



Cambridge IGCSE™

COMBINED SCIENCE

0653/21

Paper 2 Multiple Choice (Extended)

October/November 2023

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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- You may use a calculator.

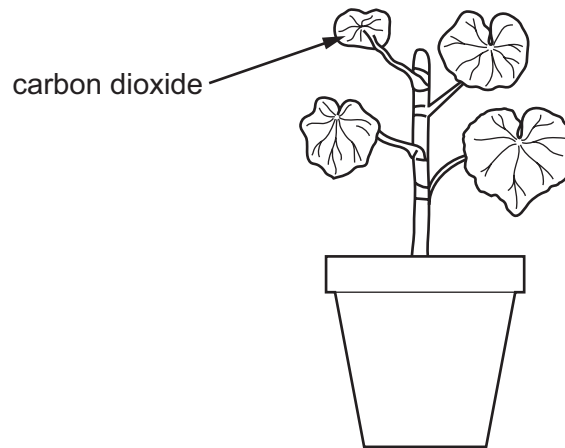
INFORMATION

- 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 The diagram shows a plant absorbing carbon dioxide in order to carry out photosynthesis.

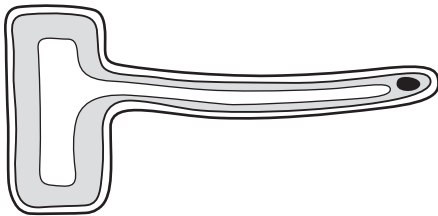


Which characteristic of all living organisms is this?

- A** movement
 - B** nutrition
 - C** excretion
 - D** reproduction
- 2 Four different cells and functions are shown.

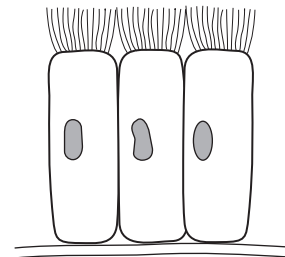
Which cell has the correct function stated?

A



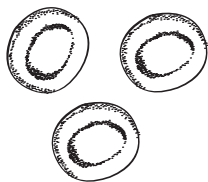
involved in reproduction

B



moves mucus in the trachea

C



involved in photosynthesis

D

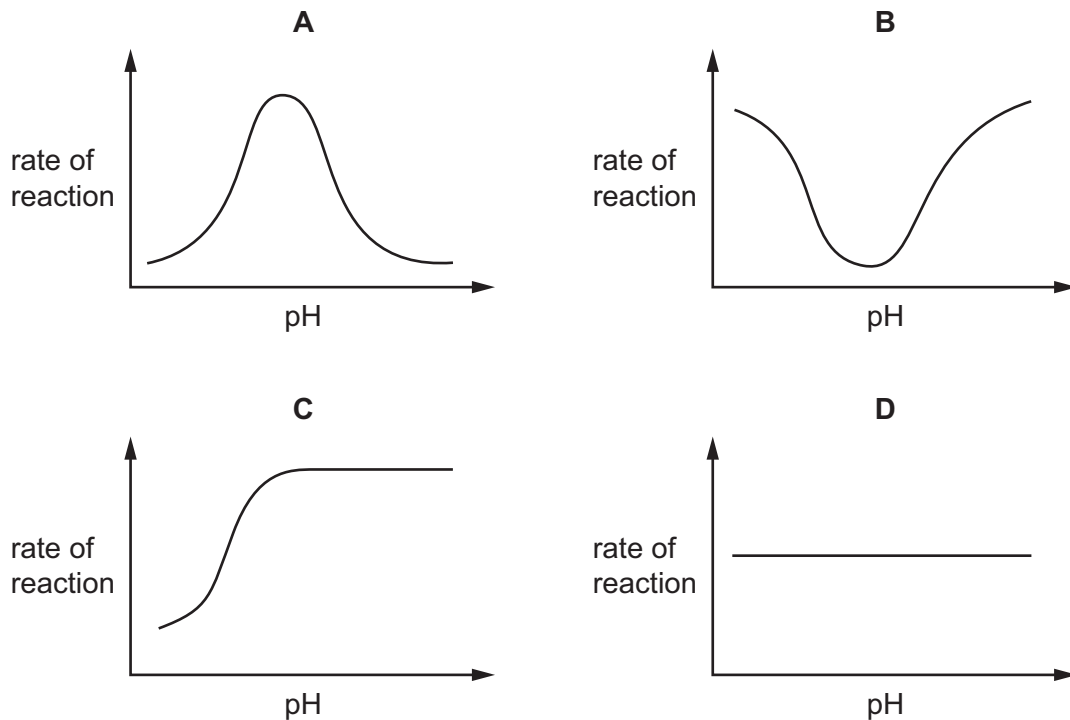


absorbs water from the soil

3 What is diffusion?

- A net movement of molecules down a concentration gradient
- B net movement of molecules up a concentration gradient
- C total movement of molecules down a concentration gradient
- D total movement of molecules up a concentration gradient

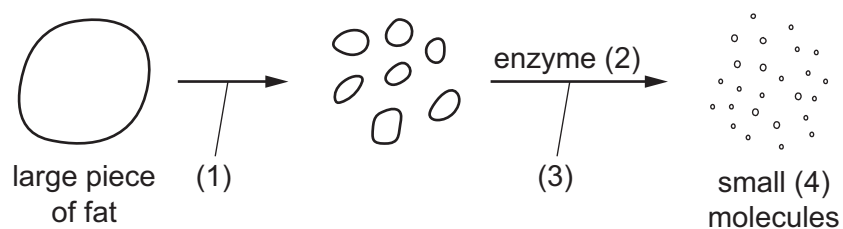
4 Which graph shows the effect of increasing pH on enzyme activity?



5 What is the correct definition of a balanced diet?

- A a diet in which all the components needed to maintain health are present in appropriate proportions
- B a diet which contains only carbohydrates, fats and proteins
- C a diet which contains mostly protein and dietary fibre
- D a diet which contains only vitamins and minerals

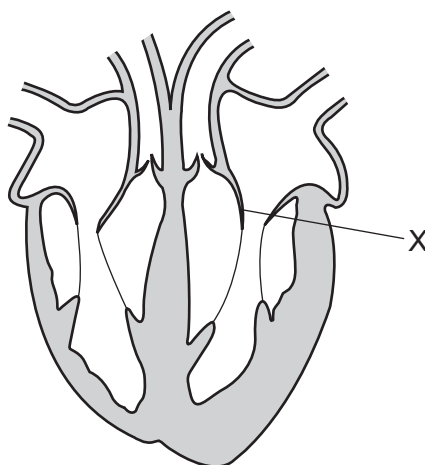
- 6 The diagram shows what happens to fat in the alimentary canal.



Which row correctly identifies 1, 2, 3 and 4?

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

- 7 The diagram shows a section through the heart.



What causes valve X to close?

- A** contraction of the left ventricle
- B** contraction of the left atrium
- C** relaxation of the left ventricle
- D** relaxation of the left atrium

8 Which chemical is used to test for carbon dioxide in expired air?

- A Benedict's solution
- B distilled water
- C iodine solution
- D limewater

9 Six molecules of glucose are aerobically respired in an animal cell.

How many molecules of carbon dioxide are released in this process?

- A 1 B 6 C 12 D 36

10 Which statement about auxin is correct?

- A Auxin is always equally distributed.
- B Auxin is made in the carpels only.
- C Auxin spreads through the plant from the sepals.
- D Auxin stimulates cell elongation.

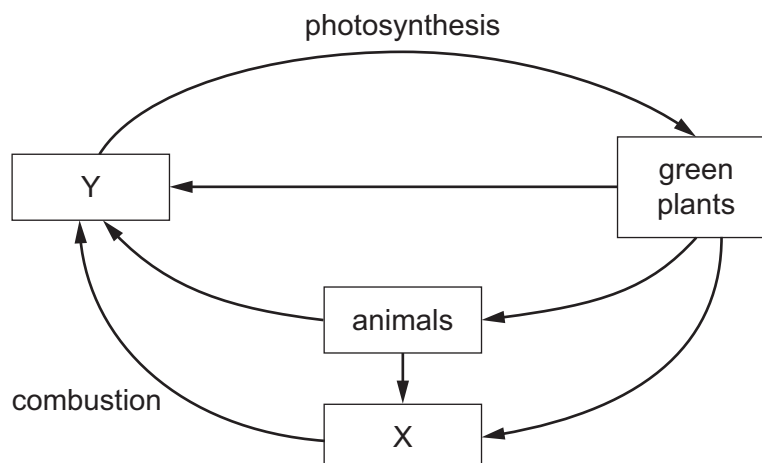
11 Which row is correct for sexual reproduction?

	genetically different offspring produced	one parent	zygote produced
A	✓	✓	x
B	✓	x	✓
C	x	✓	x
D	x	x	✓

12 Which feature is a structural adaptation found in wind-pollinated flowers?

- A Scent is produced.
- B Nectar is produced.
- C Petals are small or absent.
- D Stigma is inside flower.

13 The diagram shows part of the carbon cycle.



What are X and Y?

	X	Y
A	fossil fuel	carbon dioxide
B	carbon dioxide	oxygen
C	fossil fuel	oxygen
D	oxygen	carbon dioxide

14 Which substance is liquid at 25 °C?

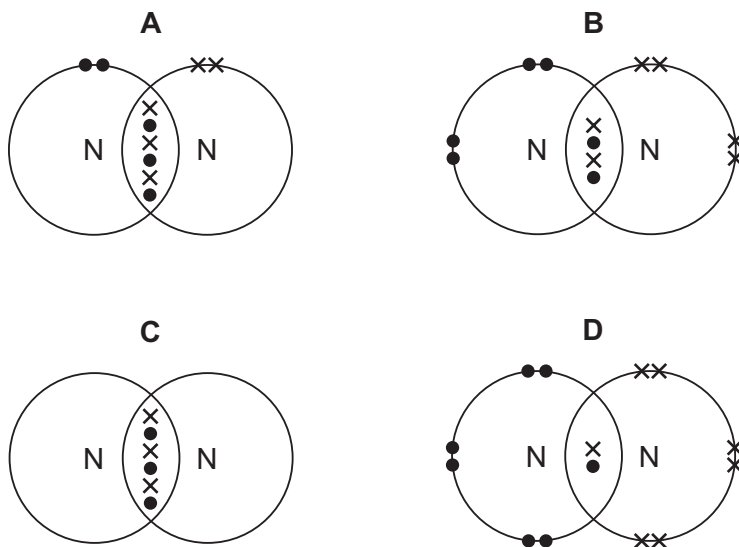
	melting point / °C	boiling point / °C
A	−182	−161
B	−100	80
C	−77	−34
D	44	280

15 A solid is added to a liquid and stirred until the solid is no longer visible.

Which word describes the type of mixture that is formed?

- A** concentration
- B** solute
- C** solution
- D** solvent

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



17 Iron(III) sulfate contains Fe^{3+} ions and SO_4^{2-} ions.

What is the formula of iron(III) sulfate?

- A** FeSO_4 **B** Fe_3SO_4 **C** $\text{Fe}_2(\text{SO}_4)_3$ **D** $\text{Fe}_3(\text{SO}_4)_2$

18 During electrolysis, positive ions are changed.

Which row describes what happens to the positive ions and identifies the electrode where this happens?

	what happens to the positive ions	electrode
A	gain electrons	anode
B	gain electrons	cathode
C	lose electrons	anode
D	lose electrons	cathode

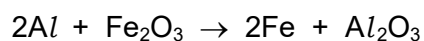
- 19** Dilute hydrochloric acid and calcium carbonate react together to produce a gas.

The rate of reaction changes if the concentration of the hydrochloric acid or the temperature is changed.

Which row about a change and how it affects the activation energy and the frequency of collisions between reacting particles is correct?

	change	activation energy	frequency of collisions
A	increased concentration	decreases	increases
B	increased concentration	no effect	no effect
C	increased temperature	decreases	no effect
D	increased temperature	no effect	increases

- 20** The equation for the redox reaction between aluminium and iron(III) oxide is shown.



Which row identifies the substance that is reduced and the oxidising agent?

	substance reduced	oxidising agent
A	Al	Fe_2O_3
B	Al	Al
C	Fe_2O_3	Fe_2O_3
D	Fe_2O_3	Al

- 21** Calcium oxide is added to water containing universal indicator. The universal indicator turns blue.

What is the pH of the solution?

- A** 1 **B** 6 **C** 7 **D** 11

22 Acid X reacts with metal Y.

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

Two tests are carried out on the solution.

test	reagents added	result
1	aqueous silver nitrate and dilute nitric acid	white precipitate
2	aqueous sodium hydroxide	green precipitate

What are acid X and metal Y?

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

23 Fluorine is at the top of Group VII in the Periodic Table.

It reacts with potassium iodide as shown.



What is substance Z?

- A** fluoride
- B** potassium
- C** potassium fluoride
- D** potassium fluorine

24 Which statements about metals and their compounds are correct?

- 1 Copper reacts with dilute hydrochloric acid to give hydrogen.
- 2 Carbon does not react with aluminium oxide.
- 3 Hydrogen is formed when steam is passed over heated zinc.
- 4 Iron is more reactive than magnesium.

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

25 Different reactions occur in the blast furnace.

Which substances are products in some reactions and reactants in other reactions in the blast furnace?

- A** carbon dioxide and carbon monoxide
- B** carbon dioxide and carbon
- C** carbon monoxide and iron
- D** iron and carbon

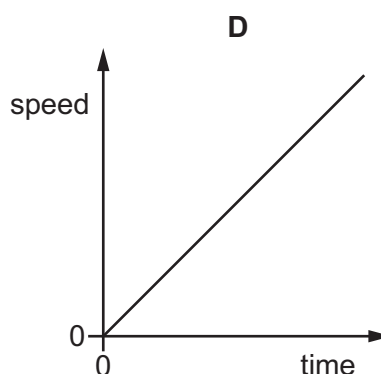
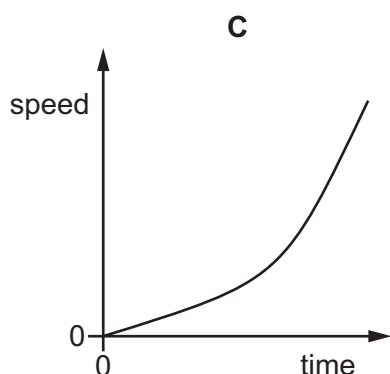
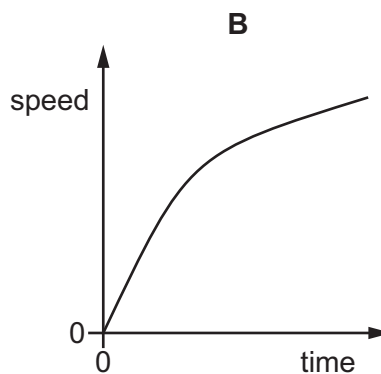
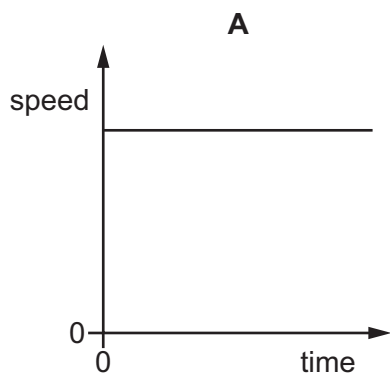
26 Which gases can directly cause an enhanced greenhouse effect?

- A** carbon monoxide and carbon dioxide
- B** carbon dioxide and methane
- C** nitrogen dioxide and sulfur dioxide
- D** sulfur dioxide and methane

27 Which statement about alkanes is correct?

- A** Their molecules are unsaturated.
- B** They are generally reactive compounds.
- C** They are mixtures of carbon and hydrogen atoms only.
- D** They produce water when they burn.

28 Which speed–time graph represents motion for which the acceleration is constant but **not** zero?



29 A glass block has a mass of 30 g and a volume of 15 cm^3 .

What is the density of the glass?

- A** 0.50 g/cm^3 **B** 2.0 g/cm^3 **C** 15 g/cm^3 **D** 450 g/cm^3

30 A spring that obeys Hooke's law is stretched by a force of 4.0 N.

The length of the spring changes from 10 cm to 12 cm.

What is the spring constant of the spring?

- A** 0.33 N/cm **B** 0.50 N/cm **C** 2.0 N/cm **D** 3.0 N/cm

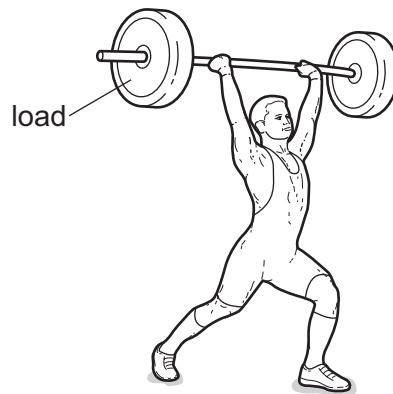
31 A car has a kinetic energy of 200 kJ as it passes a point P on a straight horizontal road.

A constant resultant force of 500 N then causes the car to accelerate.

What is the kinetic energy of the car when it has travelled a distance of 50 m past P?

- A** 2000 J **B** 25000 J **C** 225 000 J **D** 5 000 000 J

32 A man lifts a heavy load vertically, from the ground to above his head.



He then moves the load horizontally at constant speed.

During which motion is work done on the load, and why?

	work is done	reason
A	when lifting	the force exerted on the load is at right angles to the direction of movement of the load
B	when lifting	the force exerted on the load is in the same direction as the movement of the load
C	when moving horizontally	the force exerted on the load is at right angles to the direction of movement of the load
D	when moving horizontally	the force exerted on the load is in the same direction as the movement of the load

33 Which statement about a tidal energy power station is correct?

- A** It creates no environmental impact when being built.
- B** It does not work at night.
- C** It does not work when there is no wind.
- D** It supplies energy at predictable times.

34 The molecules in a substance are close together but free to change positions with each other.

Which substance at 20 °C matches this description?

- A** air
- B** copper
- C** iron
- D** water

- 35** A sound wave passes from one medium into a second medium.

What happens to the sound wave entering the second medium and why does this happen?

	what happens	why it happens
A	it is reflected	the frequency changes
B	it is reflected	the speed changes
C	it is refracted	the frequency changes
D	it is refracted	the speed changes

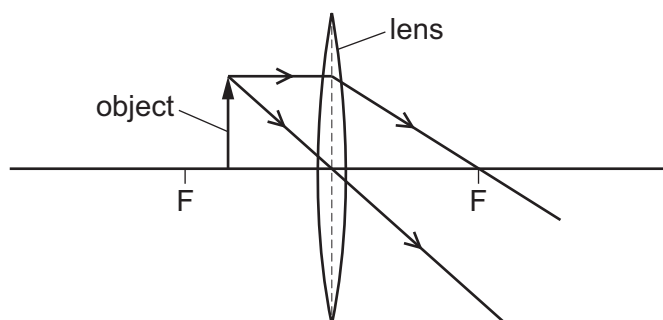
- 36** An earthquake wave shakes the ground at right angles to the direction of travel of the wave.

This wave has a frequency of 0.10 Hz and a wavelength of 30 000 m.

Which row shows the type of wave this is and its speed?

	type of wave	$\frac{\text{speed}}{\text{m/s}}$
A	longitudinal	3 000
B	longitudinal	300 000
C	transverse	3 000
D	transverse	300 000

- 37** The diagram shows two light rays from an object that pass through a thin converging lens. Each point labelled F is a principal focus of the lens.



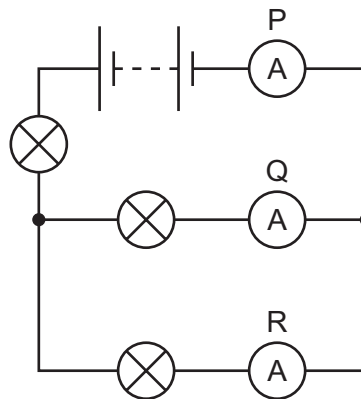
What is the nature of the image formed?

- A** right way up and larger than the object
- B** right way up and smaller than the object
- C** upside down and larger than the object
- D** upside down and smaller than the object

- 38** The amplitude of a sound wave decreases and its frequency increases.

What happens to the sound heard?

- A** It becomes louder and its pitch becomes higher.
 - B** It becomes louder and its pitch becomes lower.
 - C** It becomes quieter and its pitch becomes higher.
 - D** It becomes quieter and its pitch becomes lower.
- 39** There is a current of 6.0 A in a wire.
- How much charge flows through the wire in 2.0 minutes?
- A** 0.050 C
 - B** 3.0 C
 - C** 12 C
 - D** 720 C
- 40** A circuit contains three ammeters, P, Q and R, and three identical lamps.



How do the readings on the ammeters compare?

- A** All three ammeters show the same reading.
- B** The reading on P is greater than the reading on Q and greater than the reading on R.
- C** The reading on P is less than the reading on Q and less than the reading on R.
- D** The three ammeters show three different readings.

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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	12 Mg magnesium 24	Key atomic number atomic symbol name relative atomic mass										1 H hydrogen 1							2 He helium 4						
11 Na sodium 23											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20										
											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40										
19 K potassium 39	20 Ca calcium 40										21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88										39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137										57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	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 oganesion —

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 dm^3 at room temperature and pressure (r.t.p.).



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1 Four types of cell are listed.

- 1 egg cell
- 2 palisade mesophyll cell
- 3 red blood cell
- 4 root hair cell

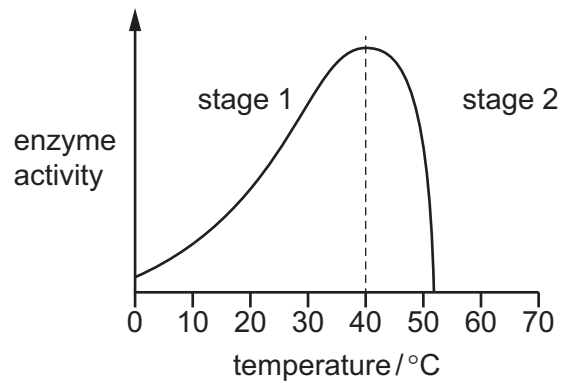
Which cell contains chlorophyll and which cell contains haemoglobin?

	contains chlorophyll	contains haemoglobin
A	1	3
B	1	4
C	2	3
D	2	4

2 What is osmosis?

- A** the movement of salt across a cell wall
- B** the movement of salt across a partially permeable membrane
- C** the movement of water across a cell wall
- D** the movement of water across a partially permeable membrane

3 The graph shows enzyme activity as temperature increases.



Which row best explains the changes in enzyme activity as temperature increases?

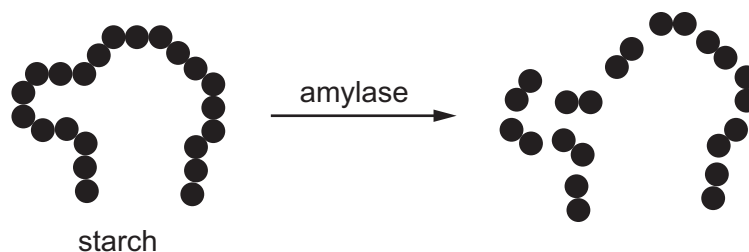
	stage 1	stage 2
A	change of shape of the active site of the enzyme	shape of the active site of the enzyme changes back to original
B	decrease in frequency of collisions of substrate and enzyme	increase in kinetic energy
C	increase in kinetic energy	change of shape of the active site of the enzyme
D	no change of shape of the active site of the enzyme	decrease in frequency of collisions of substrate and enzyme

4 A vegetable contains a high concentration of iron.

A person suffering from which condition would benefit the most from eating this vegetable?

- A** anaemia
- B** coronary heart disease
- C** obesity
- D** scurvy

- 5 The diagram shows starch being digested by amylase.



Which row shows the digestion taking place?

	chemical	mechanical
A	x	x
B	x	✓
C	✓	x
D	✓	✓

- 6 Which combination of humidity and temperature would give the lowest transpiration rate in a plant?

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

- 7 Cigarette smoke contains carbon monoxide, nicotine and tar.

These substances are harmful to human health.

Which row gives the correct information about the harmful effects?

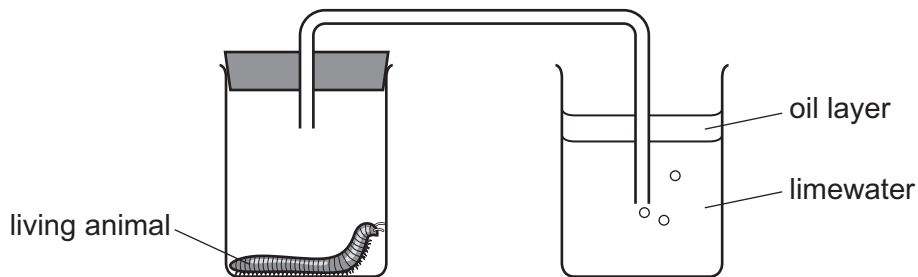
	combines with haemoglobin	causes lung cancer
A	carbon monoxide	nicotine
B	carbon monoxide	tar
C	tar	carbon monoxide
D	nicotine	carbon monoxide

- 8 A student is investigating the differences in composition of samples of inspired and expired air.

What can he use to test for carbon dioxide?

- A biuret solution
- B limewater
- C ethanol
- D iodine solution

- 9 A student sets up the experiment shown.



Which statement is correct?

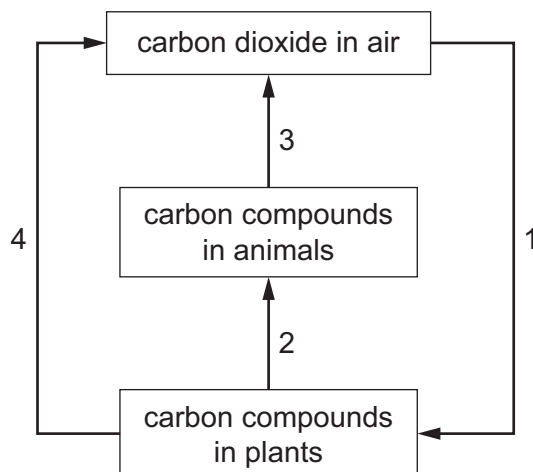
- A The limewater stays colourless because decomposition is occurring.
 - B The limewater stays colourless because photosynthesis is occurring.
 - C The limewater turns milky because aerobic respiration is occurring.
 - D The limewater turns milky because photosynthesis is occurring.
- 10 Which statement about the growth response of plant roots is correct?
- A They grow away from gravity and away from light.
 - B They grow away from gravity and towards light.
 - C They grow towards gravity and away from light.
 - D They grow towards gravity and towards light.
- 11 Which row describes asexual reproduction?

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

12 Which statement describes fertilisation in a flowering plant?

- A fusion of a pollen nucleus with a nucleus in the ovule
- B fusion of a pollen nucleus with the stigma
- C transfer of a pollen grain from the anther to the stigma
- D transfer of a pollen grain from the filament to the stigma

13 The diagram shows part of the carbon cycle.



Where does respiration occur?

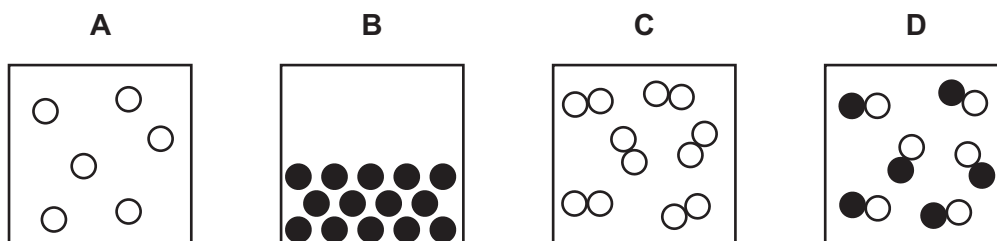
- A 1 only
- B 2 and 3
- C 3 and 4
- D 3 only

14 Substance X is an element.

It is a gas at room temperature.

It is made of X_2 molecules.

Which diagram represents X?



15 Which statement about tap water is correct?

- A It is a compound.
- B It is a mixture of elements.
- C It is a pure substance.
- D It is a solution.

16 Which statement about the boiling points of covalent compounds such as CO_2 and ionic compounds is correct?

- A These covalent compounds have higher boiling points than ionic compounds because covalent bonds are stronger than ionic bonds.
- B These covalent compounds have higher boiling points than ionic compounds because the attractive forces between covalent molecules are stronger than the attractive forces between ions.
- C Ionic compounds have higher boiling points than these covalent compounds because ionic bonds are stronger than covalent bonds.
- D Ionic compounds have higher boiling points than these covalent compounds because the attractive forces between ions are stronger than the attractive forces between covalent molecules.

17 An ionic compound contains ammonium ions, NH_4^+ , iron(III) ions, Fe^{3+} , and sulfate ions, SO_4^{2-} .

What is the formula of this compound?

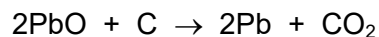
- A NH_4FeSO_4
- B $\text{NH}_4\text{Fe}(\text{SO}_4)_2$
- C $(\text{NH}_4)_2\text{FeSO}_4$
- D $\text{NH}_4\text{Fe}_3(\text{SO}_4)_2$

18 Which statement about chemical reactions is **not** correct?

- A A higher temperature increases the rate of an endothermic reaction.
- B Chemical energy is transferred to thermal energy in an endothermic reaction.
- C Temperature decreases in an endothermic reaction and there is an increase in chemical energy.
- D Temperature increases in an exothermic reaction because there is an increase in thermal energy.

- 19** Lead can be extracted from lead(II) oxide by heating with carbon.

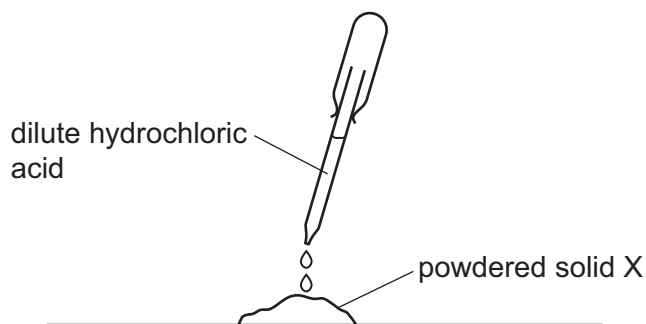
The equation for the reaction is shown.



Which statement about this reaction is correct?

- A** Carbon is a reducing agent because it removes oxygen from lead(II) oxide.
 - B** Carbon is reduced because it forms a gas.
 - C** Lead(II) oxide is a reducing agent because it forms an element.
 - D** Lead is oxidised because lead(II) oxide contains oxygen.
- 20** Dilute hydrochloric acid is added to powdered solid X.

Hydrogen gas is produced.



What is X?

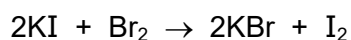
- A** zinc
 - B** zinc carbonate
 - C** zinc hydroxide
 - D** zinc oxide
- 21** Which test is used to identify ammonia?
- A** A glowing splint relights.
 - B** Damp blue litmus paper is bleached.
 - C** Damp red litmus paper turns blue.
 - D** Limewater turns milky.

22 Which properties of argon, Ar, can be determined from its position in the Periodic Table?

- 1 its number of outer-shell electrons
- 2 its density
- 3 its chemical reactivity

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

23 The equation for the reaction between aqueous potassium iodide and aqueous bromine is shown.



Which statement about this reaction is correct?

- A** Bromine acts as a reducing agent.
- B** Bromine molecules change to bromine atoms in the reaction.
- C** Iodine is displaced from its salt because it is less reactive than bromine.
- D** The mixture becomes colourless as the reaction proceeds.

24 Which substance does **not** react with dilute hydrochloric acid to produce copper chloride?

- A** copper
- B** copper carbonate
- C** copper hydroxide
- D** copper oxide

25 Part of the reactivity series of metals is shown.

calcium	most reactive
magnesium	
aluminium	
iron	
copper	
silver	least reactive



Metal X is the most reactive metal that can be extracted from its ore using carbon.

Where is X placed in the reactivity series?

- A above calcium
 - B between aluminium and iron
 - C between copper and silver
 - D between magnesium and aluminium
- 26 Which two substances react together to increase the concentration of a gas in the air that may contribute to climate change?
- A sodium oxide and carbon
 - B potassium carbonate and dilute hydrochloric acid
 - C sodium and water
 - D zinc and dilute nitric acid
- 27 Decane is an alkane.
- Which statement about decane is correct?
- A It burns in air to form carbon dioxide and hydrogen.
 - B It is an unsaturated hydrocarbon.
 - C It only contains single C–C and C–H bonds.
 - D It rapidly decolourises bromine water.
- 28 An object travels 6.0 km in two minutes.
- What is its speed?
- A 0.050 m/s B 3.0 m/s C 50 m/s D 3000 m/s

- 29** An object is moved from one location to a second location where the gravitational field strength is different.

What happens to the mass of the object and what happens to the weight of the object because of this change of location?

	mass	weight
A	changes	changes
B	changes	stays the same
C	stays the same	changes
D	stays the same	stays the same

- 30** A car has an initial kinetic energy of 120 kJ at the bottom of a slope. The car is driven up the slope. At the top of the slope, the car has 260 kJ of kinetic energy and has gained 570 kJ of gravitational potential energy.

What is the total increase in kinetic energy and gravitational potential energy of the car as it moves up the slope?

- A** 430 kJ **B** 710 kJ **C** 830 kJ **D** 950 kJ

- 31** For which energy resource is the Sun the only source?

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

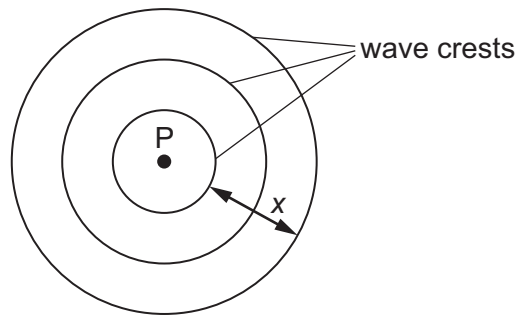
- 32** Which source of energy used on Earth is due mainly to the Moon?

- A** geothermal
B hydroelectric
C tidal
D wind

- 33** Which statement about the boiling point of a substance is correct?

- A** At all temperatures above its boiling point, a substance must be a gas.
B At all temperatures above its boiling point, a substance must be a liquid.
C At all temperatures below its boiling point, a substance must be a gas.
D At all temperatures below its boiling point, a substance must be a liquid.

- 34 The diagram shows three wave crests on a wave formed by dipping a finger into water at P at regular intervals.

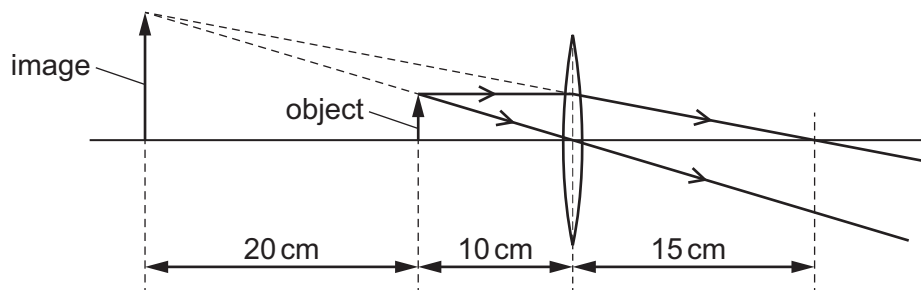


Three wave crests are produced every six seconds. Distance x is equal to 40 cm.

What is the speed and the frequency of the wave?

	speed cm/s	frequency /Hz
A	10	0.50
B	10	2.0
C	40	0.50
D	40	2.0

- 35 The ray diagram shows a thin converging lens used as a magnifying glass.



What is the focal length of the lens?

- A** 10 cm **B** 15 cm **C** 20 cm **D** 30 cm
- 36 A loudspeaker vibrates at different frequencies.

Which frequency of vibration does **not** produce a sound that a human can hear?

- A** 60 Hz **B** 600 Hz **C** 6.0 kHz **D** 60 kHz

- 37** A plastic rod is rubbed with a woollen cloth. The rod becomes negatively charged.

What happens to the woollen cloth?

- A** It gains electrons and becomes negatively charged.
- B** It gains electrons and becomes positively charged.
- C** It loses electrons and becomes negatively charged.
- D** It loses electrons and becomes positively charged.

- 38** In an X-ray machine, a beam of electrons hits a metal block.

The moving electrons in the beam are a current of 0.30 A.

How long does it take for 60 mC of charge to hit the block?

- A** 0.018 s
- B** 0.20 s
- C** 5.0 s
- D** 200 s

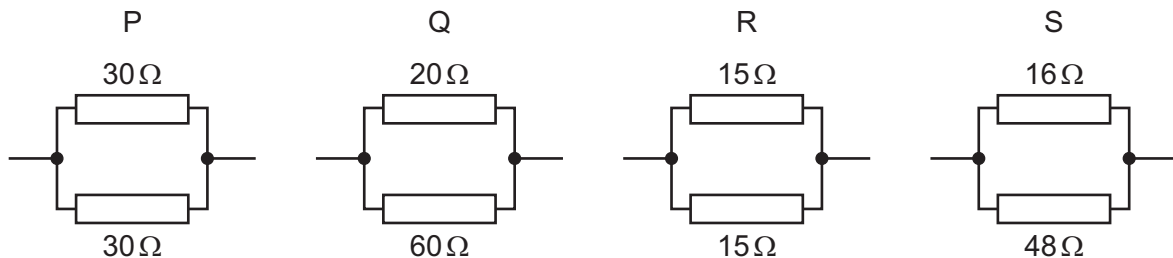
- 39** A copper wire has a resistance of $8.0\ \Omega$.

A second copper wire has double the length and double the diameter of the first wire.

What is the resistance of the second copper wire?

- A** $1.0\ \Omega$
- B** $4.0\ \Omega$
- C** $8.0\ \Omega$
- D** $16\ \Omega$

- 40** Which two combinations of resistors in parallel have an equal combined resistance?



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

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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 —

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 2023

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 adaptation of root hair cells increases their rate of absorption of water?

- A large surface area
- B phloem present
- C small surface area
- D xylem present

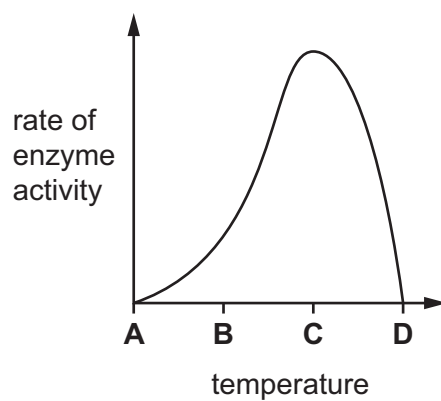
2 Which statement about diffusion is correct?

- A Diffusion occurs only in living organisms.
- B Diffusion occurs only in solution.
- C Diffusion occurs only through a cell wall.
- D Diffusion occurs only down a concentration gradient.

3 Which row contains all of the elements in fats?

	carbon	hydrogen	nitrogen	oxygen
A	✓	x	✓	✓
B	✓	✓	✓	x
C	✓	✓	x	✓
D	x	✓	✓	✓

4 At which temperature is the enzyme denatured?



- 5 A plant shoot is 5 cm tall and has two leaves half way up the stem.

What can happen to the simple sugars made by these leaves?

- 1 move down the stem from the leaves
- 2 move up the stem from the leaves
- 3 remain in the leaves

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

- 6 What is the role of mechanical digestion?

- A** It breaks down large food molecules into smaller molecules.
- B** It forms new chemical compounds for the body to utilise.
- C** It breaks down large pieces of food into smaller pieces.
- D** It makes the food particles soluble for better absorption.

- 7 From which part of a leaf does water evaporate during transpiration?

- A** the cuticle
- B** the mesophyll cells
- C** the upper epidermis
- D** the stomata

- 8 Some features of the human gas exchange system are listed.

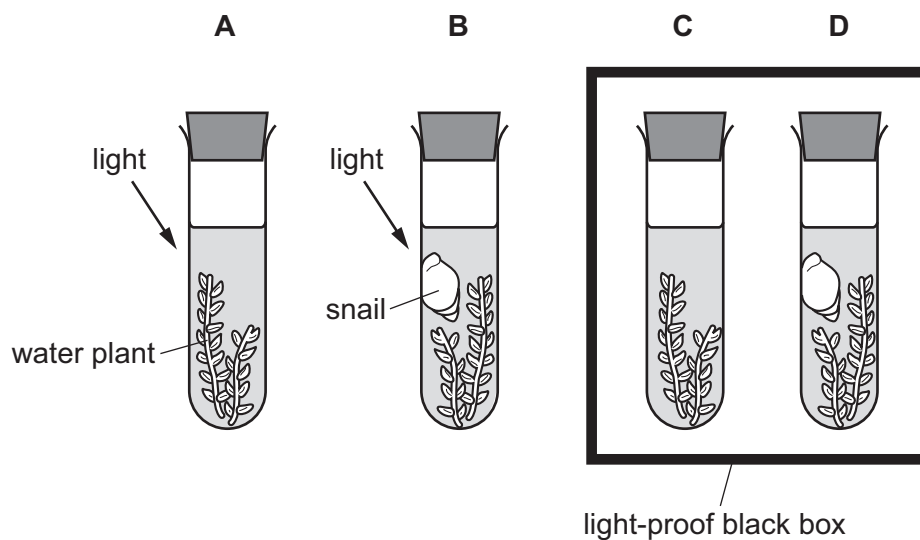
- 1 has large surface area
- 2 contains goblet cells
- 3 has a good blood supply
- 4 has ciliated cells
- 5 inner surfaces are lined with mucus

Which features are necessary for efficient diffusion of gases?

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

- 9 The diagram shows the apparatus used in an investigation on gas exchange in organisms.

In which test-tube would the concentration of oxygen decrease most rapidly?



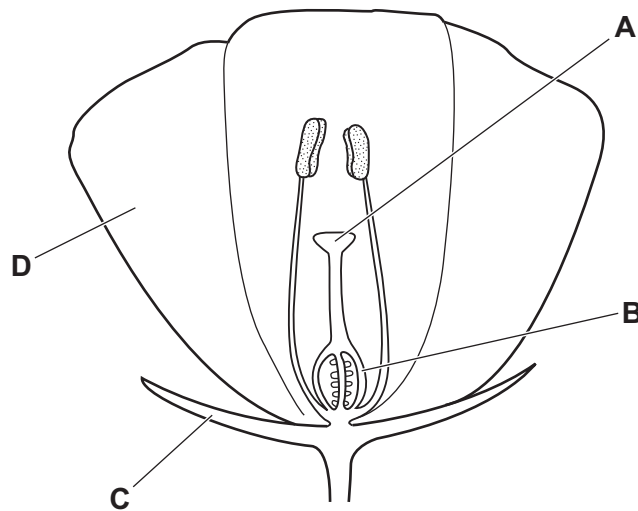
- 10 The table shows some statements about reproduction.

Which row is correct for asexual reproduction?

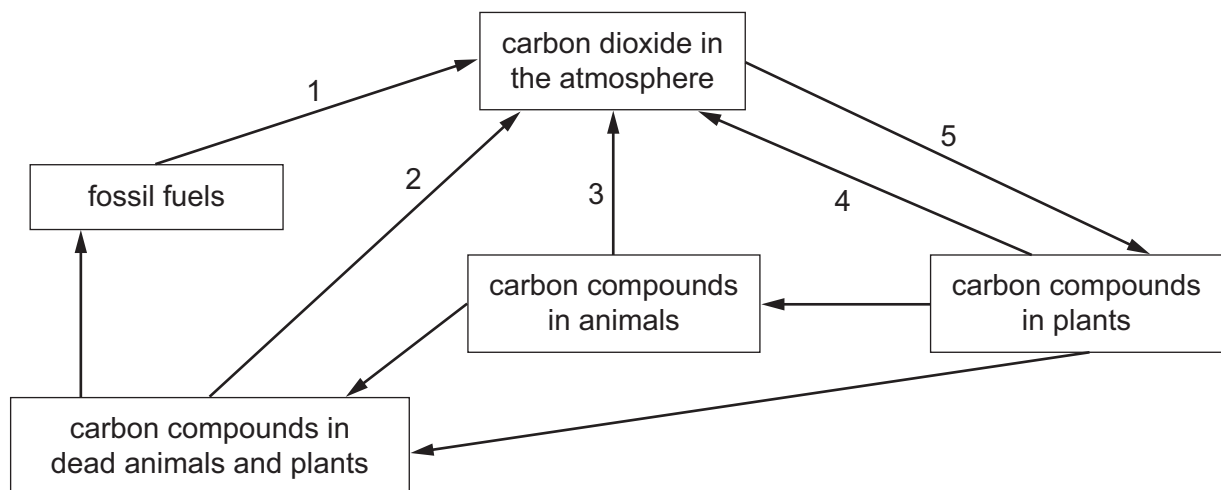
	offspring are genetically identical to each other	offspring are genetically identical to the parent	the zygote is produced when gametes fuse
A	✓	✓	x
B	✓	x	x
C	x	✓	✓
D	x	x	✓

11 The diagram shows an insect-pollinated flower.

Which label identifies a petal?



12 The diagram shows part of the carbon cycle.



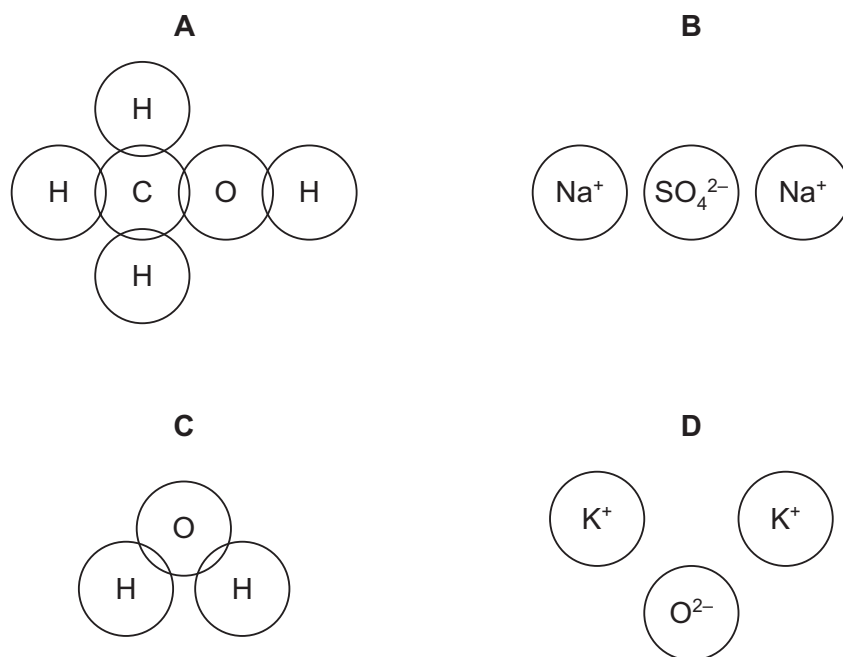
Which processes use oxygen and produce oxygen?

	uses oxygen	produces oxygen
A	1	2
B	2	3
C	3	4
D	4	5

13 What occurs as a result of eutrophication?

- A There is a decrease in the availability of nitrate ions.
- B There is a decrease in the availability of oxygen molecules.
- C There is a decrease in the growth rate of producers.
- D There is a decrease in the rate of decomposition.

14 Which diagram represents a covalent molecule containing three different types of atom?



15 What is a general property of metals?

- A They are malleable.
- B They are soluble in water.
- C They act as catalysts.
- D They have low melting points.

16 Which statement about the melting points of aluminium oxide, Al_2O_3 , and methanol, CH_3OH , is correct?

- A Aluminium oxide has a higher melting point than methanol because ionic bonding is stronger than covalent bonding.
- B Aluminium oxide has a higher melting point than methanol because the attraction between ions is stronger than the attraction between molecules.
- C Methanol has a higher melting point than aluminium oxide because covalent bonding is stronger than ionic bonding.
- D Methanol has a higher melting point than aluminium oxide because the attraction between molecules is stronger than the attraction between ions.

- 17 Aqueous lead nitrate and aqueous sodium chloride react to form aqueous sodium nitrate and solid lead chloride.

What is the ionic equation for this reaction?

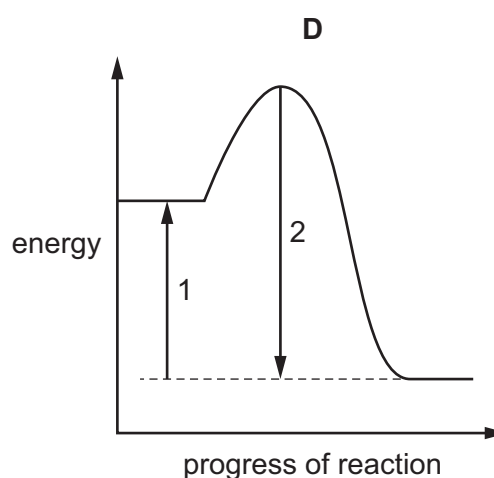
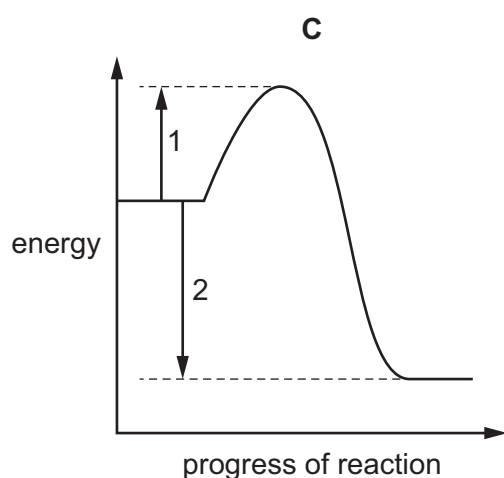
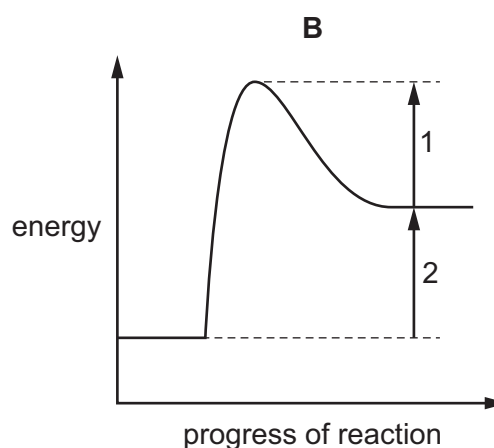
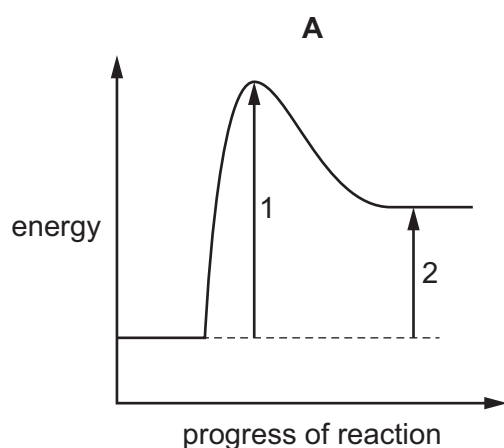
- A $\text{Pb}^{2+}(\text{aq}) + \text{Cl}^{2-}(\text{aq}) \rightarrow \text{PbCl}(\text{s})$
 B $\text{Pb}^{2+}(\text{aq}) + 2\text{Cl}^{-}(\text{aq}) \rightarrow \text{PbCl}_2(\text{s})$
 C $\text{Na}^{+}(\text{aq}) + \text{NO}_3^{-}(\text{aq}) \rightarrow \text{NaNO}_3(\text{aq})$
 D $\text{Na}^{+}(\text{aq}) + 2\text{NO}_3^{-}(\text{aq}) \rightarrow \text{Na}(\text{NO}_3)_2(\text{aq})$

- 18 Which energy level diagram identifies the activation energy and the energy change for an exothermic reaction?

key

1 = activation energy

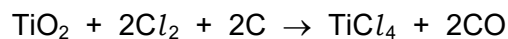
2 = energy change for the reaction



- 19** Rutile is an ore of titanium. Rutile contains titanium oxide, TiO_2 .

The first step in the extraction of titanium from rutile is heating with chlorine and carbon at a high temperature.

The equation for the reaction is shown.



Which row shows the role of carbon and of titanium oxide in this reaction?

	carbon	titanium oxide
A	oxidising agent	oxidising agent
B	oxidising agent	reducing agent
C	reducing agent	oxidising agent
D	reducing agent	reducing agent

- 20** Which element reacts with dilute sulfuric acid to form a salt?

- A** carbon
- B** copper
- C** sulfur
- D** zinc

- 21** Substance X is warmed with aqueous sodium hydroxide and aluminium.

A gas is produced which turns damp red litmus paper blue.

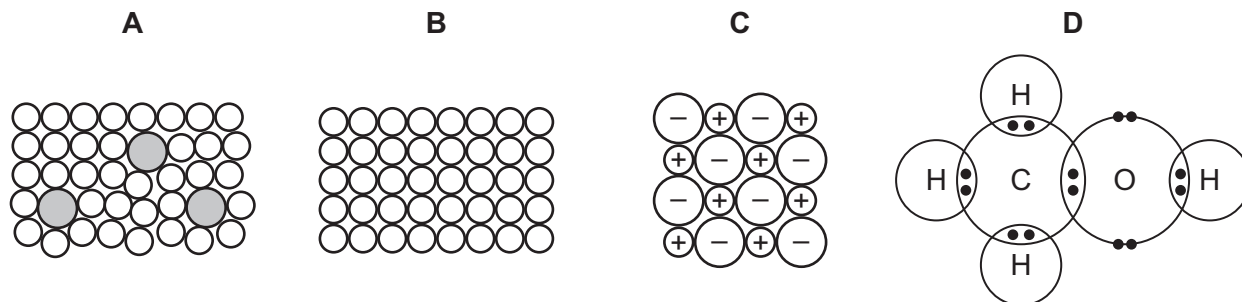
Which anion is present in X?

- A** carbonate
- B** hydroxide
- C** nitrate
- D** sulfate

- 22** Which equation represents a reaction that occurs when a halogen is added to an aqueous potassium halide?

- A** $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$
- B** $2\text{KBr} + \text{I}_2 \rightarrow 2\text{KI} + \text{Br}_2$
- C** $2\text{KCl} + \text{Br}_2 \rightarrow 2\text{KBr} + \text{Cl}_2$
- D** $2\text{KCl} + \text{I}_2 \rightarrow 2\text{KI} + \text{Cl}_2$

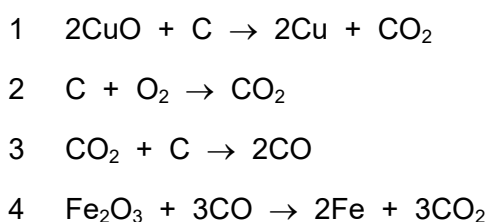
23 Which diagram represents an alloy?



24 Which row shows elements in order of reactivity?

	most reactive → least reactive			
A	aluminium	iron	zinc	hydrogen
B	calcium	carbon	aluminium	copper
C	magnesium	zinc	hydrogen	copper
D	sodium	potassium	magnesium	aluminium

25 The equations show reactions that occur in the extraction of copper and of iron.



Which equations show the reduction of a compound?

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

26 Which processes contribute to the enhanced greenhouse effect?

- 1 the electrolysis of concentrated aqueous sodium chloride
- 2 the extraction of iron in a blast furnace
- 3 the reaction of magnesium with dilute hydrochloric acid
- 4 the reaction of sodium carbonate with dilute hydrochloric acid

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

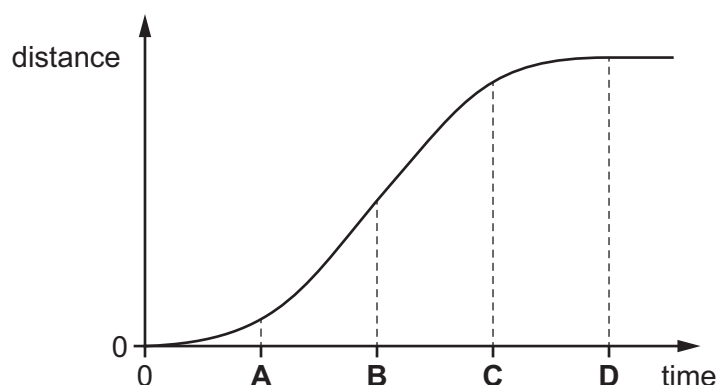
27 Which statement about alkanes is correct?

- A They are unsaturated hydrocarbons.
- B They are very reactive.
- C They burn to form carbon dioxide and hydrogen.
- D They contain only single covalent bonds.

28 A train travels between two stations.

The distance–time graph for the train is shown.

At which labelled time is the train travelling the fastest?



29 A student performs an experiment to determine the density of an irregularly shaped stone.

The student pours some water into a measuring cylinder and then lowers the stone into the water so that the stone is fully submerged. The table shows the measurements.

mass of empty measuring cylinder	270 g
volume of water	80 cm ³
mass of measuring cylinder and water	350 g
volume of water and stone	110 cm ³
mass of measuring cylinder, water and stone	420 g

What is the density of the stone?

- A 2.3 g/cm³ B 2.7 g/cm³ C 3.8 g/cm³ D 5.0 g/cm³

30 Which energy source is renewable?

- A geothermal
- B natural gas
- C nuclear fission
- D oil

31 What is the main energy transfer that takes place in the Sun?

- A chemical potential energy to thermal energy
- B thermal energy to chemical potential energy
- C thermal energy to nuclear energy
- D nuclear energy to thermal energy

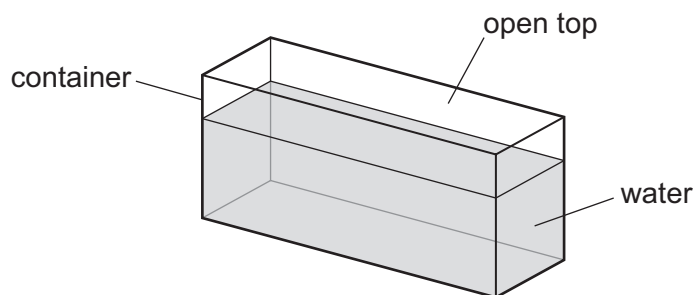
32 Which row describes the arrangement and separation of the particles in a liquid?

	arrangement of particles	separation of particles
A	random	closer than in a gas
B	random	further apart than in a gas
C	regular	closer than in a gas
D	regular	further apart than in a gas

33 An open container in a laboratory contains water. The container is placed on a bench near a closed window.

The container is in bright sunlight and it is a windy day outside.

The water in the container evaporates slowly.



Four actions are listed.

- 1 adding more water to the container
- 2 opening the window
- 3 covering the window with a curtain
- 4 increasing the room temperature

Which two actions, on their own, increase the rate of evaporation?

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

- 34** A sound wave travels in air.

What is the name of the region of the wave where the separation of particles is greatest?

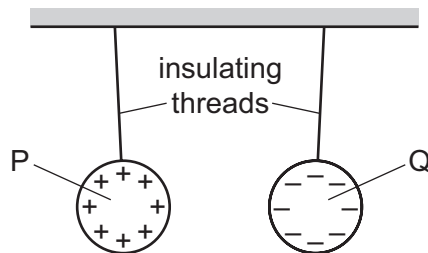
- A** compression
- B** medium
- C** rarefaction
- D** reflection

- 35** A loudspeaker vibrates with different amplitudes and at different frequencies to make a sound.

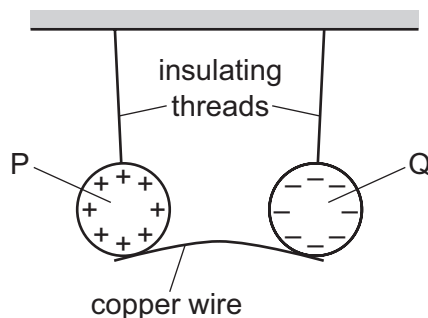
Which amplitude and frequency produces the louder, higher-pitched sound?

- A** large amplitude and high frequency
- B** large amplitude and low frequency
- C** small amplitude and high frequency
- D** small amplitude and low frequency

- 36** The diagram shows two charged metal spheres, P and Q, suspended from insulating threads. P is positively charged and Q is negatively charged.



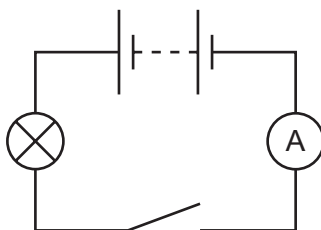
The spheres are now joined by a copper wire.



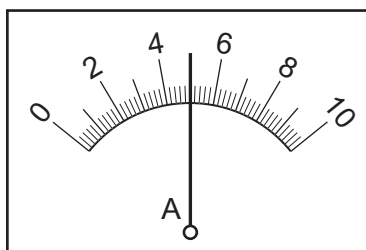
What happens in the copper wire?

- A** Electrons flow from P to Q.
- B** Electrons flow from Q to P.
- C** Protons flow from P to Q.
- D** Protons flow from Q to P.

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



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



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

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

- A** 0.25 C **B** 4.0 C **C** 90 C **D** 100 C
- 38** A wire of length 3.0 m and cross-sectional area of 0.24 mm^2 has a resistance of 6.0Ω .
A second wire, made from the same material, has a cross-sectional area of 0.12 mm^2 and a resistance of 24Ω .
What is the length of the second wire?
- A** 3.0 m **B** 6.0 m **C** 12 m **D** 24 m
- 39** A car has two headlamps connected in parallel to a 12 V battery.
The power of each headlamp is 60 W.
What is the total energy supplied by the battery to the two headlamps in 5.0 minutes?
- A** 0.60 kJ **B** 18 kJ **C** 36 kJ **D** 430 kJ
- 40** A 4.0Ω resistor and a 6.0Ω resistor are connected in parallel.
What is the combined resistance of the two resistors?
- A** 0.42Ω **B** 2.4Ω **C** 5.0Ω **D** 10Ω

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The Periodic Table of Elements

Group

I	II	Group										III	IV	V	VI	VII	VIII
		Key atomic number atomic symbol name relative atomic mass										1Hhydrogen1					
3Li lithium 7	4Be beryllium 9											5B boron 11	6C carbon 12	7N nitrogen 14	8O oxygen 16	9F fluorine 19	2He helium 4
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	57–71lanthanoids	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 —	89–103actinoids	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 oganesson —

lanthanoids

57La lanthanum 139	58Ce cerium 140	59Pr praseodymium 141	60Nd neodymium 144	61Pm promethium —	62Sm samarium 150	63Eu europium 152	64Gd gadolinium 157	65Tb terbium 159	66Dy dysprosium 163	67Ho holmium 165	68Er erbium 167	69Tm thulium 169	70Yb ytterbium 173	71Lu lutetium 175
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actinoids

89Ac actinium —	90Th thorium 232	91Pa protactinium 231	92U uranium 238	93Np neptunium —	94Pu plutonium —	95Am americium —	96Cm curium —	97Bk berkelium —	98Cf californium —	99Es einsteinium —	100Fm fermium —	101Md mendelevium —	102No nobelium —	103Lr lawrencium —
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The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).