Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/21**

Paper 2 Multiple Choice (Extended) **May/June 2022**

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.

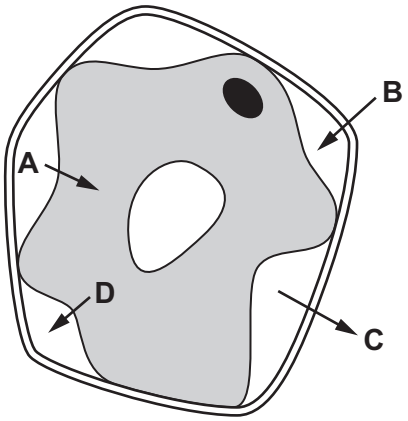
IB22 06_0653_21/2RP

1 What is the outermost layer of an animal cell and a plant cell?

	animal cell	plant cell
A	cell membrane	cell membrane
B	cell membrane	cell wall
C	cell wall	cell membrane
D	cell wall	cell wall

2 The plant cell in the diagram is in a concentrated salt solution.

Which arrow represents osmosis?



3 The enzyme salivary amylase starts digesting starchy foods in the mouth.

This stops when the food reaches the stomach.

Why does this happen?

A The acid in the stomach slows down all reactions.

B The shape of the active site of the enzyme is altered by the low pH.

C The kinetic energy of molecules is reduced by acids.

D The shape of the substrate molecules is changed.

4 Which foods are rich in carbohydrate?

1 eggs

2 meat

3 potatoes

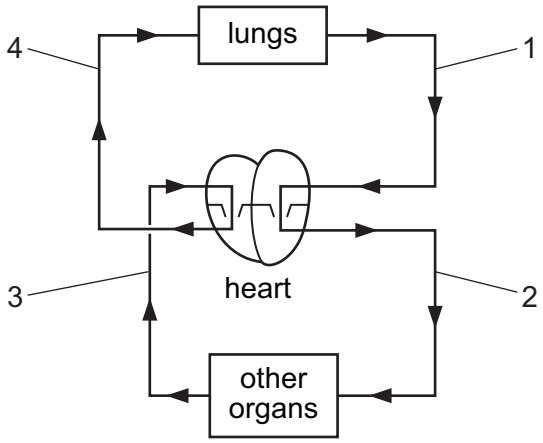
4 rice

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

5 Which row is correct for a protease enzyme?

	where secreted	molecule acted on	end product
A	stomach	protein	amino acids
B	pancreas	protein	fatty acid and glycerol
C	stomach	lipids	amino acids
D	pancreas	lipids	fatty acid and glycerol

6 The diagram shows the circulation of blood through the heart, lungs and other organs.



Which row gives a correct comparison of oxygen concentration in the blood in two of the numbered vessels?

	lower oxygen concentration	higher oxygen concentration
A	1	2
B	1	3
C	3	4
D	4	2

7 Which row shows the features of an efficient gas exchange surface in mammals?

	alveoli wall	blood supply	surface area
A	thick	low	large
B	thick	high	small
C	thin	high	large
D	thin	low	small

[Turn over

8 Physical activity affects our rate and depth of breathing.

What happens during **increased** physical activity?

	rate of breathing	depth of breathing
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

9 Which responses occur as a result of adrenaline secretion?

	increased breathing rate	decreased pupil diameter	increased pulse rate
A	✓	✗	✗
B	✓	✗	✓
C	✗	✓	✓
D	✗	✓	✗

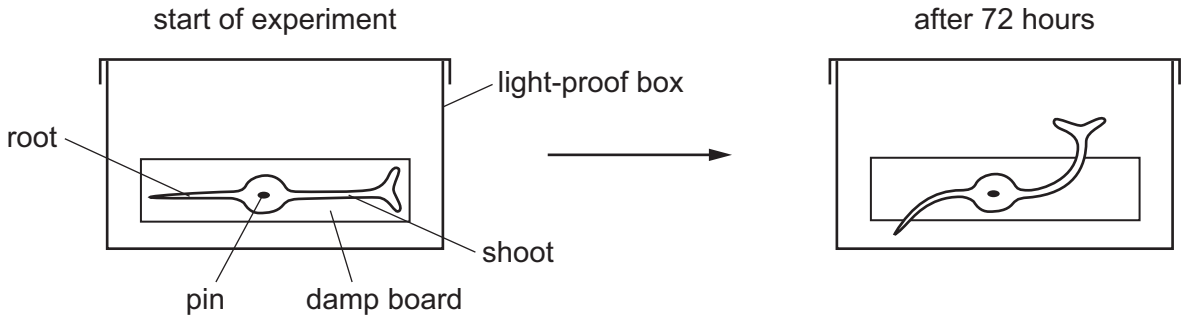
key

✓ = does occur

✗ = does not occur

10 A plant seedling is pinned horizontally onto a damp board inside a light-proof box.

The diagrams show the seedling at the start of the experiment and after 72 hours.



Which response is shown by the root and the shoot?

	root	shoot
A	gravitropism	gravitropism
B	gravitropism	phototropism
C	phototropism	gravitropism
D	phototropism	phototropism

11 During sexual intercourse the penis transfers sperm cells to the vagina.

What is the pathway for sperm cells from their site of production to the vagina?

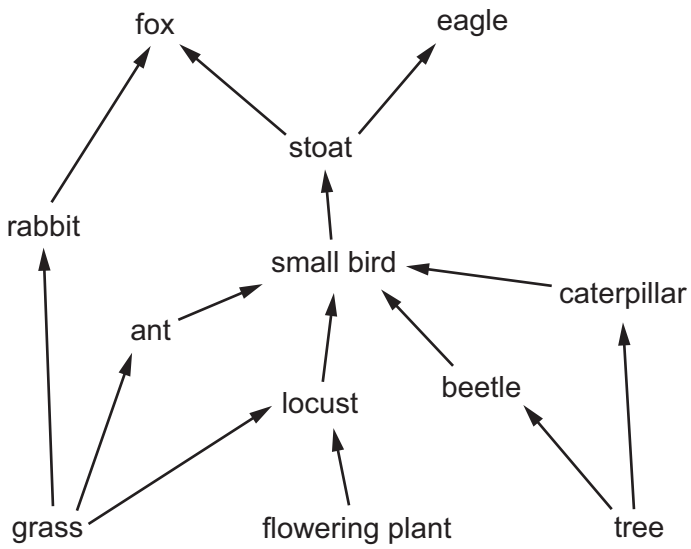
A sperm ducts → testes → urethra → vagina

B testes → sperm ducts → urethra → vagina

C testes → urethra → sperm ducts → vagina

D urethra → testes → sperm ducts → vagina

12 The diagram shows part of a food web.



Which animal is a quaternary consumer **only**?

A eagle

B fox

C locust

D small bird

13 In the process of eutrophication, what causes the increased growth of producers?

A increased carbon dioxide availability

B increased decomposition

C increased nitrate ion availability

D increased oxygen availability

[Turn over

14 Which row describes a chemical change?

	test	result
A	one end of a piece of aluminium is heated	the other end gets hot
B	calcium carbonate is heated	carbon dioxide is made
C	a piece of iron is heated	it becomes more malleable
D	a beaker of water is heated	steam is made

15 What describes a solvent?

A a solid that dissolves in a liquid

B the amount of solid that dissolves in a liquid

C the liquid in which a solid dissolves

D the mixture formed when a solid dissolves in a liquid

16 The formula of sodium phosphate is Na_3PO_4.

The formula of aluminium chloride is $AlCl_3$.

What is the formula of aluminium phosphate?

A $AlPO_4$ **B** $Al(PO_4)_3$ **C** $Al_2(PO_4)_3$ **D** Al_3PO_4

17 Magnesium reacts with dilute hydrochloric acid.

Which statement explains why the rate of this reaction increases when the concentration of the acid is increased?

A A greater proportion of the particles have the minimum energy to react.

B The particles are closer together and the particles collide more frequently.

C The particles collide more frequently and more of the particles have the minimum energy to react.

D The particles collide more frequently and the activation energy of the reaction is reduced.

18 In which equation is the <u>underlined</u> substance acting as an oxidising agent?

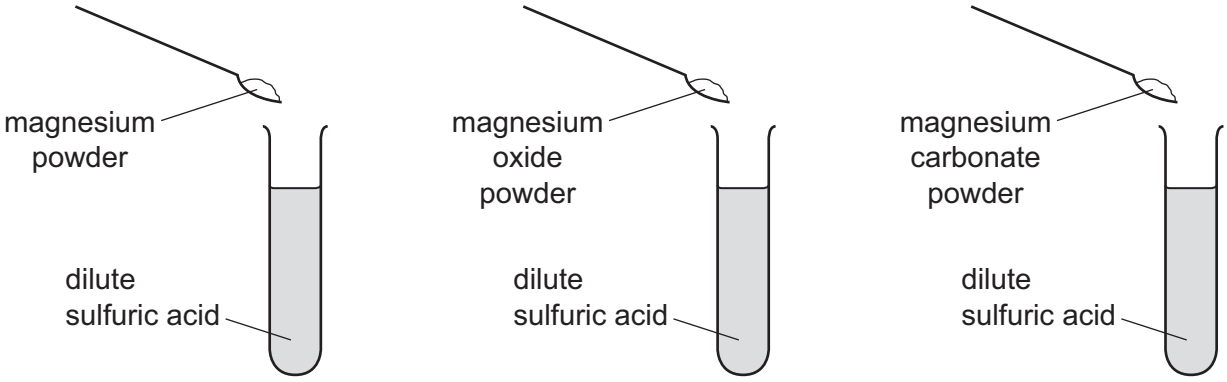
A $CaCO_3 + 2\underline{HCl} \rightarrow CaCl_2 + CO_2 + H_2O$

B $Fe_2O_3 + 3\underline{CO} \rightarrow 2Fe + 3CO_2$

C $2Mg + O_2 \rightarrow 2\underline{MgO}$

D $\underline{ZnO} + C \rightarrow Zn + CO$

19 Three powders are added to dilute sulfuric acid, as shown.



Which powders react to produce water?

	magnesium	magnesium oxide	magnesium carbonate
A	✓	✓	✗
B	✓	✗	✗
C	✗	✓	✓
D	✗	✗	✓

key

✓ = does produce water

✗ = does not produce water

20 Elements X, Y and Z are in Group I of the Periodic Table.

Some information about these elements is shown.

	melting point / °C	density / g / cm^3
X		1.53
Y	98	
Z	63	0.86

Which row correctly identifies elements X, Y and Z?

	X	Y	Z
A	potassium	sodium	rubidium
B	rubidium	potassium	sodium
C	rubidium	sodium	potassium
D	sodium	rubidium	potassium

[Turn over

21 The results of two tests on substance Q are shown.

test	result
add dilute hydrochloric acid to solid Q	bubbles of colourless gas, R, which turns limewater milky
add aqueous sodium hydroxide to a solution of Q	green precipitate

Which cation is present in Q and what is gas R?

	cation present in Q	gas R
A	iron(II)	carbon dioxide
B	iron(II)	chlorine
C	iron(III)	carbon dioxide
D	iron(III)	chlorine

22 The equation for the reaction between zinc and aqueous iron(II) sulfate is shown.

$$Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$$

Which statements about this reaction are correct?

1 Zinc atoms give electrons to iron ions.

2 Iron atoms have a greater tendency to form positive ions than zinc atoms.

3 Zinc displaces iron because it is more reactive than iron.

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

23 Iron is extracted from hematite in the blast furnace.

Coke and hematite are added at the top of the blast furnace, and hot air enters at the bottom.

Which statements are correct?

1 Coke burns to produce high temperatures.

2 Carbon monoxide is formed by the reaction of carbon with carbon dioxide.

3 Hematite contains iron(III) oxide which is oxidised by carbon monoxide.

4 The oxygen needed for the combustion of the coke comes from the hematite.

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

24 Which statement about a chemical test for water is correct?

A Anhydrous cobalt(II) chloride turns blue.

B Anhydrous cobalt(II) chloride turns white.

C Anhydrous copper(II) sulfate turns blue.

D Anhydrous copper(II) sulfate turns white.

25 Alkenes are hydrocarbons that belong to the same homologous series.

What are the general properties of a homologous series?

1 same general formula

2 same melting point

3 similar chemical properties

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

26 Methane, ethane and propane are all alkanes. Their formulae are shown.

methane, CH_4

ethane, C_2H_6

propane, C_3H_8

Which statement is **not** correct?

A All three compounds are hydrocarbons.

B All three compounds burn.

C Methane is the main constituent of natural gas.

D Propane burns completely to form carbon dioxide and hydrogen.

27 Which substance rapidly turns aqueous bromine from orange to colourless?

A ethane

B ethanol

C ethene

D methane

[Turn over

28 Which statement about forces is always correct?

A A resultant force is needed to keep an object moving at constant speed in a straight line.

B Air resistance acting on an object falling in still air causes its speed to increase.

C Friction on an object sliding along rough ground acts in the opposite direction to its motion.

D No forces act on any object that is at rest.

29 A table of mass 20 kg is supported on four legs. The area of contact between each leg and the ground is $1.0 \times 10^{-3}\,m^2$.

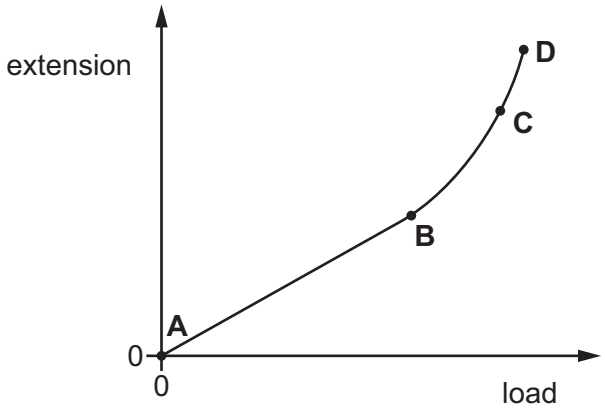
The value of the gravitational field strength g is 10 N / kg.

How much pressure is exerted on the ground by each leg?

A 5000 Pa **B** 20 000 Pa **C** 50 000 Pa **D** 200 000 Pa

30 The diagram shows an extension–load graph for a spring.

Which labelled point is the limit of proportionality of the spring?

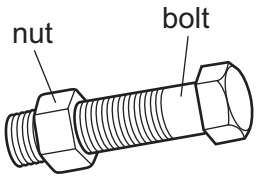


31 A boy of mass 80 kg is running at a speed of 4.0 m / s.

What is his kinetic energy?

A 160 J **B** 320 J **C** 640 J **D** 1280 J

32 A mechanic cannot remove a large steel nut from a steel bolt because it is too tight.



What does the mechanic do to help remove the nut?

A cool the nut and heat the bolt

B heat the bolt only

C heat the nut and the bolt through the same temperature rise

D heat the nut only

33 A metal rod is heated at one end.

Thermal energy moves from the hotter end to the colder end.

How do molecules and free electrons transfer thermal energy along the rod?

	molecules	free electrons
A	move from the hotter end to the colder end	move from the hotter end to the colder end
B	move from the hotter end to the colder end	pass kinetic energy to neighbouring electrons
C	pass kinetic energy to neighbouring molecules	move from the hotter end to the colder end
D	pass kinetic energy to neighbouring molecules	pass kinetic energy to neighbouring electrons

34 Light travels at a speed of 3.0×10^8 m/s in a vacuum.

A radio station transmits radio waves at a frequency of 9.1×10^7 Hz.

What is the wavelength of the radio waves?

A 0.30 m **B** 0.33 m **C** 3.0 m **D** 3.3 m

35 Which region of the electromagnetic spectrum is used in remote controllers to control a television?

A microwaves

B infrared

C ultraviolet

D visible light

36 Where does sound travel at the greatest speed?

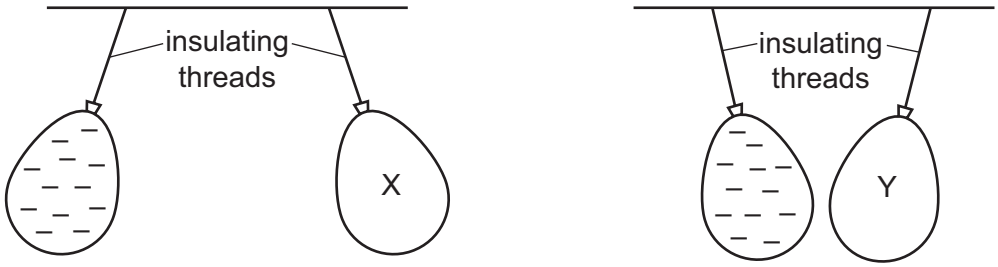
A in a gas

B in a liquid

C in a solid

D in a vacuum

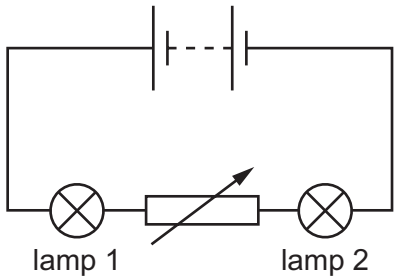
37 Two balloons X and Y are suspended by insulating threads. They are each held near a negatively charged balloon. The balloons hang as shown.



What is the charge on balloon X and what is the charge on balloon Y?

	balloon X	balloon Y
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

38 A circuit contains two lamps and a variable resistor.



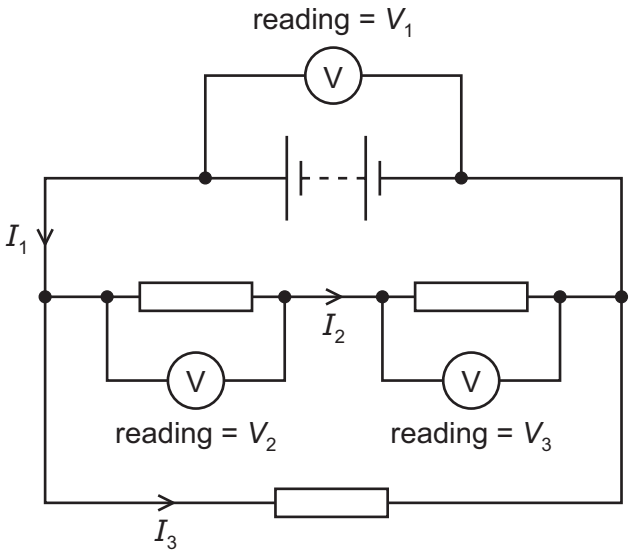
The resistance of the variable resistor is increased.

What happens to the brightness of lamp 1 and what happens to the brightness of lamp 2?

	brightness of lamp 1	brightness of lamp 2
A	decreases	decreases
B	decreases	increases
C	no change	decreases
D	no change	increases

39 The diagram shows a circuit that includes three resistors, a battery and three voltmeters.

Readings V_1, V_2 and V_3 on the voltmeters, and currents I_1, I_2 and I_3, are labelled.



Which row gives the relationships between the currents and between the voltages?

	currents	voltages
A	$I_1 = I_2 + I_3$	$V_1 = V_2 + V_3$
B	$I_1 = I_2 + I_3$	$V_1 + V_2 = V_3$
C	$I_1 + I_2 = I_3$	$V_1 = V_2 + V_3$
D	$I_1 + I_2 = I_3$	$V_1 + V_2 = V_3$

40 There is a current I in a resistor when there is a potential difference (p.d.) V across it.

Which quantity is equal to the product IV?

A the charge passing through the resistor

B the energy transferred in the resistor

C the power transferred in the resistor

D the resistance of the resistor

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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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).