Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/22**

Paper 2 Multiple Choice (Extended) **May/June 2021**

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 What is respiration?

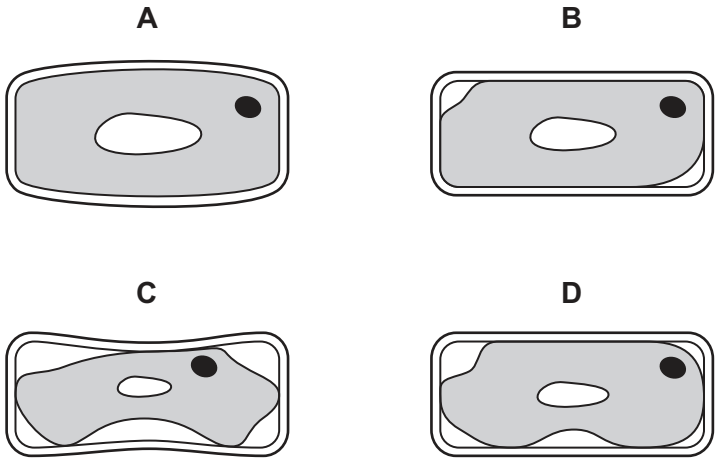
A breakdown of food by enzymes in the alimentary canal

B breathing to supply oxygen to cells

C release of carbon dioxide from the lungs

D release of energy for body activities

2 Which cell is most flaccid?



3 Which row matches the nutrient to the chemical elements that it contains?

	nutrient	carbon	hydrogen	oxygen	nitrogen
A	fat	✓	✓	✗	✗
B	protein	✓	✓	✓	✓
C	starch	✓	✗	✓	✓
D	sugar	✗	✓	✓	✓

key
✓ = contains element
✗ = does not contain element

4 Which type of molecule are enzymes?

A fat

B carbohydrate

C protein

D DNA

5 The balanced equation for photosynthesis is shown.

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} \mathbf{X} + 6O_2$$

What is **X**?

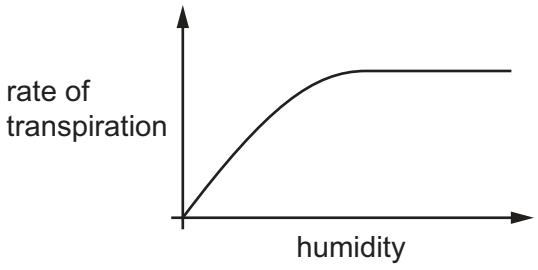
A $C_6H_{12}O_6$ **B** $C_6H_{12}O_{12}$ **C** $C_{12}H_6O_6$ **D** $C_{12}H_{12}O_2$

6 Which row about secretions in the alimentary canal is correct?

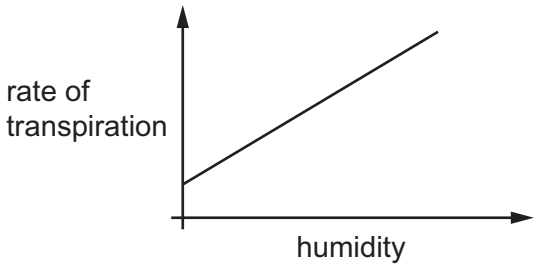
	substance secreted	action	area of alimentary canal
A	amylase	breaks down fats into fatty acids and glycerol	small intestine
B	bile	breaks down fats into fatty acids and glycerol	small intestine
C	hydrochloric acid	breaks down proteins to amino acids	stomach
D	protease	breaks down proteins to amino acids	stomach

7 Which graph shows the effect of atmospheric humidity on the rate of transpiration if all other factors are kept constant?

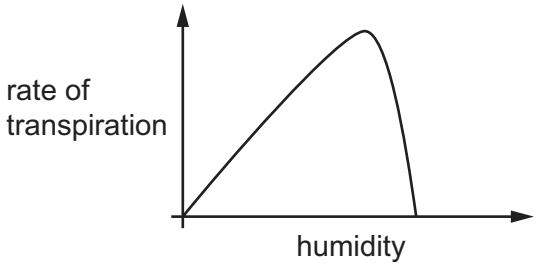
A



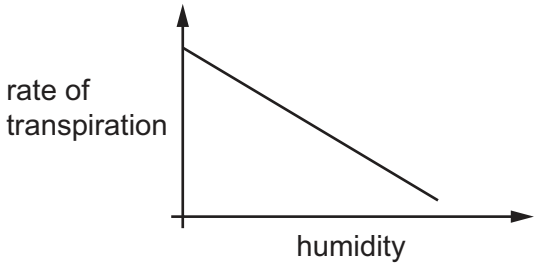
B



C



D



8 A child blows into a rubber balloon.

What is the percentage of oxygen inside the balloon?

A 0% **B** 4% **C** 16% **D** 21%

9 A student is in a dangerous situation and adrenaline is released into the blood. The table shows changes to pulse rate, breathing rate and pupil diameter.

Which row correctly describes the effect of adrenaline?

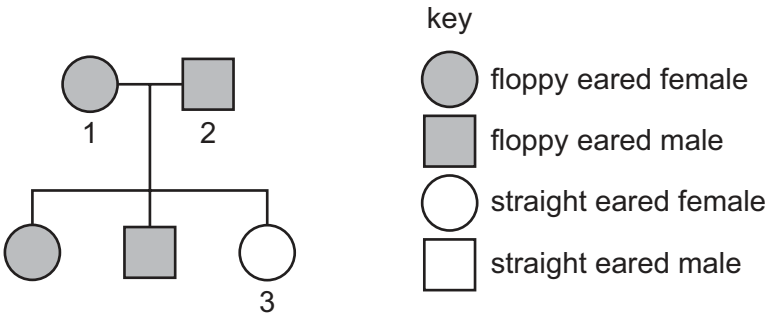
	pulse rate	breathing rate	pupil diameter
A	decrease	increase	decrease
B	decrease	decrease	increase
C	increase	increase	increase
D	increase	decrease	decrease

10 Which row about human gametes is correct?

	gamete	flagellum present	energy store present	shows motility
A	female	✓	✓	✓
B	female	✗	✓	✗
C	male	✓	✓	✗
D	male	✗	✗	✓

key
✓ = yes
✗ = no

11 Two rabbits with floppy ears were crossed and produced three offspring. The pedigree diagram of the cross is shown.



Which row is correct for this cross?

	genotype of 1	genotype of 2	dominant allele
A	heterozygous	heterozygous	floppy ears
B	homozygous	homozygous	floppy ears
C	heterozygous	heterozygous	straight ears
D	homozygous	homozygous	straight ears

12 Why do food chains usually have fewer than five trophic levels?

A All the carnivores consume herbivores.

B The energy passed on reduces from one trophic level to the next.

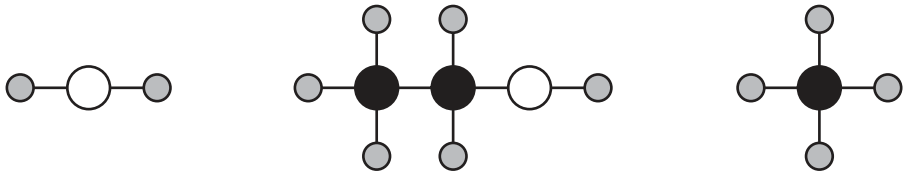
C There is less protein in each individual higher up the chain.

D There is only one producer in each chain.

13 Which row is correct for eutrophication?

	source of nitrates	effects of nitrates on producers	result of increase in decomposers
A	fertilisers	increase growth	carbon dioxide decreases
B	fertilisers	decrease growth	oxygen increases
C	sewage	decrease growth	carbon dioxide increases
D	sewage	increase growth	oxygen decreases

14 The structures of some substances are shown.



water ethanol methane

Which row shows the total number of different elements and the total number of atoms in the three structures?

	total number of different elements	total number of atoms
A	3	9
B	3	17
C	7	9
D	7	17

15 Which method can be used to separate graphite from dilute nitric acid?

A chromatography

B crystallisation

C distillation

D filtration

16 Aqueous copper(II) sulfate is electrolysed using copper electrodes.

What is the half-equation for the reaction at the cathode?

A $Cu + 2e^- \rightarrow Cu^{2+}$

B $Cu \rightarrow Cu^{2+} + 2e^-$

C $Cu^{2+} + 2e^- \rightarrow Cu$

D $Cu^{2+} \rightarrow Cu + 2e^-$

17 Phosphoric acid contains phosphate ions, PO_4^{3-}.

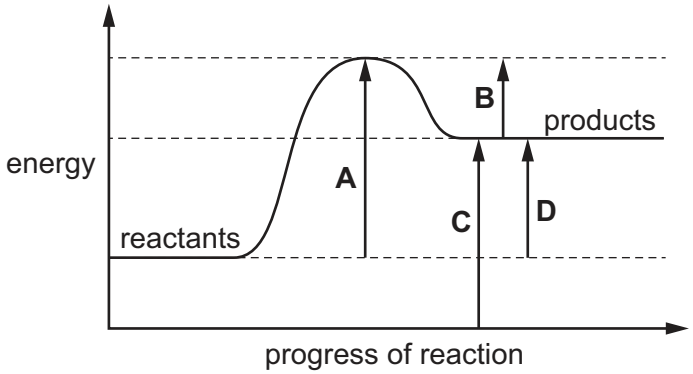
Phosphoric acid reacts with calcium hydroxide, $Ca(OH)_2$, to form the salt calcium phosphate.

What is the formula of calcium phosphate?

A $CaPO_4$ **B** $Ca(PO_4)_3$ **C** Ca_2PO_4 **D** $Ca_3(PO_4)_2$

18 An energy level diagram for a reaction is shown.

Which arrow shows the overall energy change for the reaction?



19 Which changes show oxidation?

1 $2Br^- \rightarrow Br_2$

2 $Ca \rightarrow Ca^{2+}$

3 $Fe^{3+} \rightarrow Fe^{2+}$

4 $O_2 \rightarrow 2O^{2-}$

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

20 What reacts with ammonia gas?

	hydrochloric acid	sodium hydroxide
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = reacts

✗ = does not react

21 Which row describes trends in the properties of Group I elements as the group is descended?

	melting point	reactivity with water
A	decreasing	decreasing
B	decreasing	increasing
C	increasing	decreasing
D	increasing	increasing

22 Some observations from an investigation are shown.

1 Metal W does not react with dilute hydrochloric acid.

2 Metal X does not react with cold water but does react with dilute hydrochloric acid.

3 Metal Y reacts with cold water.

4 Metal Z does not react with dilute hydrochloric acid but does react with aqueous ions of metal W.

What is the order of reactivity of the metals?

	most reactive →			least reactive
A	W	X	Z	Y
B	W	Z	X	Y
C	Y	X	Z	W
D	Y	Z	X	W

23 Which statement explains how oxides of nitrogen are formed in a car engine?

A Nitrogen from the air reacts with the fuel.

B Oxygen and nitrogen from the air react together.

C Oxygen from the air reacts with sulfur impurities in the fuel.

D Oxygen from the air reacts with the fuel.

24 Other than hydrogen and oxygen, which substance provides only **one** of the essential elements for plant growth?

A K_3PO_4 **B** KNO_3 **C** $(NH_4)_3PO_4$ **D** NH_4NO_3

25 Concentrated sulfuric acid is made by the Contact process.

During this process, sulfur trioxide is added to concentrated sulfuric acid rather than to water.

Which statement about the reaction of sulfur trioxide with water is correct?

A It produces an acid mist.

B It is endothermic.

C It produces oleum, $H_2S_2O_7$.

D The rate of reaction is low.

26 What are the products of the thermal decomposition of calcium carbonate, $CaCO_3$?

A calcium and carbon dioxide

B calcium, carbon and oxygen

C calcium oxide and carbon dioxide

D calcium oxide and carbon monoxide

27 Reactants for three chemical processes are listed.

1 ethene + steam

2 ethene + hydrogen

3 ethene in addition polymerisation

Which processes form saturated hydrocarbons?

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

28 A student measures the diameter and the length of a long, thin wire.

Which apparatus is used to give accurate measurements?

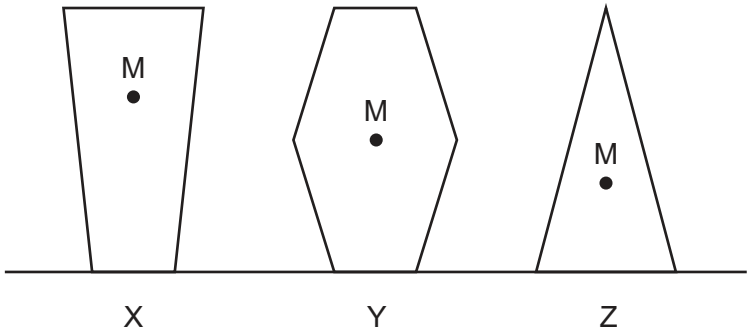
	diameter	length
A	metre rule	metre rule
B	metre rule	micrometer screw gauge
C	micrometer screw gauge	metre rule
D	micrometer screw gauge	micrometer screw gauge

29 A girl runs 5000 m in 1200 seconds and then walks a further 3000 m in 1800 seconds.

What is her average speed for this journey?

A 1.7 m/s **B** 2.7 m/s **C** 2.9 m/s **D** 5.8 m/s

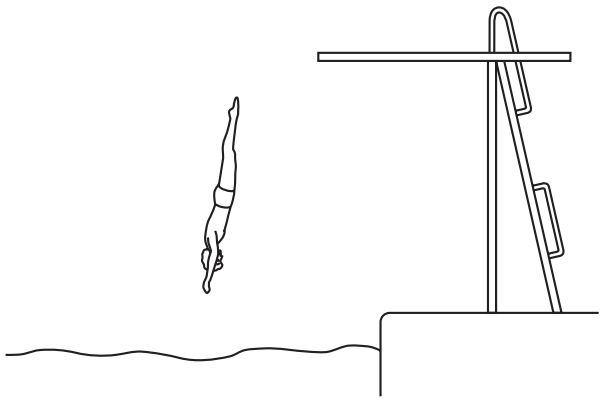
30 Three objects X, Y and Z are at rest on a table. The centre of mass of each object is labelled M.



What is the order of stability of these three objects, from most stable to least stable?

A $X \rightarrow Y \rightarrow Z$ **B** $Y \rightarrow Z \rightarrow X$ **C** $X \rightarrow Z \rightarrow Y$ **D** $Z \rightarrow Y \rightarrow X$

31 The diagram shows a man diving into water.



Which form of energy is increasing as he accelerates downwards through the air?

A chemical

B elastic potential (strain)

C gravitational potential

D kinetic

32 The Sun is an important energy resource.

Which energy source powers the Sun?

A chemical

B geothermal

C nuclear fission

D nuclear fusion

33 Which change increases the sensitivity of a liquid-in-glass thermometer?

A decreasing the diameter of the capillary bore

B decreasing the length of the capillary bore

C increasing the diameter of the capillary bore

D increasing the length of the capillary bore

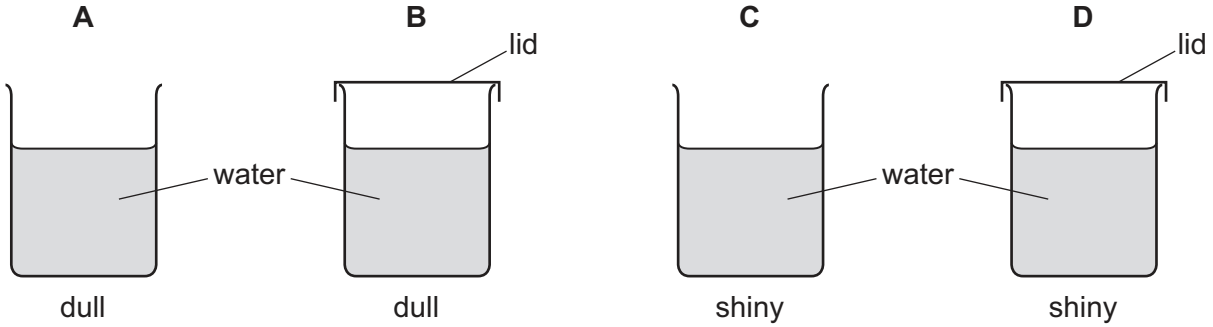
34 Four identical metal cans contain equal quantities of water at 80 °C.

The outer surfaces of two of the cans are dull and the outer surfaces of the other two cans are shiny.

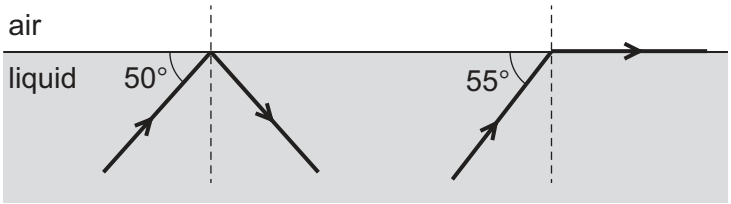
Lids are put on two of the cans, as shown.

All the cans are allowed to cool.

Which can cools the fastest?



35 The diagram represents the surface of a transparent liquid. Two rays of light are travelling in the liquid. They both reach the surface. The path of each ray is shown.



What is the critical angle for this liquid?

A 35° **B** 40° **C** 50° **D** 55°

36 A wire is 50 cm long and has a resistance of 16 Ω.

A second wire is made of the same material. It is 75 cm long and has twice the cross-sectional area of the first wire.

What is the resistance of the second wire?

A 6.0 Ω **B** 12 Ω **C** 32 Ω **D** 48 Ω

37 Which statements about the current–voltage characteristic of a filament lamp are correct?

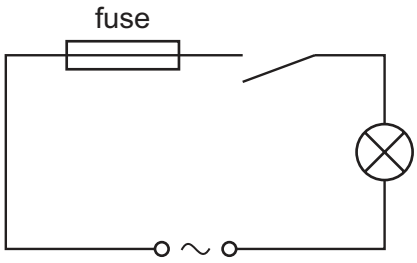
1 It is a curve.

2 It passes through the origin.

3 It shows current increasing as voltage increases.

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

38 A student connects the circuit shown.



When the switch is closed the fuse blows and stops the current.

What is a possible reason for this?

A The current rating of the fuse is too high.

B The current is too large.

C The lamp is too dim.

D The voltage is too small.

39 A magnet is moved in and out of a coil and an electromotive force (e.m.f.) is induced.

How can the size of the induced e.m.f. be decreased?

A Add more turns to the coil.

B Move the magnet more quickly.

C Move the magnet more slowly.

D Turn the magnet around before moving it in and out.

40 A radioactive nucleus emits a β-particle.

What happens to the proton number (atomic number) of the nucleus?

A It stays the same.

B It increases by 1.

C It decreases by 2.

D It decreases by 4.

BLANK PAGE

BLANK PAGE

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.).