



Cambridge IGCSE™

CO-ORDINATED SCIENCES

0654/22

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

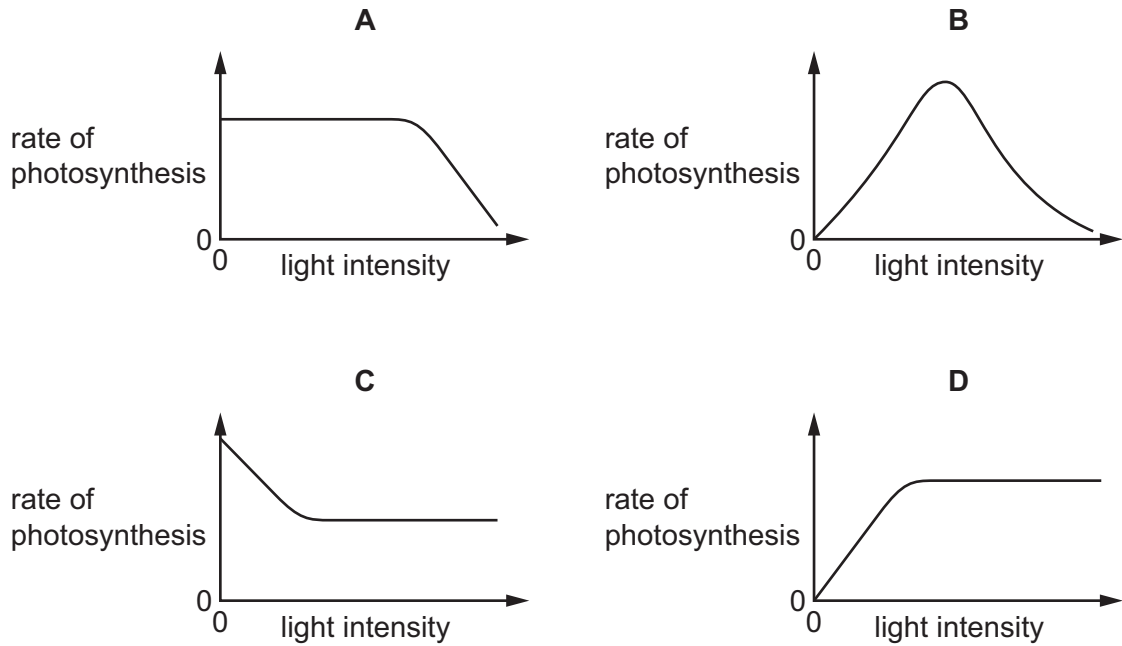
- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.

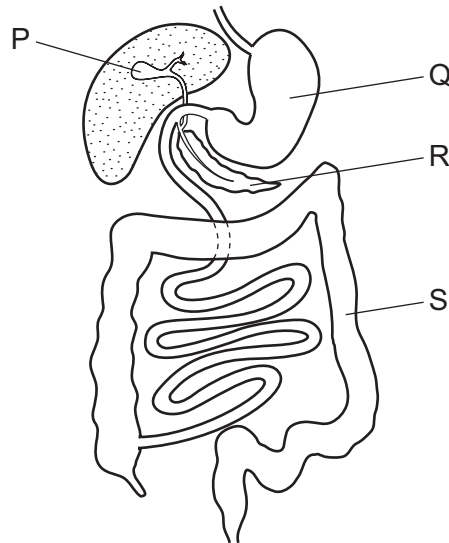


- 1 Which statement about the characteristics of living organisms is correct?
- A Excretion is the chemical reactions in cells that release energy.
 - B Nutrition is the taking in of materials for energy, growth and development.
 - C Respiration is the process that makes more of the same kind.
 - D Sensitivity is the removal of toxic materials and excess substances.
- 2 Which statement about cells is correct?
- A Cell membranes are found only in animal cells.
 - B Cell membranes are found only in plant cells.
 - C Cell walls are found only in animal cells.
 - D Cell walls are found only in plant cells.
- 3 Which reagent is used to test for the presence of protein in a food sample?
- A Benedict's solution
 - B biuret
 - C ethanol
 - D iodine
- 4 Which effect will temperature change have on enzyme activity?
- A High temperatures will denature them, making it difficult for substrate molecules to fit in the active site.
 - B High temperatures will denature them, making it easy for substrate molecules to fit in the active site.
 - C Low temperatures will denature them, making it difficult for substrate molecules to fit in the active site.
 - D Low temperatures will denature them, making it easy for substrate molecules to fit in the active site.

- 5 Which graph shows the effect of light intensity on the rate of photosynthesis, if all other factors are kept constant?



- 6 The diagram shows part of the digestive system.



Which labelled parts produce digestive enzymes, absorb water and store bile?

	produce digestive enzymes	absorb water	store bile
A	P	Q	R
B	Q	R	P
C	R	S	P
D	S	P	R

- 7 The table shows the blood pressures in the left ventricle and aorta at various times in a cardiac cycle.

Which row shows the blood pressures when blood starts to leave the heart?

	pressure in left ventricle /arbitrary units	pressure in aorta /arbitrary units
A	3.0	12.0
B	6.2	6.2
C	16.0	10.0
D	18.0	20.3

- 8 Which component of tobacco smoke reduces the amount of oxygen that red blood cells can carry to the cells of the body?

- A** carbon dioxide
- B** carbon monoxide
- C** nicotine
- D** tar

- 9 A person who is red-green colour blind cannot distinguish between red and green colours.

Which part of the eye is responsible for this?

- A** cornea
- B** iris
- C** lens
- D** retina

- 10 Which statement gives an advantage of sexual reproduction over asexual reproduction?

- A** The offspring are genetically different and therefore it is more likely that some can adapt to a changing environment.
- B** The offspring are genetically different so all can adapt to a changing environment.
- C** The offspring are genetically identical and therefore it is more likely that some can adapt to a changing environment.
- D** The offspring are genetically identical so all can adapt to a changing environment.

11 Selection in chickens has produced individuals that lay more eggs per week.

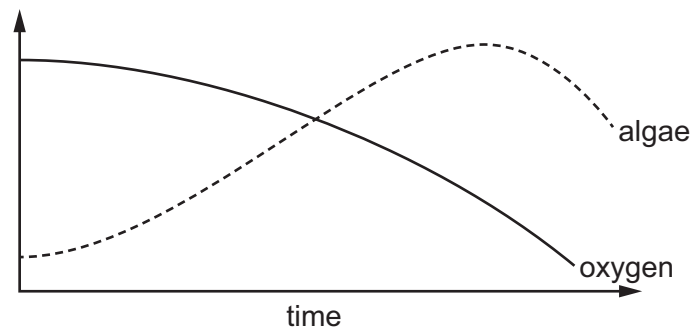
What is required for this to occur?

	reproduction	selection
A	asexual	human
B	asexual	natural
C	sexual	human
D	sexual	natural

12 Which organisms obtain energy directly from every trophic level?

- A** carnivores
- B** decomposers
- C** herbivores
- D** producers

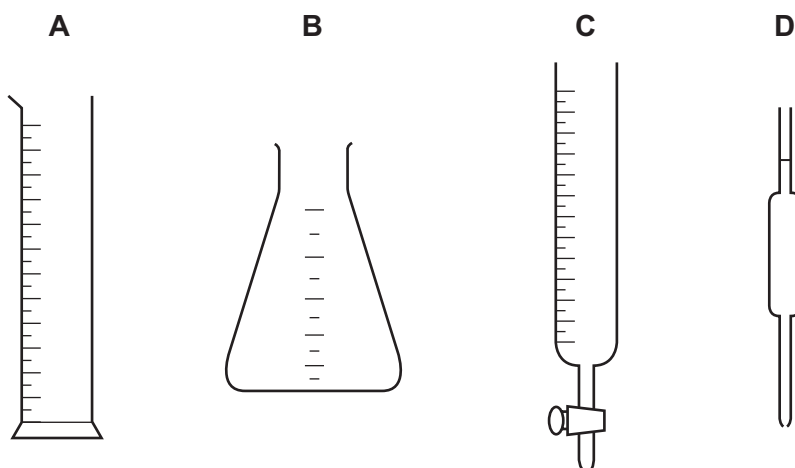
13 When fertiliser is washed into lakes, it leads to changes in the oxygen concentration and the population of algae.



Which statement explains the change in oxygen over time?

- A** The algae use up the oxygen for photosynthesis.
- B** Decomposer bacteria use up the oxygen for respiration.
- C** Nitrates react with the oxygen.
- D** The algae use up the oxygen for respiration.

- 14 Which piece of apparatus is used to measure the change in the volume of a liquid most accurately?



- 15 Some physical and chemical changes are listed.

- 1 burning methane
- 2 dissolving sugar in water
- 3 evaporating ethanol
- 4 rusting iron

Which changes are chemical changes?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4
- 16 Sodium phosphate, Na_3PO_4 , contains sodium ions, Na^+ .

Aluminium sulfate, $\text{Al}_2(\text{SO}_4)_3$, contains sulfate ions, SO_4^{2-} .

What is the formula of aluminium phosphate?

- A** AlPO_4 **B** $\text{Al}(\text{PO}_4)_2$ **C** $\text{Al}_2(\text{PO}_4)_3$ **D** $\text{Al}_3(\text{PO}_4)_2$
- 17 Which statement about electrolysis is correct?
- A** At the anode, anions are oxidised by gaining electrons.
- B** At the anode, cations are reduced by gaining electrons.
- C** At the cathode, anions are oxidised by gaining electrons.
- D** At the cathode, cations are reduced by gaining electrons.

18 In which equation is the underlined substance reduced?

- A $\underline{\text{Cl}}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$
 B $2\underline{\text{Mg}} + \text{O}_2 \rightarrow 2\text{MgO}$
 C $2\text{PbO} + \underline{\text{C}} \rightarrow \text{CO}_2 + 2\text{Pb}$
 D $\underline{\text{Zn}} + \text{CuSO}_4 \rightarrow \text{Cu} + \text{ZnSO}_4$

19 When aqueous potassium hydroxide is warmed with ammonium chloride, a gas is given off.

Which test result identifies the gas?

- A It bleaches pH paper.
 B It turns anhydrous cobalt(II) chloride blue.
 C It turns universal indicator red.
 D It turns red litmus blue.

20 A gas is used in welding metals together at high temperatures.

The gas is used to provide an inert atmosphere.

What is the gas?

- A argon
 B carbon dioxide
 C fluorine
 D oxygen

21 Which row does **not** link a general physical property to the type of element?

	type of element	general physical property
A	metal	malleable
B	metal	thermal conductor
C	non-metal	electrical conductor
D	non-metal	low melting point

22 Carbon is below aluminium but above zinc in the reactivity series.

Iron is below zinc in the reactivity series.

Which statements are correct?

- 1 Carbon can be used to extract aluminium and iron from their ores.
- 2 Aluminium can be used to extract zinc and iron from their ores.
- 3 Carbon can be used to extract zinc and iron from their ores.
- 4 Zinc can be used to extract aluminium and iron from their ores.

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

23 Gases from a car engine travel through a catalytic converter and out through the exhaust.

Some of the gases going into the converter are listed.

- 1 carbon dioxide
- 2 carbon monoxide
- 3 nitrogen
- 4 nitrogen monoxide

Which gases increase in quantity in the catalytic converter?

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

24 Which reaction in the Contact process is endothermic?

- A** $\text{S} + \text{O}_2 \rightarrow \text{SO}_2$
- B** $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
- C** $\text{SO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{S}_2\text{O}_7$
- D** $\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$

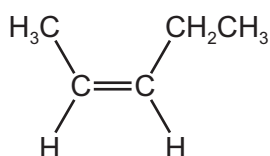
25 Why do farmers add limestone to soil?

- A** It acts as a fertiliser.
- B** It adds nitrogen to the soil.
- C** It decreases the pH of the soil.
- D** It increases the pH of the soil.

26 Which row describes the hydrocarbon CH_3CHCH_2 ?

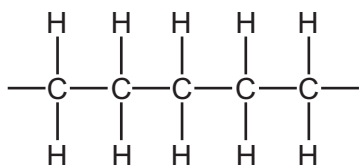
	homologous series	general formula
A	alkane	$\text{C}_n\text{H}_{2n+2}$
B	alkane	C_nH_{2n}
C	alkene	$\text{C}_n\text{H}_{2n+2}$
D	alkene	C_nH_{2n}

27 The structure of a monomer is shown.

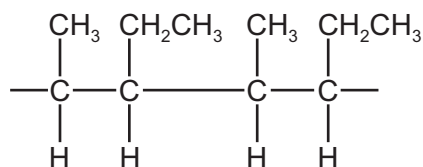


Which diagram represents the structure of the polymer formed from this monomer by addition polymerisation?

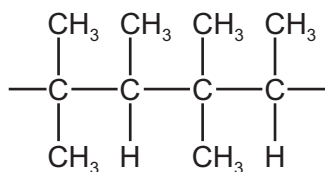
A



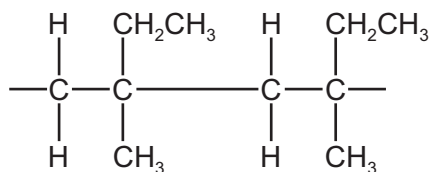
B



C



D



- 28 A spring is extended by a force but the spring does not pass its limit of proportionality.

Which expression is equal to the spring constant?

A $\frac{\text{force}}{\text{extension of the spring}}$

B $\frac{\text{force}}{\text{length of the spring}}$

C $\frac{\text{extension of the spring}}{\text{force}}$

D $\frac{\text{length of the spring}}{\text{force}}$

- 29 A force of 10 N is applied to a piston of area 0.10 m^2 , causing a pressure. This pressure is transmitted through a fluid to a piston of area 2.0 m^2 .

What is the force on this piston?

- A 2.0 N B 20 N C 200 N D 2000 N

- 30 An object moving at speed v has kinetic energy E .

What is the speed of the object when its kinetic energy is $4.0E$?

- A $0.25v$ B $2.0v$ C $4.0v$ D $16v$

- 31 The power input to a power station is 800 MW. The useful electrical power output is 320 MW.

What is the efficiency of the power station?

- A 0.40% B 2.5% C 40% D 250%

- 32 What happens to the temperature of a substance as it is melting and as it is boiling?

	melting	boiling
A	decreases	increases
B	decreases	no change
C	increases	increases
D	no change	no change

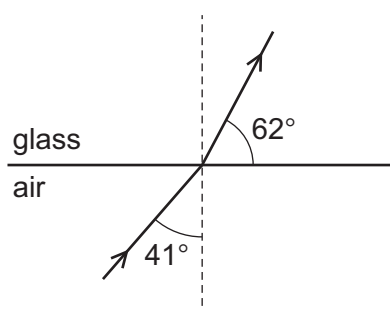
33 Solid metals transfer thermal energy by conduction.

Which conduction process occurs only in metals?

- A Atoms move freely through the solid and carry energy.
- B Atoms vibrate about fixed positions and pass energy to neighbouring atoms.
- C Electrons move freely through the solid and carry energy.
- D Electrons vibrate about fixed positions and pass energy to neighbouring electrons.

34 Light enters a glass block at an angle of incidence of 41° . The light bends toward the normal.

The angle between the refracted ray and the glass-air boundary is 62° .



Which expression is equal to the refractive index of the glass?

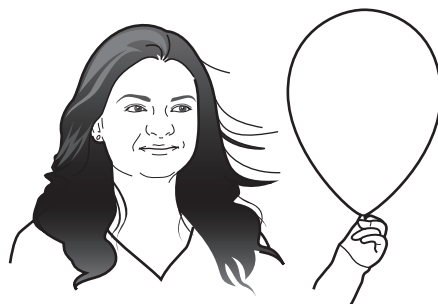
- A $\frac{\sin 41^\circ}{\sin 28^\circ}$ B $\frac{\sin 41^\circ}{\sin 62^\circ}$ C $\frac{\sin 49^\circ}{\sin 28^\circ}$ D $\frac{\sin 49^\circ}{\sin 62^\circ}$

35 Which statement about the electromagnetic spectrum is correct?

- A Gamma-radiation has a lower frequency than visible light.
- B Infrared radiation has a higher frequency than radio waves.
- C Microwaves have a smaller wavelength than ultraviolet radiation.
- D X-rays have a larger wavelength than visible light.

- 36** A student rubs a balloon against her hair. Electrons are transferred from the hair onto the balloon, and the hair and the balloon both become charged.

The hair is now attracted to the balloon.



Which row shows the charges on the hair and on the balloon after rubbing?

	charge on hair	charge on balloon
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

- 37** Which row shows how lamps are connected in a lighting circuit in a house and gives an advantage of connecting them in this way?

	how lamps are connected	advantage of connecting them in this way
A	in parallel	they can be switched separately
B	in parallel	they share the voltage
C	in series	they can be switched separately
D	in series	they share the voltage

- 38** A transformer increases the voltage from a power station in order to transfer electricity along transmission cables.

How does increasing the voltage affect the current in the cables and how does it affect the efficiency of energy transfer?

	current	efficiency
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

39 An atom of beryllium is represented by ${}^9_4\text{Be}$.

How many neutrons are in the nucleus of this type of beryllium atom?

A 4

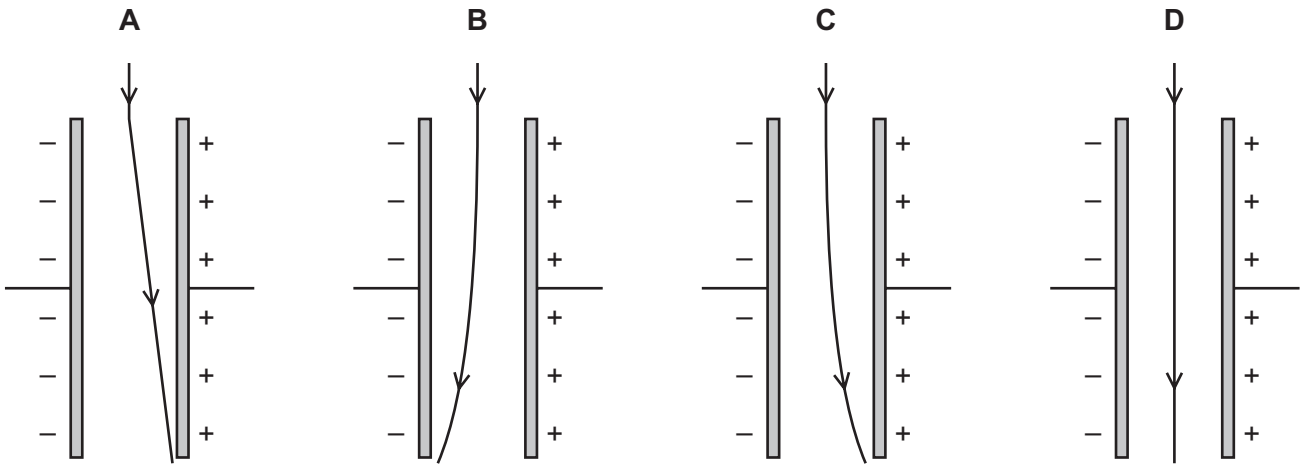
B 5

C 9

D 13

40 A beam of γ -rays passes into an electric field between two charged plates.

Which diagram shows what happens to the γ -rays?



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The Periodic Table of Elements

		Group															
I	II	III	IV	V	VI	VII	VIII										
3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1	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	<div style="border: 1px solid black; padding: 5px; text-align: center;"> Key atomic number atomic symbol name relative atomic mass </div>															
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 —				

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 dm³ at room temperature and pressure (r.t.p.).