



Cambridge IGCSE™

COMBINED SCIENCE

0653/21

Paper 2 Multiple Choice (Extended)

October/November 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 Movement is a characteristic of all living organisms.

Which two other characteristics of living organisms provide the energy for movement?

- A excretion and nutrition
- B growth and sensitivity
- C nutrition and respiration
- D respiration and growth

- 2 What are all living organisms made of?

- A cells
- B chloroplasts
- C muscles
- D organs

- 3 Which statement about enzymes is correct?

- A They are denatured at high temperatures.
- B They all have an optimum pH of 7.
- C They all have an optimum temperature of 10 °C.
- D They are made of carbohydrates.

- 4 Which letters from the list represent the balanced equation for photosynthesis?

P	$\text{C}_6\text{H}_{12}\text{O}_6$	T	H_2O
Q	$6\text{C}_6\text{H}_{12}\text{O}_6$	U	$6\text{H}_2\text{O}$
R	CO_2	V	O_2
S	6CO_2	W	6O_2

- A $\text{P} + \text{U} \rightarrow \text{R} + \text{V}$
- B $\text{Q} + \text{T} \rightarrow \text{S} + \text{U}$
- C $\text{R} + \text{T} \rightarrow \text{W} + \text{P}$
- D $\text{U} + \text{S} \rightarrow \text{P} + \text{W}$

5 What is an effect of iron deficiency in the diet?

- A anaemia
- B constipation
- C coronary heart disease
- D scurvy

6 The following paragraph is a description of the digestion of fats.

Large pieces of fat are broken down into smaller pieces of fat by 1..... digestion. These smaller pieces of fat can then be broken down by the enzyme 2..... . This is 3..... digestion. During this process, the larger molecules are broken down into smaller, ...4..... molecules.

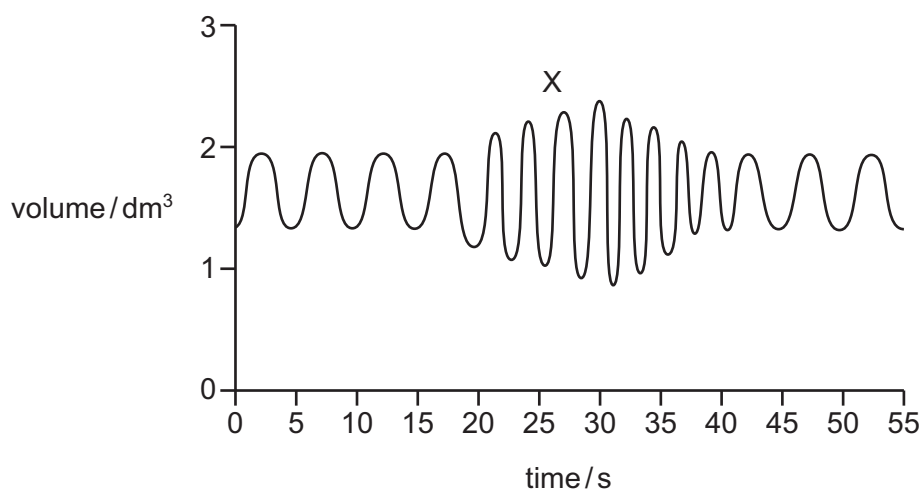
Which row correctly completes gaps 1, 2, 3 and 4?

	1	2	3	4
A	chemical	lipase	mechanical	soluble
B	chemical	protease	mechanical	insoluble
C	mechanical	lipase	chemical	soluble
D	mechanical	protease	chemical	insoluble

7 Which row correctly describes double circulation in mammals?

	pressure of blood from heart to body	pressure of blood from heart to lungs	type of blood from heart to lungs
A	high	high	oxygenated
B	high	low	deoxygenated
C	low	high	deoxygenated
D	low	low	oxygenated

8 What causes the change in breathing seen at X?



- A decreased oxygen in the blood
- B decreased lactic acid in the blood
- C increased carbon dioxide in the blood
- D increased sweating

9 A plant shoot is illuminated from one side only.

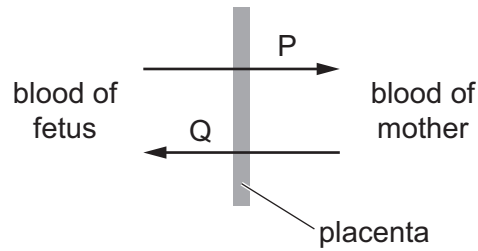
What collects on the shaded side of the plant shoot?

- A auxin
- B chlorophyll
- C glucose
- D starch

10 Which part of a flower is **not** required for pollination?

- A anther
- B sepal
- C stamen
- D stigma

11 The diagram represents the human placenta.



P and Q show the net movement of substances.

Which row identifies substances that travel in the directions of P and Q?

	in direction P	in direction Q
A	blood	urea
B	oxygen	carbon dioxide
C	excretory products	glucose
D	amino acids	toxins

12 The diagram represents four organisms in a food chain.

$T \rightarrow U \rightarrow V \rightarrow W$

Which organisms are consumers?

- A** T, U and V **B** T, U and W **C** T, V and W **D** U, V and W

13 Carbon dioxide levels in the atmosphere have risen by 30% in the last 60 years.

Which actions have contributed to this increase?

- 1 burning fossil fuels
- 2 deforestation
- 3 extinction of species

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

14 Which statement describes the change when water becomes ice at 0 °C?

- A** The particles collide with each other more frequently.
B The particles have more kinetic energy.
C The process is endothermic.
D The process is exothermic.

15 Which statement explains why ionic compounds have higher melting points than covalent compounds?

- A Attractive forces are stronger between ions than between molecules.
- B Ionic bonds are stronger than covalent bonds.
- C Ions are formed by the transfer of electrons from one atom to another.
- D The atoms in covalent molecules share electrons.

16 Aluminium sulfate is made when aluminium hydroxide, $\text{Al}(\text{OH})_3$, reacts with dilute sulfuric acid, H_2SO_4 .

What is the formula of aluminium sulfate?

- A AlSO_4 B Al_2SO_4 C $\text{Al}_2(\text{SO}_4)_3$ D $\text{Al}_3(\text{SO}_4)_2$

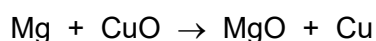
17 Hydrogen peroxide decomposes to form water and oxygen.

Which changes in temperature and in concentration **both** reduce the rate of this reaction?

	temperature of hydrogen peroxide	concentration of hydrogen peroxide
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

18 Magnesium reacts with copper oxide.

The equation for this reaction is shown.



Which substance is acting as an oxidising agent in this reaction?

- A Cu B CuO C Mg D MgO

19 Which word equation correctly describes a reaction of dilute sulfuric acid?

- A sulfuric acid + zinc $\rightarrow$ zinc sulfate + water
- B sulfuric acid + zinc carbonate $\rightarrow$ zinc sulfate + carbon dioxide
- C sulfuric acid + zinc hydroxide $\rightarrow$ zinc sulfate + water
- D sulfuric acid + zinc oxide $\rightarrow$ zinc sulfate + hydrogen

- 20** A piece of damp blue litmus paper is placed in a gas.

The litmus paper turns red and then turns white.

What is the gas?

- A** carbon dioxide
- B** chlorine
- C** hydrogen
- D** oxygen

- 21** Elements in Group I and Group VII of the Periodic Table are listed.

Group I	Group VII
Li	F
Na	Cl
K	Br
Rb	I

Group I elements react with Group VII elements.

Which compound is formed most vigorously?

- A** LiF
- B** LiI
- C** RbF
- D** RbI

- 22** Which part of the Periodic Table contains elements that are used as catalysts?

- A** Group I
- B** Group VII
- C** noble gases
- D** transition metals

- 23** Brass is an alloy.

What is brass?

- A** a compound containing two metallic elements
- B** a compound containing two non-metallic elements
- C** a mixture containing two metallic elements
- D** a mixture containing two non-metallic elements

24 Four metals E, F, G and H are mixed with solutions of metal salts.

The results are shown.

metal	metal salt	result
H	E chloride	no reaction
E	F chloride	reacts
E	G chloride	reacts
F	H chloride	no reaction
G	H chloride	reacts

What is the order of reactivity of these metals, from most to least reactive?

- A** E → H → G → F
- B** E → G → H → F
- C** F → H → G → E
- D** F → G → H → E

25 Carbon is used in the production of iron in a blast furnace.

A student suggests four reasons why carbon is added to the blast furnace.

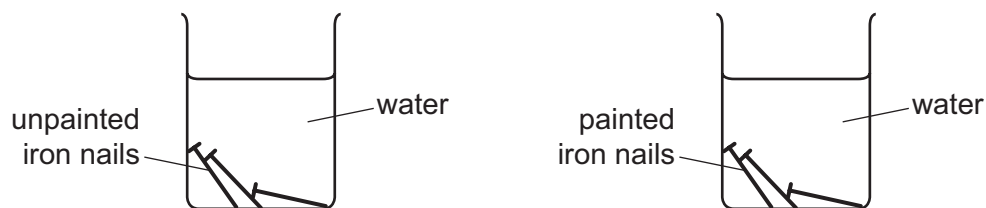
- 1 It is an oxidising agent.
- 2 It burns to produce high temperatures.
- 3 It removes impurities by forming slag.
- 4 It reacts with carbon dioxide to form carbon monoxide.

Which reasons are correct?

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

26 A student measures the masses of three unpainted and three painted iron nails.

The student places the nails into separate beakers of water.

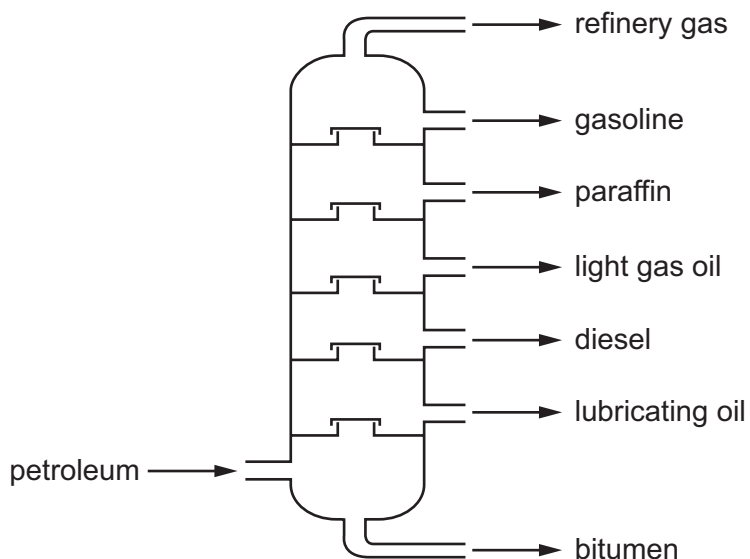


After one week, the student removes the nails from the beakers, dries them and measures the masses again.

Which row about the masses of the iron nails is correct?

	mass of unpainted iron nails	mass of painted iron nails
A	decreased	decreased
B	decreased	unchanged
C	increased	increased
D	increased	unchanged

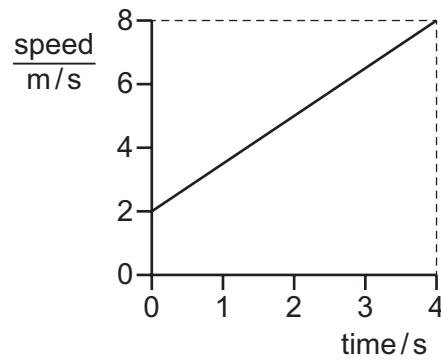
27 The fractional distillation of petroleum is shown.



Which fraction contains molecules that have the largest attractive forces?

- A** bitumen
- B** diesel
- C** gasoline
- D** refinery gas

- 28 The diagram shows the speed–time graph for an object that is accelerating.



What is the acceleration of the object and what is the distance it travels in 4.0 s?

	acceleration m/s^2	distance / m
A	1.5	20
B	1.5	32
C	2.0	20
D	2.0	32

- 29 A ball of mass m is thrown vertically upwards with an initial speed v .

The gravitational field strength is g .

What is the kinetic energy of the ball when it has risen through a height h above its starting point?

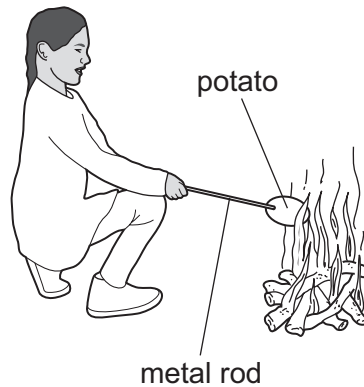
- A** $\frac{1}{2}(mv)^2 + mgh$
B $\frac{1}{2}(mv)^2 - mgh$
C $\frac{1}{2}mv^2 + mgh$
D $\frac{1}{2}mv^2 - mgh$

- 30 A gas loses energy and changes state to become a liquid.

How do the forces between the molecules and the distances between the molecules change?

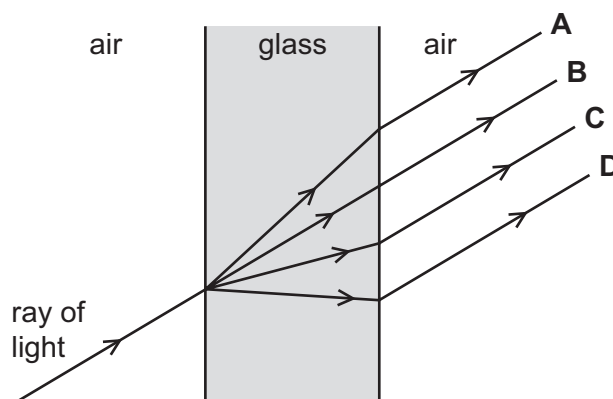
	forces between molecules	distances between molecules
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

- 31 A student cooks a potato in a fire. The student holds the potato using a metal rod.



Which transfer of thermal energy is caused mainly by radiation?

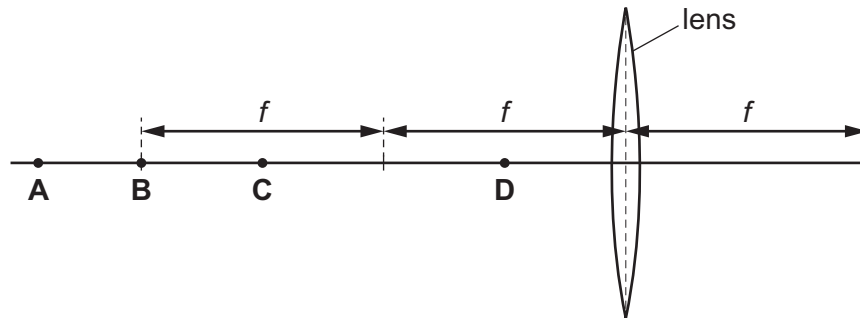
- A from the fire to the air above the fire
 - B from the fire to the student's face
 - C from the inside of the potato to the student's hand
 - D from the outside of the potato to the inside of the potato
- 32 A microwave oven uses microwaves with a frequency of 2.5×10^9 Hz.
- What is the wavelength of these microwaves?
- A 0.0075 m
 - B 0.12 m
 - C 7.5 m
 - D 12 m
- 33 A ray of light passes through a glass window.
- Which path does it take?



- 34** The diagram shows a thin converging lens with focal length f .

The lens forms a magnified, upright image of an object.

At which point is the object placed?



- 35** Sound travels at different speeds in air, glass and water.

Which list shows these three materials in the order of increasing speed of sound (slowest to fastest)?

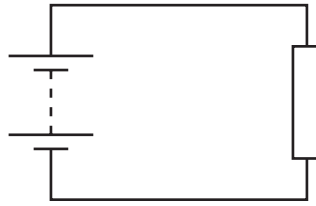
- A** air → water → glass
- B** glass → water → air
- C** water → air → glass
- D** water → glass → air

- 36** There is a current of 4.0 A in a resistor.

How much charge passes through the resistor in 8.0 s ?

- A** 0.50 C
- B** 2.0 C
- C** 12 C
- D** 32 C

- 37 A circuit contains a battery connected to a resistor.



Which values of electromotive force (e.m.f.) and resistance produce the smallest current in the circuit?

	e.m.f. / V	resistance / Ω
A	6.0	10
B	6.0	20
C	24	80
D	24	160

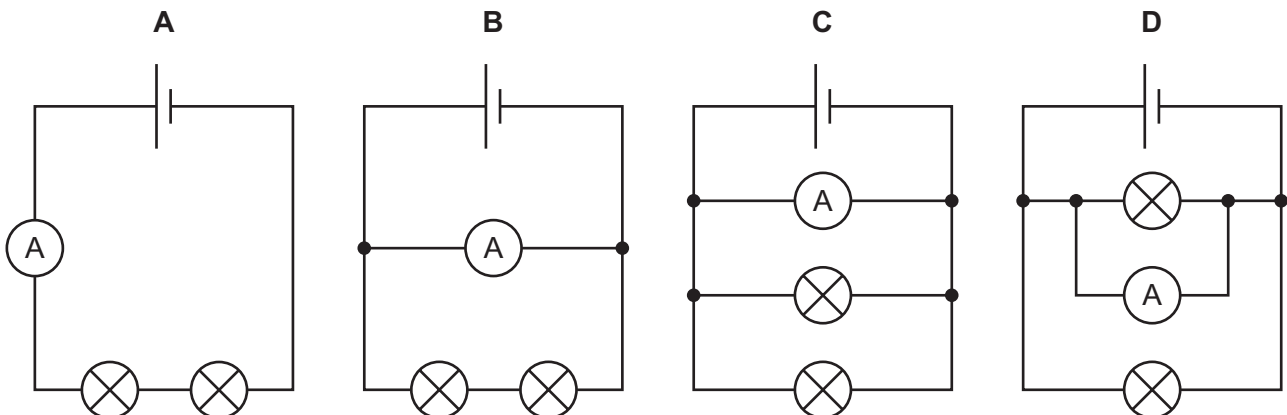
- 38 Four wires are made from the same material but have different lengths and diameters.

Which wire has the smallest resistance?

	length / cm	diameter / mm
A	50	0.10
B	50	0.20
C	100	0.10
D	100	0.20

- 39 The diagrams show four circuits, each containing an ammeter and two lamps with different resistances.

Which circuit shows an ammeter with a reading equal to the current in each lamp?



40 What is the purpose of a fuse in an electric circuit?

- A** It acts as an extra resistor in the circuit.
- B** It keeps the current at a steady value.
- C** It keeps the voltage at a steady value.
- D** It protects the circuit from a current that is too large.

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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	Key atomic number atomic symbol name relative atomic mass										1 H hydrogen 1						
	11 Na sodium 23											12 Mg magnesium 24						
	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

actinoids

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
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.).



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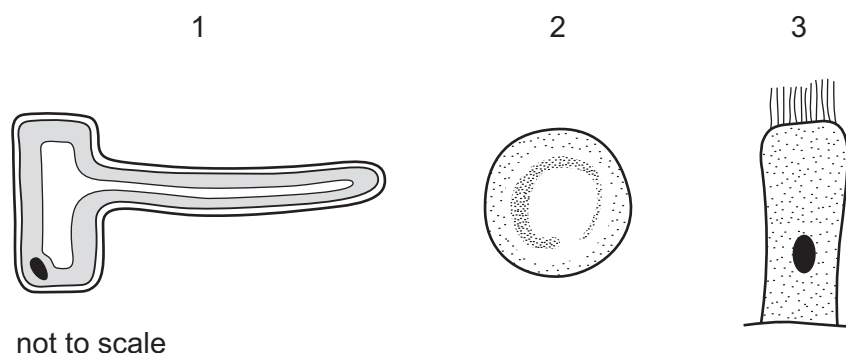


- 1 Movement is a characteristic of all living organisms.

Which two other characteristics of living organisms provide the energy for movement?

- A excretion and nutrition
- B growth and sensitivity
- C nutrition and respiration
- D respiration and growth

- 2 The diagrams show three different specialised cells.



Which row shows the correct functions of cells 1, 2 and 3?

	1	2	3
A	absorbs water	transports oxygen	moves mucus
B	absorbs water	transports oxygen	absorbs digested food
C	transports oxygen	absorbs water	moves mucus
D	transports oxygen	absorbs water	absorbs digested food

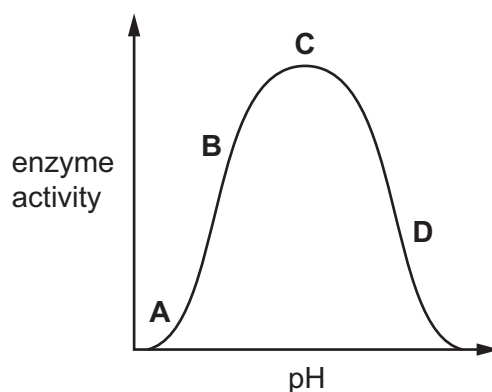
- 3 A biological molecule is analysed and found to contain carbon, oxygen, hydrogen and nitrogen.

What is this biological molecule?

- A fat
- B glucose
- C protein
- D starch

- 4 The graph shows the effect of pH on the activity of an enzyme.

Where on the graph would collisions between enzyme and substrate be most effective?



- 5 Which letters from the list represent the balanced equation for photosynthesis?

P	$\text{C}_6\text{H}_{12}\text{O}_6$	T	H_2O
Q	$6\text{C}_6\text{H}_{12}\text{O}_6$	U	$6\text{H}_2\text{O}$
R	CO_2	V	O_2
S	6CO_2	W	6O_2

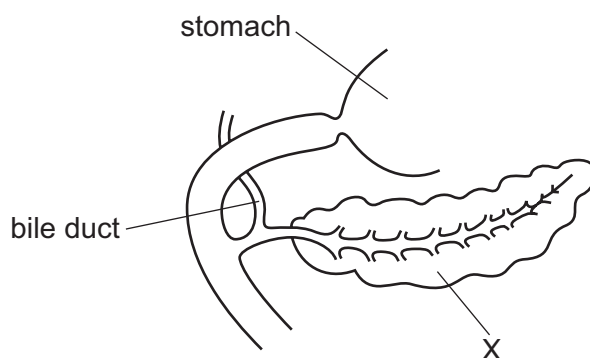
- A** $\text{P} + \text{U} \rightarrow \text{R} + \text{V}$
B $\text{Q} + \text{T} \rightarrow \text{S} + \text{U}$
C $\text{R} + \text{T} \rightarrow \text{W} + \text{P}$
D $\text{U} + \text{S} \rightarrow \text{P} + \text{W}$

- 6 During pregnancy, a woman is told she is iron-deficient.

Which food could she eat to increase the iron content in her diet?

- A** cheese
B fruit
C milk
D red meat

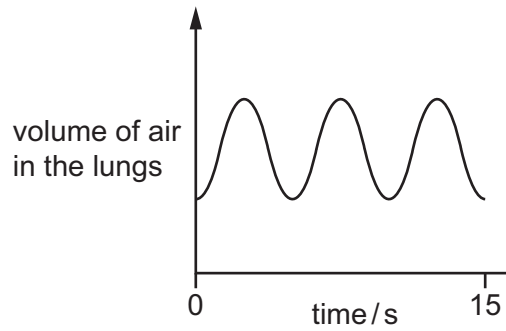
- 7 The diagram shows part of the alimentary canal and associated structures.



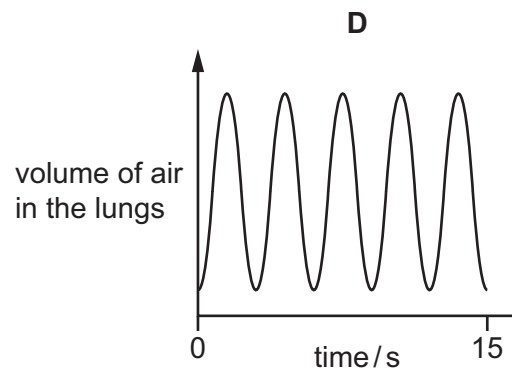
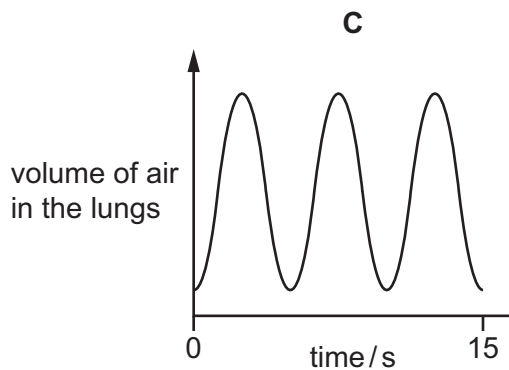
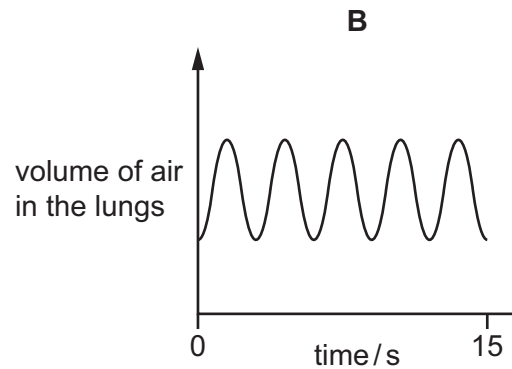
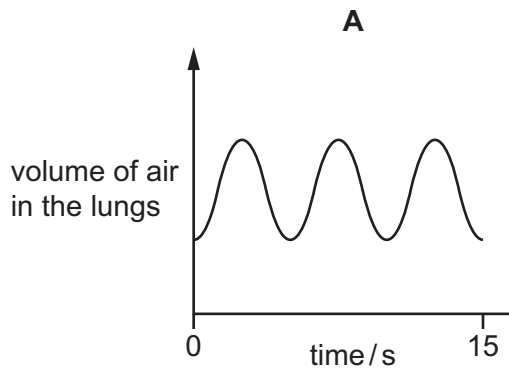
Which row correctly identifies structure X, an enzyme secreted by structure X and the action of this enzyme?

	structure X	enzyme	action of enzyme
A	liver	amylase	converts proteins to amino acids
B	pancreas	amylase	converts starch to simple sugars
C	liver	protease	converts proteins to amino acids
D	pancreas	protease	converts starch to simple sugars

- 8 The graph shows the rate and depth of breathing of a student at rest.



Which graph shows the rate and depth of breathing of the student immediately after five minutes of physical activity?



- 9 A plant shoot is illuminated from one side only.

What collects on the shaded side of the plant shoot?

- A** auxin
- B** chlorophyll
- C** glucose
- D** starch

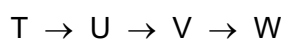
10 Which row is correct for sexual reproduction?

	gametes are formed	offspring genetically identical to parents
A	no	no
B	yes	no
C	no	yes
D	yes	yes

11 Which row correctly describes features of human egg cells and sperm cells?

	egg cells	sperm cells
A	energy stores present	enzymes present
B	enzymes present	energy stores present
C	produced in large numbers	flagellum present
D	flagellum present	produced in large numbers

12 The diagram represents four organisms in a food chain.



Which organisms are consumers?

- A** T, U and V **B** T, U and W **C** T, V and W **D** U, V and W

13 During eutrophication, what is the **main** reason for the increased growth of producers?

- A** increased availability of carbon dioxide
B increased availability of nitrate
C increased availability of oxygen
D increased availability of water

14 Which dot-and-cross diagram represents the bonding in a molecule of carbon dioxide?



- 15 Copper forms two different ions, Cu^{2+} and Cu^+ .

Copper forms two different oxides.

What are the formulae of these two oxides?

- A** CuO_2 and Cu_2O
B Cu_2O_2 and CuO
C Cu_2O_2 and CuO_2
D CuO and Cu_2O

- 16 Which statements about bond breaking and bond forming are correct?

- 1 Bond breaking is endothermic.
- 2 Bond breaking is exothermic.
- 3 Bond forming is endothermic.
- 4 Bond forming is exothermic.

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

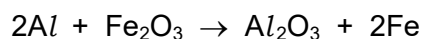
- 17 Hydrogen peroxide decomposes to form water and oxygen.

Which changes in temperature and in concentration **both** reduce the rate of this reaction?

	temperature of hydrogen peroxide	concentration of hydrogen peroxide
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

- 18** Aluminium reacts with iron oxide to produce iron.

The equation is shown.



Which row identifies the oxidising agent and the reducing agent?

	oxidising agent	reducing agent
A	Fe	Al
B	Fe	Al ₂ O ₃
C	Fe ₂ O ₃	Al
D	Fe ₂ O ₃	Al ₂ O ₃

- 19** Ammonia dissolves in water.

Which test shows that the solution has a pH of 9?

- A** Blue litmus paper stays blue.
 - B** Red litmus paper turns blue.
 - C** Universal indicator paper turns green.
 - D** Universal indicator paper turns blue.
- 20** A piece of damp blue litmus paper is placed in a gas.

The litmus paper turns red and then turns white.

What is the gas?

- A** carbon dioxide
 - B** chlorine
 - C** hydrogen
 - D** oxygen
- 21** Fluorine is an element in Group VII of the Periodic Table.

Which statement about fluorine is correct?

- A** Fluorine is a metal with a low melting point.
- B** Fluorine is a gas and is less reactive than bromine.
- C** Fluorine molecules are diatomic.
- D** Chlorine displaces fluorine from its compounds.

22 Which statement about transition elements is **not** correct?

- A They can act as catalysts.
- B They can be metals or non-metals.
- C They have high densities.
- D They have high melting points.

23 Brass is an alloy.

What is brass?

- A a compound containing two metallic elements
- B a compound containing two non-metallic elements
- C a mixture containing two metallic elements
- D a mixture containing two non-metallic elements

24 Which two substances react together?

- A aluminium and aqueous magnesium sulfate
- B copper and aqueous iron(II) sulfate
- C iron and aqueous zinc sulfate
- D zinc and aqueous copper sulfate

25 Which row shows how copper can be obtained from copper oxide?

	heat copper oxide with carbon	electrolysis of molten copper oxide
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

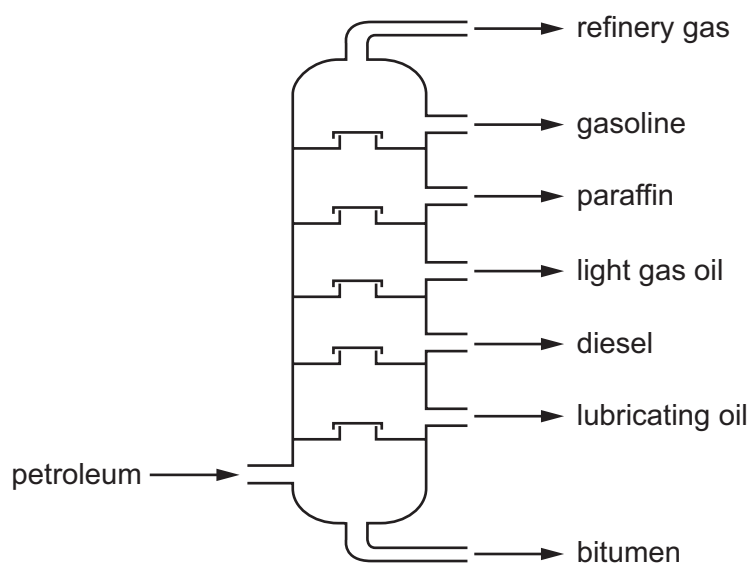
26 Magnesium carbonate reacts with dilute hydrochloric acid.

Calcium carbonate decomposes when heated.

Which gas is produced in **both** reactions?

- A carbon dioxide
- B carbon monoxide
- C chlorine
- D hydrogen

27 The fractional distillation of petroleum is shown.

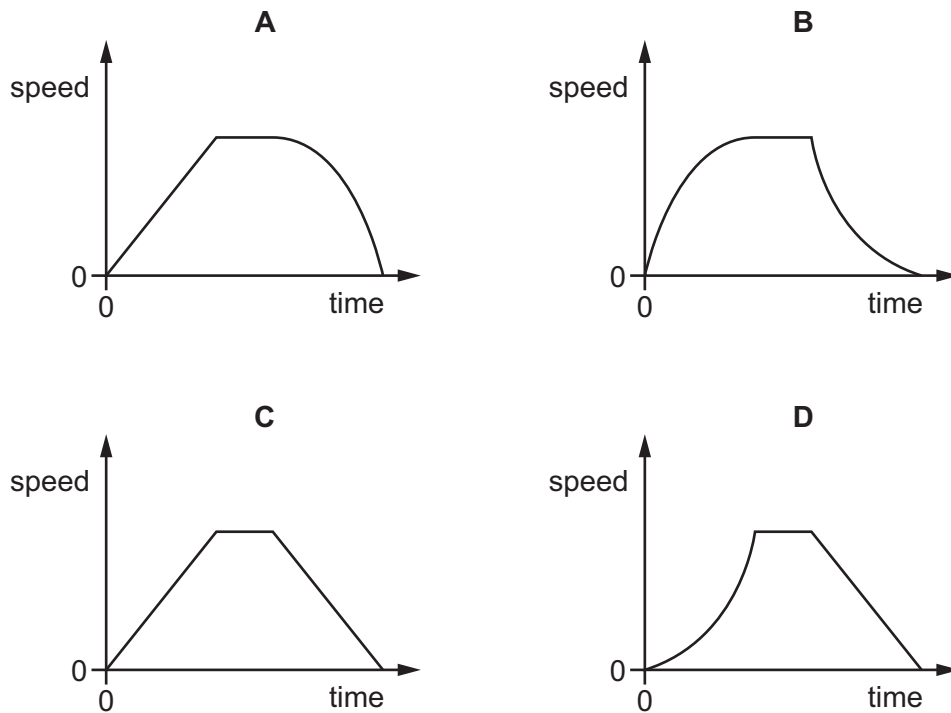


Which fraction contains molecules that have the largest attractive forces?

- A bitumen
- B diesel
- C gasoline
- D refinery gas

- 28** A car accelerates from rest at a constant rate. It then moves with constant speed and finally comes to rest with non-constant deceleration.

Which diagram shows the speed–time graph for the car?



- 29** Four planets have different gravitational field strengths.

An object has a mass of 50 kg.

Which gravitational field strength causes the object to have a weight of 450 N?

	<u>gravitational field strength</u> N/kg
A	4.5
B	5.0
C	9.0
D	10.0

- 30** Which process is the source of the energy released from the Sun?

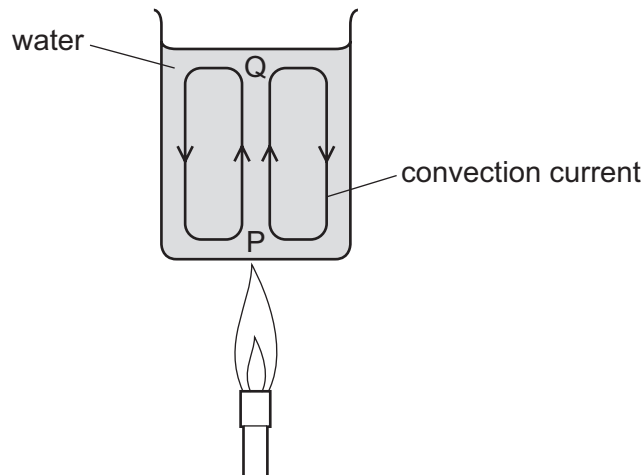
- A** chemical reactions
- B** geothermal heating
- C** nuclear fission
- D** nuclear fusion

31 Which statements about liquids and gases are correct?

- 1 Molecules in gases are further apart than molecules in liquids.
- 2 Molecules in liquids and gases are arranged randomly.
- 3 When a liquid evaporates, the temperature of the remaining liquid decreases.

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

32 The bottom of a container of water is heated.



A convection current forms and water rises from P to Q.

Which statement is correct?

- A** Water at P expands and decreases in density.
- B** Water at P expands and increases in density.
- C** Water at Q expands and decreases in density.
- D** Water at Q expands and increases in density.

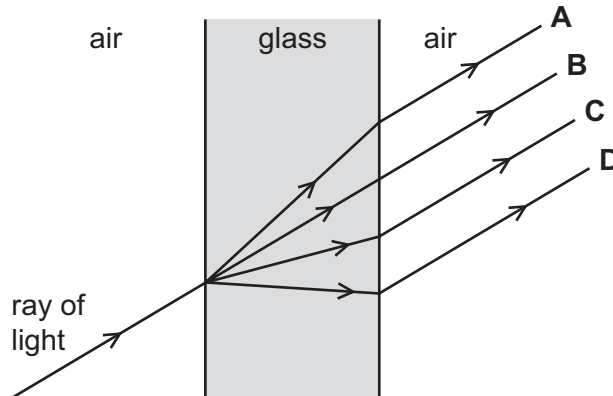
33 A microwave oven uses microwaves with a frequency of 2.5×10^9 Hz.

What is the wavelength of these microwaves?

- A** 0.0075 m **B** 0.12 m **C** 7.5 m **D** 12 m

- 34** A ray of light passes through a glass window.

Which path does it take?



- 35** A thin converging lens is used as a magnifying glass.

The focal length of the lens is 5.0 cm.

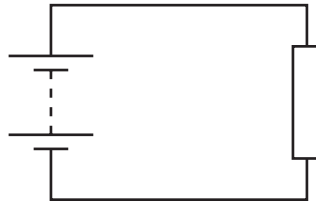
How far from the lens is the object placed?

- A** less than 5.0 cm
 - B** between 5.0 cm and 10 cm
 - C** 10 cm
 - D** more than 10 cm
- 36** A lightning strike transfers 20 C of charge in 5.0×10^{-4} s.

What is the average current during the lightning strike?

- A** 2.5×10^{-5} A
- B** 1.0×10^{-2} A
- C** 1.0×10^2 A
- D** 4.0×10^4 A

- 37 A circuit contains a battery connected to a resistor.



Which values of electromotive force (e.m.f.) and resistance produce the smallest current in the circuit?

	e.m.f. / V	resistance / Ω
A	6.0	10
B	6.0	20
C	24	80
D	24	160

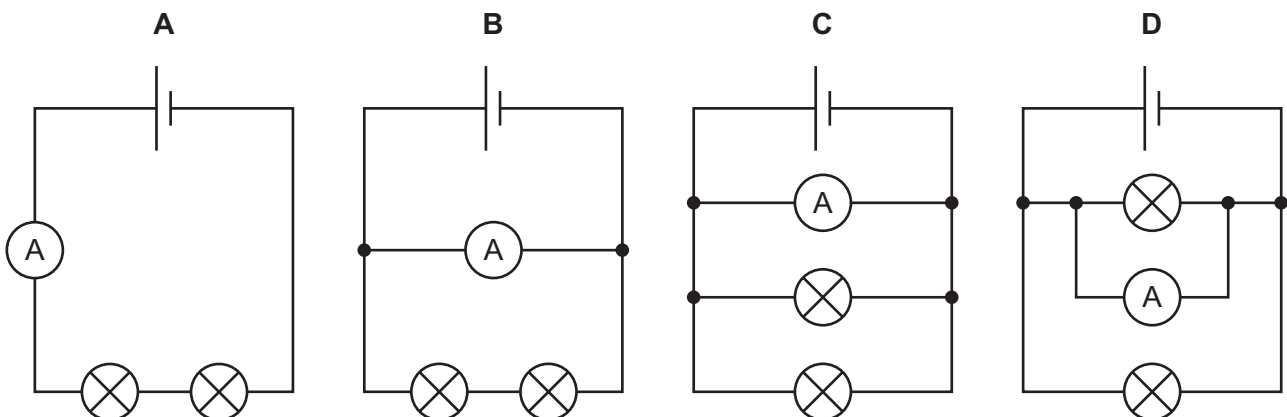
- 38 Four wires are made from the same material but have different lengths and diameters.

Which wire has the smallest resistance?

	length / cm	diameter / mm
A	50	0.10
B	50	0.20
C	100	0.10
D	100	0.20

- 39 The diagrams show four circuits, each containing an ammeter and two lamps with different resistances.

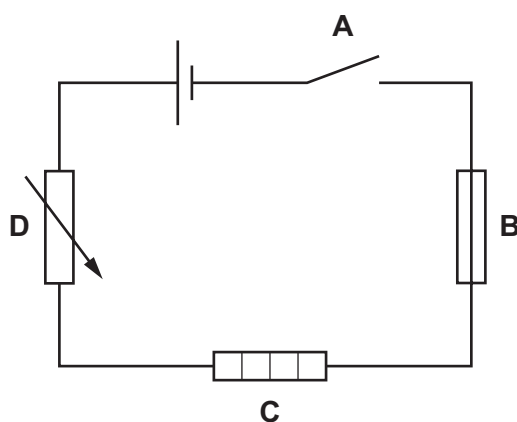
Which circuit shows an ammeter with a reading equal to the current in each lamp?



40 The diagram shows a circuit with four labelled components.

One component breaks the circuit automatically when the current becomes too large.

Which component does this?



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The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	VIII
3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										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 —				

lanthanoids

actinoids

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
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.).



Cambridge IGCSE™

COMBINED SCIENCE

0653/23

Paper 2 Multiple Choice (Extended)

October/November 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 Movement is a characteristic of all living organisms.

Which two other characteristics of living organisms provide the energy for movement?

- A excretion and nutrition
- B growth and sensitivity
- C nutrition and respiration
- D respiration and growth

- 2 Which row correctly describes a feature of a specialised cell?

	specialised cell	feature
A	egg cell	energy store
B	palisade cell	cilia
C	red blood cell	cell wall
D	root hair cell	chloroplasts

- 3 Which small molecules are used to make proteins?

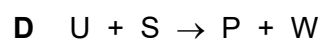
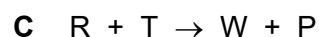
- A amino acids
- B fatty acids
- C glucose
- D glycerol

- 4 What is a suitable range for investigating the effect of temperature on the activity of an enzyme from a human body?

- A 0 °C to 30 °C
- B 20 °C to 60 °C
- C 40 °C to 60 °C
- D 50 °C to 100 °C

5 Which letters from the list represent the balanced equation for photosynthesis?

P	$C_6H_{12}O_6$	T	H_2O
Q	$6C_6H_{12}O_6$	U	$6H_2O$
R	CO_2	V	O_2
S	$6CO_2$	W	$6O_2$



6 Which type of digestion causes the breakdown of large, insoluble molecules into small, soluble molecules?

A chemical

B hormonal

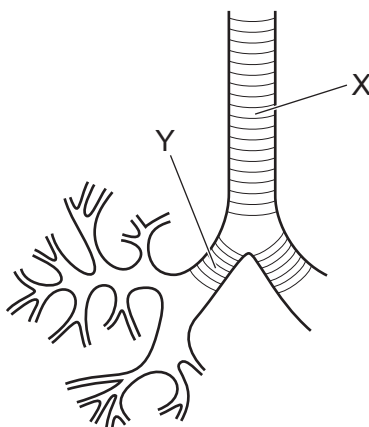
C mechanical

D physical

7 Which conditions cause plants to lose most mass by transpiration?

	humidity	temperature
A	high	high
B	high	low
C	low	high
D	low	low

- 8 The diagram shows part of the gas exchange system in humans.



What are the structures labelled X and Y?

	X	Y
A	bronchiole	trachea
B	bronchus	trachea
C	trachea	bronchiole
D	trachea	bronchus

- 9 A plant shoot is illuminated from one side only.

What collects on the shaded side of the plant shoot?

- A** auxin
- B** chlorophyll
- C** glucose
- D** starch

- 10 What is a characteristic of **insect**-pollinated flowers?

- A** anthers hanging outside the flower
- B** hairy or sticky stigmas
- C** large quantities of smooth, light pollen
- D** no scent or nectar

11 Which comparison between human female and male gametes is correct?

	eggs	sperm
A	have a flagellum	have no flagellum
B	move a short distance	move a long distance
C	produced in greater numbers	produced in fewer numbers
D	smaller size	larger size

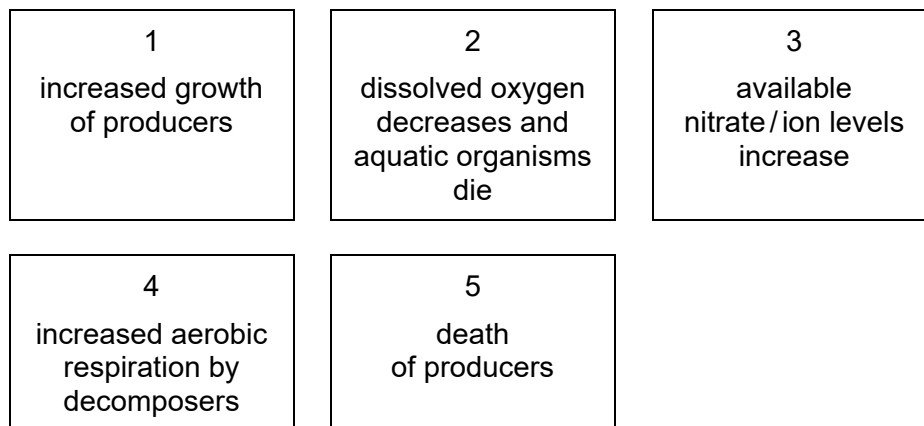
12 The diagram represents four organisms in a food chain.

$T \rightarrow U \rightarrow V \rightarrow W$

Which organisms are consumers?

- A** T, U and V **B** T, U and W **C** T, V and W **D** U, V and W

13 The eutrophication of water has a number of stages.



What is the correct order of the stages?

- A** 1 → 3 → 5 → 4 → 2
B 1 → 2 → 5 → 4 → 3
C 3 → 1 → 5 → 4 → 2
D 3 → 1 → 4 → 2 → 5

14 How many electrons are shared by the atoms in a nitrogen molecule, N₂?

- A** 2 **B** 4 **C** 6 **D** 8

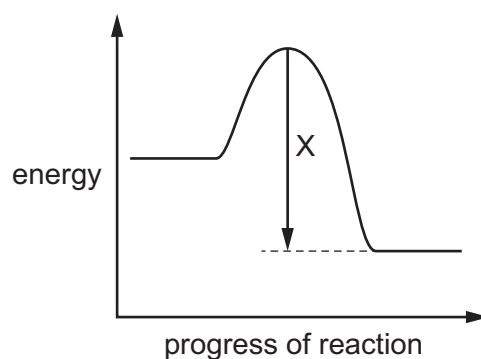
- 15 The formula of magnesium chloride is MgCl_2 .

The formula of sodium phosphide is Na_3P .

What is the formula of magnesium phosphide?

- A** MgP **B** MgP_2 **C** Mg_2P_3 **D** Mg_3P_2

- 16 An energy level diagram for a reaction is shown.



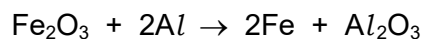
Which statement describes and explains energy change X?

- A** Energy is given out as bonds break.
B Energy is given out as bonds form.
C Energy is taken in as bonds break.
D Energy is taken in as bonds form.
- 17 Hydrogen peroxide decomposes to form water and oxygen.

Which changes in temperature and in concentration **both** reduce the rate of this reaction?

	temperature of hydrogen peroxide	concentration of hydrogen peroxide
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

18 Iron oxide reacts with aluminium.



Which row identifies the oxidising agent and reducing agent in the reaction?

	oxidising agent	reducing agent
A	aluminium oxide	aluminium
B	aluminium oxide	iron
C	iron(III) oxide	aluminium
D	iron(III) oxide	iron

19 Which statement describes an acid?

- A** It has a pH less than 7.
- B** It reacts with calcium carbonate to form a white precipitate.
- C** It reacts with hydrochloric acid to form a salt and water.
- D** It turns universal indicator blue.

20 A piece of damp blue litmus paper is placed in a gas.

The litmus paper turns red and then turns white.

What is the gas?

- A** carbon dioxide
- B** chlorine
- C** hydrogen
- D** oxygen

21 Some properties of noble gases are shown.

	melting point/°C	boiling point/°C	<u>density</u> g/cm ³
helium	–272	–269	0.0002
neon			
argon	–189		
krypton		–152	0.0059
xenon	–112	–108	0.0097

What are the properties of neon?

	melting point/°C	boiling point/°C	<u>density</u> g/cm ³
A	–251	–274	0.0004
B	–178	–174	0.0041
C	–249	–246	0.0008
D	–240	–236	0.0062

22 P, Q, R and S are four metals.

P is soft.

Q reacts violently with water.

R has a high melting point.

S forms blue compounds.

Which metals are transition elements?

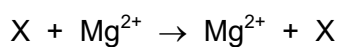
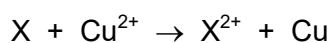
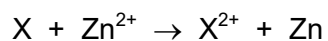
- A** P and Q **B** P and R **C** Q and S **D** R and S

23 Brass is an alloy.

What is brass?

- A** a compound containing two metallic elements
B a compound containing two non-metallic elements
C a mixture containing two metallic elements
D a mixture containing two non-metallic elements

24 The results of mixing metal X with aqueous metal ions are shown.



What is the position of X in the reactivity series?

	most reactive → least reactive			
A	X	Mg	Zn	Cu
B	Mg	X	Zn	Cu
C	Mg	Zn	X	Cu
D	Mg	Zn	Cu	X

25 Which substance reduces iron(III) oxide in the blast furnace?

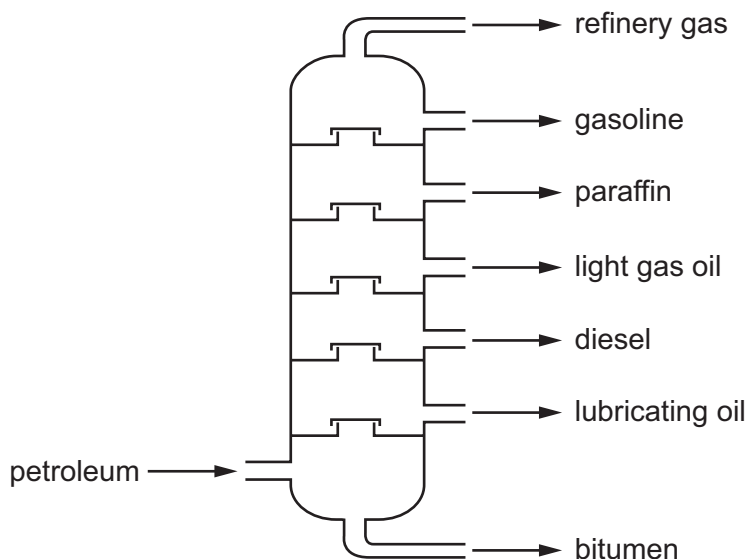
- A** carbon dioxide
- B** carbon monoxide
- C** limestone
- D** oxygen

26 Which statements about the rusting of iron are correct?

- 1 It requires oxygen and water.
- 2 It is prevented by coating with another metal.
- 3 Painted iron nails do not rust.

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

27 The fractional distillation of petroleum is shown.



Which fraction contains molecules that have the largest attractive forces?

- A bitumen
- B diesel
- C gasoline
- D refinery gas

28 A distance–time graph and a speed–time graph are plotted for a moving vehicle.

Which feature gives the acceleration of the vehicle?

- A the area under the distance–time graph
- B the area under the speed–time graph
- C the gradient of the distance–time graph
- D the gradient of the speed–time graph

29 A container is filled to the top with water. An object is slowly lowered into the water until it is completely submerged. The water that overflows from the container is collected.

The mass of the object is 84 kg. The volume of water collected is 0.12 m^3 .

What is the density of the object?

- A 1.4 kg/m^3
- B 10 kg/m^3
- C 84 kg/m^3
- D 700 kg/m^3

- 30** A spring that obeys Hooke's Law has unstretched length l .

A load F is suspended from the spring, and the spring extends by an amount x .

Which equation is used to define the spring constant k ?

- A** $k = Fx$ **B** $k = \frac{F}{(l + x)}$ **C** $k = \frac{F}{x}$ **D** $k = \frac{x}{F}$

- 31** A force pushes an object in a straight line.

Which expression gives the work done by the force?

- A** force $\times$ distance moved
B force $\times$ time taken
C force $\div$ distance moved
D force $\div$ time taken

- 32** Water in a beaker evaporates quickly.

Which statements about the evaporation of the water from the beaker are correct?

- 1 Evaporation happens at all temperatures between 0°C and 100°C .
- 2 The more-energetic water molecules escape from the surface of the water.
- 3 The temperature of the water remaining in the beaker decreases.

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

- 33** A gas is heated.

Which statement explains how thermal energy is transferred by convection in the gas?

- A** The heated gas expands, becomes less dense and falls.
B The heated gas expands, becomes less dense and rises.
C The heated gas expands, becomes more dense and falls.
D The heated gas expands, becomes more dense and rises.

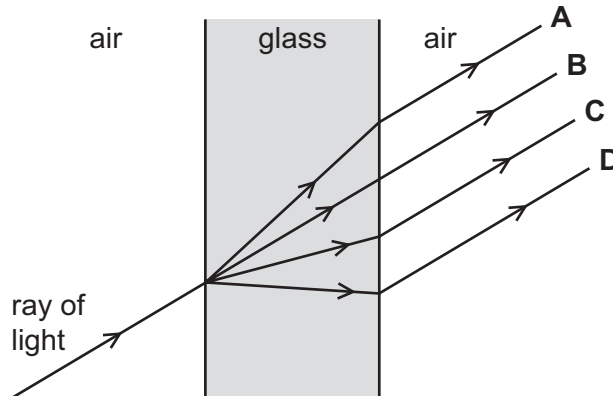
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What is the wavelength of these microwaves?

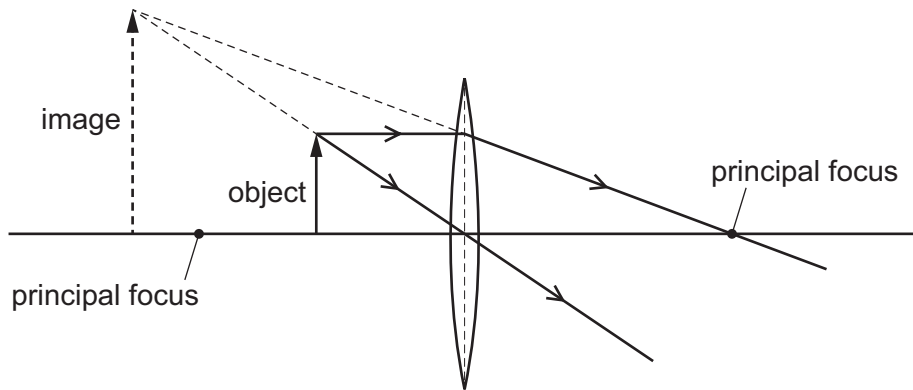
- A** 0.0075 m **B** 0.12 m **C** 7.5 m **D** 12 m

- 35 A ray of light passes through a glass window.

Which path does it take?



- 36 The diagram shows a thin converging lens used as a magnifying glass. Each principal focus of the lens is labelled.



The object is moved to the right, closer to the lens.

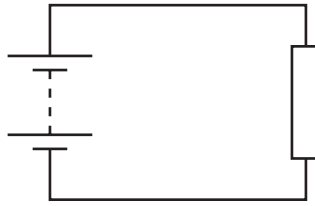
What happens to the image?

- A It moves to the left and becomes larger.
 - B It moves to the left and becomes smaller.
 - C It moves to the right and becomes larger.
 - D It moves to the right and becomes smaller.
- 37 There is a potential difference of 4.0 V across a resistor of resistance $2.0\ \Omega$.

How much charge passes through the resistor in 10 s ?

- A 0.80 C
- B 5.0 C
- C 20 C
- D 80 C

- 38 A circuit contains a battery connected to a resistor.



Which values of electromotive force (e.m.f.) and resistance produce the smallest current in the circuit?

	e.m.f. / V	resistance / Ω
A	6.0	10
B	6.0	20
C	24	80
D	24	160

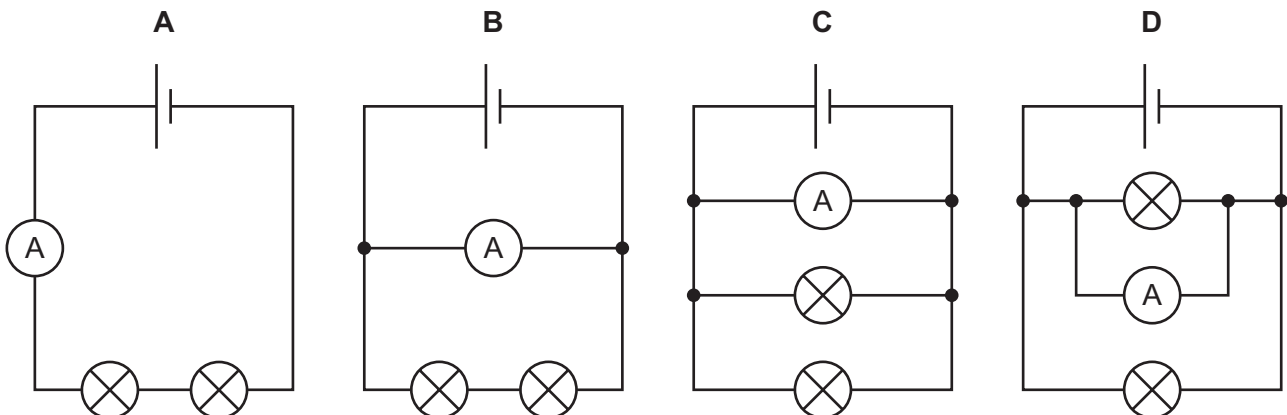
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Which circuit shows an ammeter with a reading equal to the current in each lamp?



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	11 Na sodium 23													12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31
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
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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

actinoids

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
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 —

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