



Cambridge IGCSE™

COMBINED SCIENCE

0653/21

Paper 2 Multiple Choice (Extended)

October/November 2020

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.
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- 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.

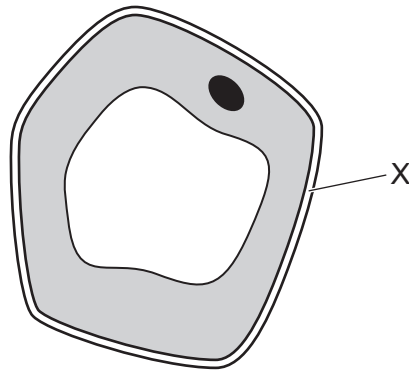
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.

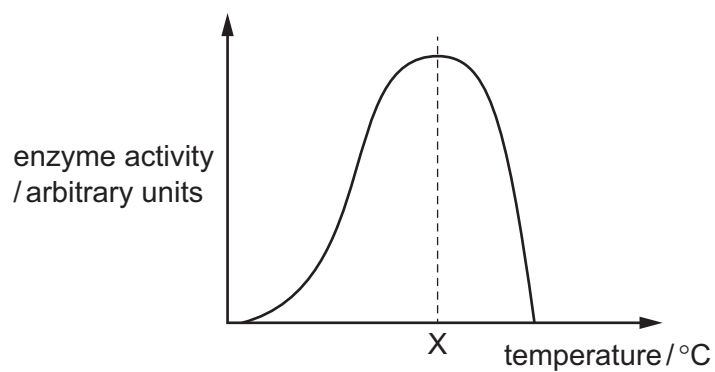


- 1 The diagram shows a cell.



What is the function of X?

- A** contains the genetic information
 - B** controls substances entering and leaving the cell
 - C** maintains the shape of the cell
 - D** photosynthesis
- 2 What is the function of ciliated cells in the bronchi?
- A** absorption of oxygen
 - B** movement of mucus
 - C** production of mucus
 - D** transport of oxygen
- 3 The diagram shows how the activity of an enzyme changes with temperature.



This enzyme works in the human body.

What is the most likely value of temperature X?

- A** 10 °C
- B** 40 °C
- C** 70 °C
- D** 100 °C

4 What is necessary for photosynthesis?

- 1 carbon dioxide
- 2 chlorophyll
- 3 glucose
- 4 light
- 5 oxygen
- 6 water

A 1, 2, 4 and 6

B 1, 3, 4 and 6

C 2, 3, 4 and 5

D 3, 4, 5 and 6

5 Deficiencies in vitamin D and in iron can cause diseases.

Which statement is correct?

A Vitamin D deficiency can cause anaemia.

B Vitamin D deficiency can cause rickets.

C Iron deficiency can cause rickets.

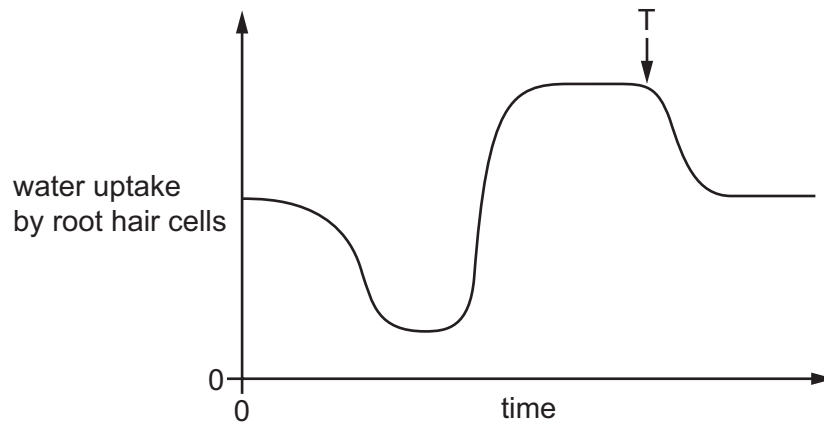
D Iron deficiency can cause scurvy.

6 Which enzymes are secreted from the pancreas?

- 1 amylase
- 2 lipase
- 3 protease

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

- 7 The graph shows the uptake of water by root hair cells over many hours during a day.



What could have caused the change in the rate of uptake at T?

- A** decrease in temperature
 - B** decrease in humidity
 - C** increase in light intensity
 - D** increase in temperature
- 8 How does mucus benefit the gas exchange system?
- A** It absorbs carbon monoxide before it reaches the alveoli.
 - B** It prevents friction between the air and the trachea.
 - C** It removes the nicotine in cigarette smoke.
 - D** It traps pathogens.
- 9 Which statement about adrenaline is correct?
- A** It is produced by a gland.
 - B** It is transported in the red blood cells.
 - C** It only has one target organ.
 - D** It reduces the size of the pupils.

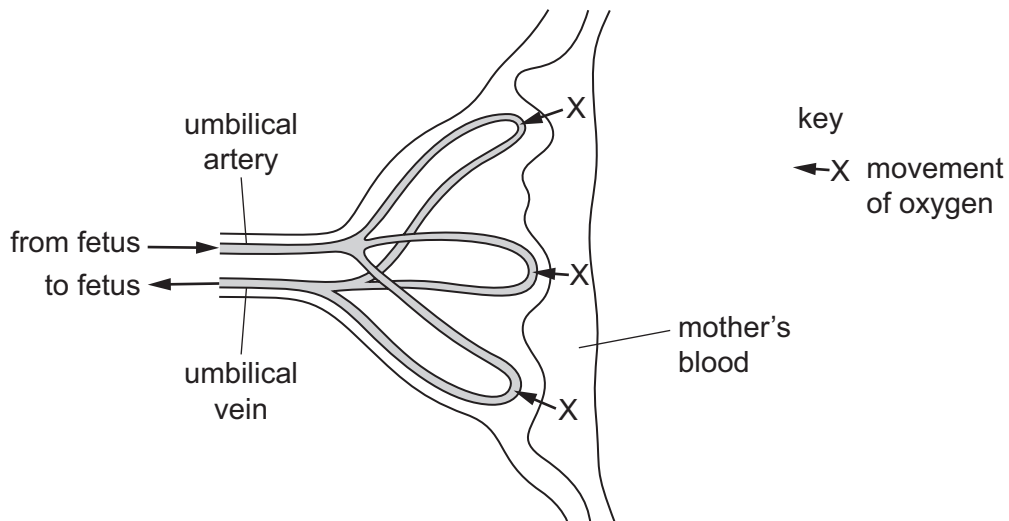
10 Which row shows the correct descriptions for the anther and stigma of a wind-pollinated flower?

	anther position	stigma position	stigma description
A	inside flower	inside flower	smooth
B	exposed	exposed	feathery
C	exposed	inside flower	smooth
D	inside flower	exposed	feathery

11 Which row describes asexual reproduction?

	number of parents	a zygote is produced	offspring identical to the parent
A	1	no	yes
B	1	yes	no
C	2	no	yes
D	2	yes	no

12 The diagram shows a placenta and umbilical cord.



Which row is correct?

	high oxygen concentration present	low oxygen concentration present	name of process X
A	umbilical artery	umbilical vein	diffusion
B	umbilical artery	umbilical vein	osmosis
C	umbilical vein	umbilical artery	diffusion
D	umbilical vein	umbilical artery	osmosis

13 Eutrophication results in the death of aquatic organisms.

What is a stage in this process?

- A** reduced aerobic respiration by decomposers
- B** reduced decomposition after death of producers
- C** reduced growth of producers
- D** reduced levels of dissolved oxygen

14 Which term describes ammonia, NH_3 ?

- A** element
- B** ion
- C** atom
- D** molecule

- 15 Two different dyes are analysed using chromatography.

Each dye produces only one coloured spot on the chromatogram.

The R_f values of the coloured spots are shown.

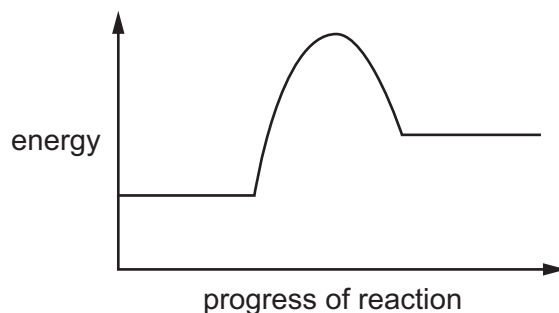
coloured spot	R_f value
red	0.2
blue	0.4

The two different dyes are then mixed together to make a purple dye.

What is observed on the chromatogram of the purple dye?

- A** one spot with R_f value 0.3
- B** one spot with R_f value 0.6
- C** two spots with R_f values 0.2 and 0.4
- D** three spots with R_f values 0.2, 0.3 and 0.4
- 16 Which statement describes a mixture?
- A** It contains molecules made from the same type of atom.
- B** It contains only one type of atom.
- C** It contains two different types of atom joined by chemical bonds.
- D** It contains two different types of atom that can be separated by physical processes.
- 17 Aqueous lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2$, reacts with potassium iodide to make a precipitate of lead(II) iodide.
- What is the ionic equation for this reaction?
- A** $\text{Pb}^+ + \text{I}^- \rightarrow \text{PbI}$
- B** $\text{Pb}^{2+} + 2\text{I}^- \rightarrow \text{PbI}_2$
- C** $\text{Pb}(\text{NO}_3)_2 + \text{I}^- \rightarrow \text{PbI} + 2\text{NO}_3^-$
- D** $\text{Pb}^{2+} + 2\text{NO}_3^- + 2\text{I}^- \rightarrow \text{PbI}_2 + 2\text{NO}_3^-$
- 18 Which statement about the electrolysis of a molten metal halide is correct?
- A** Cations move to the anode.
- B** Electrons flow through the electrolyte.
- C** Ions gain protons at the cathode.
- D** Ions lose electrons at the anode.

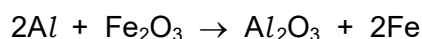
- 19 The energy level diagram for an endothermic reaction is shown.



Which statement about this reaction is correct?

- A The activation energy is the energy required to break bonds.
 - B The energy required to break bonds is less than the energy released on making new bonds.
 - C The activation energy is less than the energy change for the reaction.
 - D The final products have less energy than the reactants.
- 20 Iron can be obtained from iron(III) oxide by heating with aluminium powder.

The equation is shown.



What is the oxidising agent?

- A Al
 - B Fe_2O_3
 - C Al_2O_3
 - D Fe
- 21 Which substances react with dilute sulfuric acid to make copper sulfate?
- 1 copper
 - 2 copper carbonate
 - 3 copper hydroxide
 - 4 copper nitrate
- A 1 and 2
 - B 1 and 4
 - C 2 and 3
 - D 3 and 4

22 Acid X reacts with metal Y.

A colourless gas is given off and a pale green solution is produced.

Two tests are carried out on the solution.

test	reagent(s) added	result
1	aqueous silver nitrate and nitric acid	white precipitate
2	aqueous sodium hydroxide	green precipitate

What are acid X and metal Y?

	acid	metal
A	hydrochloric	iron
B	hydrochloric	zinc
C	sulfuric	iron
D	sulfuric	zinc

23 Rubidium and sodium are elements in Group I of the Periodic Table.

The atomic number of sodium is 11, and the atomic number of rubidium is 37.

Rubidium has a 1..... melting point and a 2..... density than sodium. The reactivity of rubidium is 3..... than the reactivity of sodium.

Which row completes gaps 1, 2 and 3?

	1	2	3
A	higher	lower	lower
B	lower	lower	higher
C	lower	higher	higher
D	higher	higher	lower

24 Ammonia, NH_3 , can be made by combining the gases nitrogen, N_2 , and hydrogen, H_2 .

This reaction is slow.

When element Y is added, the rate of reaction increases.

What is Y?

- A** Al **B** Fe **C** Rb **D** I_2

25 Which method is used to extract copper from copper(II) oxide?

- A** dissolving copper(II) oxide in hydrochloric acid and then filtering
- B** dissolving copper(II) oxide in water and then filtering
- C** heating the copper(II) oxide
- D** heating the copper(II) oxide mixed with carbon

26 Which statement describes a hydrocarbon?

- A** a compound that burns to form carbon dioxide and hydrogen
- B** a compound that contains carbon and hydrogen only
- C** a compound that only contains ionic bonds
- D** a compound that reacts easily with metals

27 What can be produced when naphtha is cracked?

- A** alkanes, alkenes and hydrogen
- B** alkanes and alkenes only
- C** alkanes and hydrogen only
- D** alkenes only

28 What does the area under a speed–time graph represent?

- A** acceleration
- B** average speed
- C** distance travelled
- D** maximum speed

29 A satellite of mass 20 kg is in orbit around the Earth.

At the height of the satellite's orbit, the gravitational field strength is one quarter of its strength on the surface of the Earth.

The gravitational field strength on the surface of the Earth is 10 N/kg.

What is the weight of the satellite as it orbits the Earth?

- A** 0 N **B** 20 N **C** 50 N **D** 200 N

- 30** A raindrop falls vertically at a constant speed.

What is the resultant force on the raindrop as it falls?

- A** It is equal to the air pressure on the drop.
- B** It is equal to the air resistance on the drop.
- C** It is equal to the weight of the drop.
- D** It is zero.

- 31** An apple falls to the ground.

Which form of energy decreases as the apple falls?

- A** chemical potential
- B** gravitational potential
- C** kinetic
- D** sound

- 32** A builder drops a brick from a height of 15 m above the ground.

The gravitational field strength g is 10 N/kg.

What is the speed of the brick as it hits the ground?

- A** 12 m/s **B** 17 m/s **C** 150 m/s **D** 300 m/s

- 33** The molecules in a substance vibrate about fixed positions.

The substance is now cooled.

Which row gives the state of the substance and the effect of cooling on the distance between its molecules?

	state of substance	effect on distance between molecules
A	solid	decreases
B	solid	increases
C	liquid	decreases
D	liquid	increases

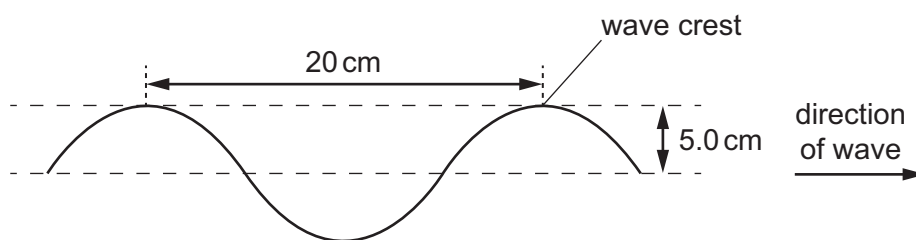
34 In which states of matter can convection occur?

	in a solid	in a liquid	in a gas
A	no	no	yes
B	no	yes	yes
C	yes	no	no
D	yes	yes	no

35 The diagram shows a section of a rope.

Four wave crests pass a point on the rope every second.

Each wave crest travels 80 cm in one second.



What is the speed of the wave?

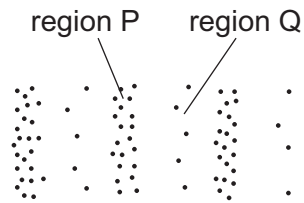
- A** 4.0 cm/s **B** 5.0 cm/s **C** 20 cm/s **D** 80 cm/s

36 A converging lens is used as a magnifying glass.

Where is the image formed and what is the nature of the image?

	position of image	nature
A	on the opposite side of the lens to the object	real
B	on the opposite side of the lens to the object	virtual
C	on the same side of the lens as the object	real
D	on the same side of the lens as the object	virtual

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



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

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

- 38 A power supply causes a current in a circuit.

The electromotive force (e.m.f.) of the power supply and the resistance of the circuit are both changed.

Which pair of changes **must** result in a smaller current in the circuit?

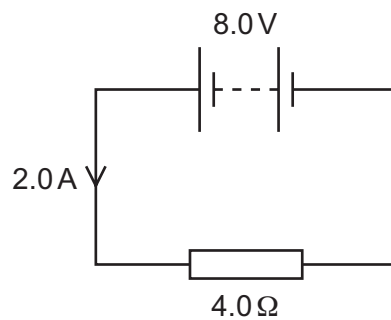
	e.m.f.	resistance
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

- 39 There is a current of 0.25 A in a wire.

How long does it take for 120 C of charge to pass a point in the wire?

- A** 0.50 minutes
- B** 8.0 minutes
- C** 30 minutes
- D** 480 minutes

40 The diagram shows an electric circuit.



The battery of electromotive force (e.m.f.) 8.0 V produces a current of 2.0 A in a $4.0\ \Omega$ resistor.

How much power is delivered to the resistor?

- A** 0.25 W **B** 4.0 W **C** 16 W **D** 64 W

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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							
												2 He helium 4							
												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.).



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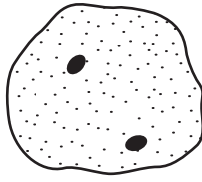
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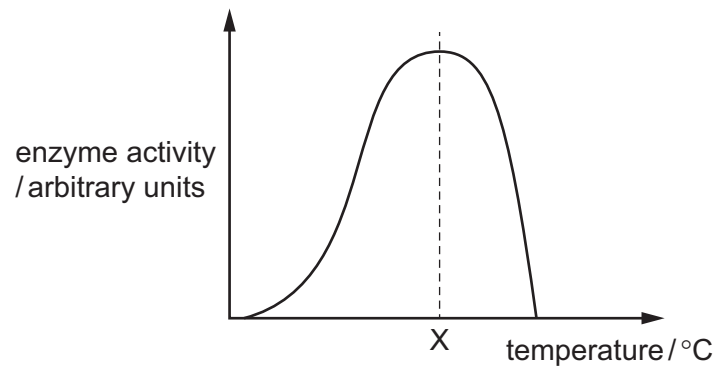


- 1 The diagram shows a cell from an animal's liver.



In what way does this cell differ from a typical animal cell?

- A** It contains a central vacuole.
 - B** It contains cytoplasm.
 - C** It contains two nuclei.
 - D** It has a cell wall.
- 2 The diagram shows how the activity of an enzyme changes with temperature.



This enzyme works in the human body.

What is the most likely value of temperature X?

- A** 10 °C
 - B** 40 °C
 - C** 70 °C
 - D** 100 °C
- 3 Some undigested food passes out of the digestive system as faeces.

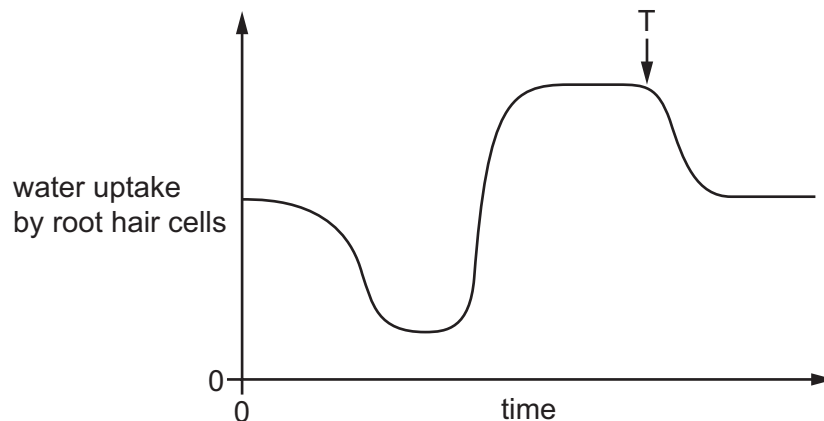
What is this process?

- A** absorption
- B** digestion
- C** egestion
- D** ingestion

4 What is a function of the hydrochloric acid produced in the stomach?

- A to help absorption of all food in the stomach
- B to kill bacteria in the ingested food
- C to prevent chemical digestion
- D to prevent the stomach contents being too acidic

5 The graph shows the uptake of water by root hair cells over many hours during a day.



What could have caused the change in the rate of uptake at T?

- A decrease in temperature
 - B decrease in humidity
 - C increase in light intensity
 - D increase in temperature
- 6 How does mucus benefit the gas exchange system?
- A It absorbs carbon monoxide before it reaches the alveoli.
 - B It prevents friction between the air and the trachea.
 - C It removes the nicotine in cigarette smoke.
 - D It traps pathogens.

7 Which row about the effects of adrenaline in humans is correct?

	blood glucose concentration	pulse rate
A	increases	decreases
B	increases	increases
C	stays the same	decreases
D	stays the same	increases

8 The following are features of human gametes.

- 1 have a jelly coat
- 2 have energy stores
- 3 have flagella
- 4 motile
- 5 produced in large numbers

What are features of human **male** gametes?

A 1 and 2 only **B** 1, 2 and 4 **C** 2, 3 and 5 **D** 3, 4 and 5

9 Which row describes asexual reproduction?

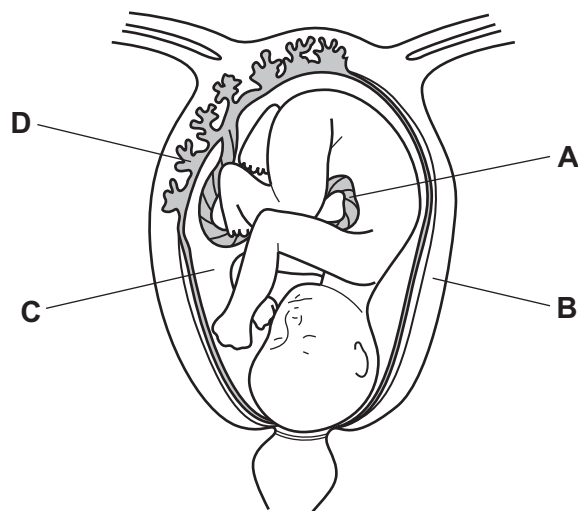
	number of parents	a zygote is produced	offspring identical to the parent
A	1	no	yes
B	1	yes	no
C	2	no	yes
D	2	yes	no

10 On which part of a flower is pollen deposited during pollination?

- A** ovary
B stamen
C stigma
D style

11 The diagram shows a fetus in the uterus.

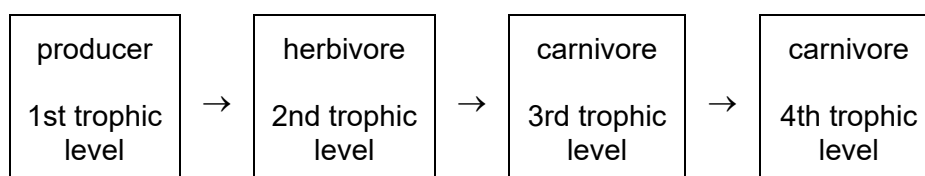
Which letter identifies the umbilical cord?



12 Which is an effect of the process of eutrophication of water?

- A increased fish population
- B increased growth of algae
- C decreased availability of nitrates and other ions in the water
- D increased levels of dissolved carbon dioxide in the water

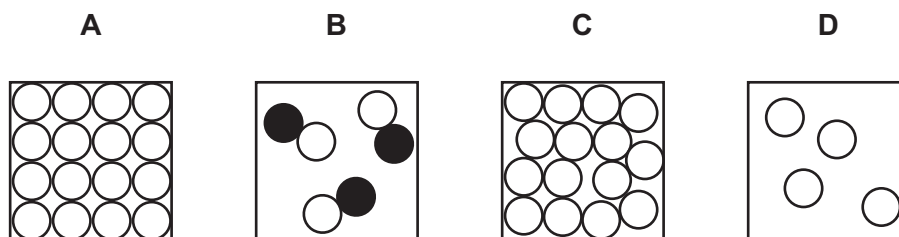
13 The diagram shows the trophic levels of a food chain.



Why do most food chains **not** have more than four trophic levels?

- A There are too many carnivores in the 3rd trophic level.
- B There are too many herbivores in the 2nd trophic level.
- C There is no energy transferred from the 2nd trophic level to the 3rd trophic level.
- D There is not enough energy available to be transferred to a 5th trophic level.

14 Which diagram represents particles in a gaseous element?



15 Which statement describes a mixture?

- A It contains molecules made from the same type of atom.
- B It contains only one type of atom.
- C It contains two different types of atom joined by chemical bonds.
- D It contains two different types of atom that can be separated by physical processes.

16 Which statement about the formation of ions is correct?

- A Metal atoms gain electrons to form cations and non-metal atoms lose electrons to form anions.
- B Metal atoms gain electrons to form anions and non-metal atoms lose electrons to form cations.
- C Metal atoms lose electrons to form cations and non-metal atoms gain electrons to form anions.
- D Metal atoms lose electrons to form anions and non-metal atoms gain electrons to form cations.

17 The formula of a magnesium ion is Mg^{2+} .

The formula of a nitride ion is N^{3-} .

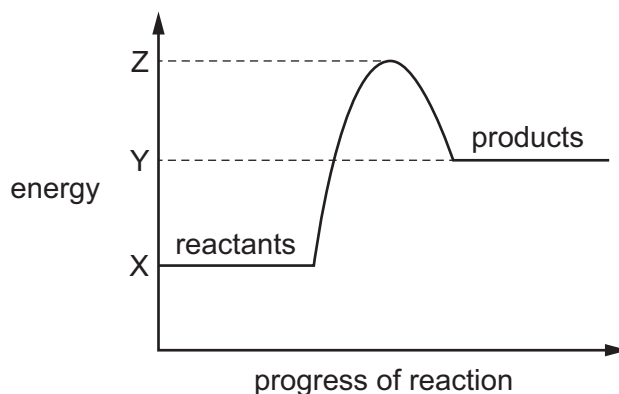
What is the formula of magnesium nitride?

- A MgN B Mg_2N_2 C Mg_2N_3 D Mg_3N_2

18 Which statement describes the movement of electrons during electrolysis?

- A They move from the anode to the cathode through the external circuit.
- B They move from the anode to the cathode through the electrolyte.
- C They move from the cathode to the anode through the external circuit.
- D They move from the cathode to the anode through the electrolyte.

19 The energy level diagram for a reaction is shown.



Which statement about the reaction is correct?

- A** The activation energy for this reaction is equal to the value of $(Z - Y)$.
- B** The energy released by this reaction is equal to the value of $(Y - X)$.
- C** The energy used to break bonds is more than the energy released in forming bonds.
- D** The overall energy change for this reaction is equal to the value of $(Z - X)$.

20 What are the effects of increasing the temperature of a reaction?

	frequency of particle collisions	number of particles having activation energy
A	less	more
B	less	same
C	more	more
D	more	same

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

Which row shows the results?

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

22 Acid X reacts with metal Y.

A colourless gas is given off and a pale green solution is produced.

Two tests are carried out on the solution.

test	reagent(s) added	result
1	aqueous silver nitrate and nitric acid	white precipitate
2	aqueous sodium hydroxide	green precipitate

What are acid X and metal Y?

	acid	metal
A	hydrochloric	iron
B	hydrochloric	zinc
C	sulfuric	iron
D	sulfuric	zinc

23 Substance X is a coloured solid.

Substance X acts as a catalyst for the reaction between zinc and dilute sulfuric acid.

Molten X can be electrolysed.

What is X?

- A** a Group I compound
- B** a Group I metal
- C** a transition metal compound
- D** a transition metal

24 The elements in Group II of the Periodic Table show a similar trend in reactivity to the elements in Group I.

Which statement about Group II elements is correct?

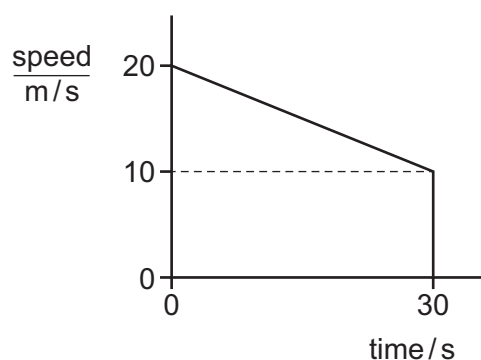
- A** Barium atoms lose electrons more readily than magnesium atoms.
- B** Calcium reacts with water more rapidly than strontium reacts with water.
- C** Magnesium displaces strontium ions from aqueous solution.
- D** Strontium oxide is reduced by heating with carbon.

- 25 Which method is used to extract copper from copper(II) oxide?
- A dissolving copper(II) oxide in hydrochloric acid and then filtering
 - B dissolving copper(II) oxide in water and then filtering
 - C heating the copper(II) oxide
 - D heating the copper(II) oxide mixed with carbon

- 26 Which process does **not** produce carbon dioxide?
- A complete combustion of methane
 - B cracking of large alkane molecules
 - C reaction between an acid and magnesium carbonate
 - D thermal decomposition of calcium carbonate

- 27 Which statement describes a hydrocarbon?
- A a compound that burns to form carbon dioxide and hydrogen
 - B a compound that contains carbon and hydrogen only
 - C a compound that only contains ionic bonds
 - D a compound that reacts easily with metals

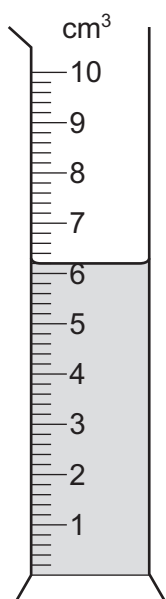
- 28 The diagram shows the speed–time graph for an object.



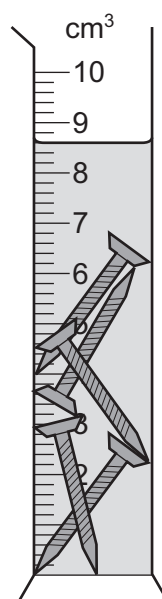
What is the distance travelled by the object in 30 s?

- A 150 m B 300 m C 450 m D 600 m

- 29 A measuring cylinder contains water. Five identical metal screws are added to the water as shown.



before
screws added



after
screws added

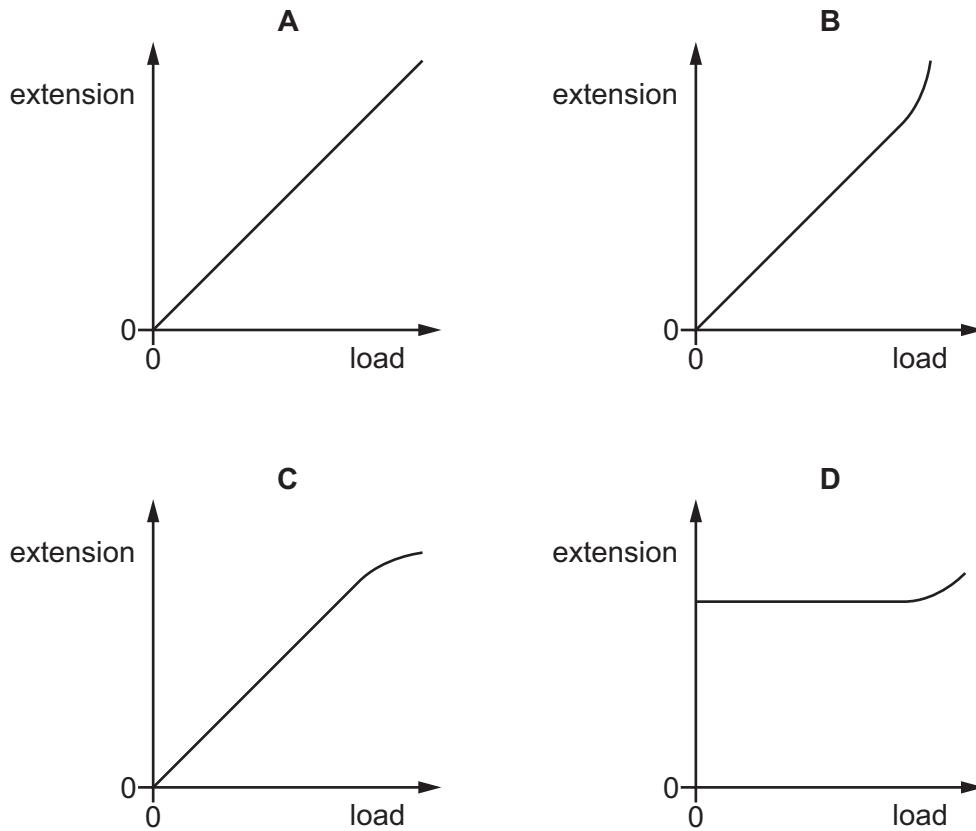
The mass of each screw is 3.8 g.

What is the density of the metal of the screws?

- A** 1.6 g/cm³ **B** 2.2 g/cm³ **C** 7.9 g/cm³ **D** 8.6 g/cm³

- 30** A spring is stretched by a load that is gradually increased until the spring extends beyond its limit of proportionality.

Which graph shows the relationship between the load and the extension produced?



- 31** A device uses 0.50 kJ of energy in 25 minutes.

What is the power of the device?

- A** 0.33 W **B** 12.5 W **C** 20 W **D** 750 W

- 32** The molecules in a substance vibrate about fixed positions.

The substance is now cooled.

Which row gives the state of the substance and the effect of cooling on the distance between its molecules?

	state of substance	effect on distance between molecules
A	solid	decreases
B	solid	increases
C	liquid	decreases
D	liquid	increases

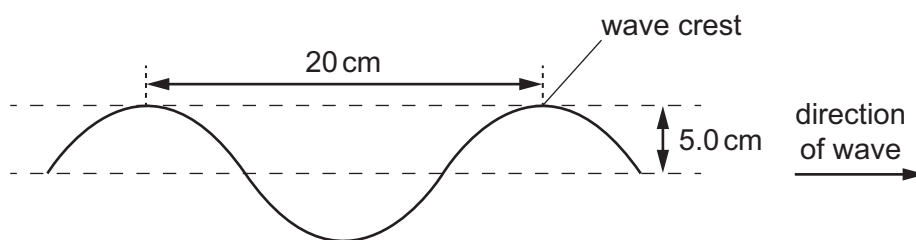
33 In which states of matter can convection occur?

	in a solid	in a liquid	in a gas
A	no	no	yes
B	no	yes	yes
C	yes	no	no
D	yes	yes	no

34 The diagram shows a section of a rope.

Four wave crests pass a point on the rope every second.

Each wave crest travels 80 cm in one second.

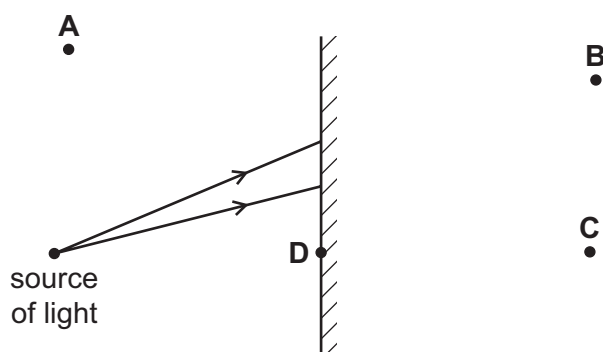


What is the speed of the wave?

- A** 4.0 cm/s **B** 5.0 cm/s **C** 20 cm/s **D** 80 cm/s

35 A source of light is placed in front of a plane mirror.

Which labelled point shows the position of the image of the source?

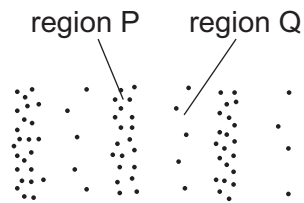


36 Radio waves, visible light and X-rays all travel in a vacuum.

Which wave travels at the greatest speed?

- A radio waves
- B visible light
- C X-rays
- D they all travel at the same speed

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



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

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

38 A power supply causes a current in a circuit.

The electromotive force (e.m.f.) of the power supply and the resistance of the circuit are both changed.

Which pair of changes **must** result in a smaller current in the circuit?

	e.m.f.	resistance
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

- 39** There is a current of 2.0 A in a 4.0Ω resistor for 20 s .

What is the charge that flows through the resistor in this time and what is the p.d. across it?

	charge/C	p.d./V
A	10	2.0
B	10	8.0
C	40	2.0
D	40	8.0

- 40** The current in the starter motor of a car is 400 A when it is connected to a 12 V battery.

How much energy is delivered to the starter motor in 2.0 seconds?

- A** 0.060 J **B** 67 J **C** 2400 J **D** 9600 J

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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	2 He helium 4
	11 Na sodium 23											12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	
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 —	127 Ts tennessine —	118 Og oganesson —	119 Nh nihonium —	120 Fl flerovium —

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 2020

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.

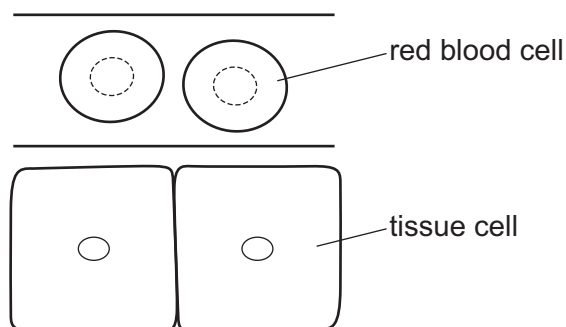
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.

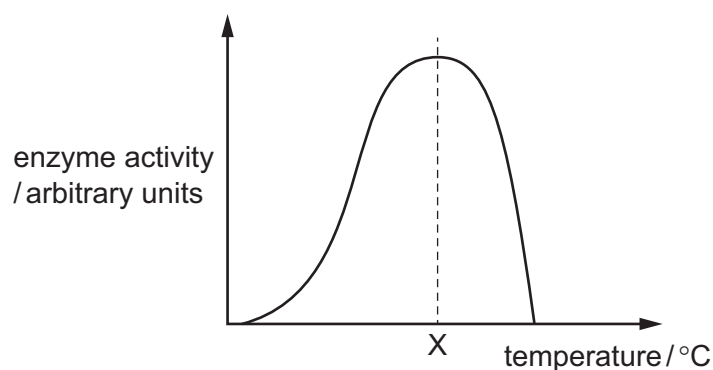


- 1 The diagram shows two red blood cells inside a capillary and two tissue cells near this capillary.



How does the oxygen in the red blood cells reach the tissue cells?

- A by absorption
 - B by diffusion
 - C by respiration
 - D by transpiration
- 2 The diagram shows how the activity of an enzyme changes with temperature.



This enzyme works in the human body.

What is the most likely value of temperature X?

- A 10 °C
 - B 40 °C
 - C 70 °C
 - D 100 °C
- 3 Which row shows the results of mechanical digestion?

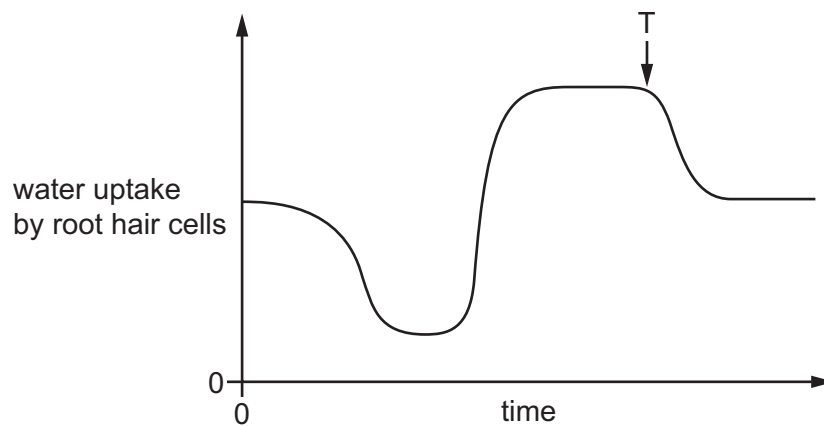
	food is broken down into		
	smaller pieces	smaller molecules	soluble molecules
A	x	✓	✓
B	x	x	✓
C	✓	x	x
D	✓	x	✓

- 4 Protease breaks down protein.

What is the protein broken down into?

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

- 5 The graph shows the uptake of water by root hair cells over many hours during a day.



What could have caused the change in the rate of uptake at T?

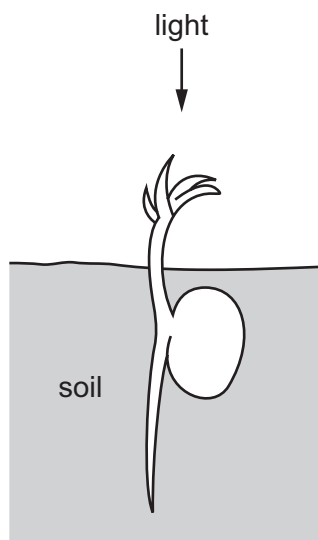
- A decrease in temperature
 - B decrease in humidity
 - C increase in light intensity
 - D increase in temperature
- 6 How does mucus benefit the gas exchange system?
- A It absorbs carbon monoxide before it reaches the alveoli.
 - B It prevents friction between the air and the trachea.
 - C It removes the nicotine in cigarette smoke.
 - D It traps pathogens.
- 7 Which shows the balanced chemical equation for aerobic respiration?
- A $6\text{CO}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 6\text{O}_2 + 6\text{H}_2\text{O}$
 - B $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
 - C $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$
 - D $6\text{O}_2 + 6\text{H}_2\text{O} \rightarrow 6\text{CO}_2 + \text{C}_6\text{H}_{12}\text{O}_6$

- 8** A person's body secretes adrenaline in response to a frightening experience.

Which statement is correct?

- A** The person's blood glucose concentration decreases.
- B** The person's breathing rate does not change.
- C** The person's pulse rate increases.
- D** The person's pupils become narrower.

- 9 The diagram shows a germinating seed.



What does the germinating seed show?

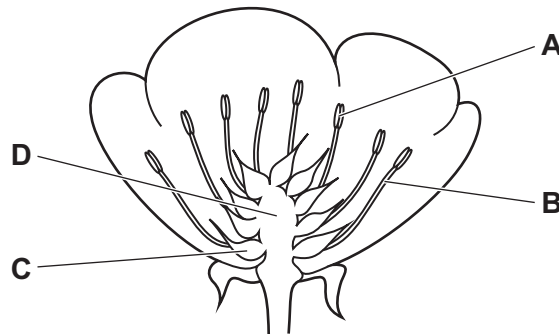
	shoot	root
A	negative phototropism	negative gravitropism
B	negative phototropism	positive gravitropism
C	positive phototropism	negative gravitropism
D	positive phototropism	positive gravitropism

- 10 Which row describes asexual reproduction?

	number of parents	a zygote is produced	offspring identical to the parent
A	1	no	yes
B	1	yes	no
C	2	no	yes
D	2	yes	no

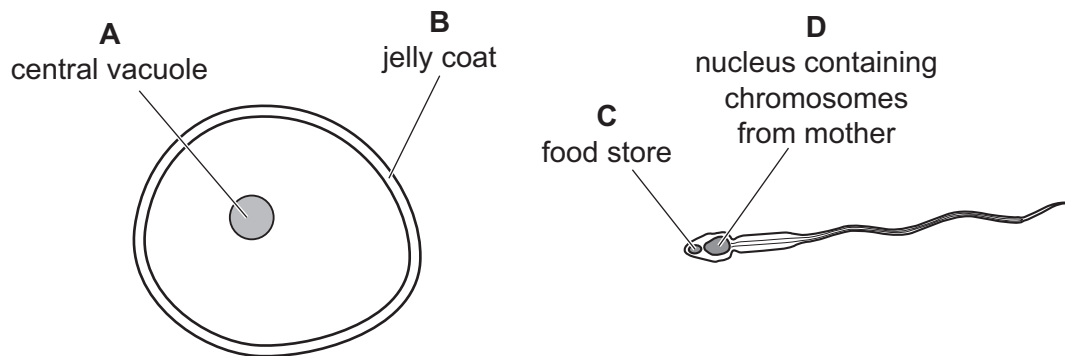
11 The diagram shows a section through a buttercup flower.

Which structure produces pollen grains?



12 The diagram shows a male gamete and a female gamete.

Which label is correct?



13 Some stages in the process of eutrophication are listed.

- 1 reduction in dissolved oxygen
- 2 increased aerobic respiration by decomposers
- 3 increased availability of nitrates
- 4 death of organisms requiring dissolved oxygen
- 5 increased growth of producers and increased decomposition after death of producers

In which sequence do these stages take place?

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

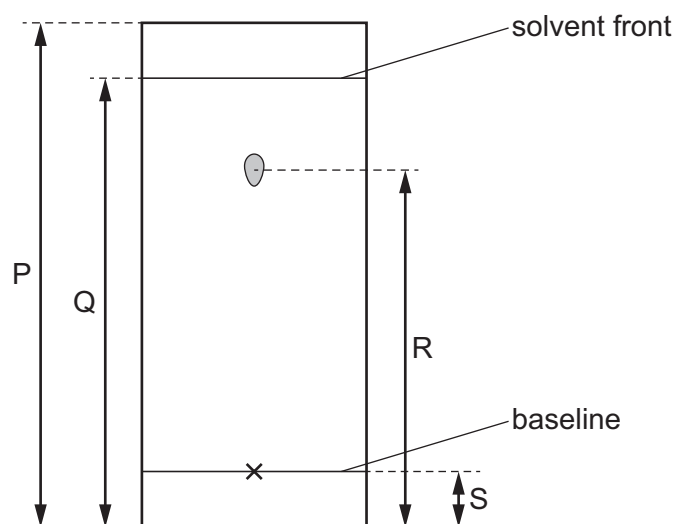
- 14 The temperature and pressure of oxygen in two different containers are shown.

	temperature /°C	pressure kN/m ²
container 1	20	200
container 2	50	150

Which statement about the oxygen molecules in container 1 compared to container 2 is correct?

- A In container 1 they are closer together and moving faster.
 - B In container 1 they are closer together and moving slower.
 - C In container 1 they are further apart and moving faster.
 - D In container 1 they are further apart and moving slower.
- 15 A pure sample of a coloured dye is tested using chromatography.

The chromatogram obtained is shown.



How is the R_f value of the dye calculated?

- A $\frac{R}{P}$
 - B $\frac{R}{Q}$
 - C $\frac{R-S}{Q-S}$
 - D $\frac{R-S}{P-S}$
- 16 Which statement describes a mixture?
- A It contains molecules made from the same type of atom.
 - B It contains only one type of atom.
 - C It contains two different types of atom joined by chemical bonds.
 - D It contains two different types of atom that can be separated by physical processes.

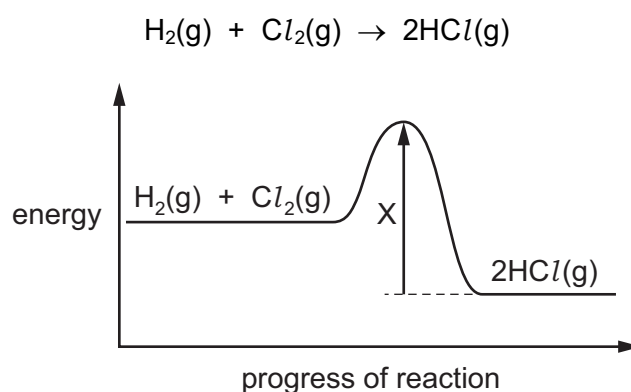
17 Which equation is **not** correctly balanced?

- A $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$
- B $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- C $\text{CaO} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$
- D $\text{Ca}(\text{OH})_2 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$

18 What happens to cations during electrolysis?

- A They gain electrons.
- B They gain oxygen.
- C They lose electrons.
- D They lose oxygen.

19 The equation and the energy level diagram for the reaction between hydrogen and chlorine are shown.



Which statement about this reaction is correct?

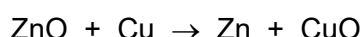
- A The reaction is endothermic.
- B The products have less energy than the reactants.
- C X is the activation energy.
- D More bonds are being broken than are being formed.

- 20** Dilute hydrochloric acid reacts with solid calcium carbonate.

Decreasing the temperature and diluting the acid both decrease the rate of reaction.

Which statement explains why these changes cause the rate of reaction to decrease?

- A** Both result in the acid particles having less energy.
 - B** Both result in a lower proportion of collisions between reacting particles being successful.
 - C** Both result in fewer acid particles per cm^3 of solution.
 - D** Both result in a lower frequency of collisions between reacting particles.
- 21** The equation for the reaction between zinc oxide and copper is shown.



Which statement about this reaction is correct?

- A** Copper is the oxidising agent.
 - B** Copper oxide is being oxidised.
 - C** Zinc is the reducing agent.
 - D** Zinc oxide is being reduced.
- 22** Which two substances both react with dilute sulfuric acid to make the salt magnesium sulfate?
- A** magnesium carbonate and magnesium chloride
 - B** magnesium chloride and magnesium nitrate
 - C** magnesium oxide and magnesium carbonate
 - D** magnesium oxide and magnesium nitrate

23 Acid X reacts with metal Y.

A colourless gas is given off and a pale green solution is produced.

Two tests are carried out on the solution.

test	reagent(s) added	result
1	aqueous silver nitrate and nitric acid	white precipitate
2	aqueous sodium hydroxide	green precipitate

What are acid X and metal Y?

	acid	metal
A	hydrochloric	iron
B	hydrochloric	zinc
C	sulfuric	iron
D	sulfuric	zinc

24 X, Y and Z are elements in Group VII.

X reacts with potassium iodide but not with potassium bromide.

Y reacts with potassium bromide but not with sodium chloride.

Z does not react with potassium bromide or with potassium iodide.

What are X, Y and Z?

	X	Y	Z
A	bromine	chlorine	iodine
B	bromine	iodine	chlorine
C	chlorine	bromine	iodine
D	iodine	chlorine	bromine

25 Some physical properties of four elements are shown.

Which element can act as a catalyst?

	melting point /°C	conductivity as a solid	density g/cm ³
A	98	good	0.97
B	113	poor	2.07
C	1455	good	8.9
D	1683	poor	2.32

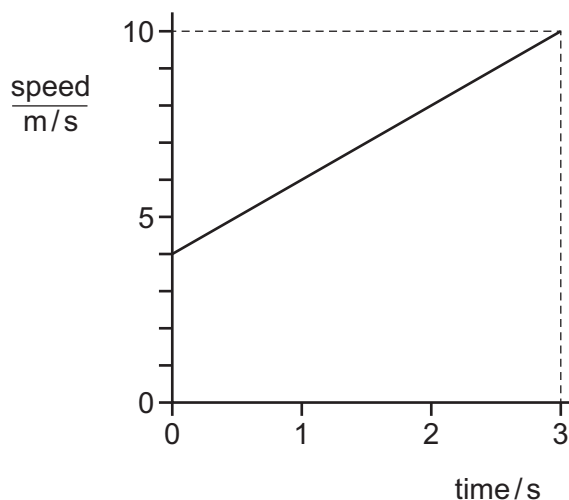
26 Which method is used to extract copper from copper(II) oxide?

- A** dissolving copper(II) oxide in hydrochloric acid and then filtering
- B** dissolving copper(II) oxide in water and then filtering
- C** heating the copper(II) oxide
- D** heating the copper(II) oxide mixed with carbon

27 Which statement describes a hydrocarbon?

- A** a compound that burns to form carbon dioxide and hydrogen
- B** a compound that contains carbon and hydrogen only
- C** a compound that only contains ionic bonds
- D** a compound that reacts easily with metals

28 The diagram shows a speed–time graph for an object.



What is the average speed of the object?

- A** 2.0 m/s
- B** 4.0 m/s
- C** 7.0 m/s
- D** 10 m/s

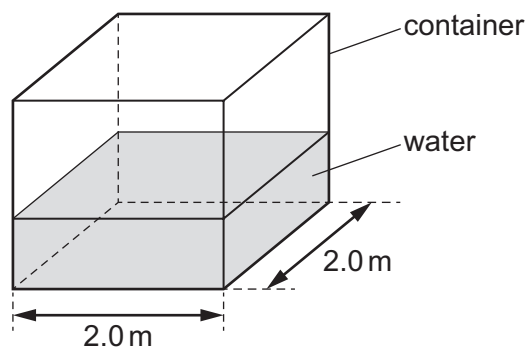
- 29 A load is hung from a spring. Measurements are taken to determine the spring constant of the spring.

Which calculation is used to obtain the spring constant?

- A $\frac{\text{extension of spring}}{\text{mass of load}}$
- B $\frac{\text{extension of spring}}{\text{weight of load}}$
- C $\frac{\text{mass of load}}{\text{extension of spring}}$
- D $\frac{\text{weight of load}}{\text{extension of spring}}$

- 30 A container has a square base of side 2.0 m.

The pressure due to the water on the base of the container is $20\,000\text{ N/m}^2$.



What is the force due to the water on the base of the container?

- A 5000 N B 10 000 N C 40 000 N D 80 000 N
- 31 A crane raises a mass of 200 kg through a vertical distance of 12 m.
- The gravitational field strength g is 10 N/kg .
- How much work is done on the mass?
- A 17 J B 170 J C 2400 J D 24 000 J
- 32 A car of mass 1200 kg travels at a speed of 15 m/s.
- The speed of the car now increases to 25 m/s.
- What is the increase in the kinetic energy of the car?
- A 60 000 J B 135 000 J C 240 000 J D 375 000 J

33 For which energy resource is the Sun the only source?

- A** geothermal
- B** natural gas
- C** nuclear
- D** tidal

34 The molecules in a substance vibrate about fixed positions.

The substance is now cooled.

Which row gives the state of the substance and the effect of cooling on the distance between its molecules?

	state of substance	effect on distance between molecules
A	solid	decreases
B	solid	increases
C	liquid	decreases
D	liquid	increases

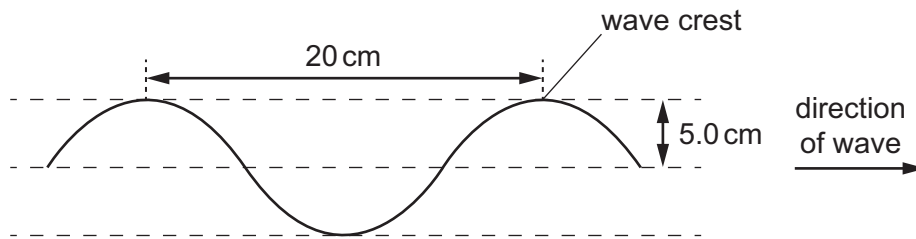
35 In which states of matter can convection occur?

	in a solid	in a liquid	in a gas
A	no	no	yes
B	no	yes	yes
C	yes	no	no
D	yes	yes	no

- 36 The diagram shows a section of a rope.

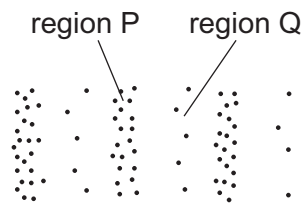
Four wave crests pass a point on the rope every second.

Each wave crest travels 80 cm in one second.



What is the speed of the wave?

- A** 4.0 cm/s **B** 5.0 cm/s **C** 20 cm/s **D** 80 cm/s
- 37 The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.



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

	region P	region Q	type of wave
A	compression	rarefaction	longitudinal
B	compression	rarefaction	transverse
C	rarefaction	compression	longitudinal
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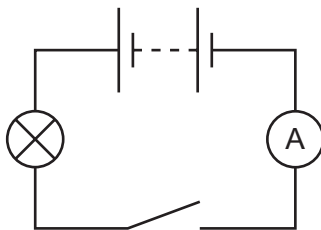
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The electromotive force (e.m.f.) of the power supply and the resistance of the circuit are both changed.

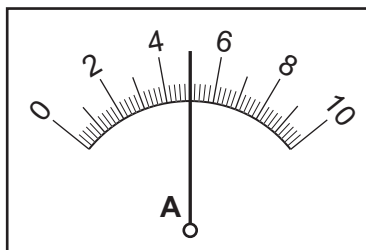
Which pair of changes **must** result in a smaller current in the circuit?

	e.m.f.	resistance
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

- 39 A circuit includes a lamp, a switch and an ammeter. The switch is open.



The switch is now closed and the ammeter displays the current reading shown.



The switch remains closed for 20 seconds before it is opened again.

What is the charge that flows while the switch is closed?

- A** 0.25 C **B** 4.0 C **C** 90 C **D** 100 C
- 40 What is the purpose of a fuse in an electrical appliance?
- A** to maintain the correct current in the appliance
- B** to maintain the correct voltage across the appliance
- C** to prevent the insulation around the cables from becoming too thin
- D** to protect the wires from overheating when the current is too large

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11 Na sodium 23	12 Mg magnesium 24											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20		
												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	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 —	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.).