Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/21**

Paper 2 Multiple Choice (Extended) **May/June 2023**

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.

IB23 06_0653_21/2RP

1 Which characteristic of living organisms involves chemical reactions in cells that break down nutrient molecules and release energy?

A excretion

B nutrition

C respiration

D sensitivity

2 Which structures are present in an animal cell?

	cell membrane	cell wall	cytoplasm	nucleus
A	✓	✗	✓	✓
B	✓	✓	✗	✓
C	✓	✗	✗	✓
D	✗	✓	✓	✗

key

✓ = present

✗ = not present

3 Which row describes the movement of water by osmosis?

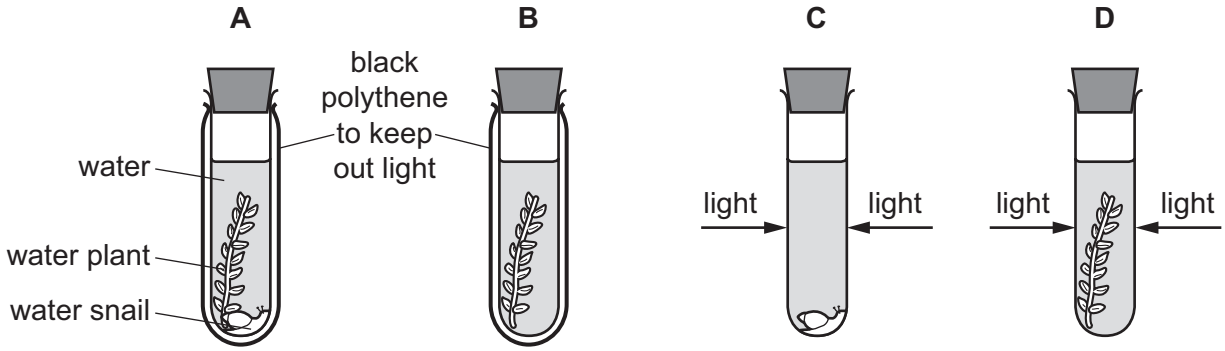
	from a region of	to a region of	through
A	low water potential	high water potential	a partially permeable membrane
B	low water potential	high water potential	a totally permeable membrane
C	high water potential	low water potential	a totally permeable membrane
D	high water potential	low water potential	a partially permeable membrane

4 Which combination of pH and temperature does **not** denature a protease enzyme from the stomach?

	pH	temperature / °C
A	3	37
B	3	60
C	10	37
D	10	60

5 Four test-tubes are set up as shown.

In which test-tube is there an increase in oxygen concentration after 4 hours?



6 What is the purpose of chemical digestion?

A to absorb minerals including calcium and iron

B to pass food out as faeces

C to break down large nutrient molecules into smaller molecules

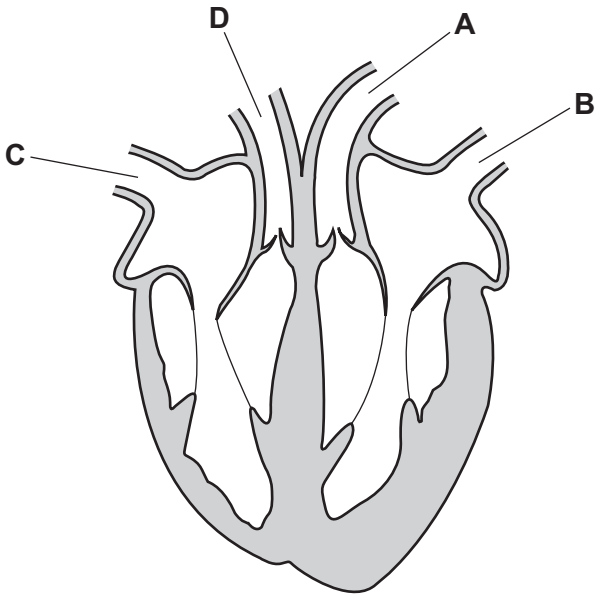
D to secrete enzymes

7 Which row matches the adaptation of a root hair cell to its function?

	adaptation	function
A	large surface area	uptake of water and glucose
B	large surface area	uptake of water and ions
C	small surface area	uptake of water and glucose
D	small surface area	uptake of water and ions

8 The diagram shows a section through the heart.

Which vessel is the pulmonary vein?



9 Which molecule contains the energy that is released in aerobic respiration?

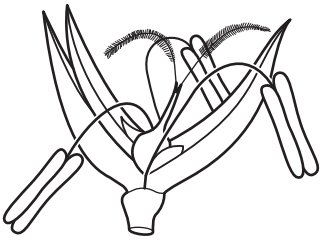
A $C_6H_{12}O_6$ **B** CO_2 **C** H_2O **D** O_2

10 What are features of sexual reproduction?

	fusion of nuclei	nature of offspring
A	no	genetically different
B	yes	genetically identical
C	no	genetically identical
D	yes	genetically different

11 The diagrams show four different flowers.

1



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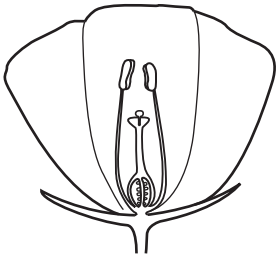

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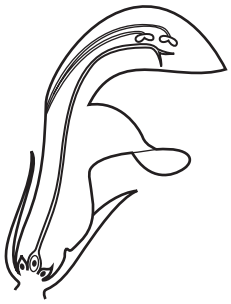


4

Which flowers are wind pollinated?

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

12 Which letter represents the secondary consumer in the food chain shown?

A → **B** → **C** → **D**

13 The flow chart shows some of the steps in the process of eutrophication.

increased availability of nitrates and other ions
↓
step X
↓
increased decomposition after death of producers
↓
step Y
↓
reduction in amount of dissolved oxygen
↓
death of fish requiring dissolved oxygen in water

What is happening at step Y?

A increased aerobic respiration by decomposers

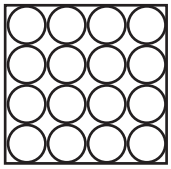
B decreased aerobic respiration by decomposers

C increased growth of aquatic plants

D decreased growth of aquatic plants

14 Which diagram represents particles in a gaseous element?

A



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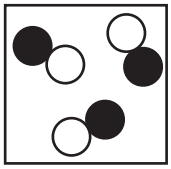

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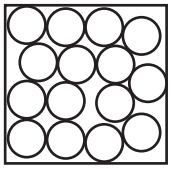

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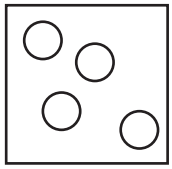


15 What is the relative mass of a proton and the relative charge on a proton?

	relative mass	relative charge
A	0.0005	+1
B	0.0005	–1
C	1	–1
D	1	+1

16 Sodium reacts with chlorine to form sodium chloride.

Which statement describes a change that occurs during this reaction?

A Each chlorine atom loses one proton.

B Each sodium atom loses one electron.

C The mass number of each chlorine atom increases.

D The atomic number of sodium decreases.

17 Sodium burns in oxygen forming sodium oxide.

An equation for this reaction is shown.

$$x\text{Na} + y\text{O}_2 \rightarrow z\text{Na}_2\text{O}$$

What are *x*, *y* and *z*?

	x	*y*	*z*
A	2	1	2
B	2	2	1
C	4	1	2
D	4	2	2

18 Which statement about the electrolysis of molten lead(II) bromide is correct?

A Lead anions move to the anode where they gain electrons.

B Lead anions move to the cathode where they lose electrons.

C Lead cations move to the anode where they lose electrons.

D Lead cations move to the cathode where they gain electrons.

19 Which process is endothermic?

A the reaction of petrol with air in a car engine

B $Cl–Cl \rightarrow Cl + Cl$

C the reaction of potassium with water

D $C + O_2 \rightarrow CO_2$

20 The equation for the reaction of zinc oxide with carbon monoxide is shown.

$$ZnO + CO \rightarrow Zn + CO_2$$

Which statement explains the role of carbon monoxide in this reaction?

A It is the oxidising agent and it is oxidised.

B It is the oxidising agent and it is reduced.

C It is the reducing agent and it is oxidised.

D It is the reducing agent and it is reduced.

21 Dilute hydrochloric acid is tested with universal indicator and with calcium carbonate.

Which row shows the pH and describes the reaction with calcium carbonate?

	pH	reaction with calcium carbonate
A	2	a colourless gas is given off
B	2	no reaction
C	10	a colourless gas is given off
D	10	no reaction

22 The results of two tests on a solution of substance R are shown.

test	result
aqueous sodium hydroxide added	red-brown precipitate formed, insoluble in excess
dilute nitric acid added followed by aqueous silver nitrate added	white precipitate formed

What is R?

A iron(II) carbonate

B iron(III) carbonate

C iron(II) chloride

D iron(III) chloride

23 The character of the elements changes from metallic to non-metallic across a period of the Periodic Table.

Which statement explains this change?

A Metal atoms need to gain electrons to form metal ions.

B It becomes more difficult for elements to lose electrons across a period.

C Non-metal atoms lose electrons more easily than metal atoms.

D Atoms get bigger across a period.

24 Copper oxide and excess carbon are mixed together.

The mass before heating is 12.2 g.

The mixture is heated strongly and allowed to cool.

The mass after heating is 10.4 g.

Why does the mass change?

A Carbon forms carbon dioxide which then combines with the copper oxide.

B Carbon reduces the copper oxide and leaves the test-tube as carbon dioxide.

C Copper oxide loses oxygen, turns into copper and the carbon remains unchanged.

D Carbon oxidises the copper oxide and leaves the test-tube as carbon dioxide.

25 Which statement about both carbon dioxide and methane is correct?

A Increased concentrations of carbon dioxide and methane in the air cause an enhanced greenhouse effect.

B Methane and carbon dioxide are hydrocarbons.

C Respiration increases the concentration of carbon dioxide and methane in the air.

D The combustion of fossil fuels increases the concentration of carbon dioxide and methane in the air.

26 Why are alkanes members of the same homologous series?

A They are all hydrocarbons.

B They have similar physical properties.

C They have the same general formula.

D They all undergo combustion to give carbon dioxide and water.

27 What are the products of cracking large alkane molecules?

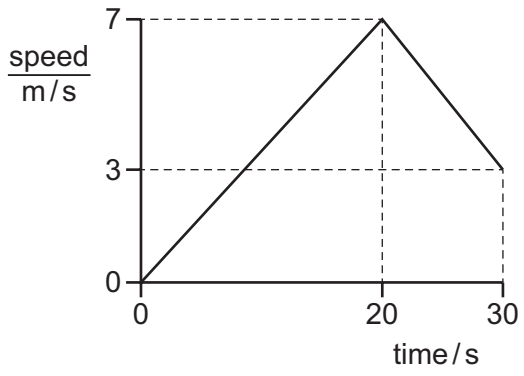
A smaller alkanes only

B smaller alkenes only

C smaller alkanes, alkenes and hydrogen

D smaller alkanes and hydrogen only

28 The graph shows the motion of a cyclist over a period of 30 s.

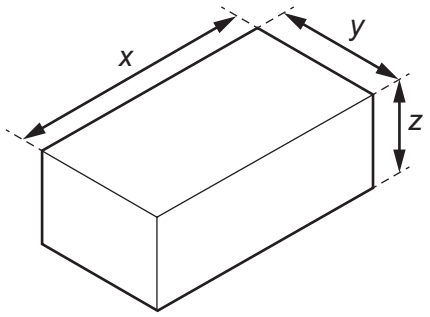


Which distance does the cyclist travel?

A 90 m **B** 105 m **C** 115 m **D** 120 m

29 A solid cuboid block of metal has density ρ.

The diagram shows its dimensions.



Which expression is used to calculate the mass of the block?

A $\frac{\rho}{xy}$ **B** $\frac{\rho}{xyz}$ **C** ρxy **D** ρxyz

30 A spring that obeys Hooke's law is fixed at one end.

When the spring is pulled by a force of 30 N, it has a stretched length of 14 cm.

When the spring is pulled by a force of 48 N, it has a stretched length of 20 cm.

What is the spring constant of the spring?

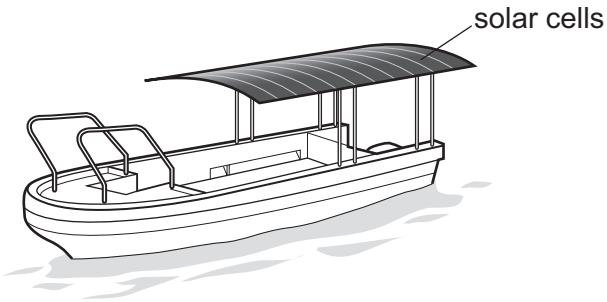
A 2.1 N / cm **B** 2.4 N / cm **C** 3.0 N / cm **D** 8.0 N / cm

31 A 3.0 kW electric kettle is switched on for 30 seconds.

Which row gives the equation that defines power and gives the energy transferred in the kettle?

	equation	energy / J
A	$P = \frac{\Delta E}{t}$	90
B	$P = \frac{\Delta E}{t}$	90 000
C	$P = \Delta E t$	0.10
D	$P = \Delta E t$	100

32 Solar cells mounted on a boat produce electrical energy to power the motor.



Which resource does this energy come from?

A hydroelectric energy

B light energy

C tidal energy

D wind energy

33 The molecules in a liquid are close together.

What are other features of the molecules in a liquid?

A They are arranged in a regular pattern but change positions with each other.

B They are arranged in a regular pattern and vibrate about fixed positions.

C They are arranged randomly and change positions with each other.

D They are arranged randomly and vibrate about fixed positions.

34 What is a method of thermal conduction in a metal?

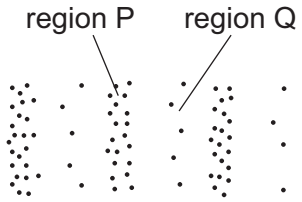
A electrons moving through the metal, hitting distant molecules

B electrons vibrating and passing on energy to other electrons

C molecules moving through the metal, hitting other molecules

D protons moving through the metal, hitting distant molecules

35 The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.



What are the names of regions P and Q, and which type of wave is represented?

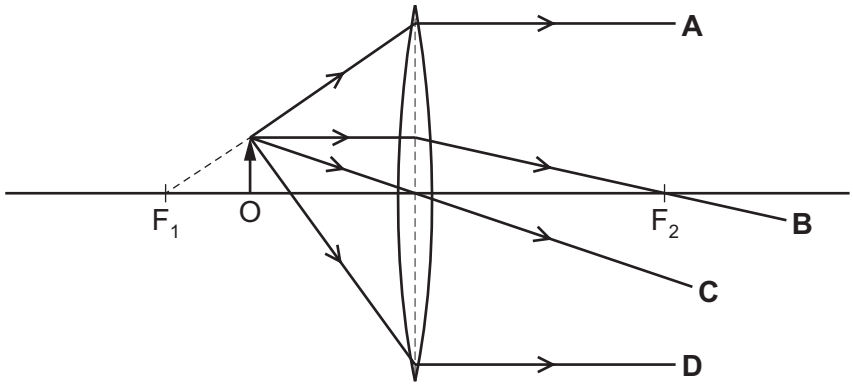
	region P	region Q	type of wave
A	compression	rarefaction	longitudinal
B	compression	rarefaction	transverse
C	rarefaction	compression	longitudinal
D	rarefaction	compression	transverse

36 The diagram shows an object placed at position O near a thin converging lens.

F_1 and F_2 are the principal focuses of the lens.

A student draws four rays that leave the top of the object and pass through the lens.

Which labelled ray is **not** correct?



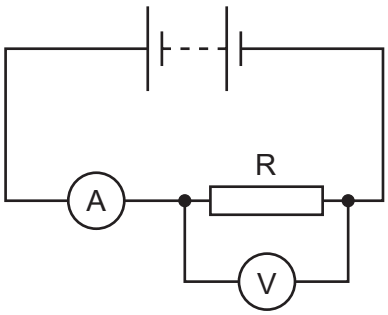
37 The unit of electric charge is the coulomb (C).

Which combination of other units is equivalent to the coulomb?

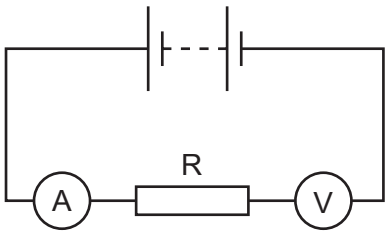
A A/s **B** As **C** V/A **D** VA

38 Which circuit is used to determine the resistance of resistor R?

A



B



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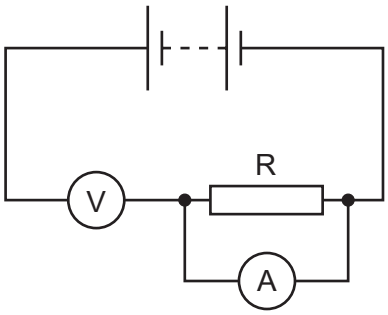

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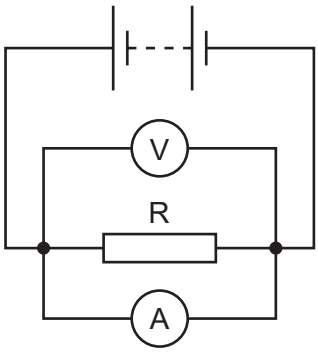
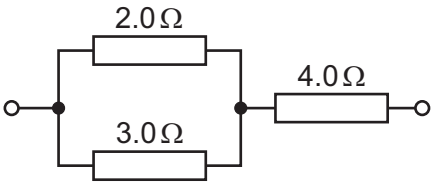
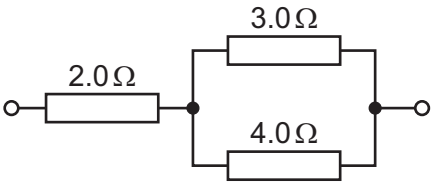


39 Which arrangement of resistors has the smallest combined resistance?

A



B



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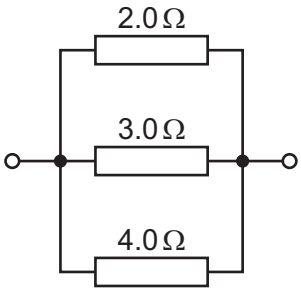

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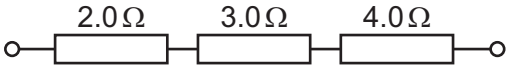
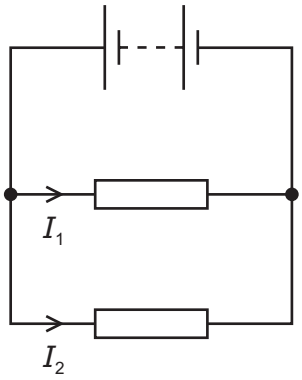


40 The diagram shows two resistors connected in parallel to a battery.

Currents I_1 and I_2 are labelled.

Current I_1 is greater than current I_2.



Which calculation gives the current in the battery?

A $I_1 + I_2$ **B** $I_1 - I_2$ **C** $I_1 \times I_2$ **D** $\frac{(I_1 + I_2)}{2}$

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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.).