



Cambridge IGCSE™

COMBINED SCIENCE

0653/21

Paper 2 Multiple Choice (Extended)

October/November 2024

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.
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- 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 characteristics are found in all living organisms?

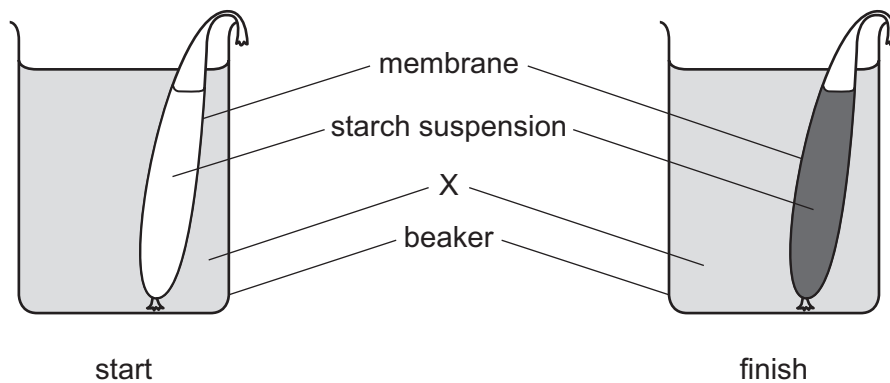
	excretion	growth	photosynthesis	respiration
A	yes	yes	no	yes
B	yes	yes	yes	no
C	yes	no	yes	yes
D	no	yes	yes	yes

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 A student uses a starch suspension contained in a transparent partially permeable membrane to investigate diffusion. The membrane is placed in a beaker of X.

The diagram shows the start and finish of the investigation.



The colour of the starch suspension changes from white to blue-black.

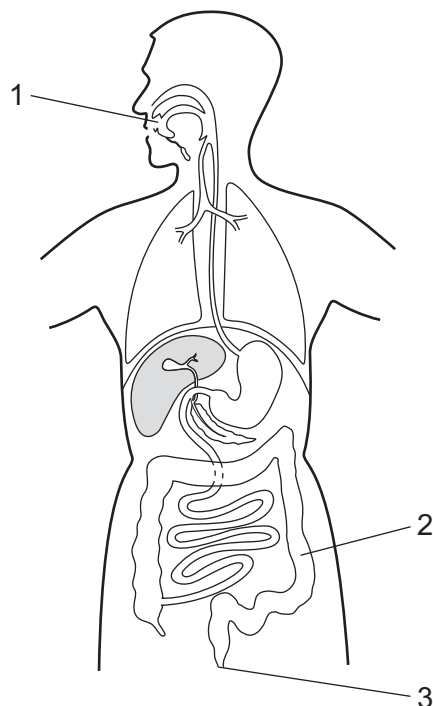
What is X?

- A** Benedict's solution
- B** biuret solution
- C** ethanol
- D** iodine solution

4 Which two components of cow's milk are essential for strong teeth and bones?

- A minerals and vitamins
- B fats and proteins
- C carbohydrates and vitamins
- D minerals and water

5 The diagram shows the human alimentary canal.

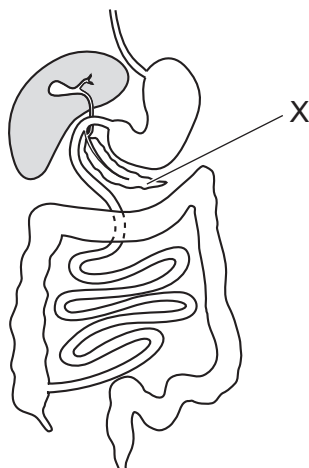


Where do egestion and ingestion occur?

	egestion	ingestion
A	1	3
B	2	3
C	3	1
D	3	2

6 A list of enzymes and a diagram of some human organs are shown.

- 1 amylase
- 2 protease
- 3 lipase



Which enzymes are secreted by the organ labelled X?

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

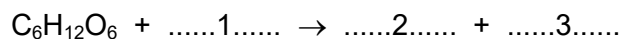
7 Which row is correct for the transport of water during transpiration in plants?

	tissue	direction of transport
A	phloem	leaf to root
B	phloem	root to leaf
C	xylem	leaf to root
D	xylem	root to leaf

8 What happens after blood has filled the atria of the heart?

	muscles of the atria	muscles of the ventricles	valves between atria and ventricles
A	contract	contract	open
B	relax	contract	close
C	contract	relax	open
D	relax	relax	close

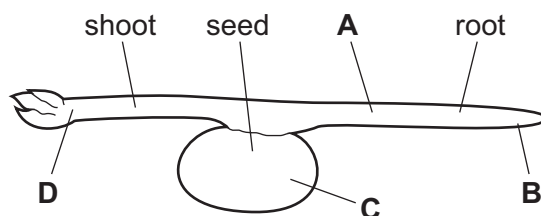
- 9 Which row completes the balanced chemical equation for aerobic respiration?



	1	2	3
A	6H ₂ O	6O ₂	6CO ₂
B	6O ₂	6CO ₂	3H ₂ O
C	3O ₂	6CO ₂	3H ₂ O
D	6O ₂	6H ₂ O	6CO ₂

- 10 The diagram shows a germinated seed in a horizontal position.

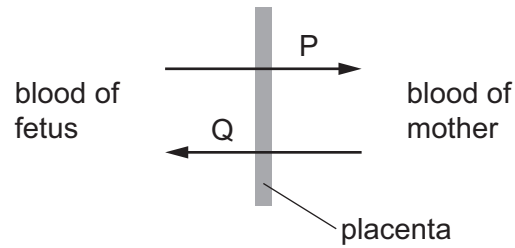
In which area is the cell elongation the greatest?



- 11 Which row about wind-pollinated plants is correct?

	position of stamens and stigmas	size of petals compared to insect-pollinated plants
A	outside the flower	large
B	outside the flower	small
C	inside the flower	large
D	inside the flower	small

12 The diagram represents the human placenta.



P and Q show the net movement of substances.

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

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

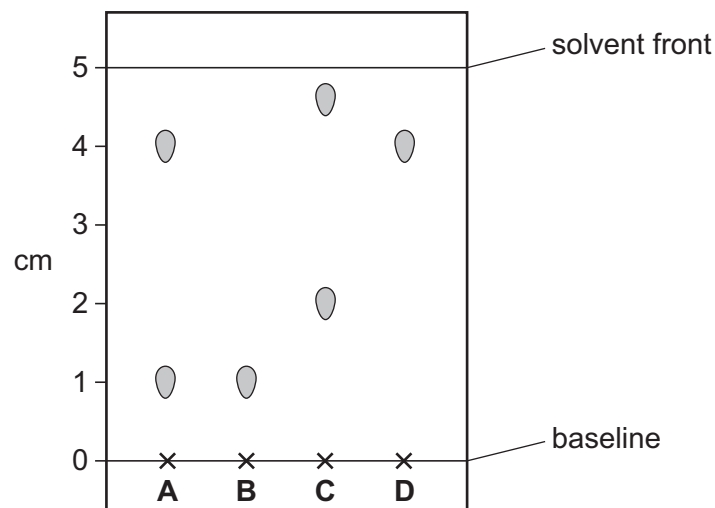
13 Which factors reduce the possible number of trophic levels in a food chain?

- 1 energy lost in faeces
- 2 energy absorbed by a plant leaf
- 3 energy released by respiration
- 4 energy stored in an animal

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

14 The diagram shows a chromatogram produced by four different substances.

Which pure substance has an R_f value of 0.8?



15 Which process is **not** a chemical change?

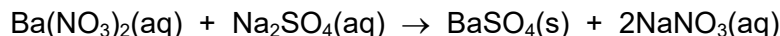
- A electrolysis of molten lead bromide
- B fractional distillation of petroleum
- C oxidation of copper
- D rusting of iron

16 Magnesium chloride is an ionic compound.

Which row describes the formation of magnesium chloride and the strength of the attraction between its ions?

	formation of magnesium chloride	strength of the attraction between ions
A	Electrons are shared between magnesium and chlorine.	strong
B	Electrons are shared between magnesium and chlorine.	weak
C	Electrons are transferred from magnesium to chlorine.	strong
D	Electrons are transferred from magnesium to chlorine.	weak

17 The equation for the reaction between barium nitrate and sodium sulfate is shown.



What is the ionic equation for this reaction?

- A $\text{Ba}^+(\text{aq}) + \text{SO}_4^-(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$
- B $\text{Na}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{NaNO}_3(\text{aq})$
- C $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$
- D $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{Ba}^{2+}(\text{s}) + \text{SO}_4^{2-}(\text{s})$

18 When molten sodium chloride is electrolysed using inert electrodes, sodium and chlorine are produced at the electrodes.

Which row describes what happens at the anode and at the cathode?

	at the anode	at the cathode
A	chloride ions gain electrons	sodium ions lose electrons
B	chloride ions lose electrons	sodium ions gain electrons
C	sodium ions lose electrons	chloride ions gain electrons
D	sodium ions gain electrons	chloride ions lose electrons

19 Which row about bond breaking is correct?

	type of process	net energy transfer
A	endothermic	to surroundings
B	endothermic	from surroundings
C	exothermic	to surroundings
D	exothermic	from surroundings

20 Which statement explains how decreasing the concentration of reactants affects the rate of a reaction?

- A** It decreases because the frequency of collisions decreases.
- B** It decreases because the proportion of colliding particles with the activation energy decreases.
- C** It increases because the frequency of collisions increases.
- D** It increases because the proportion of colliding particles with the activation energy increases.

21 Compound X reacts with compound Y to form sodium sulfate, water and carbon dioxide.

What are X and Y?

	X	Y
A	sodium carbonate	hydrochloric acid
B	sodium carbonate	sulfuric acid
C	sodium hydroxide	hydrochloric acid
D	sodium hydroxide	sulfuric acid

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

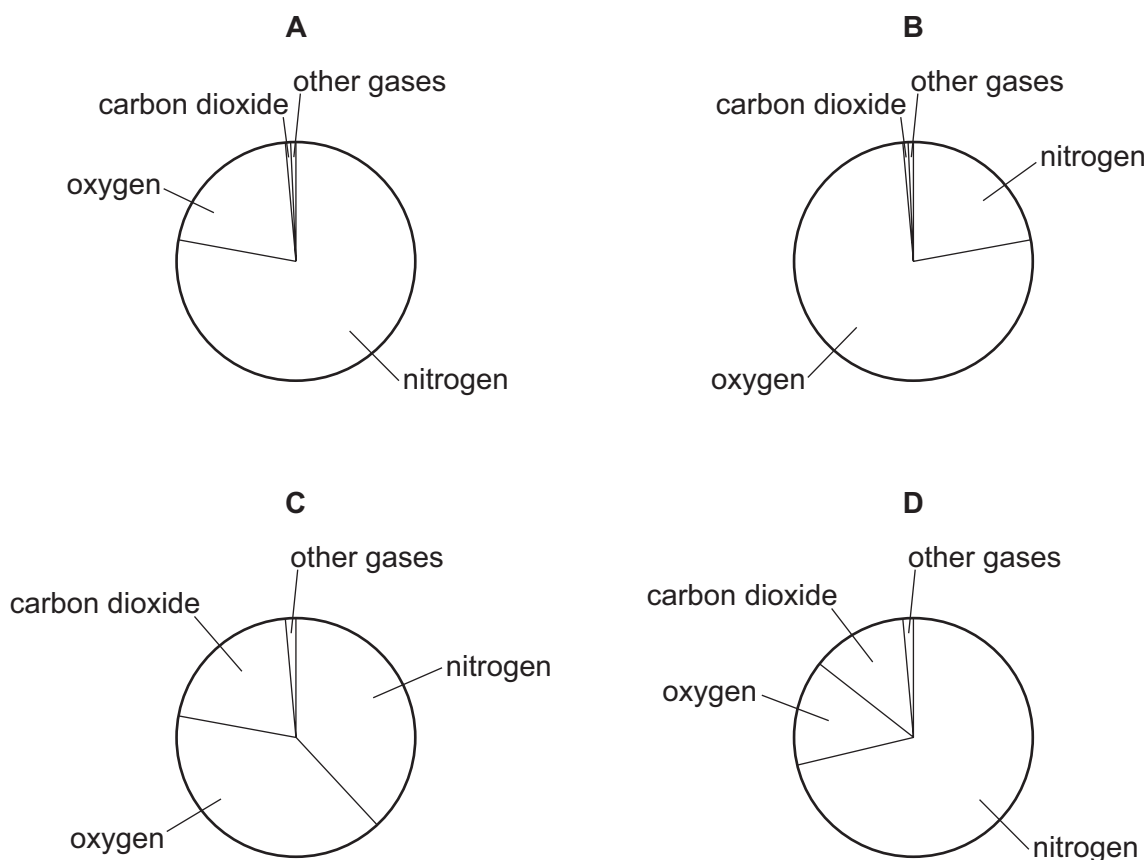
23 Which statement explains why the elements in Group VIII of the Periodic Table are unreactive?

- A** They are gases.
- B** They are non-metals.
- C** They have equal numbers of protons and electrons in their atoms.
- D** They have a full outer shell of electrons.

24 Which metal can be obtained by passing hydrogen over its heated metal oxide?

- A** copper
- B** magnesium
- C** iron
- D** zinc

25 Which pie chart shows the composition of clean air?



26 Which statements about the alkanes are correct?

- 1 They are saturated hydrocarbons.
- 2 They produce carbon monoxide and water during complete combustion.
- 3 They are generally unreactive, except in terms of burning.

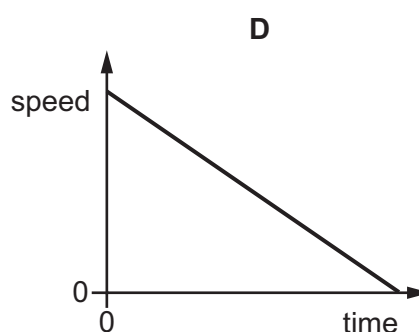
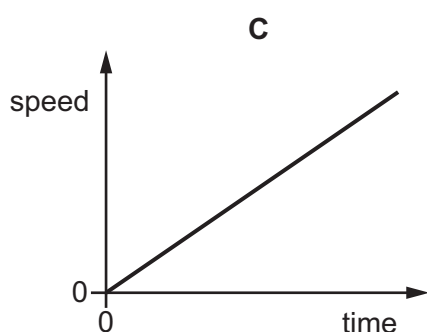
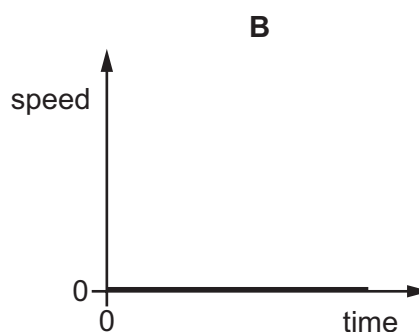
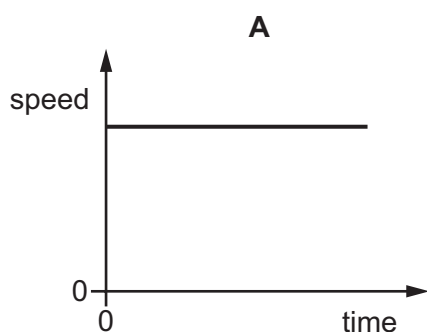
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

27 Which statement about cracking is correct?

- A** Alkanes are produced, which are used to make polymers.
B Low temperatures are used.
C Alkenes are the only products.
D A catalyst is used.

28 A car is moving downhill along a road at a constant speed.

Which graph is the speed–time graph for the car?



- 29** A cube is made of material with a density of 5.0 g/cm^3 .

Which row shows the length of one side and the mass of the cube?

	length of one side of cube / cm	mass of cube / g
A	2.0	0.62
B	2.0	40
C	4.0	20
D	4.0	80

- 30** A block of weight 65 N rests on a horizontal surface.

The pressure on the surface due to the block is 10 Pa.

What is the area of contact between the block and the surface?

- A** 6.5 cm^2 **B** 6.5 m^2 **C** 650 cm^2 **D** 650 m^2

- 31** A wind-powered generator is used to charge a car battery.

In which form is energy stored in the moving air, and in which form is energy stored in the charged battery?

	energy in moving air	energy in charged battery
A	kinetic	chemical
B	kinetic	electrical
C	thermal	chemical
D	thermal	electrical

- 32** For which energy resource is the Sun the main source of energy?

- A** geothermal
B nuclear
C tidal
D wind

- 33** A gas 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

- 34** A small coloured crystal is at the bottom of a beaker of water at room temperature. The beaker is gently heated from underneath the crystal, and the crystal dissolves slowly.

Coloured water just above the crystal is observed to rise up through the water in the beaker.

Which process is being observed, and which density change causes it?

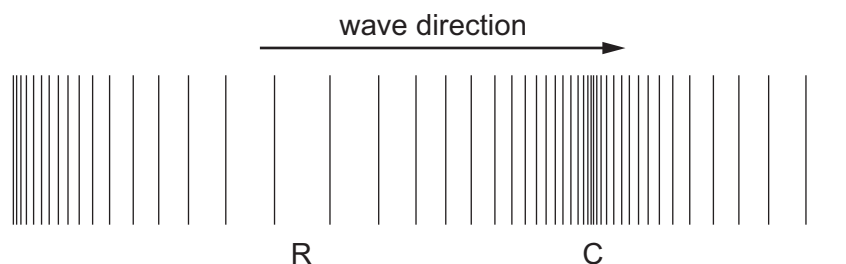
	process	density change
A	conduction	Water becomes less dense when heated.
B	conduction	Water becomes more dense when heated.
C	convection	Water becomes less dense when heated.
D	convection	Water becomes more dense when heated.

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

Where is the object positioned, and is the image real or virtual?

	position of object	image
A	closer to the lens than the principal focus	real
B	closer to the lens than the principal focus	virtual
C	further away from the lens than the principal focus	real
D	further away from the lens than the principal focus	virtual

- 36 The diagram represents a sound wave travelling from left to right in a solid.



R is a rarefaction, and C is a compression.

In which direction do R and C move, and in which direction do the particles in the solid vibrate?

	direction of movement of R and C	direction of vibration of particles
A	same as wave direction	parallel to wave direction
B	same as wave direction	perpendicular to wave direction
C	opposite to wave direction	perpendicular to wave direction
D	opposite to wave direction	parallel to wave direction

- 37 A resistor of resistance $3.0\ \Omega$ is connected to a 6.0 V power supply.

What is the rate of flow of charge through the resistor?

- A** 0.50 C/min **B** 2.0 C/min **C** 30 C/min **D** 120 C/min

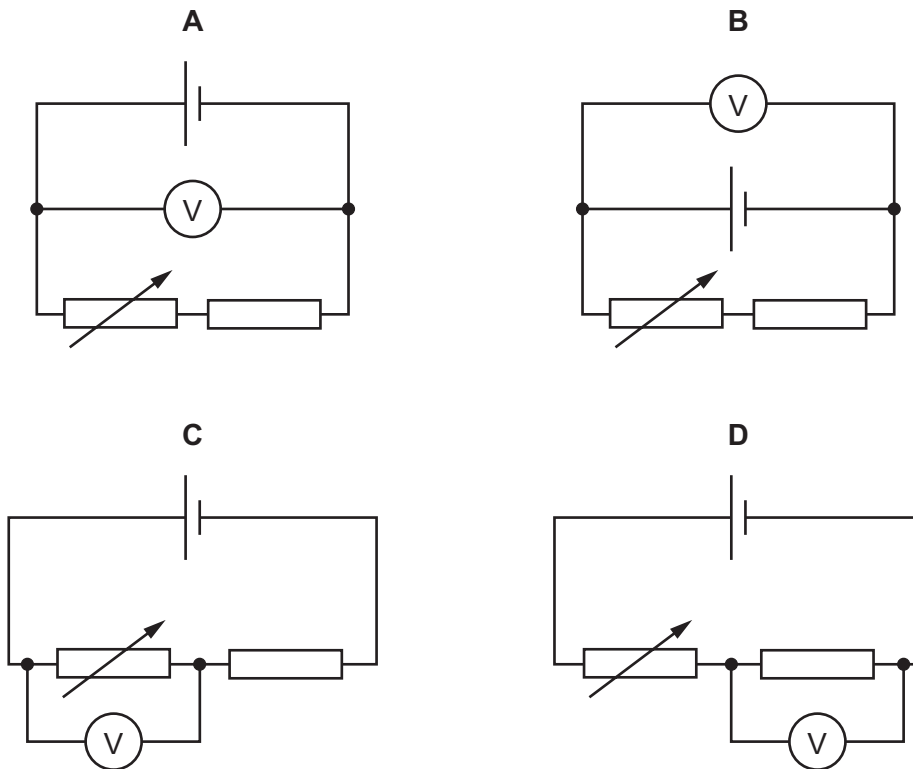
- 38 A power supply causes a current in a circuit.

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

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

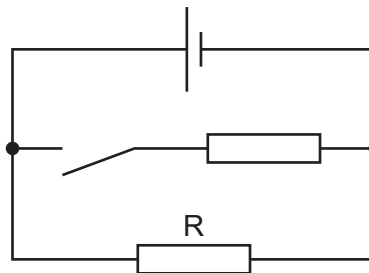
	e.m.f.	resistance
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

- 39 Which circuit shows a voltmeter that measures the potential difference (p.d.) across a variable resistor?



- 40 An electric circuit contains two resistors connected to a cell.

One resistor is labelled R. The switch is shown open.



The switch is now closed.

What happens to the potential difference (p.d.) across resistor R, and what happens to the current in resistor R?

- A The p.d. decreases and the current increases.
- B The p.d. decreases and the current remains the same.
- C The p.d. remains the same and the current increases.
- D The p.d. remains the same and the current remains the same.

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The Periodic Table of Elements

Group																		
I	II											III	IV	V	VI	VII	VIII	
1Hhydrogen1 Key atomic number atomic symbol name relative atomic mass																		
3Li lithium 7	4Be beryllium 9																	
11Na sodium 23	12Mg magnesium 24	13Al aluminium 27	14Si silicon 28	15P phosphorus 31	16S sulfur 32	17Cl chlorine 35.5	18Ar argon 40											
19K potassium 39	20Ca calcium 40	21Sc scandium 45	22Ti titanium 48	23V vanadium 51	24Cr chromium 52	25Mn manganese 55	26Fe iron 56	27Co cobalt 59	28Ni nickel 59	29Cu copper 64	30Zn zinc 65	31Ga gallium 70	32Ge germanium 73	33As arsenic 75	34Se selenium 79	35Br bromine 80	36Kr krypton 84	
37Rb rubidium 85	38Sr strontium 88	39Y yttrium 89	40Zr zirconium 91	41Nb niobium 93	42Mo molybdenum 96	43Tc technetium —	44Ru ruthenium 101	45Rh rhodium 103	46Pd palladium 106	47Ag silver 108	48Cd cadmium 112	49In indium 115	50Sn tin 119	51Sb antimony 122	52Te tellurium 128	53I iodine 127	54Xe xenon 131	
55Cs caesium 133	56Ba barium 137	57–71 lanthanoids		72Hf hafnium 178	73Ta tantalum 181	74W tungsten 184	75Re rhenium 186	76Os osmium 190	77Ir iridium 192	78Pt platinum 195	79Au gold 197	80Hg mercury 201	81Tl thallium 204	82Pb lead 207	83Bi bismuth 209	84Po polonium —	85At astatine —	86Rn radon —
87Fr francium —	88Ra radium —	89–103 actinoids		104Rf rutherfordium —	105Db dubnium —	106Sg seaborgium —	107Bh bohrium —	108Hs hassium —	109Mt meitnerium —	110Ds darmstadtium —	111Rg roentgenium —	112Cn copernicium —	113Nh nihonium —	114Fl flerovium —	115Mc moscovium —	116Lv livermorium —	117Ts tennessine —	118Og oganeson —

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
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 —

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).



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- 1 A car is filled with fuel and is driven away.

Which characteristic of living organisms is **not** matched by a similar process in the car?

- A excretion
- B growth
- C movement
- D respiration

- 2 Which row shows the site of chemical reactions in a cell and identifies the partially permeable structure in a cell?

	site of chemical reactions	partially permeable structure
A	cytoplasm	cell membrane
B	cytoplasm	cell wall
C	vacuole	cell membrane
D	vacuole	cell wall

- 3 Uncooked potato pieces of identical size and mass are placed in different sugar solutions for two hours.

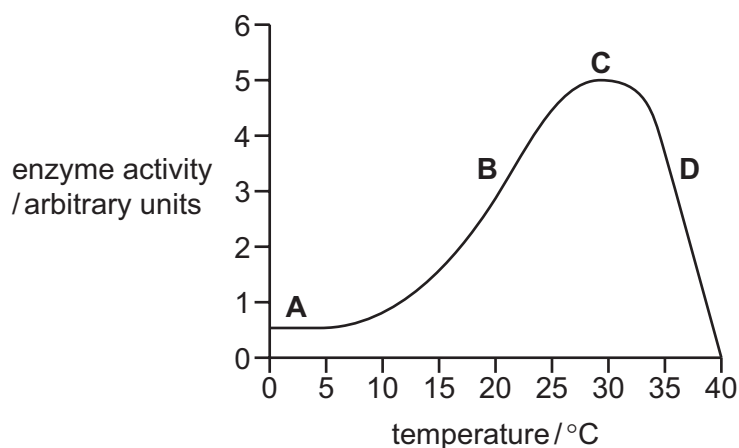
Which sugar solutions cause a decrease in the mass of a potato piece?

- 1 a solution with a higher sugar concentration than the potato piece
- 2 a solution with a lower sugar concentration than the potato piece
- 3 a solution with a higher water potential than the potato piece
- 4 a solution with a lower water potential than the potato piece

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

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

At which point is the frequency of effective collisions the highest?



- 5 Which substances produced by plants contain either magnesium ions or nitrogen atoms?

	chlorophyll	enzymes	starch
A	x	✓	✓
B	✓	x	✓
C	✓	x	x
D	✓	✓	x

- 6 The table shows two plant tissues with their possible functions.

	tissue	functions	
		support	transport
1	phloem	✓	✓
2	phloem	x	✓
3	xylem	✓	✓
4	xylem	✓	x

Which rows show the correct functions for phloem and xylem?

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

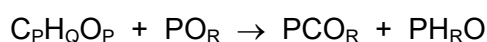
7 What is **not** a possible risk factor for coronary heart disease?

- A genetic predisposition
- B healthy diet
- C smoking
- D stress

8 What is the sequence of structures that air passes through when entering the body?

- A larynx → trachea → bronchi → bronchioles
- B larynx → trachea → bronchioles → bronchi
- C trachea → larynx → bronchi → bronchioles
- D trachea → larynx → bronchioles → bronchi

9 The chemical equation for aerobic respiration is shown with the numbers replaced by the letters P, Q and R.



Which row shows the correct values for P, Q and R?

	P	Q	R
A	2	12	6
B	6	2	12
C	6	12	2
D	12	2	6

10 Which row shows the changes in pulse rate and pupil width that occur when a person is frightened?

	pulse rate	pupil width
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

11 Which statement about auxin is correct?

- A It causes cell division.
- B It is equally distributed in response to gravity.
- C It is made in the leaves.
- D It is unequally distributed in response to light.

12 During pregnancy in humans, gas exchange occurs between a mother and her fetus.

Where does this gas exchange occur?

- A amniotic fluid
- B amniotic sac
- C placenta
- D umbilical cord

13 Which animal gets its energy from eating other animals only?

- A carnivore
- B decomposer
- C herbivore
- D producer

14 Which process produces a chemical change?

- A adding ethanol to water
- B adding sodium to water
- C boiling water
- D melting ice

15 Which row describes an element and a compound?

	element	compound
A	contains more than one type of atom	contains elements chemically combined
B	contains more than one type of atom	contains elements mixed together
C	contains only one type of atom	contains elements chemically combined
D	contains only one type of atom	contains elements mixed together

- 16 Potassium chloride, KCl , is a solid at room temperature.

Ammonia, NH_3 , is a gas at room temperature.

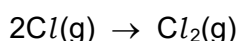
Which statement explains this difference?

- A Ionic bonds are stronger than covalent bonds.
 - B Covalent bonds are stronger than ionic bonds.
 - C The attractive forces between ions in KCl are much stronger than the covalent bonds in NH_3 .
 - D Attractive forces between molecules are weaker than ionic bonds.
- 17 Titanium oxide contains Ti^{4+} ions and O^{2-} ions.

What is the formula of titanium oxide?

- A TiO
 - B TiO_2
 - C Ti_2O
 - D Ti_4O_2
- 18 Which statement about changes at the electrodes during electrolysis is correct?
- A Anions gain electrons at the positive electrode.
 - B Anions lose electrons at the negative electrode.
 - C Cations gain electrons at the negative electrode.
 - D Cations lose electrons at the positive electrode.

- 19 The equation representing the formation of a chlorine molecule from two chlorine atoms is shown.



Which statement about this process is correct?

- A The chlorine molecule has less chemical energy than two chlorine atoms.
- B The two chlorine atoms obtain full outer electron shells by forming a double covalent bond.
- C The process is endothermic and energy is taken in.
- D The process involves only chlorine so energy is neither given out nor taken in.

- 20** The rate of a reaction increases when the temperature or the concentration of the reactants is increased.

Which row explains why the rate of reaction increases?

	change	activation energy	collisions per second	number of particles with energy greater than the activation energy
A	increase in concentration	increases	increases	stays the same
B	increase in concentration	stays the same	stays the same	increases
C	increase in temperature	stays the same	increases	stays the same
D	increase in temperature	stays the same	increases	increases

- 21** Magnesium chloride is a soluble salt which is made when excess magnesium reacts with dilute hydrochloric acid.

Four separation techniques are listed.

- 1 chromatography
- 2 crystallisation
- 3 distillation
- 4 filtration

Which processes are used to obtain a sample of magnesium chloride crystals from the reaction mixture?

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

- 22** What is used to show that a compound contains potassium?

- A** a flame test
B aqueous ammonia
C aqueous silver nitrate
D aqueous sodium hydroxide

- 23** Sodium has a melting point of 98 °C and a density of 0.97 g/cm³.

Which row shows the melting point and density of rubidium?

	melting point/°C	$\frac{\text{density}}{\text{g/cm}^3}$
A	39	0.53
B	39	1.53
C	180	0.53
D	180	1.53

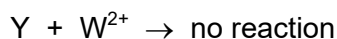
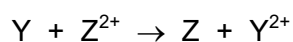
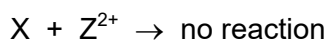
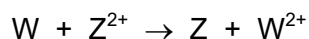
- 24** Which group of the Periodic Table contains monoatomic gaseous elements?

- A** Group I
B Group II
C Group VII
D Group VIII

- 25** W, X, Y and Z are metals.

The metals are added to separate aqueous metal ion solutions.

Some of the results are shown.



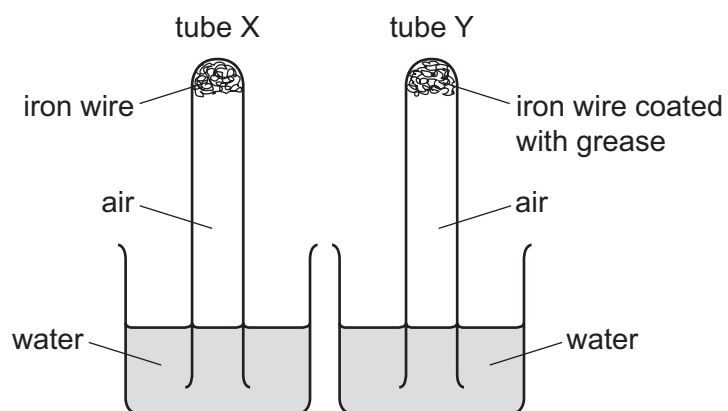
Which row shows the order of reactivity of the metals?

	most reactive	$\longrightarrow$			least reactive
A	W	Y	Z	X	
B	W	Z	Y	X	
C	X	Y	Z	W	
D	X	Z	Y	W	

26 Which metal can be extracted from its ore using hydrogen?

- A calcium
- B sodium
- C copper
- D zinc

27 An experiment is set up to show the effect of air and water on iron.

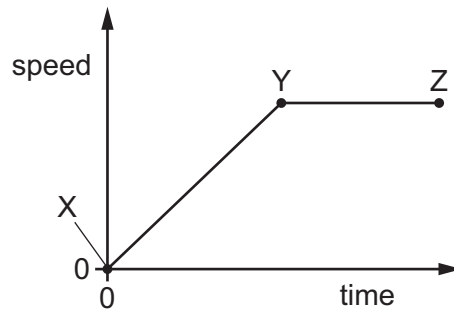


The experiment is left for one week.

What happens to the water level in each tube?

	tube X	tube Y
A	falls	falls
B	no change	rises
C	rises	rises
D	rises	no change

28 A car is travelling along a straight road. The speed–time graph for part of its journey is shown.

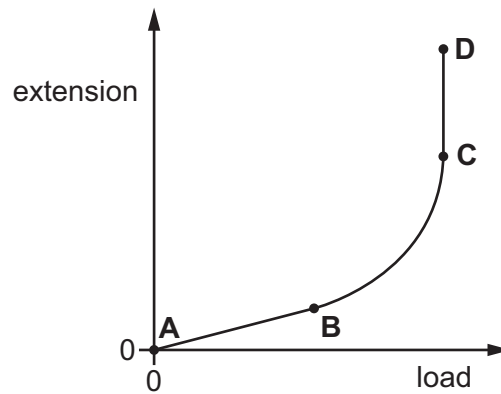


Which row describes the motion of the car between X and Y and between Y and Z?

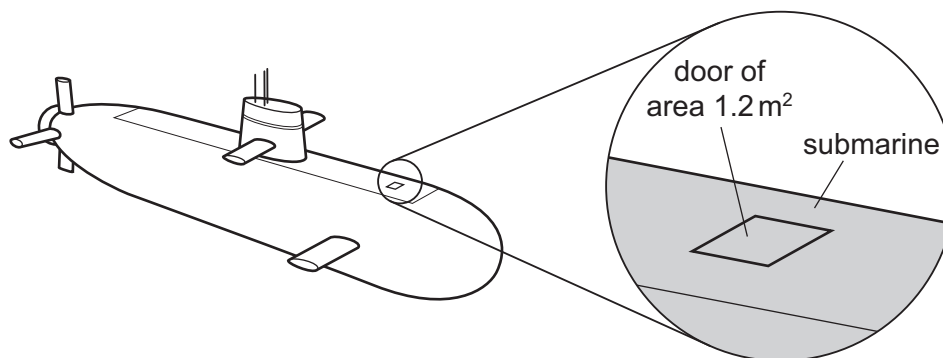
	between X and Y	between Y and Z
A	changing speed	constant speed
B	changing speed	not moving
C	constant speed	constant speed
D	constant speed	not moving

29 The extension–load graph for a wire is shown.

Which labelled point represents the limit of proportionality of the wire?



- 30 A flat door on the top of a submarine has an area of 1.2 m^2 .



The pressure of the water above the door of the submarine is $3.0 \times 10^5 \text{ Pa}$, and the pressure of the air inside the submarine is $1.0 \times 10^5 \text{ Pa}$.

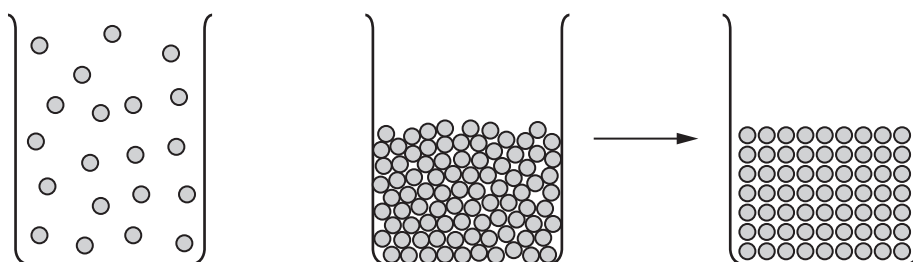
What is the magnitude of the resultant force on the door?

- A $1.2 \times 10^5 \text{ N}$ B $2.4 \times 10^5 \text{ N}$ C $3.6 \times 10^5 \text{ N}$ D $4.8 \times 10^5 \text{ N}$
- 31 A force F acts on an object as it moves a distance d across a smooth surface. The energy of the object changes by ΔE .

Which equation gives the work done W on the object by the force?

- A $W = \frac{\Delta E}{F \times d}$ B $W = \Delta E \times d$ C $W = \frac{\Delta E}{d}$ D $W = \Delta E$

- 32 Three beakers contain samples of the same substance. The diagrams indicate the molecular structures of the substance in each of the beakers.



Which change of state is represented by the arrow?

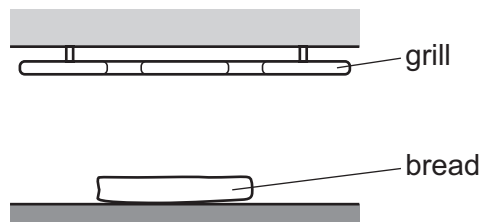
- A liquid to gas
B liquid to solid
C solid to gas
D solid to liquid

- 33** A room is heated by a heater on a wall.

Which statement describes what happens to the heated air just above the heater?

- A** The heated air becomes denser and falls.
- B** The heated air becomes denser and rises.
- C** The heated air becomes less dense and falls.
- D** The heated air becomes less dense and rises.

- 34** Bread is toasted under a hot grill.



What is the main part of the electromagnetic spectrum involved in transferring thermal energy from the grill to the bread?

- A** infrared
 - B** gamma radiation
 - C** radio waves
 - D** X-rays
- 35** A sound wave is travelling at a speed of 300 m/s in air. The sound wave has a frequency of 7.5 kHz.

What is the wavelength of the sound wave?

- A** 4.0 cm
 - B** 25 cm
 - C** 4.0 m
 - D** 25 m
- 36** A ray of light is incident on a plane mirror at an angle of incidence of 20° .

What is the angle between the incident ray and the reflected ray?

- A** 10°
- B** 20°
- C** 40°
- D** 70°

- 37** A thin converging lens is used as a magnifying glass to view an object.

Where is the object placed?

- A** further than two focal lengths from the lens
- B** at exactly two focal lengths from the lens
- C** between one and two focal lengths from the lens
- D** closer to the lens than one focal length

- 38** A potential difference (p.d.) of 10 V across a resistor produces a current of 2.0 A in the resistor.

What is the resistance of the resistor?

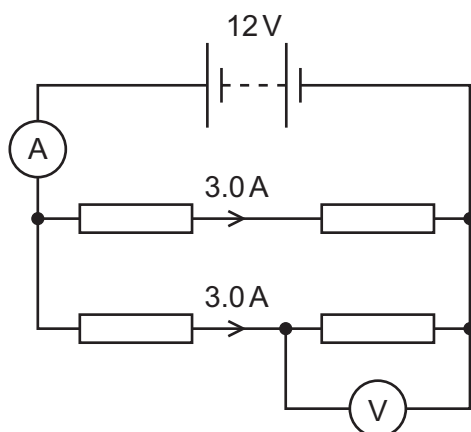
- A** $0.050\ \Omega$ **B** $0.20\ \Omega$ **C** $5.0\ \Omega$ **D** $20\ \Omega$

- 39** Four wires are made of the same material. They have different lengths and different cross-sectional areas.

Which wire has the smallest resistance?

	length	cross-sectional area
A	l	$\frac{A}{2}$
B	l	A
C	$2l$	$\frac{A}{2}$
D	$2l$	A

- 40 The diagram shows a circuit containing a 12 V battery, four identical resistors, an ammeter and a voltmeter. Two values of current are shown.



What is the reading on the ammeter, and what is the reading on the voltmeter?

	reading on ammeter / A	reading on voltmeter / V
A	3.0	6.0
B	3.0	12
C	6.0	6.0
D	6.0	12

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The Periodic Table of Elements

Group																																																																															
I	II											III	IV	V	VI	VII	VIII																																																														
1 H hydrogen 1 Key atomic number atomic symbol name relative atomic mass																																																																															
3 Li lithium 7	4 Be beryllium 9																																																																														
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 —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganesson —

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
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 —

actinoids

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 2024

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 row correctly identifies the function of a ciliated cell in the bronchus of a healthy human?

	substance being moved	direction of movement
A	air	towards bronchioles
B	air	towards trachea
C	mucus	towards bronchioles
D	mucus	towards trachea

- 2 Water enters a plant cell.

In which order does the water pass through the cell structures before reaching the vacuole?

- A** cell membrane → cell wall → cytoplasm
B cell wall → cell membrane → cytoplasm
C cell wall → cytoplasm → cell membrane
D cytoplasm → cell wall → cell membrane

- 3 Which row describes an enzyme?

	molecule	function
A	carbohydrate	biological catalyst
B	carbohydrate	hormone
C	protein	biological catalyst
D	protein	hormone

- 4 What is a symptom of iron deficiency?

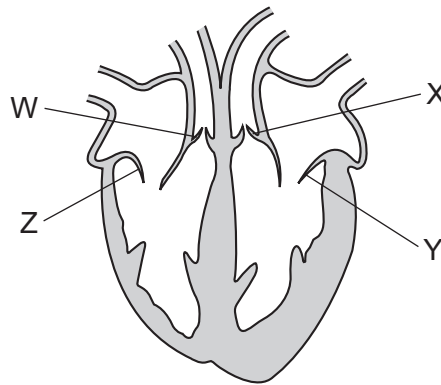
- A** constipation
B feeling tired
C coronary heart disease
D scurvy

- 5 Chemical digestion produces small, soluble molecules.

For which process is chemical digestion necessary?

- A absorption
- B egestion
- C excretion
- D ingestion

- 6 The diagram shows a section through the human heart. The four valves are labelled W, X, Y and Z.



When the left ventricle contracts, valve Y closes.

Which row shows the position of the other valves when valve Y is closed?

	valve W	valve X	valve Z
A	closed	closed	closed
B	open	closed	open
C	open	open	closed
D	open	open	open

- 7 Which row describes how the oxygen concentration and carbon dioxide concentration in blood changes as the blood passes through the lungs?

	oxygen concentration	carbon dioxide concentration
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 8 The incomplete equation for aerobic respiration is shown.



What is the formula of X?

- A** $\text{C}_6\text{H}_6\text{O}_{12}$ **B** $\text{C}_6\text{H}_{12}\text{O}_6$ **C** $\text{C}_{12}\text{H}_{12}\text{O}_6$ **D** $6\text{CH}_{12}\text{O}_6$

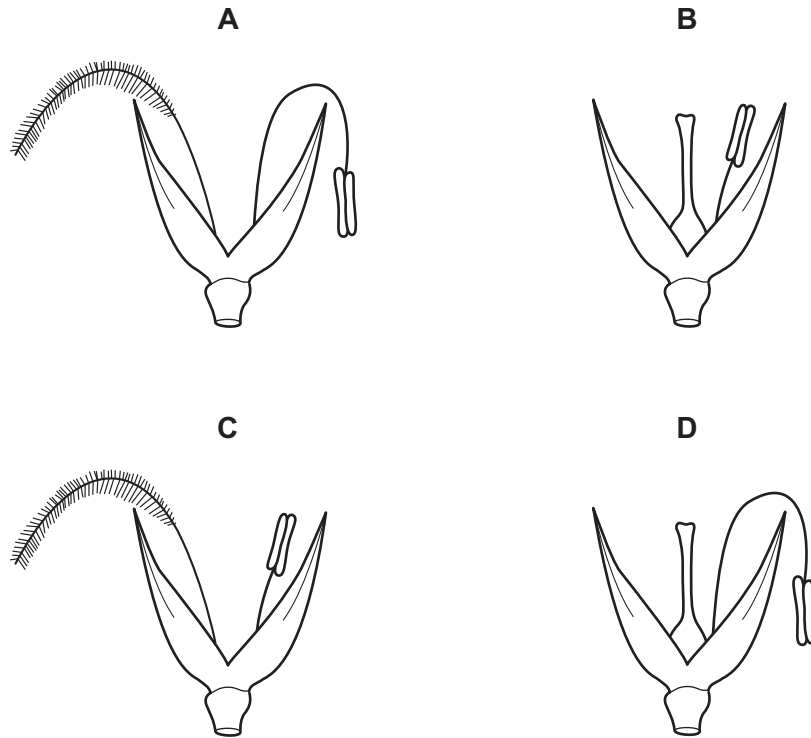
- 9 Which row is correct for auxin in a shoot?

	effect of auxin	side of shoot where more auxin is found
A	cell division	closer to the light
B	cell division	further away from the light
C	cell elongation	closer to the light
D	cell elongation	further away from the light

- 10 Which row is correct for sexual reproduction?

	requires gametes	offspring produced
A	yes	genetically different
B	yes	genetically identical
C	no	genetically different
D	no	genetically identical

11 Which diagram shows the stigma and stamen of a wind-pollinated flower?



12 What is the function of the placenta?

- A to allow the mixing of the mother's blood with the blood of the fetus
- B to exchange nutrients and waste
- C to keep the fetus warm
- D to stop the fetus from moving

13 What are the effects of deforestation and the combustion of fossil fuels on the concentrations of carbon dioxide and oxygen in the atmosphere?

	concentration of carbon dioxide	concentration of oxygen
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 14 Solid mixtures X and Y are made from the salts as shown in the table.

mixture X	mixture Y
barium sulfate: white, insoluble iron(III) sulfate: brown, soluble	potassium chromate(VI): yellow, soluble potassium manganate(VII): purple, soluble

Each mixture is shaken with water.

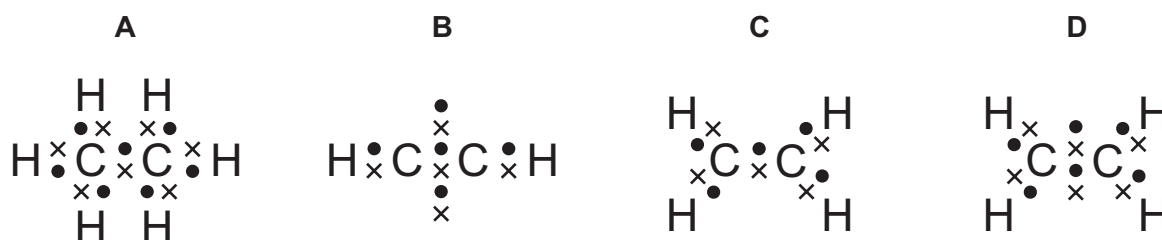
How can the salts in each mixture be separated?

	mixture X	mixture Y
A	chromatography	chromatography
B	chromatography	filtration
C	filtration	chromatography
D	filtration	filtration

- 15 Which particle has the smallest mass?

- A** atom
B electron
C neutron
D proton

- 16 Which dot-and-cross diagram represents the bonding in a molecule of ethene?



- 17 What are the correct numbers of atoms in one molecule of nitric acid?

	hydrogen	nitrogen	oxygen
A	1	1	3
B	1	3	1
C	2	1	3
D	2	3	1

18 Molten silver chloride is electrolysed using inert electrodes.

Which statement about this electrolysis is correct?

- A** Silver ions gain electrons at the anode.
- B** Silver ions gain electrons at the cathode.
- C** Silver ions lose electrons at the anode.
- D** Silver ions lose electrons at the cathode.

19 The reaction of bromine with ethene is exothermic.

Which statement about this reaction is correct?

- A** The activation energy is greater than the energy released in bond formation.
- B** The activation energy must be less than the overall energy change.
- C** The energy gained in bond forming causes the temperature to fall.
- D** The energy released in bond forming is greater than the energy used in bond breaking.

20 Which row describes what happens to the rate of reaction and the frequency of collisions between particles when the concentration of a reactant is increased?

	rate of reaction	frequency of collisions
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

21 Which statements about an oxidising agent are correct?

- 1 It is oxidised in a redox reaction.
- 2 It is reduced in a redox reaction.
- 3 It oxidises another substance in a redox reaction.
- 4 It reduces the reducing agent in a redox reaction.

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

- 22** Magnesium chloride crystals can be made by reacting solid magnesium carbonate with dilute hydrochloric acid.

What is **not** used in this process?

- A** excess solid
- B** crystallisation
- C** distillation
- D** filtration

- 23** Which statement about the halogens is correct?

- A** Aqueous sodium bromide reacts with chlorine to produce aqueous sodium chloride.
- B** Aqueous sodium chloride reacts with iodine to produce aqueous sodium iodide.
- C** Bromine reacts with aqueous sodium chloride to produce chlorine.
- D** Iodine reacts with aqueous sodium bromide to produce bromine.

- 24** Which metal is extracted from bauxite?

- A** aluminium
- B** copper
- C** iron
- D** zinc

- 25** Two different bottles each contain a colourless liquid.

One bottle contains an alkene and the other contains water.

Three different tests are listed.

- 1 addition of pink cobalt(II) chloride
- 2 addition of brown aqueous bromine
- 3 addition of white copper(II) sulfate

Which tests can be used to positively identify the bottle that contains water?

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

26 Which statement about greenhouse gases is correct?

- A Increased concentrations of greenhouse gases cause a reduced greenhouse effect, which may contribute to climate change.
- B Increased concentrations of greenhouse gases cause an enhanced greenhouse effect, which may contribute to climate change.
- C Increased concentrations of greenhouse gases cause an enhanced greenhouse effect, which does **not** contribute to climate change.
- D Decreased concentrations of greenhouse gases cause an enhanced greenhouse effect, which may contribute to climate change.

27 Q, R and S are fossil fuels.

The main constituent of Q is methane.

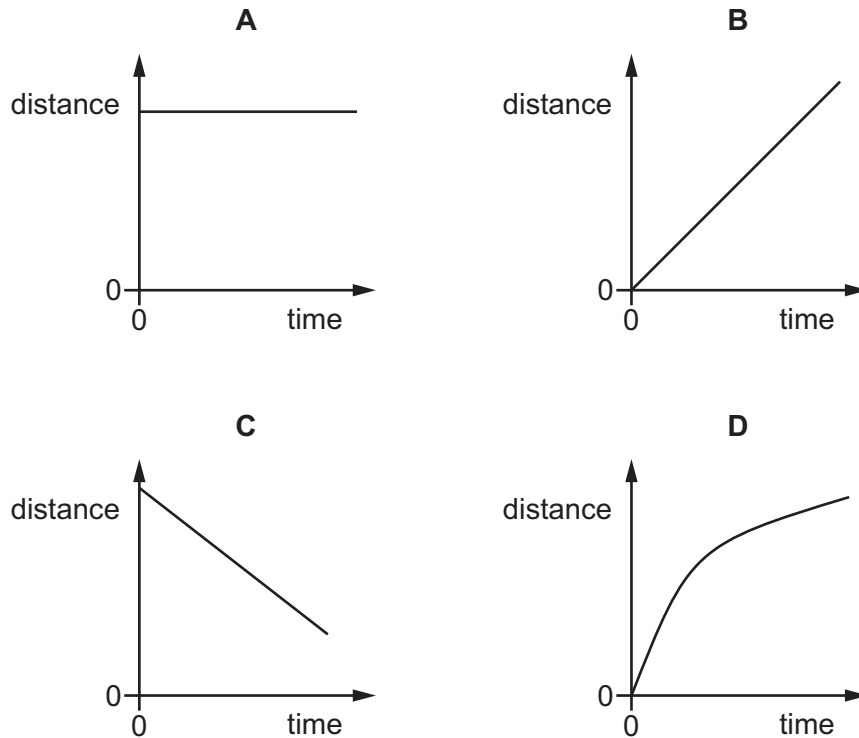
R is a source of diesel oil and bitumen.

S is burned in car engines.

Which row identifies Q, R and S?

	Q	R	S
A	natural gas	gasoline	petroleum
B	natural gas	petroleum	gasoline
C	coal	gasoline	petroleum
D	coal	petroleum	gasoline

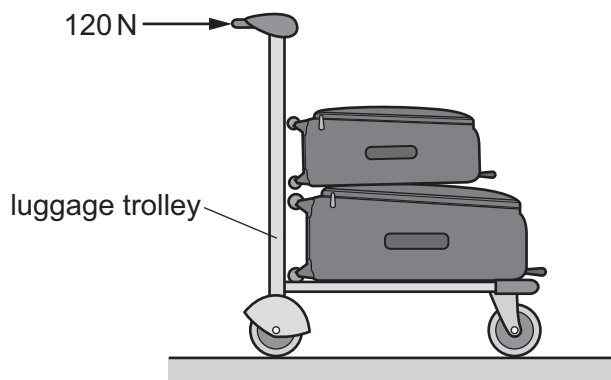
28 Which distance–time graph represents an object that is moving with changing speed?



29 Which statement about mass and weight is correct?

- A** Mass is the gravitational field that acts on a weight.
- B** Mass is the gravitational force that acts on a weight.
- C** Weight is the gravitational field that acts on a mass.
- D** Weight is the gravitational force that acts on a mass.

30 A luggage trolley is pushed with a horizontal force of 120 N.



The trolley travels a distance of 500 cm in the direction of the force.

How much work is done?

- A** 24 J
- B** 60 J
- C** 600 J
- D** 60 000 J

- 31** A brick of mass 3.0 kg rests on a shelf. The brick falls from the shelf. The brick hits the ground at a speed of 8.0 m/s.

Ignore air resistance.

How much kinetic energy does the brick have just before hitting the ground, and how much gravitational potential energy does the brick have when on the shelf?

	kinetic energy before hitting ground / J	gravitational potential energy on shelf / J
A	24	24
B	24	96
C	96	0
D	96	96

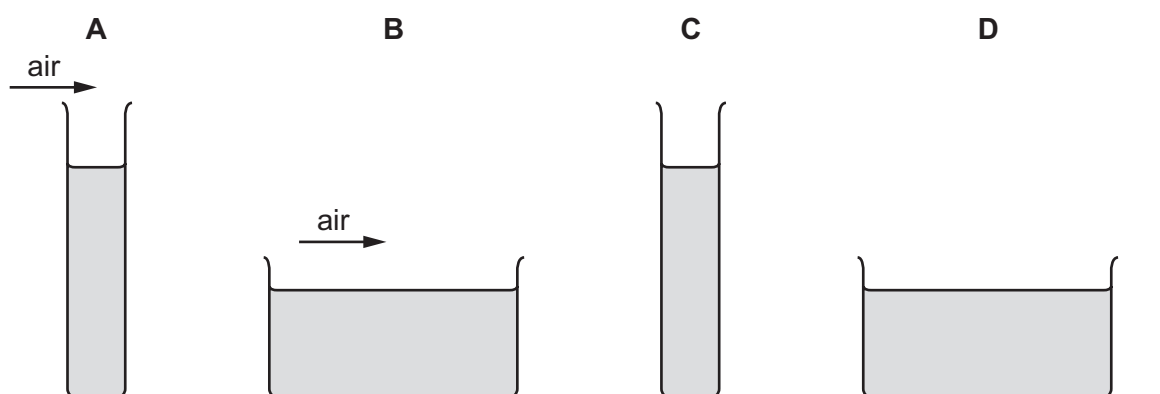
- 32** Which row states an advantage and a disadvantage of the energy resource given?

	energy resource	advantage	disadvantage
A	natural gas	renewable	produces carbon dioxide
B	nuclear fission	no hazardous waste	expensive to build a power station
C	solar energy	does not produce carbon dioxide	not always available
D	wind energy	cheap to run	non-renewable

- 33** The water in four containers is at the same temperature.

There is a movement of air over the surface of containers **A** and **B** but **not** over **C** and **D**.

From which container does the water evaporate at the lowest rate?



- 34** An aluminium cap is screwed onto the top of an aluminium bottle.

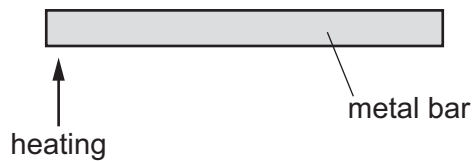


The cap is difficult to unscrew.

Which action makes removing the cap easier?

- A** cooling only the cap in cold water
- B** heating only the bottle in hot water
- C** placing both the bottle and the cap in a freezer
- D** placing both the bottle and the cap in a hot oven

- 35** A metal bar is heated at one end.



What is the main method by which thermal energy reaches the other end of the bar?

- A** Electrons at the heated end gain kinetic energy and move along the bar.
 - B** Electrons at the heated end move apart and set up a convection current along the bar.
 - C** Molecules at the heated end gain kinetic energy and move along the bar.
 - D** Molecules at the heated end move apart and set up a convection current along the bar.
- 36** Three types of wave are listed.

- 1 microwaves
- 2 sound waves
- 3 radio waves

Which waves are longitudinal waves?

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

- 37 A wave is refracted when it moves from one medium to another.

What **must** remain constant?

- A direction of motion
- B frequency
- C speed
- D wavelength

- 38 The current in a resistor is 4.0 A.

What is the time taken for 1200 C of charge to flow through the resistor?

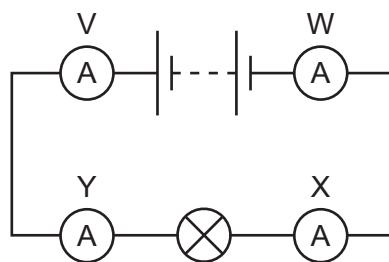
- A 0.20 min B 5.0 min C 80 min D 300 min

- 39 A student connects a lamp to a cell.

Which change to the circuit can increase the current in the circuit?

- A connecting a second cell in series
- B connecting a second lamp in series
- C connecting a variable resistor in series
- D connecting an ammeter in series

- 40 Four ammeters, V, W, X and Y, are connected in the circuit shown.



Which ammeters have the same reading as each other?

- A V, W, X and Y
- B V and W only
- C V and Y only
- D X and Y only

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The Periodic Table of Elements

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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 —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganeson —

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
	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.).