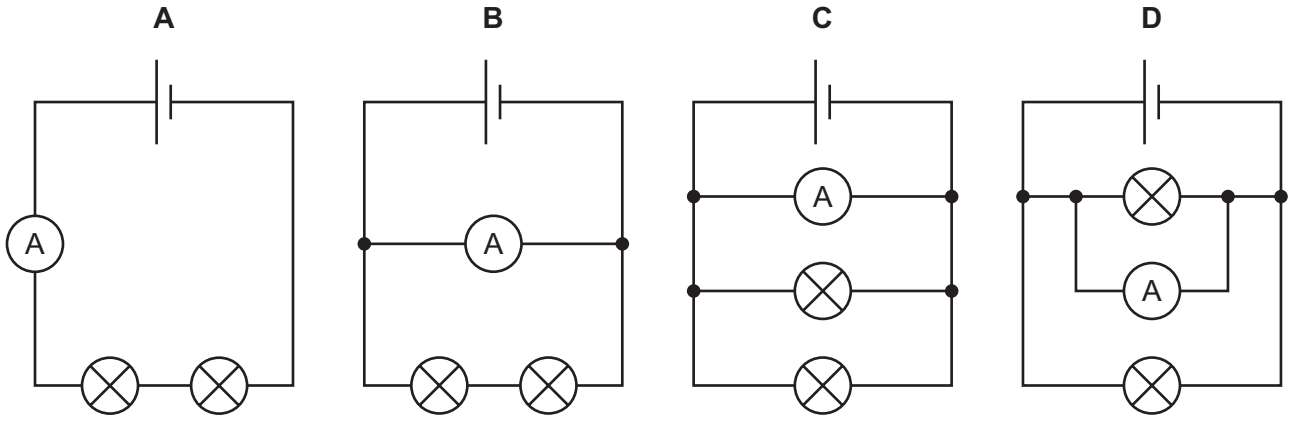
B $\frac{\text{charge}}{\text{time}}$

C resistance × 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											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.).