



Cambridge IGCSE™

COMBINED SCIENCE

Paper 2 Multiple Choice (Extended)

0653/21

May/June 2025

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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- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m/s^2).

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 Osmosis can be defined as the net movement of 1..... molecules from a region of 2..... water potential to a region of 3..... water potential, through a partially permeable membrane.

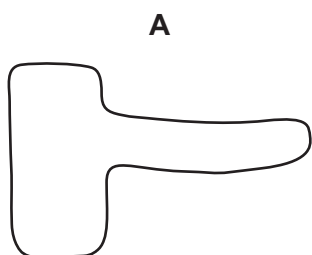
Which words complete gaps 1, 2 and 3?

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

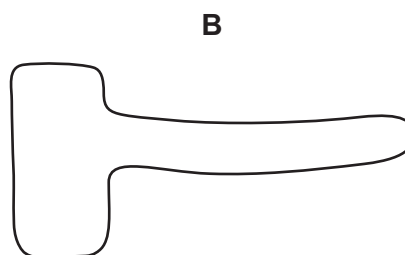
- 2 The diagrams show four root hair cells.

Each cell is surrounded by soil with the same volume of water present.

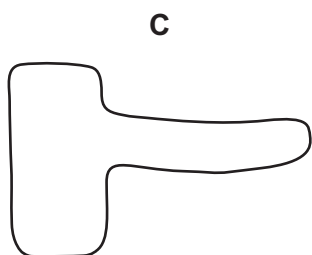
Which root hair cell absorbs water the most rapidly?



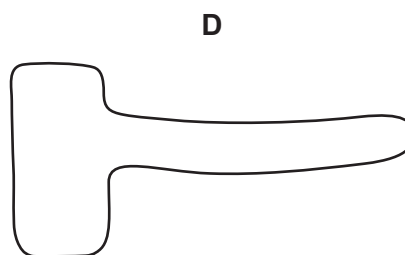
soil temperature 10 °C



soil temperature 10 °C



soil temperature 20 °C



soil temperature 20 °C

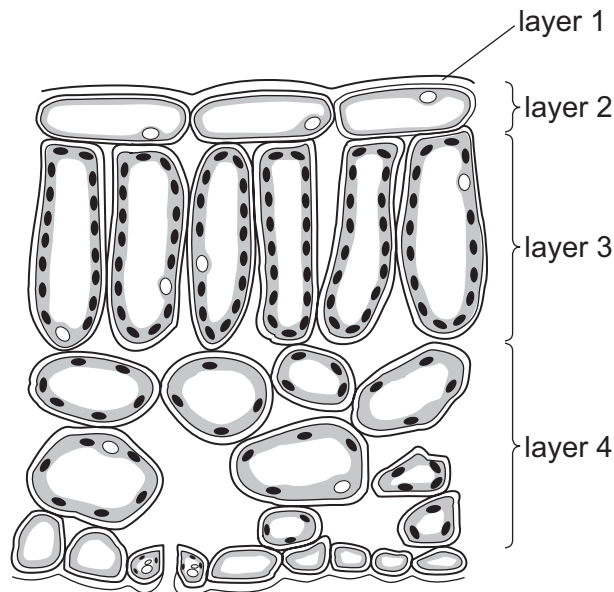
- 3 Which statement explains how an increase in pH affects enzyme activity?

- A** The active site changes shape.
- B** The substrate is denatured.
- C** There is an increase in the kinetic energy.
- D** The number of collisions increases.

4 What is the balanced equation for photosynthesis?

- A $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
- B $\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow 6\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
- C $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- D $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow 6\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

5 The diagram shows a transverse section through a leaf.

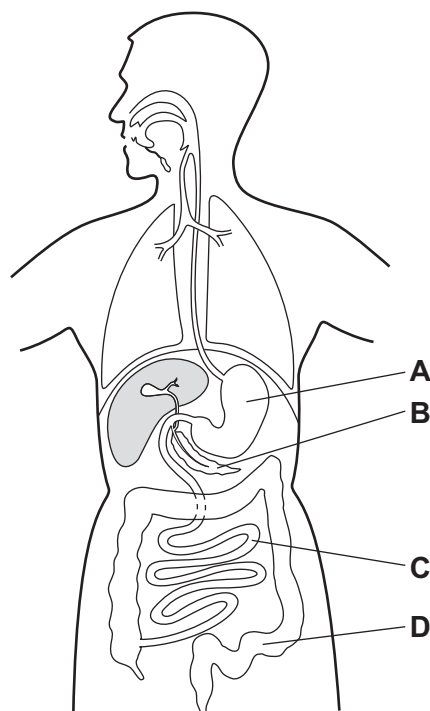


Which layers have cells that can produce oxygen in the presence of light?

- A 1, 2, 3 and 4
 - B 1, 2 and 3 only
 - C 2 and 3 only
 - D 3 and 4 only
- 6 What is the purpose of physical digestion?
- A break down food into smaller pieces
 - B break down insoluble food into soluble molecules
 - C change food so that it can be absorbed into the blood
 - D digest insoluble food molecules using enzymes

- 7 The diagram shows the human alimentary canal and other organs.

Which label shows where glycerol is absorbed?



- 8 Which row describes aerobic respiration?

	nutrient molecules broken down	produces water	releases energy
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = true

✗ = false

- 9 Which row about the anther and stigma of a wind-pollinated flower is correct?

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

- 10 Which row shows the effect of deforestation on oxygen and carbon dioxide concentrations in the atmosphere?

	oxygen concentration	carbon dioxide concentration
A	decreases	increases
B	decreases	no change
C	increases	decreases
D	no change	increases

- 11 Which term describes an area that contains all the organisms and their environment interacting together?

- A** community
B ecosystem
C food chain
D food web

- 12 Which row shows how active immunity is gained?

	from antibodies supplied in an injection	by vaccination	after an infection by a pathogen
A	✓	✗	✗
B	✗	✓	✗
C	✗	✓	✓
D	✓	✗	✓

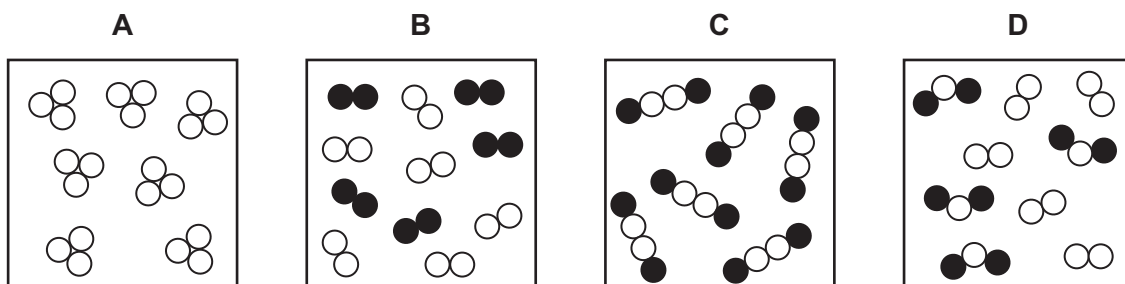
key
 ✓ = yes
 ✗ = no

- 13 Which statements about antibiotics are correct?

- 1 An antibiotic is a drug.
- 2 Antibiotics kill bacteria and viruses.
- 3 MRSA is a type of bacteria resistant to antibiotics.

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

14 Which diagram represents a mixture of elements?



15 A neutral atom of chlorine contains 17 electrons and 18 neutrons.

What is the atomic number and what is the mass number of this atom?

	atomic number	mass number
A	17	35
B	17	52
C	18	35
D	18	52

16 The elements in Period 2 and Period 3 of the Periodic Table are shown.

Period 2	Li	Be	B	C	N	O	F	Ne
Period 3	Na	Mg	Al	Si	P	S	Cl	Ar

Which statement about atoms of these elements is correct?

- A** Beryllium and boron have the same number of outer-shell electrons.
- B** Boron and aluminium both have three electron shells.
- C** Oxygen and sulfur have the same number of neutrons.
- D** Phosphorus has eight more protons than nitrogen.

17 Which statement describes the formation of ions?

- 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.

- 18 The formula of sodium phosphate is Na_3PO_4 . The formula of calcium nitrate is $\text{Ca}(\text{NO}_3)_2$.

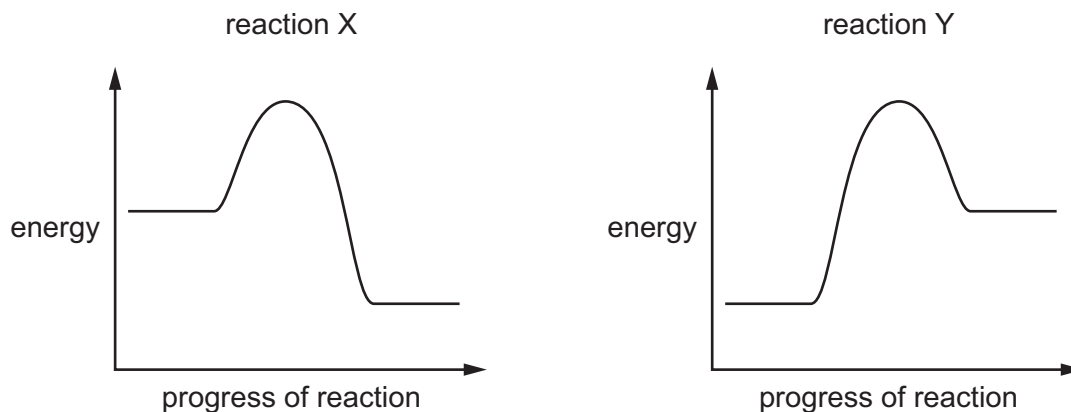
Which row shows the formula for calcium phosphate and the formula for sodium nitrate?

	calcium phosphate	sodium nitrate
A	$\text{Ca}_2(\text{PO}_4)_3$	NaNO_3
B	$\text{Ca}_2(\text{PO}_4)_3$	$\text{Na}(\text{NO}_3)_2$
C	$\text{Ca}_3(\text{PO}_4)_2$	NaNO_3
D	$\text{Ca}_3(\text{PO}_4)_2$	$\text{Na}(\text{NO}_3)_2$

- 19 Which row shows what forms at the electrodes during electrolysis of an aqueous compound?

	anode	cathode
A	metal	non-metal
B	non-metal	metal
C	hydrogen	metal
D	hydrogen	oxygen

- 20 The reaction pathway diagrams for reaction X and for reaction Y are shown.



Which statement about the reactions is correct?

- A** Reaction X has a greater activation energy than reaction Y.
- B** Reaction X is endothermic and reaction Y is exothermic.
- C** The overall energy change in reaction X is much greater than in reaction Y.
- D** The temperature increases during reaction X and decreases during reaction Y.

21 Which statement about catalysts is correct?

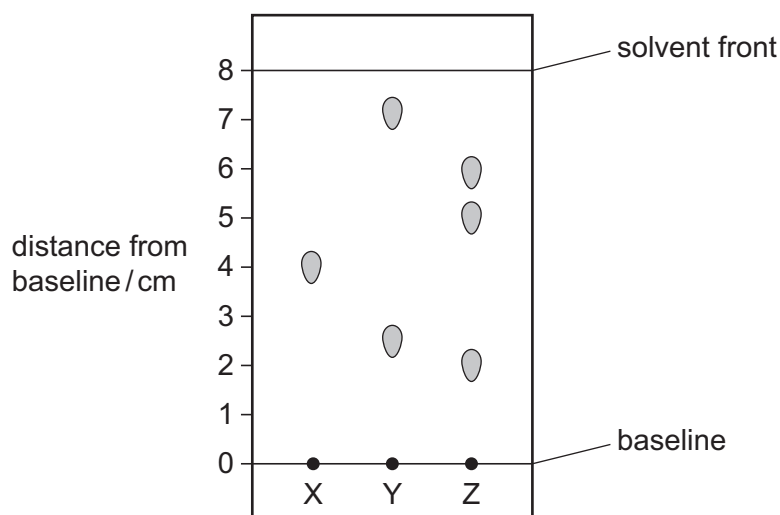
- A Catalysts decrease the rate of reaction.
- B Catalysts increase the concentration of reactants.
- C Catalysts are unchanged at the end of a reaction.
- D The mass of catalyst decreases during a reaction.

22 Which processes involve a chemical change?

- 1 cracking of an alkane
- 2 polymerisation of ethene
- 3 corrosion of iron

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

23 A chromatogram of dyes X, Y and Z is shown.



Which statement about the chromatogram is correct?

- A Dye Y has the spot with the lowest R_f value.
- B Every dye is a mixture of colours.
- C The dyes X, Y and Z do **not** contain the same colour.
- D The spot in dye X has an R_f value of 4.

24 An excess of an insoluble metal carbonate is mixed with an acid.

A salt is produced.

Which row shows steps to obtain a pure salt from the reaction mixture?

	step 1	step 2
A	distil the mixture	collect and dry the solid left behind
B	distil the mixture	condense the gas and collect the liquid formed
C	filter the mixture	collect and dry the solid from the filter paper
D	filter the mixture	crystallise the liquid obtained from the filtration

25 Which type of reaction occurs when alkenes react with bromine?

- A** addition
- B** combustion
- C** displacement
- D** polymerisation

26 Which substances are initially placed in the blast furnace during the production of iron?

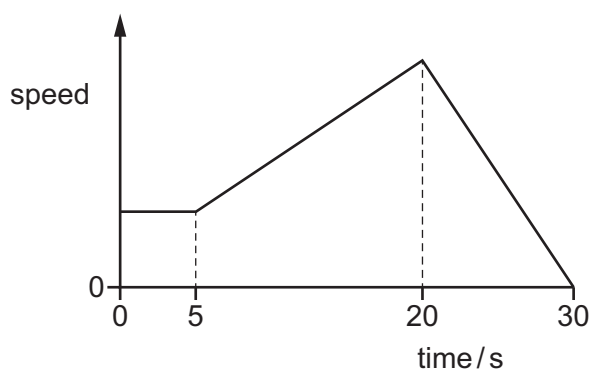
- 1 carbon
- 2 carbon monoxide
- 3 hematite

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

27 Which row correctly explains a strategy to reduce the effects of climate change?

	strategy	explanation
A	plant more trees	trees use up land for growing crops
B	reduce livestock farming	livestock produce methane
C	decrease the use of fossil fuels	combustion of fossil fuels produces nitrogen
D	increase the use of solar power	solar power uses up energy from the Sun

- 28 The graph shows how the speed of a car changes with time. The car travels at constant speed, then accelerates and finally brakes to a stop.



The car travels 60 m while it brakes to a stop.

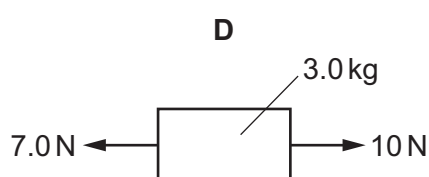
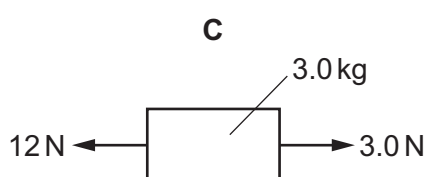
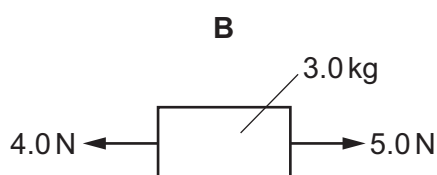
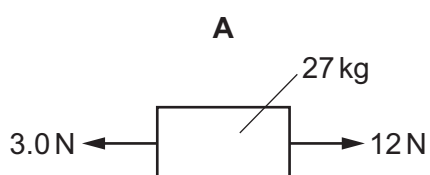
What is the average speed of the car while it brakes?

- A** 3.0 m/s **B** 4.0 m/s **C** 6.0 m/s **D** 12 m/s

- 29 The diagrams show all the forces acting on different objects.

The masses of the objects are shown.

Which object has an acceleration of 3.0 m/s^2 ?



- 30 Which row shows what the weight of an object depends on?

	mass	gravitational field strength
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = depends on this

✗ = does **not** depend on this

- 31 The temperature of a gas increases.

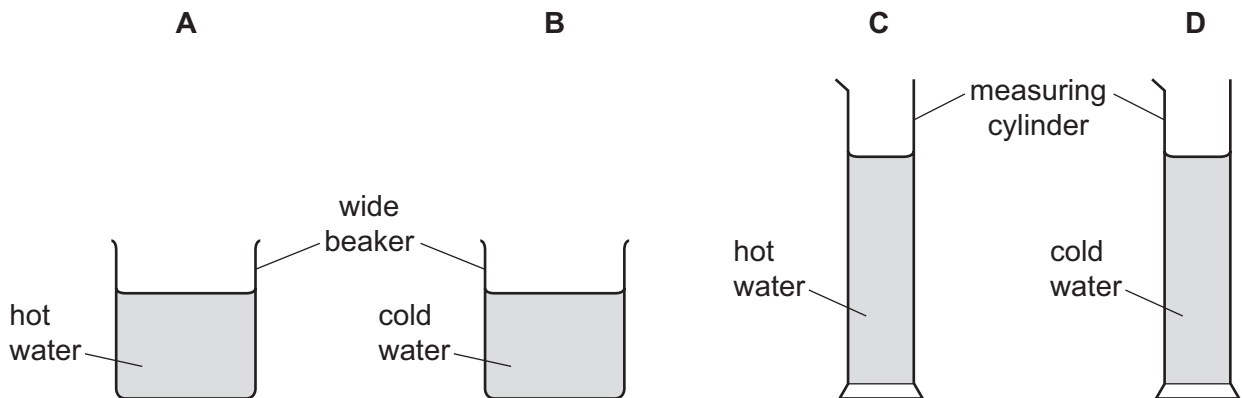
Which row is correct for the particles of the gas?

	force between particles	average speed of particles
A	strong	decreases
B	strong	increases
C	very weak	decreases
D	very weak	increases

- 32 The diagrams show two identical wide beakers and two identical narrow measuring cylinders.

One of the beakers and one of the measuring cylinders contain hot water. The other beaker and measuring cylinder contain cold water.

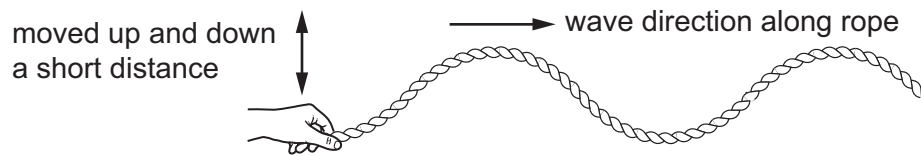
From which container does water evaporate at the greatest rate?



- 33 Which row shows the main method of thermal conduction in metallic and in non-metallic solids?

	metallic solids	non-metallic solids
A	molecular vibrations	molecular vibrations
B	molecular vibrations	movement of electrons
C	movement of electrons	molecular vibrations
D	movement of electrons	movement of electrons

- 34** A student moves one end of a long rope up and down through a short distance. A wave travels along the rope in the direction shown.



The student now moves the rope up and down through a larger distance and more times in each minute.

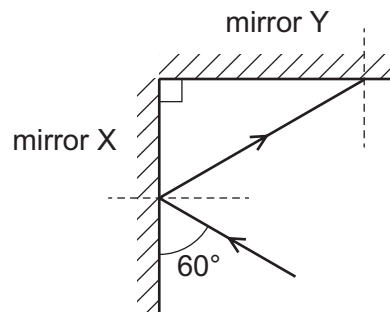
Which row shows the effects of these changes on the amplitude and the frequency of the wave?

	amplitude	frequency
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 35** The diagram shows a ray of light reflected at a plane mirror, X.

The reflected ray strikes another plane mirror, Y.

Mirror Y is at 90° to mirror X.



What is the angle of reflection at mirror Y?

- A** 30° **B** 60° **C** 90° **D** 120°

- 36** Sound travels in solids, liquids and gases. The speed of sound is different in each state.

Which row shows the state with the lowest and highest speed?

	lowest speed	highest speed
A	liquid	solid
B	gas	solid
C	solid	gas
D	solid	liquid

- 37** In which unit is charge measured?

- A** ampere
- B** coulomb
- C** volt
- D** watt

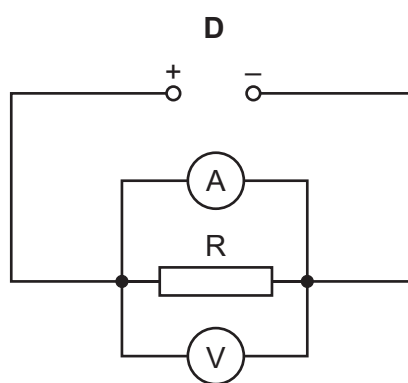
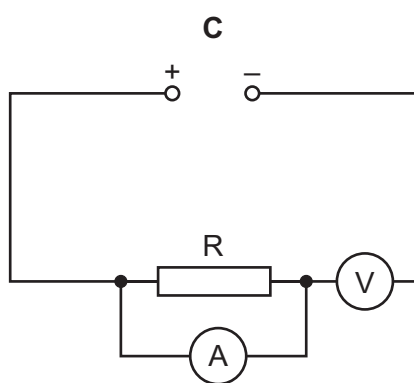
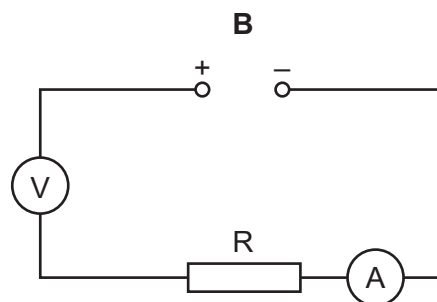
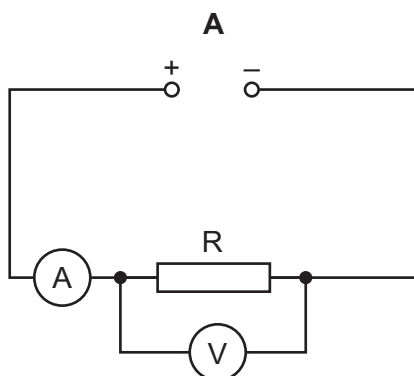
- 38** There is a current of 2.0 A in a resistor of resistance 7.5 Ω .

What is the power and energy transferred in the resistor in 5.0 s?

	power / W	energy / J
A	15	3.0
B	15	75
C	30	6.0
D	30	150

39 A student determines the resistance of resistor R.

Which circuit is used to obtain the readings needed?



40 What is a possible set of stages in the life cycle of stars?

- A** protostar → black hole → red supergiant
- B** protostar → interstellar cloud of gas and dust → new stars
- C** supernova → nebula → new stars
- D** supernova → red supergiant → nebula

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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	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 —	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
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

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



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COMBINED SCIENCE

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- 1 Movement is a characteristic of all living organisms.

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

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

- 2 Which plant cell structure matches its function?

	structure	function
A	cell membrane	provides strength and support
B	chloroplast	absorbs light energy
C	ribosome	provides protection
D	vacuole	site of chemical reactions

- 3 Which row describes osmosis?

	osmosis is the net movement of water molecules through a partially permeable membrane	
	from	to
A	a dilute solution with a higher water potential	a concentrated solution with a lower water potential
B	a concentrated solution with a higher water potential	a dilute solution with a lower water potential
C	a dilute solution with a lower water potential	a concentrated solution with a higher water potential
D	a concentrated solution with a lower water potential	a dilute solution with a higher water potential

- 4 The table shows the results of tests carried out on different food samples.

food sample	ethanol emulsion test	biuret test	Benedict's solution test
1	x	✓	x
2	✓	x	x
3	x	✓	✓
4	✓	x	✓

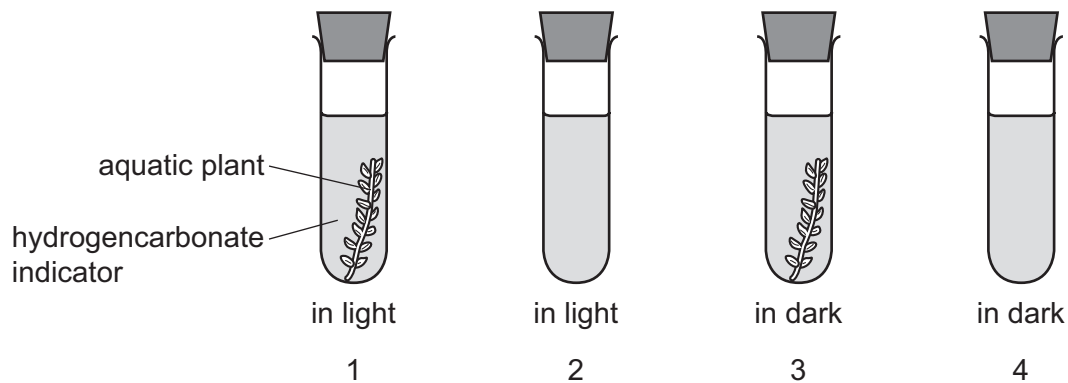
key

✓ = positive result

x = negative result

Which food samples contain reducing sugar?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4
- 5 Which statement describes enzyme action in humans?
- A** Enzymes become denatured at 0 °C.
- B** The activity of enzymes always increases with an increasing temperature.
- C** The enzyme active site and its substrate are the same shape.
- D** There are more-frequent effective collisions when the temperature increases from 20 °C to 30 °C.
- 6 Four tubes that contain red hydrogencarbonate indicator are set up as shown. After five hours, the colour of the hydrogencarbonate indicator is recorded.



Which row shows the colour of the hydrogencarbonate indicator in each tube after five hours?

	1	2	3	4
A	purple	red	red	red
B	purple	red	yellow	red
C	red	yellow	red	purple
D	yellow	red	purple	red

- 7 A diet provides the correct energy requirements for a person but is **not** balanced.

What are possible effects of this diet?

- 1 constipation
- 2 obesity
- 3 scurvy

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

- 8 What is a function of hydrochloric acid in the stomach?

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

- 9 Which statement explains why root hair cells have a long, thin shape?

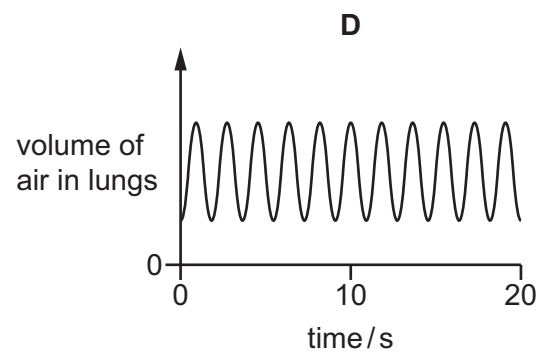
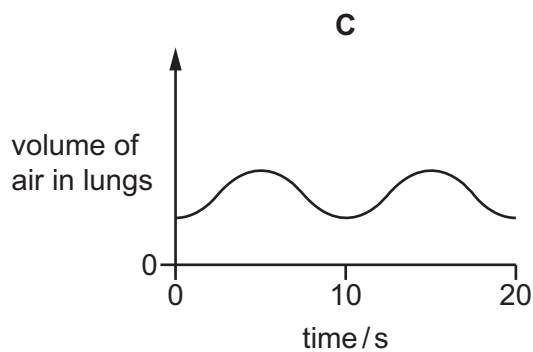
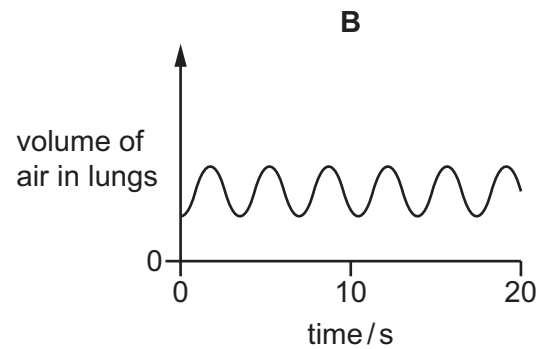
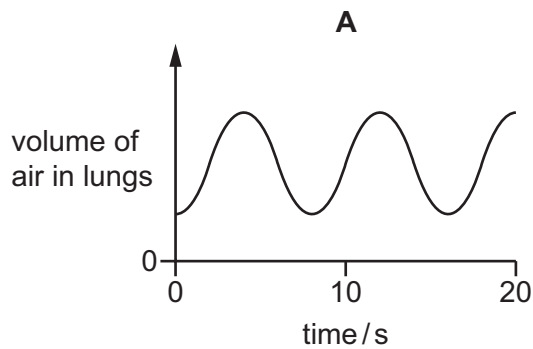
- A** They are squeezed into this shape as they grow between soil particles.
- B** It is the most efficient shape for taking up food such as glucose.
- C** It provides a large surface area for diffusion of water.
- D** The narrow diameter allows them to gain carbon dioxide from between soil particles.

- 10 Which row describes viruses?

	are pathogens	have a protein coat	contain genetic material
A	✓	✓	✓
B	✓	x	x
C	x	✓	x
D	x	x	✓

- 11** The graphs show how the rate and depth of breathing varies when a student does four different activities.

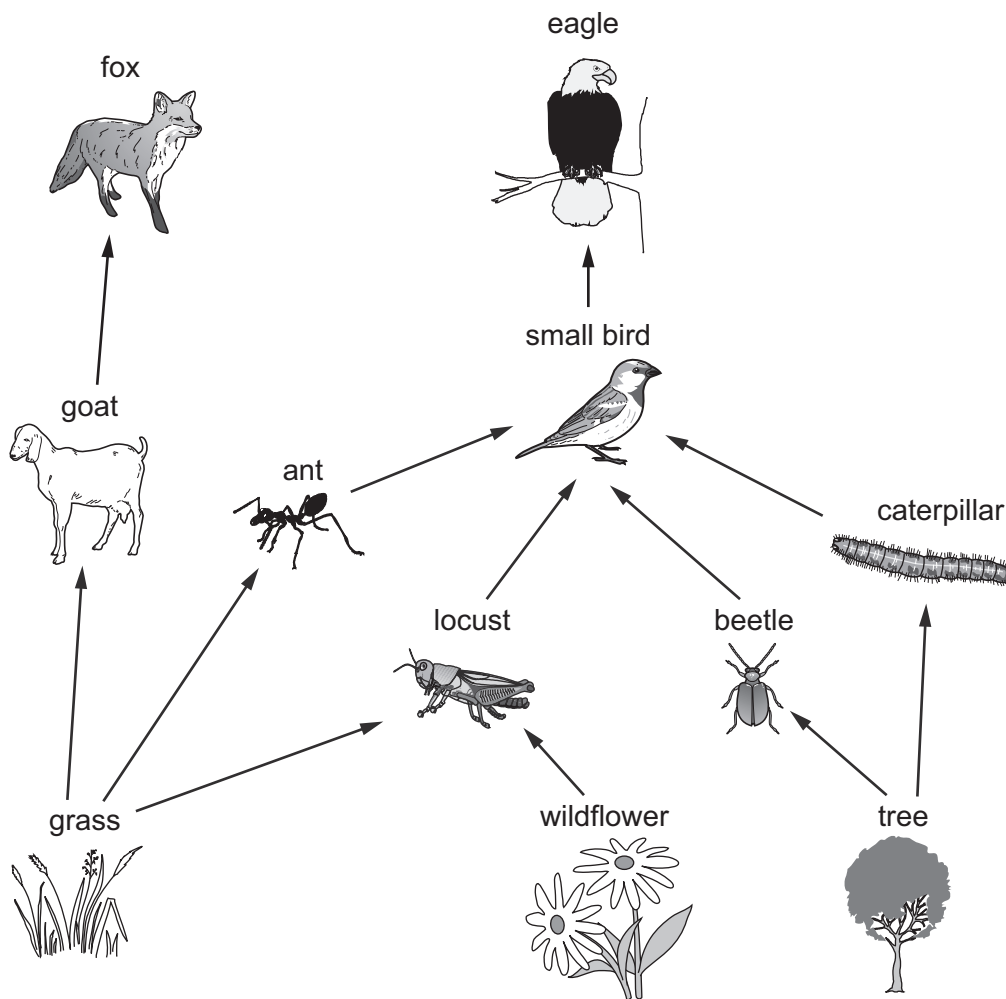
Which graph shows when the student is most active?



- 12** Which statement about the use of antibiotics is correct?

- A** Overuse of antibiotics causes the development of bacteria such as MRSA.
- B** Antibiotics are prescribed for infections caused by viruses and bacteria.
- C** Antibiotics increase reproduction of non-resistant bacteria.
- D** Antibiotics only kill resistant bacteria.

13 The diagram shows a food web.



Which row states the number of species of each category in this food web?

	number of primary consumer species	number of secondary consumer species	number of tertiary consumer species
A	6	1	1
B	5	2	1
C	5	2	2
D	3	4	3

14 The table describes three changes of state, W, X and Y.

change of state	particle arrangement	particle motion	energy
W	further apart and random	faster	increases
X	closer together and random	slower	decreases
Y	closer together and regular	vibration	decreases

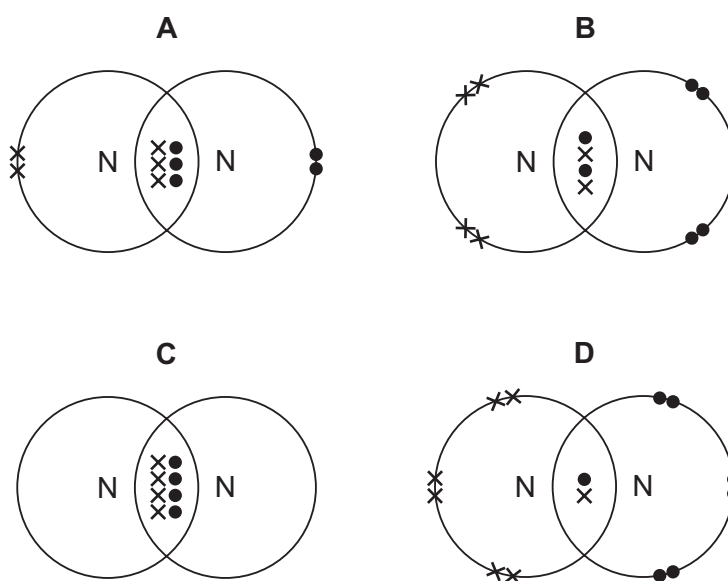
Which statement about the changes of state is correct?

- A W is melting and Y is condensing.
- B X is evaporating and W is condensing.
- C Y is freezing and W is evaporating.
- D W is melting and X is freezing.

15 Which statement describes a substance that contains covalent bonds?

- A It is a coloured compound that contains a transition element.
- B It is a good conductor of electricity when molten.
- C It is a compound formed from two non-metallic elements.
- D It can be broken down by the passage of an electric current.

16 Which dot-and-cross diagram represents the arrangement of outer-shell electrons in a molecule of nitrogen?



- 17 Which statement explains why a reaction is exothermic?
- A More thermal energy is absorbed by breaking bonds than is released by making bonds.
 - B More thermal energy is absorbed by making bonds than is released by breaking bonds.
 - C More thermal energy is released by breaking bonds than is absorbed by making bonds.
 - D More thermal energy is released by making bonds than is absorbed by breaking bonds.
- 18 Which statement explains why the rate of a reaction is greater at a higher temperature?
- A The activation energy is higher.
 - B More colliding particles have the minimum energy to react.
 - C The frequency of collisions between reacting particles decreases.
 - D There are more reacting particles per unit volume.
- 19 Which word equation represents the reaction of an acid with a carbonate?
- A acid + carbonate → salt + carbon dioxide
 - B acid + carbonate → salt + carbon dioxide + water
 - C acid + carbonate → salt + hydrogen + water
 - D acid + carbonate → salt + water
- 20 Which row describes the physical state of the Group VII elements at room temperature?

	chlorine	bromine	iodine
A	gas	gas	liquid
B	gas	liquid	solid
C	liquid	liquid	gas
D	liquid	solid	solid

- 21 Which statement explains why all Group VIII elements are unreactive?
- A They all have a complete outer shell of electrons.
 - B They all have only two electrons in their outer shell.
 - C They all have eight electrons in their outer shell.
 - D They all have no electrons in their outer shell.

22 Which element does **not** produce a gas when added to dilute hydrochloric acid?

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

23 Which row describes the extraction of iron from its ore?

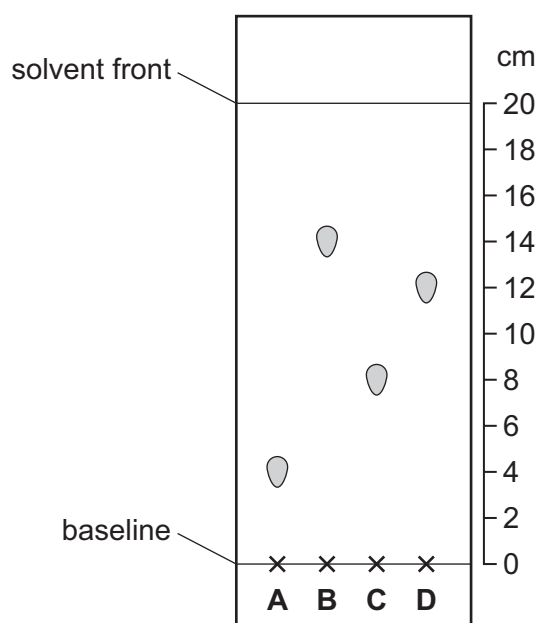
	name of ore	method of extraction
A	bauxite	electrolysis
B	bauxite	reduction in a blast furnace
C	hematite	electrolysis
D	hematite	reduction in a blast furnace

24 Which process is a physical change?

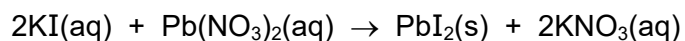
- A combustion of solid carbon
- B cracking of an alkane to give an alkene
- C fractional distillation of petroleum
- D rusting of iron

25 The chromatogram of four different substances is shown.

Which substance has an R_f value of 0.6?



- 26 Potassium iodide reacts with lead(II) nitrate to produce yellow lead(II) iodide and potassium nitrate.



Which row describes this reaction and how to separate lead(II) iodide from the reaction mixture?

	reaction	separation
A	neutralisation	chromatography
B	neutralisation	filtration
C	precipitation	chromatography
D	precipitation	filtration

- 27 Which row shows an electrolyte and the products of electrolysis for this electrolyte?

	electrolyte	products
A	concentrated aqueous sodium chloride	sodium and chlorine
B	molten potassium bromide	hydrogen and bromine
C	molten sodium chloride	sodium and chlorine
D	dilute sulfuric acid	hydrogen and sulfur dioxide

- 28 The diagram shows the horizontal forces acting on a car of mass 1200 kg.



What is the acceleration of the car?

- A** 0.25 m/s² **B** 0.75 m/s² **C** 1.3 m/s² **D** 4.0 m/s²
- 29 A brick of mass 2.0 kg rests on a platform at a height of 15 m above the ground.

The brick falls to the ground.

The gravitational field strength g is 9.8 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** 290 m/s

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

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

31 What is a property of both solids and liquids?

- A** They always fill a container.
- B** They can flow.
- C** They have a fixed shape.
- D** They have a fixed volume.

32 Which material is a good thermal conductor?

- A** copper
- B** glass
- C** plastic
- D** wood

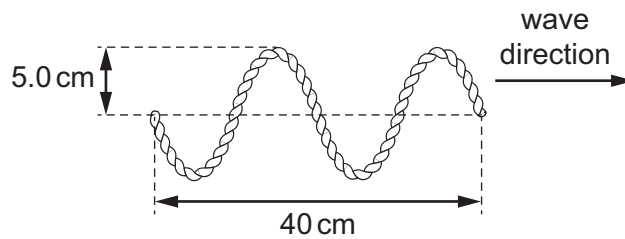
33 A room contains cold air.

An electric heater is used to warm the air.

Which statement explains why the warm air rises?

- A** Air contracts as it is warmed.
- B** Particles in warm air have less energy than particles in cold air.
- C** The mass of the air particles decreases as the air is warmed.
- D** Warm air is less dense than cold air.

- 34** A student vibrates the end of a horizontal rope and sends a wave along the rope. The wave is shown in the diagram.



Which row shows the amplitude of the wave and the wavelength of the wave?

	amplitude / cm	wavelength / cm
A	5.0	10
B	5.0	20
C	10	10
D	10	20

- 35** Which description of the image of an object in a plane mirror is correct?

- A** real and smaller than the object
- B** real and the same size as the object
- C** virtual and smaller than the object
- D** virtual and the same size as the object

- 36** What is the speed of infrared waves in a vacuum?

- A** 3.0 m/s
- B** 330 m/s
- C** 3.0×10^8 m/s
- D** 330×10^8 m/s

- 37 Two charged rods, X and Y, are brought, one at a time, close to positively charged rod Z.

Rod Z is repelled by rod X. Rod Z is attracted by rod Y.

Which row shows the charges on rods X and Y?

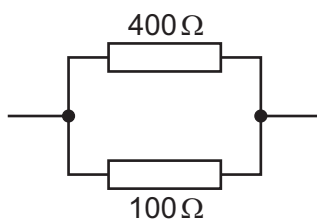
	charge on rod X	charge on rod Y
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

- 38 There is a current of 2.0 A in a resistor of resistance $2.0\ \Omega$.

How much charge flows through the resistor in 4.0 s ?

- A** 0.50 C **B** 2.0 C **C** 8.0 C **D** 16 C

- 39 A $400\ \Omega$ resistor and a $100\ \Omega$ resistor are connected in parallel.



What is the combined resistance of the two resistors?

- A** $40\ \Omega$ **B** $80\ \Omega$ **C** $250\ \Omega$ **D** $500\ \Omega$

- 40 An object orbits a planet. The period of the orbit is 8.0 hours. The speed of the object is 2.0 km/s .

What is the radius of the orbit?

- A** $1.5 \times 10^5\text{ m}$ **B** $9.2 \times 10^6\text{ m}$ **C** $2.9 \times 10^7\text{ m}$ **D** $3.6 \times 10^8\text{ m}$

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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													5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19		
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		
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 —	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
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

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



Cambridge IGCSE™

COMBINED SCIENCE

Paper 2 Multiple Choice (Extended)

0653/23

May/June 2025

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.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m/s^2).

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.



1 Which structure is **not** found in animal cells?

- A cell wall
- B cytoplasm
- C nucleus
- D cell membrane

2 Palisade mesophyll cells are specialised cells.

What is the function of these specialised cells?

- A photosynthesis
- B transport
- C reproduction
- D immunity

3 A human egg cell is 0.12 mm in diameter.

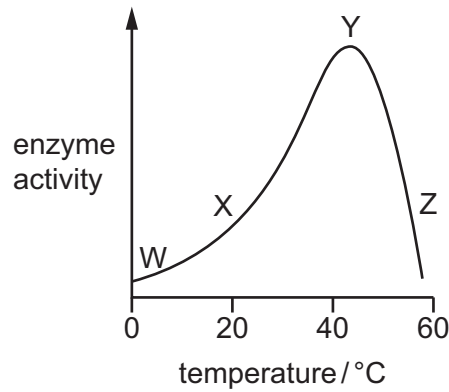
How is this converted to a measurement in micrometres, μm ?

- A multiply by 100
- B multiply by 1000
- C divide by 100
- D divide by 1000

4 Which row about osmosis is correct?

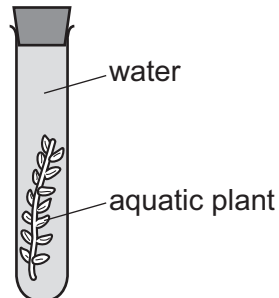
	molecules that move	details of movement	type of permeable membrane
A	water	from a dilute solution to a concentrated solution	partially
B	water	from a concentrated solution to a dilute solution	fully
C	solute	from a dilute solution to a concentrated solution	partially
D	solute	from a concentrated solution to a dilute solution	fully

- 5 The graph shows the activity of an enzyme at different temperatures.



Which statement about the effect of temperature on the activity of this enzyme is correct?

- A** At X and Z, the activity of the enzyme is the same because the kinetic energy of the enzymes is the same.
 - B** At W, the enzyme activity is lower than at X because there are less-frequent effective collisions between the enzyme and the substrate.
 - C** At Y, the enzyme is working at its optimum rate because it has the most kinetic energy.
 - D** At Z, the enzyme is completely denatured.
- 6 An aquatic plant is in a test-tube of water. The test-tube is sealed and placed in the dark.



Which changes occur to the concentration of carbon dioxide and oxygen in the water after two hours?

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

- 7 A pregnant woman is told she is deficient in iron.

Which food increases the iron content in her diet?

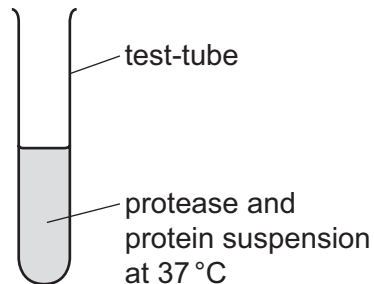
- A cheese
- B rice
- C milk
- D red meat

- 8 Chemical digestion and physical digestion happen in various parts of the alimentary canal and associated organs.

In which organ do both processes happen?

- A liver
- B mouth
- C oesophagus
- D pancreas

- 9 A test-tube is used to model the effect of protease on a protein suspension in the stomach.



What should be added to the test-tube to provide the optimum conditions for the digestion of protein?

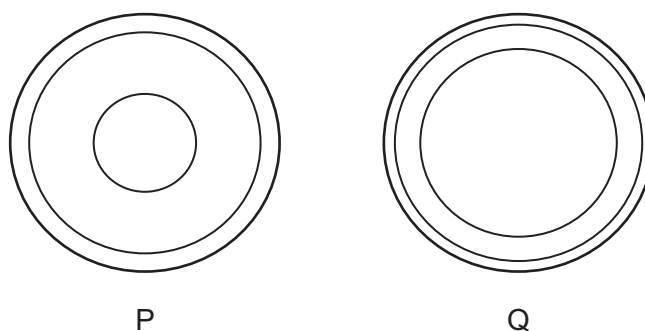
- A amylase
- B bacteria
- C hydrochloric acid
- D lipase

10 Water moves through the stomata of leaves during transpiration.

Which row shows the direction of water movement and the form of the water?

	direction	form
A	into the leaf	liquid
B	into the leaf	vapour
C	out of the leaf	vapour
D	out of the leaf	liquid

11 The diagrams show cross-sections of two different blood vessels.

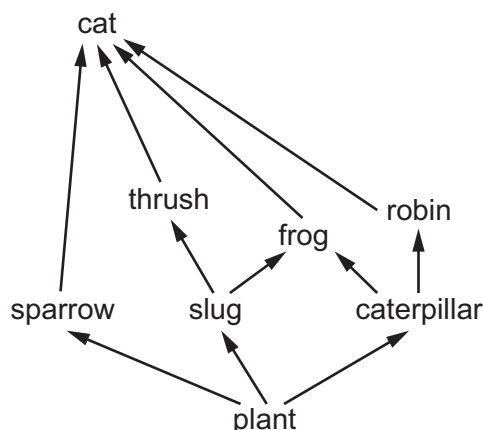


Which type of blood vessel is Q and what is the relative blood pressure in Q compared with P?

	blood vessel Q	relative blood pressure in Q
A	artery	higher
B	artery	lower
C	vein	higher
D	vein	lower

12 Which types of consumer describe the cat in this food web?

- 1 primary consumer
- 2 secondary consumer
- 3 tertiary consumer

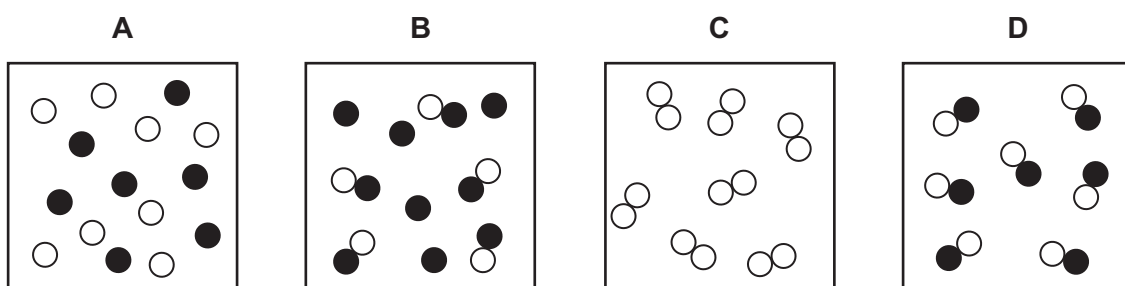


- A** 1, 2 and 3 **B** 1 only **C** 2 and 3 only **D** 3 only

13 What is an ecosystem?

- A** a network of inter-connected food chains
B a specific area in which a plant or an animal lives
C all the plants and animals that live within a specific area
D the interactions between all living organisms and their environment, in a specific area

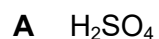
14 Which diagram represents molecules of a single compound?



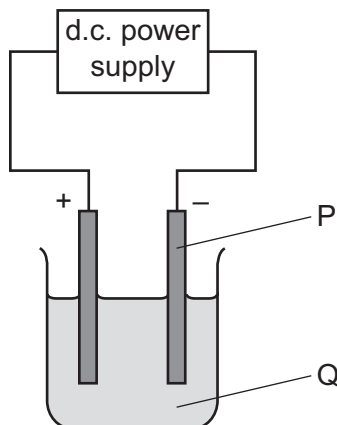
15 Which statement about ions is correct?

- A** Atoms lose or gain electrons to form ions.
B Ions are held together by strong attraction between negative ions.
C Ions form when atoms share electrons.
D Metal ions are attracted to each other.

16 Which formula does **not** represent an acid?



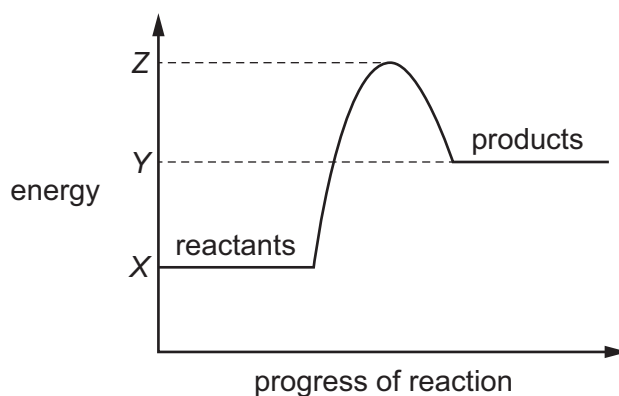
17 Apparatus used to electrolyse molten lead(II) bromide is shown.



Which row identifies P and Q?

	P	Q
A	cathode	electrolyte
B	anode	electrode
C	anode	electrolyte
D	cathode	electrode

18 The reaction pathway 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 $(Z - X)$.

- 19 Calcium carbonate pieces react with dilute hydrochloric acid.

Which change decreases the rate of the reaction?

- A Add a catalyst.
- B Decrease the temperature.
- C Increase the concentration of hydrochloric acid.
- D Use calcium carbonate powder.

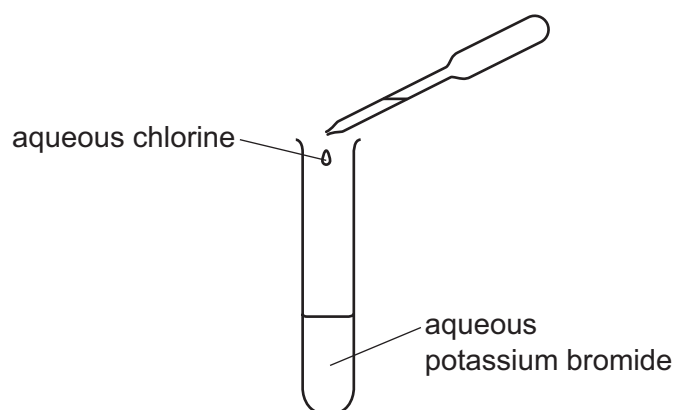
- 20 Barium sulfate is an insoluble salt.

It is made when aqueous barium chloride reacts with compound W.

Which row identifies compound W and the method used to obtain barium sulfate from the reaction mixture?

	compound W	method
A	dilute hydrochloric acid	crystallisation
B	dilute hydrochloric acid	filtration
C	dilute sulfuric acid	crystallisation
D	dilute sulfuric acid	filtration

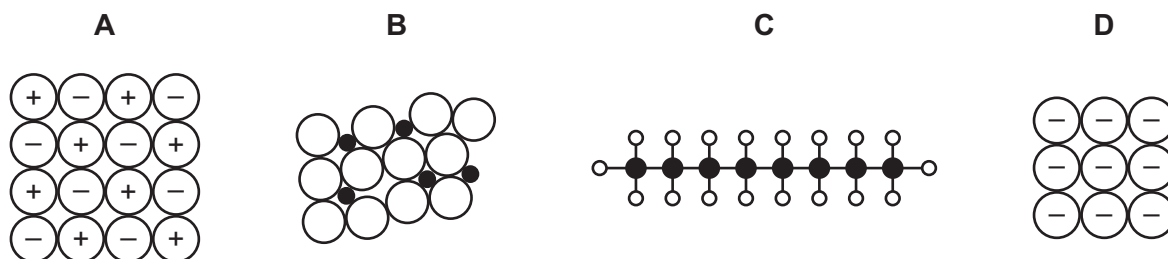
- 21 Aqueous chlorine is added to colourless aqueous potassium bromide.



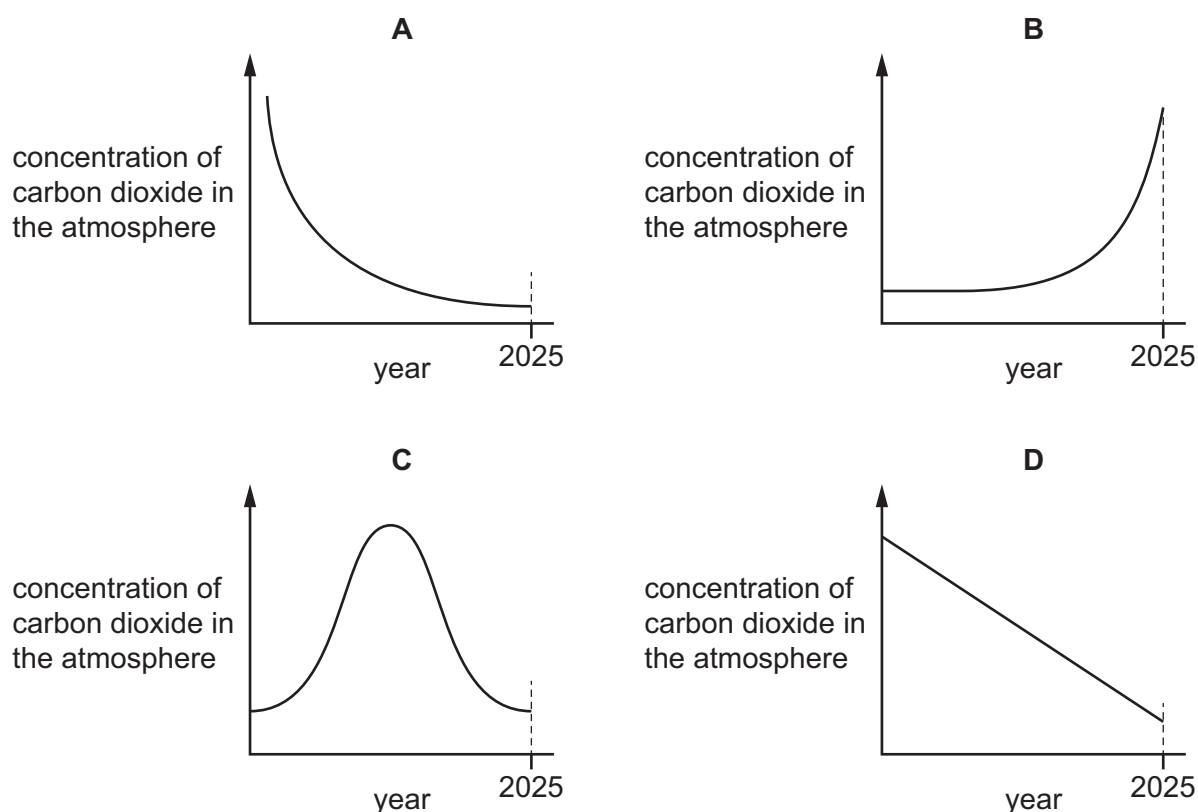
Which row describes and explains the observation?

	observation	explanation
A	white precipitate forms	solution contains chloride ions
B	effervescence	bromine gas forms
C	orange solution forms	solution contains aqueous bromine
D	solution remains colourless	there is no change

22 Which diagram represents the structure of an alloy?



23 Which graph explains why scientists are concerned about climate change?

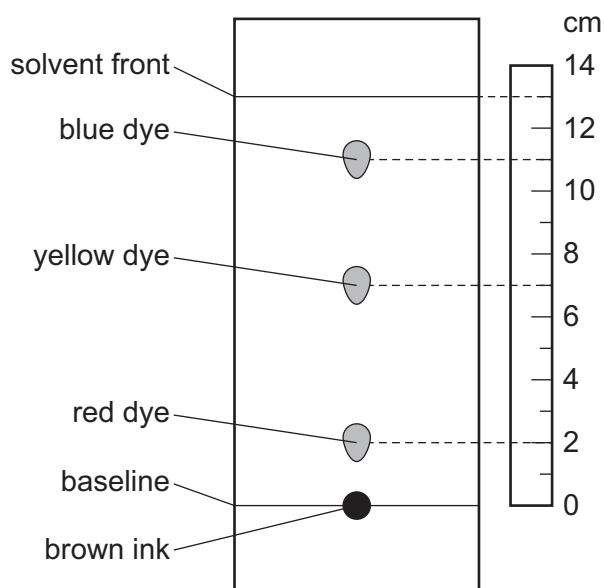


24 Methane, ethane and propane are all members of the same homologous series.

Which statement about these compounds is correct?

- A** They contain double carbon-carbon covalent bonds.
- B** They have different general formulas.
- C** They have the same molecular structure.
- D** They react in similar ways.

25 The diagram shows a chromatogram for a brown ink.



What is the R_f value of the blue dye?

- A** 0.15 **B** 0.54 **C** 0.85 **D** 1.18

26 Which row describes the properties of fractions obtained from petroleum, from the bottom of the fractionating column to the top?

	chain lengths	boiling points
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

27 Iron is extracted from hematite in the blast furnace.

Which row shows the substance that reduces iron(III) oxide and the source of this substance in the blast furnace?

	substance	source of this substance
A	carbon monoxide	complete combustion of carbon-containing fuels
B	carbon monoxide	reduction of carbon dioxide
C	carbon dioxide	incomplete combustion of carbon-containing fuels
D	carbon dioxide	oxidation of carbon monoxide

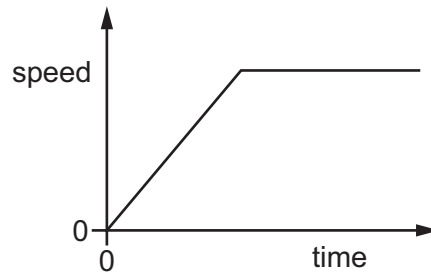
- 28** On planet R, there is no atmosphere and the acceleration of free fall g is 4.5 m/s^2 .

A rock of mass 2.0 kg falls from rest on planet R and hits the ground 4.0 m below.

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

- A** 4.5 m/s **B** 6.0 m/s **C** 18 m/s **D** 36 m/s

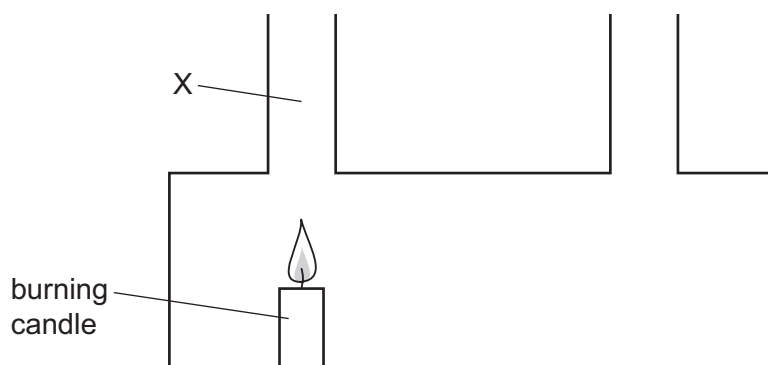
- 29** The diagram shows a speed–time graph for the motion of a car.



Which statement describes the motion of the car?

- A** It accelerates and then travels at a constant speed.
B It accelerates and then decelerates.
C It travels at a constant speed and then is stationary.
D It travels at a constant speed and then decelerates.
- 30** A boy runs up some stairs to get to the top.
- Which two quantities on their own are used to calculate the useful power transferred?
- A** his weight and the height of the stairs
B his weight and the time he takes to run up the stairs
C the work he does and the height of the stairs
D the work he does and the time he takes to run up the stairs

- 31 The diagram shows equipment used to demonstrate convection in air. Point X is labelled.



Which row describes and explains the movement of air at X?

	movement of air at X	explanation
A	downwards	air becomes less dense when heated
B	downwards	air becomes more dense when heated
C	upwards	air becomes less dense when heated
D	upwards	air becomes more dense when heated

- 32 Which states of matter contain particles that are close together?

- A** solids, liquids and gases
- B** liquids and gases only
- C** solids and gases only
- D** solids and liquids only

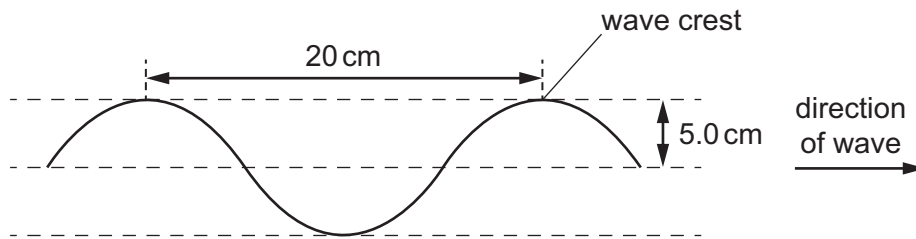
- 33 Which two factors **both** increase the rate at which a shallow pool of water evaporates?

- A** greater surface area and higher temperature
- B** greater surface area and lower temperature
- C** smaller surface area and higher temperature
- D** smaller surface area and lower temperature

- 34** The diagram shows a section of a rope.

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

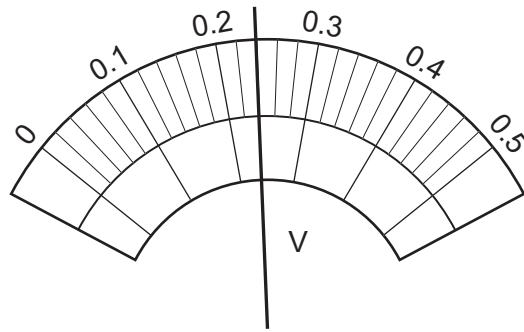
Each wave crest travels 80 cm in one second.



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** Which statement about waves is correct?
- A** In a longitudinal wave, the vibration of the particles is at right angles to the direction of the wave.
- B** In a sound wave, the vibration of the particles is parallel to the direction of the wave.
- C** Radio waves are longitudinal waves.
- D** Sound waves are transverse waves.
- 36** A student measures the time taken for sound to travel a distance of 1.0 m in air, in water and in steel.
- The student puts the three materials in order of time taken, from shortest time to longest time.
- Which order is correct?
- A** air → steel → water
- B** air → water → steel
- C** steel → water → air
- D** water → steel → air

- 37 The diagram shows the scale of an analogue voltmeter.

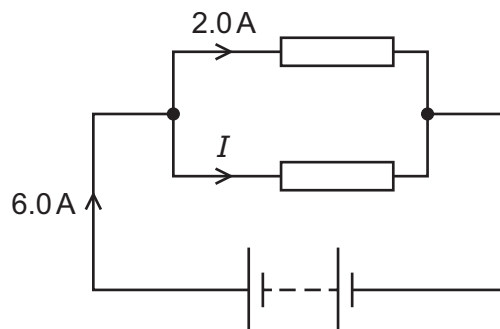


What is the reading on the voltmeter?

- A** 0.22 V **B** 0.24 V **C** 0.27 V **D** 0.36 V
- 38 What is the relationship between the current in a resistor, the potential difference (p.d.) across it and its resistance?

- A** $\text{current} = \frac{\text{p.d.}}{\text{resistance}}$
- B** $\text{current} = \frac{(\text{p.d.})^2}{\text{resistance}}$
- C** $\text{current} = \text{resistance} \times \text{p.d.}$
- D** $\text{current} = \frac{\text{resistance}}{\text{p.d.}}$

- 39 The diagram shows two resistors connected to a battery.



What is current I ?

- A** 2.0 A **B** 4.0 A **C** 6.0 A **D** 8.0 A

- 40** The life cycle of a star depends on whether it has a small mass, a large mass or a very large mass.

Which stars have a supernova as one of the later stages in their life cycles?

- A** a small mass star, a large mass star and a very large mass star
- B** a small mass star and a large mass star only
- C** a small mass star and a very large mass star only
- D** a large mass star and a very large mass star only

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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													5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19		
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	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 —	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
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

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