



Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

COMBINED SCIENCE

Paper 2 Multiple Choice (Extended)

0653/21

October/November 2019

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

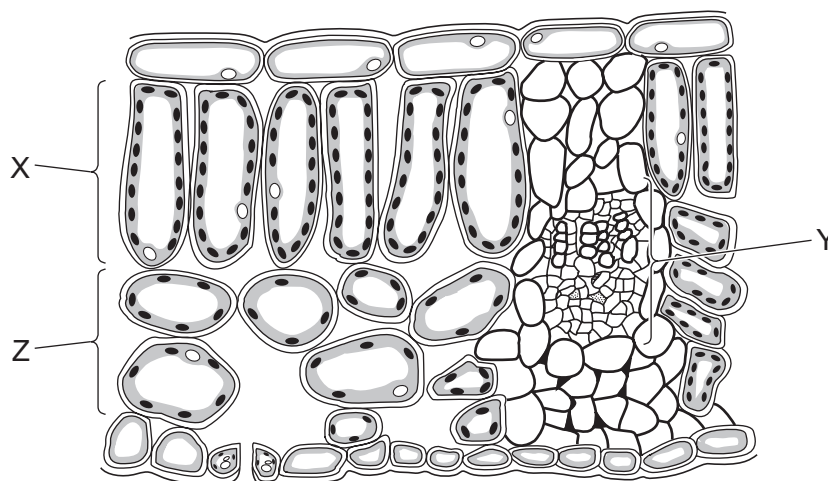


- 1 A biologist keeps a potted plant in a laboratory.

Which feature of the potted plant shows that it is a living organism?

- A It grows larger over time.
- B It has green leaves.
- C The compost in the pot dries after he waters it.
- D The stems contain xylem.

- 2 The diagram shows a section through a leaf.



Which row correctly identifies the labelled parts of the leaf section?

	X	Y	Z
A	cuticle	vascular bundle	palisade mesophyll
B	palisade mesophyll	vascular bundle	spongy mesophyll
C	palisade mesophyll	cuticle	spongy mesophyll
D	spongy mesophyll	cuticle	vascular bundle

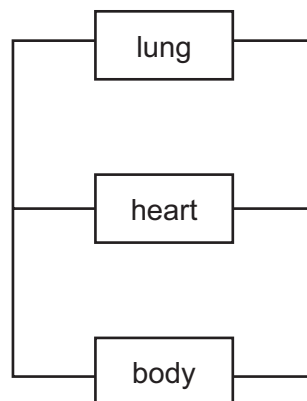
- 3 1 cm³ of substance **X** is added to 10 cm³ starch suspension and mixed. Food tests are carried out immediately after mixing and again after an hour.

The results of the tests are shown in the table.

test reagent	colour of solution after mixing	colour of solution after one hour
Benedict's solution	blue	orange
iodine solution	blue / black	brown

What is substance **X**?

- A amylase
 - B protease
 - C lipase
 - D sugar
- 4 How are root hair cells adapted for absorption of water?
- A large surface area
 - B thick cell wall
 - C many chloroplasts
 - D no nucleus
- 5 The diagram shows a double circulatory system.



In which direction does the blood flow in this type of system?

- A heart → body → heart → lung
- B body → heart → body → lung
- C heart → body → lung → heart
- D lung → heart → lung → body

- 6 The concentrations of carbon dioxide and oxygen in expired air differ from the concentrations in inspired air.

	gas	concentration in expired air
1	carbon dioxide	higher
2	carbon dioxide	lower
3	oxygen	higher
4	oxygen	lower

Which rows correctly show the difference?

- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4
- 7 Which statement about aerobic respiration is correct?
- A** It exchanges gases through the walls of the alveoli.
- B** It expels carbon dioxide from the lungs.
- C** It only produces carbon dioxide and energy.
- D** It uses oxygen to release energy from glucose.
- 8 What is the effect of adrenaline on the rate of breathing and pulse rate?

	rate of breathing	pulse rate
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 9 Auxins are produced in the tip of a shoot.

In an experiment, auxin was applied to a plant shoot just below its tip.

Which row describes the change to the shoot and explains this change?

	shoot	explanation
A	becomes longer	cells divide
B	becomes longer	cells elongate
C	becomes longer	cells elongate and then divide
D	did not change length	the auxin has no effect

10 Which statement about sexual reproduction is **always** correct?

- A It involves only one parent.
- B It involves the fusion of nuclei.
- C It produces genetically identical offspring.
- D It takes place only in animals.

11 The table gives comparisons between insect-pollinated and wind-pollinated flowers.

Which row is correct?

	surface of stigma		surface of pollen	
	insect	wind	insect	wind
A	feathery	sticky	smooth	spiky
B	feathery	sticky	spiky	smooth
C	sticky	feathery	smooth	spiky
D	sticky	feathery	spiky	smooth

12 The following are adaptive features of some gametes.

- 1 a flagellum
- 2 a jelly coat
- 3 a sac of enzymes at one end
- 4 a store of energy

Which are features of a human male gamete?

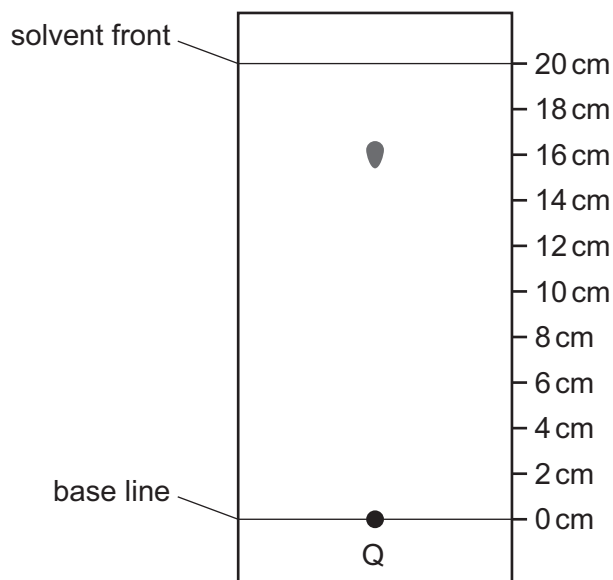
- A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

13 An increased volume of nitrate ions is washed into a lake.

Why does this result in a decrease in the number of fish in the lake?

- A There is a decrease in the decomposition of producers.
- B There is a decrease in the growth of producers.
- C There is an increase in aerobic respiration by decomposers.
- D There is an increase in dissolved oxygen.

14 A chromatogram of substance Q is shown.



What is the R_f value of Q?

- A** 0.2 **B** 0.4 **C** 0.8 **D** 1.6

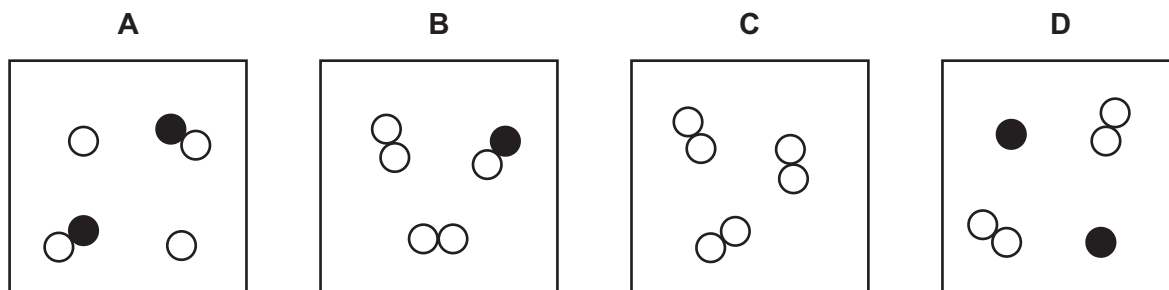
15 Four processes are listed.

- 1 melting of ice
- 2 electrolysis of molten lead(II) bromide
- 3 combustion of carbon
- 4 rusting of iron

Which processes are chemical changes?

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

16 Which diagram represents a mixture of two different elements?



17 The fertiliser ammonium sulfate has the formula $(\text{NH}_4)_2\text{SO}_4$.

How many atoms of each element are present in the formula?

	number of hydrogen atoms	number of nitrogen atoms	number of oxygen atoms	number of sulfur atoms
A	4	1	1	1
B	4	2	4	1
C	8	1	4	1
D	8	2	4	1

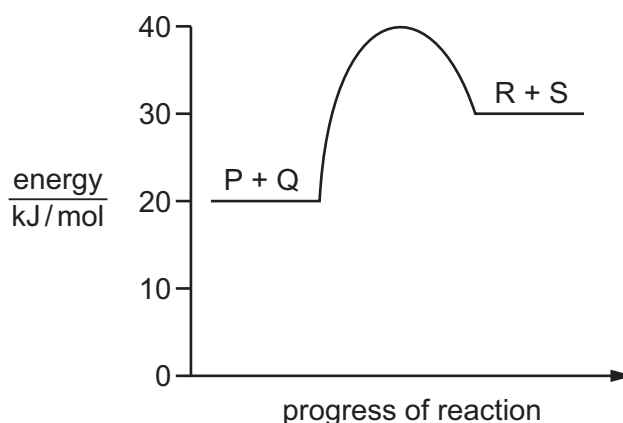
18 Element X is a non-metal used in the treatment of the water supply.

It is made during the electrolysis of a metal salt.

What is the colour of X and at which electrode is it made?

	colour	electrode
A	red	anode
B	red	cathode
C	yellow-green	anode
D	yellow-green	cathode

19 The energy level diagram for the reaction between P and Q to produce R and S is shown.



Which statement about this reaction is correct?

- A** Energy is required to form new bonds.
- B** The activation energy is 10 kJ/mol.
- C** The energy required to break bonds is greater than the energy given out when bonds form.
- D** The reaction is exothermic because the energy of the products is greater than the energy of the reactants.

- 20** Calcium carbonate reacts with dilute hydrochloric acid.

The time taken to collect 10 cm³ of carbon dioxide is recorded.

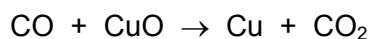
The experiment is repeated at a different temperature. The results are shown.

experiment	temperature /°C	time taken /s
1	20	55
2	80	30

The rate of reaction in each experiment is different.

Which statement about the rate of reaction of experiment 1, compared with experiment 2, is correct?

- A** It is greater because at the lower temperature the particles move more slowly so they have more time to react.
 - B** It is greater because the particles collide more frequently.
 - C** It is lower because the particles collide at the same frequency and fewer of them have the minimum energy to react.
 - D** It is lower because the particles collide less frequently and fewer of them have the minimum energy to react.
- 21** The equation for the reaction of carbon monoxide with copper oxide is shown.

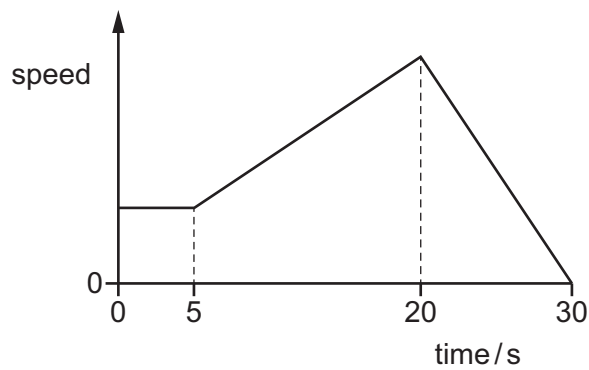


Which statement about this reaction is **not** correct?

- A** Carbon dioxide is the oxidising agent.
 - B** Carbon monoxide is the reducing agent.
 - C** Carbon monoxide is being oxidised.
 - D** Copper oxide is the oxidising agent.
- 22** Which two substances are used to make copper sulfate?
- A** copper and dilute sulfuric acid
 - B** copper and sulfur
 - C** copper oxide and dilute sulfuric acid
 - D** copper oxide and sulfur

- 23 Which statement about elements in the Periodic Table is **not** correct?
- A Elements in Group I react by gaining electrons to form ions.
 - B Elements in Group II have two electrons in their outer shell.
 - C Elements in Group VIII are unreactive because they have full outer shells of electrons.
 - D Elements with seven outer shell electrons are non-metals.
- 24 Which statement about alloys is correct?
- A They are made from metals because metals are poor electrical conductors.
 - B They are mixtures of compounds that contain metals.
 - C They have all the same properties as the metals from which they are made.
 - D They have different properties to the metals from which they are made.
- 25 Which gas is **not** present in clean air?
- A carbon monoxide
 - B neon
 - C nitrogen
 - D water vapour
- 26 Which two gases cause an enhanced greenhouse effect when their concentrations in the atmosphere increase?
- A carbon monoxide and carbon dioxide
 - B carbon dioxide and methane
 - C methane and sulfur dioxide
 - D sulfur dioxide and carbon monoxide
- 27 Which statement about fractions obtained from petroleum is **not** correct?
- A Different fractions have different boiling points.
 - B Gasoline contains molecules of only one hydrocarbon.
 - C Molecules in diesel oil are smaller than molecules in bitumen.
 - D Naphtha is used as a feedstock for making chemicals.

- 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 is braking?

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

- 29 The gravitational field strength on Mars is less than that on Earth.

An object is taken from Earth to Mars.

Which statement describes the object when it is on Mars?

- A** It has greater mass than on Earth.
B It has less mass than on Earth.
C It has less weight than on Earth.
D It has the same weight as on Earth.

- 30** A student wants to determine the density of an irregularly shaped stone. He has a measuring cylinder, water, a balance and a thermometer.

These are his measurements:

- P initial volume of water in measuring cylinder
- Q mass of measuring cylinder
- R mass of stone
- S mass of water in measuring cylinder
- T reading on measuring cylinder with stone fully immersed in the water
- U temperature of water

Which three measurements are needed to determine the density of the stone?

- A** P, R and T
 - B** P, T and U
 - C** Q, R and S
 - D** Q, S and U
- 31** Which device uses a non-renewable energy source?

- A** diesel engine
- B** solar cell
- C** water turbine
- D** windmill

- 32** A metal pan containing water is heated on a hot stove. Energy is transferred thermally from the stove to the water.

How is the energy transferred through the pan and then throughout the water?

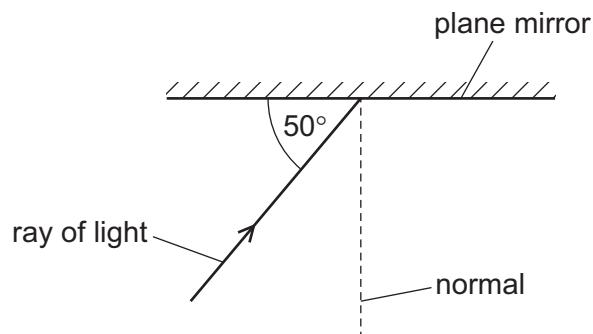
	through the pan	throughout the water
A	conduction	conduction
B	conduction	convection
C	convection	conduction
D	convection	convection

- 33** On a hot, sunny day a boy finds that his head stays cooler when he wears a white hat than when he wears an otherwise identical black hat.

Why does the white hat keep his head cooler?

- A** It absorbs less radiation from the Sun than the black hat.
 - B** It conducts less heat energy than the black hat.
 - C** It conducts more heat energy than the black hat.
 - D** It emits more radiation from his head than the black hat.
- 34** Which wave is longitudinal?
- A** infrared
 - B** radio
 - C** sound
 - D** ultraviolet

- 35** The diagram shows light striking a plane mirror.

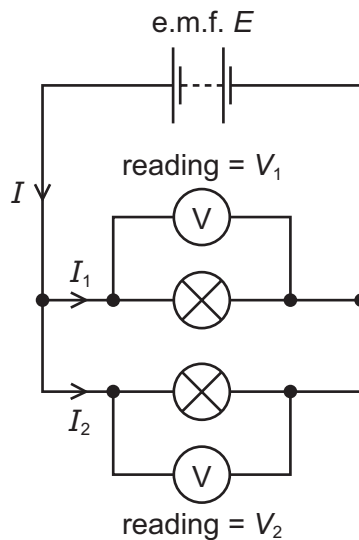


What is the angle of reflection of the ray when it is reflected from the mirror?

- A** 40°
- B** 50°
- C** 80°
- D** 100°

- 36 A circuit contains a battery of e.m.f. E , two lamps and two voltmeters, connected as shown.

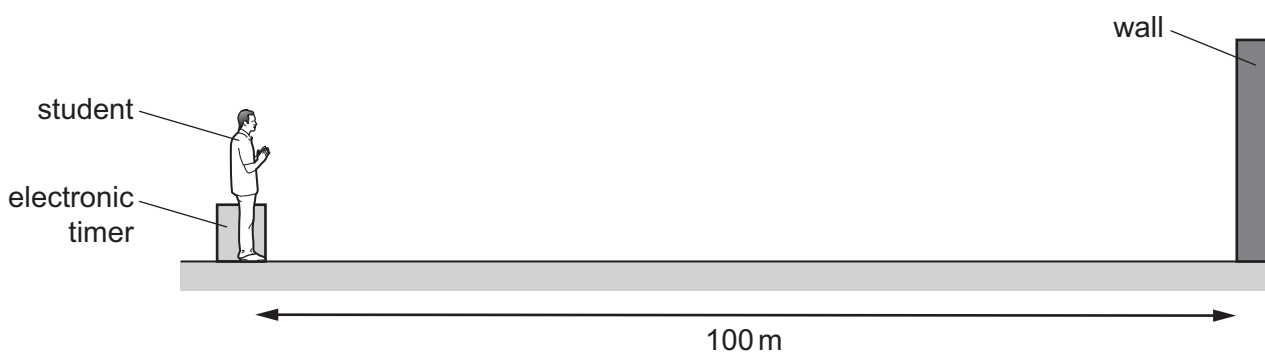
The voltmeter readings V_1 and V_2 , and the current in three parts of the circuit I , I_1 and I_2 are labelled.



Which row gives expressions for current I and e.m.f. E ?

	current I	e.m.f. E
A	$I = I_1 = I_2$	$E = V_1 = V_2$
B	$I = I_1 = I_2$	$E = V_1 + V_2$
C	$I = I_1 + I_2$	$E = V_1 = V_2$
D	$I = I_1 + I_2$	$E = V_1 + V_2$

- 37 A student measures the speed of sound. He claps his hands and the sound reflects from a wall that is 100 m away from him.



An electronic timer next to the student detects the echo of the sound 0.60 s after it is made.

Which calculation gives the speed of sound?

- A** $\frac{200}{0.30}$ m/s **B** $\frac{200}{0.60}$ m/s **C** $\frac{100}{0.60}$ m/s **D** $\frac{100}{1.2}$ m/s

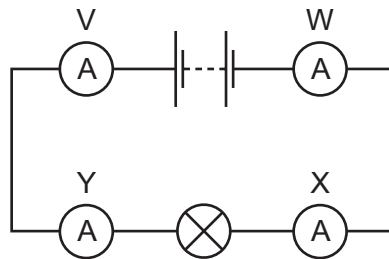
- 38 A piece of wire has a resistance of $8.0\ \Omega$.

The length of the wire is doubled and the diameter of the wire is halved.

What is the new resistance of the wire?

- A** $2.0\ \Omega$ **B** $4.0\ \Omega$ **C** $8.0\ \Omega$ **D** $64\ \Omega$

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



Which ammeters have the same reading as each other?

- A** V and W only
B V and Y only
C X and Y only
D V, W, X and Y
- 40 A 20 V power supply provides a current of 5.0 A for 1.0 minute.

How much energy does the power supply deliver?

- A** 4.0 J **B** 100 J **C** 240 J **D** 6000 J

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The Periodic Table of Elements

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

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

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



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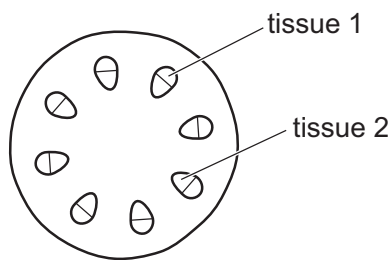
Which feature of the potted plant shows that it is a living organism?

- A It grows larger over time.
- B It has green leaves.
- C The compost in the pot dries after he waters it.
- D The stems contain xylem.

- 2 Which statement about human gametes is correct?

- A Egg cells are much smaller than sperm cells.
- B Egg cells are produced in larger numbers than sperm cells.
- C Egg cells have a jelly coating that changes after fertilisation.
- D The flagellum is an adaptive feature of an egg cell.

- 3 The diagram shows a cross section of a stem.



Which row shows the correct names and functions of the tissues?

	tissue 1		tissue 2	
	name	function	name	function
A	phloem	support only	phloem	transport only
B	phloem	transport only	xylem	support and transport
C	xylem	transport only	phloem	support and transport
D	xylem	support only	xylem	transport only

- 4 1 cm³ of substance **X** is added to 10 cm³ starch suspension and mixed. Food tests are carried out immediately after mixing and again after an hour.

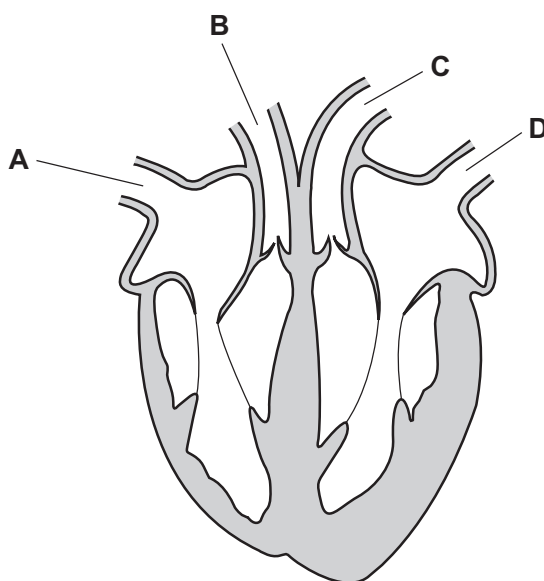
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iodine solution	blue / black	brown

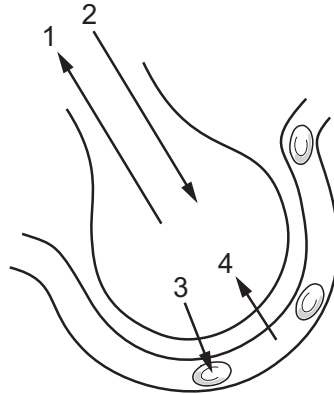
What is substance **X**?

- A amylase
 - B protease
 - C lipase
 - D sugar
- 5 The diagram represents the human heart and four blood vessels.

Which blood vessel contains blood at the highest pressure?



- 6 The diagram shows an alveolus and a blood capillary.



Which two arrows represent gas exchange by diffusion only?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4
- 7 Which statement about aerobic respiration is correct?
- A** It exchanges gases through the walls of the alveoli.
B It expels carbon dioxide from the lungs.
C It only produces carbon dioxide and energy.
D It uses oxygen to release energy from glucose.
- 8 Nitrates in the soil are taken up by the roots of a plant.
 What are the nitrates used to make?
- A** fat
B glucose
C protein
D starch
- 9 Which statement about sexual reproduction is **always** correct?
- A** It involves only one parent.
B It involves the fusion of nuclei.
C It produces genetically identical offspring.
D It takes place only in animals.

10 Which row gives the most suitable characteristics of a wind-pollinated flower?

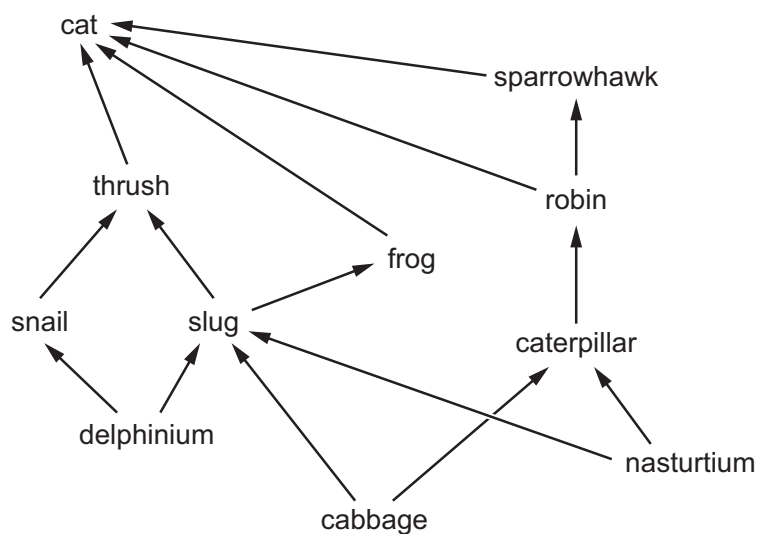
	pollen grains	anthers	stigma
A	smooth	few	small
B	smooth	many	large
C	sticky	few	large
D	sticky	many	small

11 A developing fetus is connected to its mother by an umbilical cord and placenta.

What is the function of the placenta?

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

12 The diagram shows a food web.



How could the frog be classed?

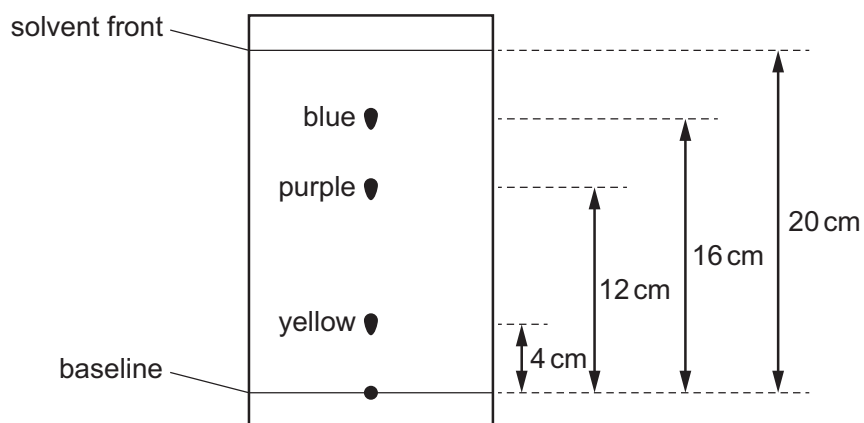
- A** second trophic level and secondary consumer
- B** second trophic level and tertiary consumer
- C** third trophic level and secondary consumer
- D** third trophic level and tertiary consumer

- 13 The table shows the possible effects of two processes on the concentration of two gases in the atmosphere.

	process	concentration of gases in atmosphere	
		carbon dioxide	oxygen
1	combustion of fossil fuels	decrease	increase
2	combustion of fossil fuels	increase	decrease
3	deforestation	decrease	increase
4	deforestation	increase	decrease

Which rows show the effects of deforestation and combustion of fossil fuels on the concentration of carbon dioxide and oxygen in the atmosphere?

- A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4
- 14 The chromatogram of a black ink containing three dyes is shown.



What is the R_f value of the purple ink?

- A 0.2 B 0.4 C 0.6 D 1.67
- 15 A white solid X is formed when magnesium reacts with oxygen.

What is X?

- A a compound
B a mixture
C an alloy
D an element

- 16 The fertiliser ammonium sulfate has the formula $(\text{NH}_4)_2\text{SO}_4$.

How many atoms of each element are present in the formula?

	number of hydrogen atoms	number of nitrogen atoms	number of oxygen atoms	number of sulfur atoms
A	4	1	1	1
B	4	2	4	1
C	8	1	4	1
D	8	2	4	1

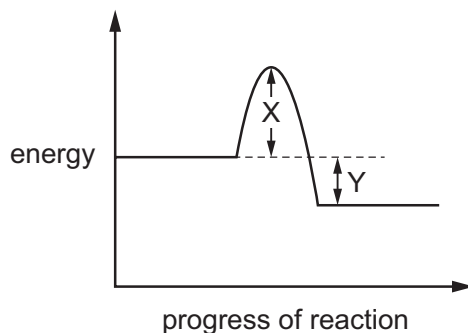
- 17 Element X is a non-metal used in the treatment of the water supply.

It is made during the electrolysis of a metal salt.

What is the colour of X and at which electrode is it made?

	colour	electrode
A	red	anode
B	red	cathode
C	yellow-green	anode
D	yellow-green	cathode

- 18 The energy level diagram for a reaction is shown.



Which statement is correct?

- A** X is the energy change of the reaction.
- B** Y is the activation energy of the reaction.
- C** The energy change of the reaction is larger than the activation energy of the reaction.
- D** The reaction is exothermic.

- 19** Dilute hydrochloric acid reacts with excess calcium carbonate.

The amount of carbon dioxide made in one minute is recorded.

The experiment is repeated using the same volume of more concentrated hydrochloric acid.

How does the volume of carbon dioxide collected in one minute and the frequency of collisions of reacting particles change?

	volume of carbon dioxide	frequency of collisions
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 20** Copper sulfate is a soluble salt.

How are pure crystals of copper sulfate prepared?

- A** Mix copper chloride solution with sodium sulfate solution, filter, rinse and dry.
- B** React copper oxide with excess dilute sulfuric acid, evaporate, cool, filter, rinse and dry.
- C** React excess copper carbonate, with dilute sulfuric acid, filter, evaporate, cool, filter, rinse and dry.
- D** React excess copper with dilute sulfuric acid, filter, evaporate, cool, filter, rinse and dry.

- 21** Which row describes the reactivity and the electronic structure of a noble gas?

	reactivity	electronic structure
A	reactive	full outer shell
B	reactive	incomplete outer shell
C	unreactive	incomplete outer shell
D	unreactive	full outer shell

- 22** Which statement about alloys is correct?

- A** They are made from metals because metals are poor electrical conductors.
- B** They are mixtures of compounds that contain metals.
- C** They have all the same properties as the metals from which they are made.
- D** They have different properties to the metals from which they are made.

- 23** Which statement about the extraction of iron in a blast furnace is **not** correct?
- A** Carbon dioxide reduces iron oxide.
 - B** Carbon monoxide is oxidised by iron oxide.
 - C** Carbon reduces carbon dioxide.
 - D** The high temperatures required are produced by reacting carbon with oxygen.
- 24** What is the composition of clean air?
- A** 78% nitrogen, 21% carbon dioxide and small amounts of other gases
 - B** 78% nitrogen, 21% oxygen and small amounts of other gases
 - C** 78% oxygen, 21% carbon dioxide and small amounts of other gases
 - D** 78% oxygen, 21% nitrogen and small amounts of other gases
- 25** Which two gases cause an enhanced greenhouse effect when their concentrations in the atmosphere increase?
- A** carbon monoxide and carbon dioxide
 - B** carbon dioxide and methane
 - C** methane and sulfur dioxide
 - D** sulfur dioxide and carbon monoxide
- 26** Gasoline is one fraction obtained from petroleum.

Which row describes the boiling point of the compounds and the molecules in this fraction?

	boiling point	molecules
A	they have different boiling points	they contain different numbers of carbon atoms
B	they have different boiling points	they contain the same number of carbon atoms
C	they have the same boiling point	they contain different numbers of carbon atoms
D	they have the same boiling point	they contain the same number of carbon atoms

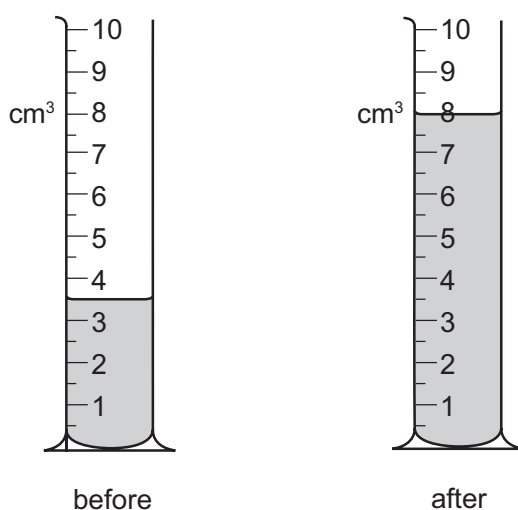
27 Which hydrocarbons belong to the same homologous series?

- A C_2H_2 , C_2H_4 , C_2H_6
- B CH_4 , C_2H_4 , C_3H_4
- C C_2H_4 , C_3H_6 , C_4H_8
- D C_2H_4 , C_3H_8 , C_4H_{10}

28 A measuring cylinder contains liquid.

More liquid is now poured into the measuring cylinder.

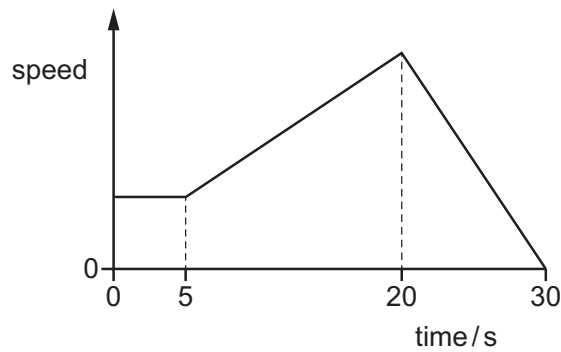
The diagrams show the measuring cylinder before and after the liquid is poured into it.



What volume of liquid is **poured** into the measuring cylinder?

- A 3.5 cm^3
- B 4.0 cm^3
- C 4.5 cm^3
- D 8.0 cm^3

- 29** 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.

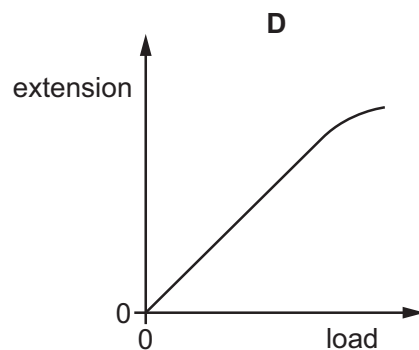
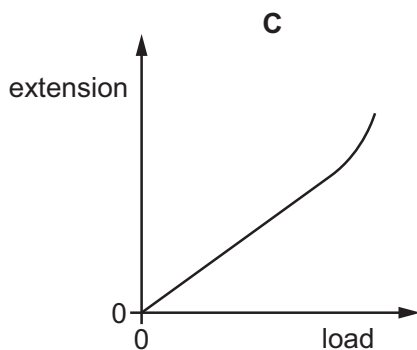
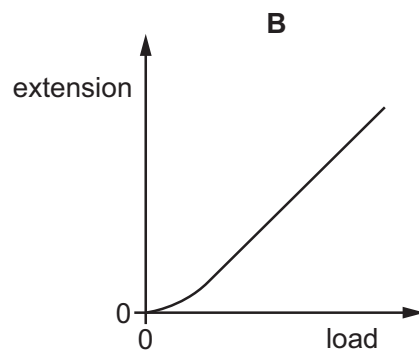
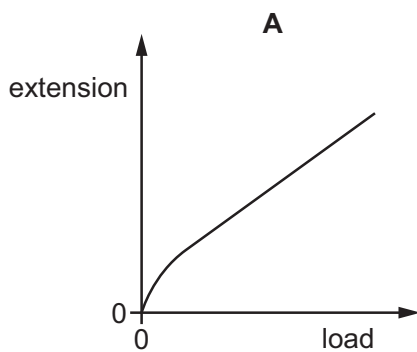
What is the average speed of the car while it is braking?

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

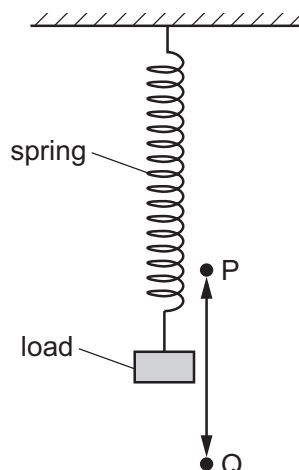
- 30** A spring obeys Hooke's law until it reaches its limit of proportionality.

A load is hung from the spring. The load is gradually increased and the spring is stretched beyond its limit of proportionality.

Which is the extension-load graph for the spring?



31 The diagram shows a load attached to a spring.



The load is pulled down and then released so that it oscillates between point P (highest point) and point Q (lowest point).

Which form of energy does the load have at point P?

- A** gravitational potential energy only
- B** kinetic energy only
- C** kinetic energy and gravitational potential energy
- D** neither kinetic energy nor gravitational potential energy

32 Liquids consist of molecules that are constantly moving.

Which row describes the motion of the molecules in a liquid and compares the forces between them to the forces between molecules in a gas?

	motion of molecules	forces between molecules
A	random	stronger than in a gas
B	random	weaker than in a gas
C	vibrating about fixed positions	stronger than in a gas
D	vibrating about fixed positions	weaker than in a gas

33 A circular bowl in a room contains water.

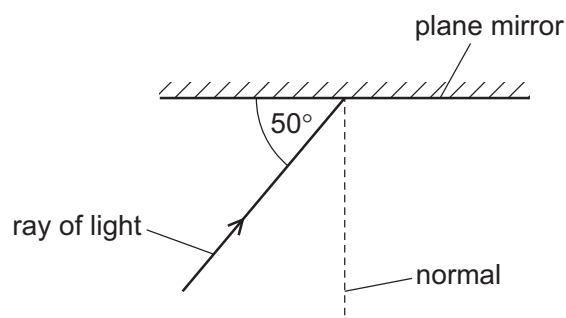
Which two factors both ensure that the smallest quantity of water evaporates in a day?

	temperature of room	diameter of bowl
A	high	large
B	high	small
C	low	large
D	low	small

34 In which process is thermal energy transferred by molecular vibrations?

- A** conduction
- B** convection
- C** evaporation
- D** radiation

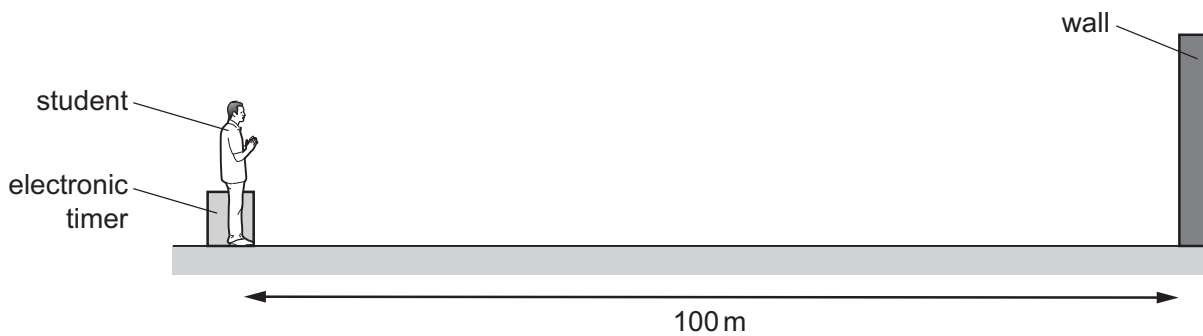
35 The diagram shows light striking a plane mirror.



What is the angle of reflection of the ray when it is reflected from the mirror?

- A** 40°
- B** 50°
- C** 80°
- D** 100°

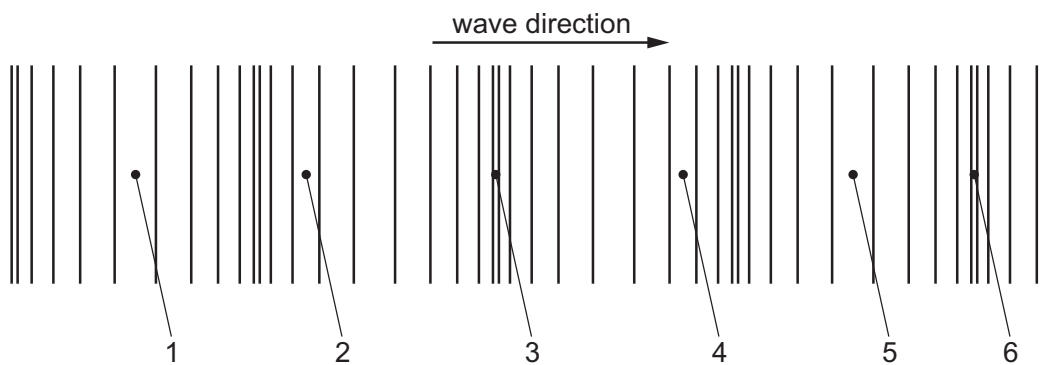
- 36** A student measures the speed of sound. He claps his hands and the sound reflects from a wall that is 100 m away from him.



An electronic timer next to the student detects the echo of the sound 0.60 s after it is made.

Which calculation gives the speed of sound?

- A** $\frac{200}{0.30}$ m/s **B** $\frac{200}{0.60}$ m/s **C** $\frac{100}{0.60}$ m/s **D** $\frac{100}{1.2}$ m/s
- 37** The diagram represents a sound wave travelling in air.



Which numbered points are at the centre of a compression and which numbered points are at the centre of a rarefaction?

	centre of a compression	centre of a rarefaction
A	1 and 5	2 and 4
B	1 and 5	3 and 6
C	3 and 6	1 and 5
D	3 and 6	2 and 4

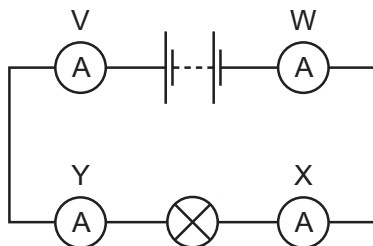
- 38 A piece of wire has a resistance of $8.0\ \Omega$.

The length of the wire is doubled and the diameter of the wire is halved.

What is the new resistance of the wire?

- A $2.0\ \Omega$ B $4.0\ \Omega$ C $8.0\ \Omega$ D $64\ \Omega$

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



Which ammeters have the same reading as each other?

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

- 40 There is a current I in a lamp. The potential difference across the lamp is V and the power produced by the lamp is P .

In a second lamp, the current is $2I$ and the potential difference across it is $\frac{V}{2}$.

What is the power produced by this other lamp?

- A $\frac{P}{4}$ B $\frac{P}{2}$ C P D $2P$

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The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).



Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

COMBINED SCIENCE

0653/23

Paper 2 Multiple Choice (Extended)

October/November 2019

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO NOT WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 20.
Electronic calculators may be used.

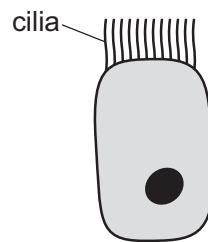
This document consists of **17** printed pages and **3** blank pages.

- 1 A biologist keeps a potted plant in a laboratory.

Which feature of the potted plant shows that it is a living organism?

- A It grows larger over time.
- B It has green leaves.
- C The compost in the pot dries after he waters it.
- D The stems contain xylem.

- 2 The diagram shows a ciliated cell.



Which row shows where ciliated cells are found in the human gas exchange system and their correct function?

	location of ciliated cells		function of ciliated cells	
	bronchi	trachea	move mucus away from lungs	move mucus towards lungs
A	✓	✓	✓	✗
B	✓	✓	✗	✓
C	✓	✗	✓	✗
D	✗	✓	✗	✓

- 3 What is the word equation for photosynthesis?

- A carbon dioxide + oxygen → glucose + water
- B carbon dioxide + water → glucose + oxygen
- C glucose + oxygen → carbon dioxide + water
- D glucose + water → carbon dioxide + oxygen

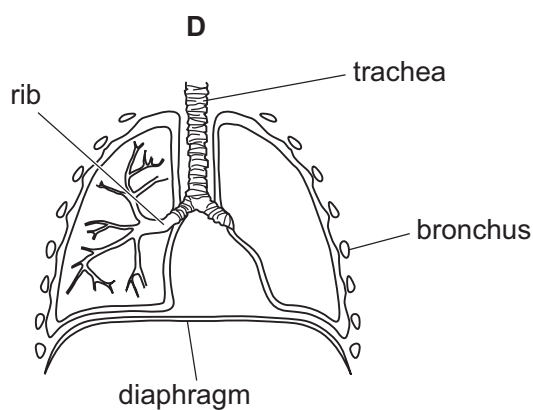
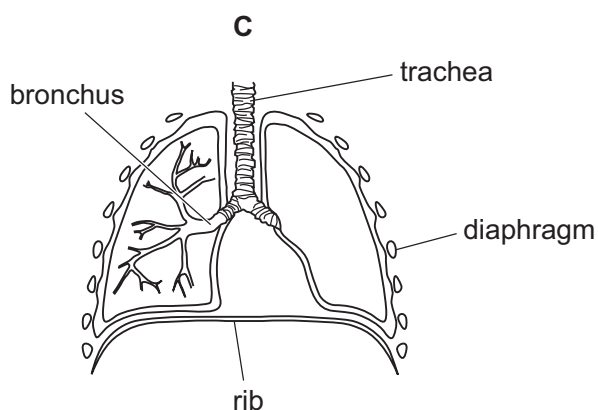
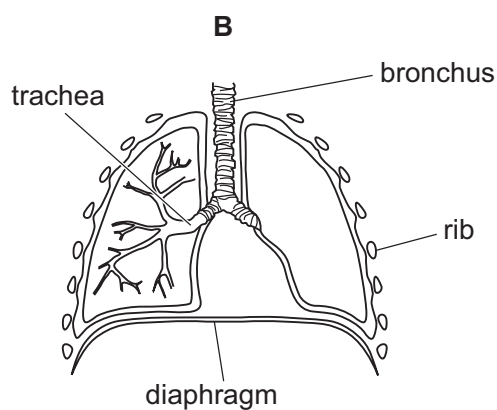
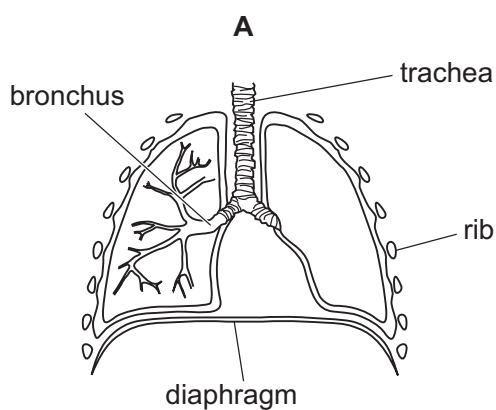
- 4 1 cm³ of substance **X** is added to 10 cm³ starch suspension and mixed. Food tests are carried out immediately after mixing and again after an hour.

The results of the tests are shown in the table.

test reagent	colour of solution after mixing	colour of solution after one hour
Benedict's solution	blue	orange
iodine solution	blue / black	brown

What is substance **X**?

- A amylase
 - B protease
 - C lipase
 - D sugar
- 5 Which diagram is correctly labelled?



6 Which statement about aerobic respiration is correct?

- A It exchanges gases through the walls of the alveoli.
- B It expels carbon dioxide from the lungs.
- C It only produces carbon dioxide and energy.
- D It uses oxygen to release energy from glucose.

7 Which are absorbed from the alimentary canal into the blood?

- 1 fibre
- 2 glucose
- 3 vitamin C

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

8 Shoots were grown in different light conditions.

Some shoots had their tips covered with foil.

	shoot tip	direction of light
1	covered	from all around
2	covered	from one direction
3	uncovered	from all around
4	uncovered	from one direction

Which shoots would grow straight upwards?

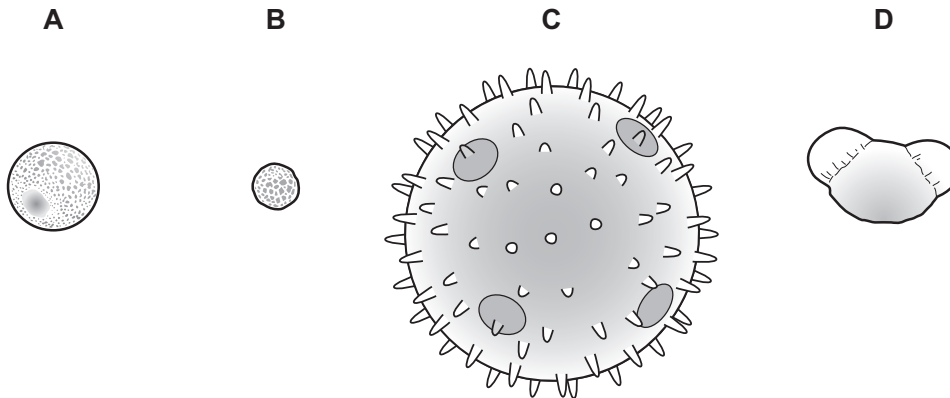
- A 1, 2 and 3 B 1 and 3 only C 3 and 4 only D 3 only

9 Which statement about sexual reproduction is **always** correct?

- A It involves only one parent.
- B It involves the fusion of nuclei.
- C It produces genetically identical offspring.
- D It takes place only in animals.

10 The diagram shows four pollen grains.

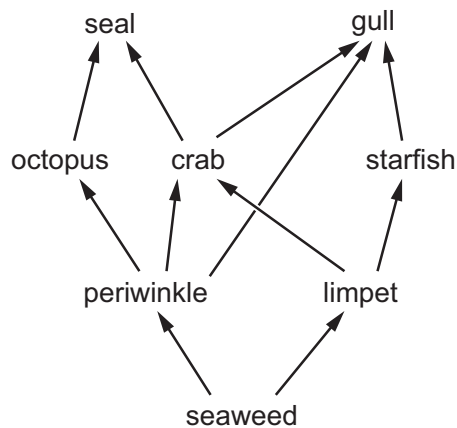
Which pollen grain is most likely to be distributed by an animal?



11 Which statement about human gametes is correct?

- A Sperm cells are much larger than egg cells.
- B Sperm cells are produced in smaller numbers than egg cells.
- C Sperm cells have a jelly coating that changes after fertilisation.
- D The flagellum is an adaptive feature of a sperm cell.

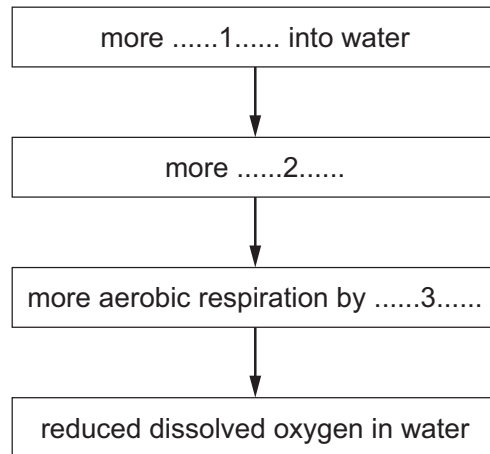
12 The diagram shows a food web.



Which organism is found in more than one trophic level?

- A crab
- B gull
- C octopus
- D starfish

13 The flow diagram shows some stages in the eutrophication of a pond.

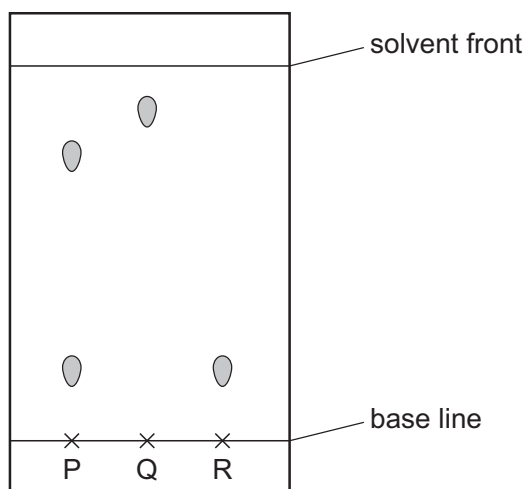


Which words complete gaps 1, 2 and 3?

	1	2	3
A	decomposers	nitrates	producers
B	decomposers	producers	nitrates
C	nitrates	producers	decomposers
D	nitrates	decomposers	producers

14 Chromatography is carried out on three solutions P, Q and R.

The chromatogram obtained is shown.



Which statement is **not** correct?

- A P contains at least two substances.
- B Q contains the substance with the highest R_f value.
- C R is insoluble in the solvent.
- D P, Q and R together may contain only three substances.

15 Which substance is a single compound?

- A air
- B oxygen
- C petroleum
- D water

16 The fertiliser ammonium sulfate has the formula $(\text{NH}_4)_2\text{SO}_4$.

How many atoms of each element are present in the formula?

	number of hydrogen atoms	number of nitrogen atoms	number of oxygen atoms	number of sulfur atoms
A	4	1	1	1
B	4	2	4	1
C	8	1	4	1
D	8	2	4	1

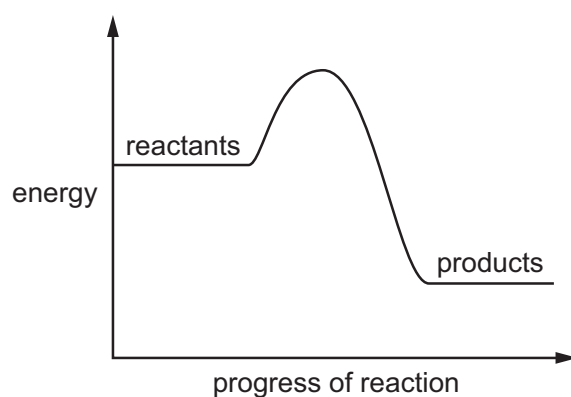
17 Element X is a non-metal used in the treatment of the water supply.

It is made during the electrolysis of a metal salt.

What is the colour of X and at which electrode is it made?

	colour	electrode
A	red	anode
B	red	cathode
C	yellow-green	anode
D	yellow-green	cathode

18 An energy level diagram for a reaction is shown.



Which row describes the energy transfer and the type of energy change for this reaction?

	energy transfer	energy change
A	energy is absorbed by reactants	endothermic
B	energy is absorbed by reactants	exothermic
C	energy is released to surroundings	endothermic
D	energy is released to surroundings	exothermic

- 19 Calcium carbonate reacts with 50 cm³ hydrochloric acid.

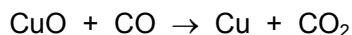
The carbon dioxide produced is collected in a gas syringe.

The experiment is done four times using concentrated or dilute hydrochloric acid and using 5 g calcium carbonate in powder or lump form.

Which experiment takes the longest time to collect 10 cm³ of gas?

	calcium carbonate	hydrochloric acid
A	lumps	concentrated
B	lumps	dilute
C	powder	concentrated
D	powder	dilute

- 20 The equation for a reaction is shown.



Which statement about this reaction is correct?

- A** CO acts as a reducing agent.
 - B** CO₂ is reduced.
 - C** Cu is oxidised.
 - D** CuO acts as a reducing agent.
- 21 Copper sulfate is a soluble salt which is prepared by reacting insoluble copper oxide with dilute sulfuric acid.

Which statement about the preparation of copper sulfate crystals is **not** correct?

- A** After the reaction, the mixture is filtered and copper sulfate solution is collected.
 - B** Excess copper oxide is used to ensure that all the acid is used up.
 - C** The final solution is heated so that all the water boils off.
 - D** The mixture of copper oxide and dilute sulfuric acid is heated to speed up the reaction.
- 22 Which statement about alloys is correct?
- A** They are made from metals because metals are poor electrical conductors.
 - B** They are mixtures of compounds that contain metals.
 - C** They have all the same properties as the metals from which they are made.
 - D** They have different properties to the metals from which they are made.

23 Which equation does **not** represent a reaction that takes place in the blast furnace?

- A** $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
- B** $\text{C} + \text{CO}_2 \rightarrow 2\text{CO}$
- C** $2\text{Fe} + \text{CO}_2 \rightarrow 2\text{FeO} + \text{C}$
- D** $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$

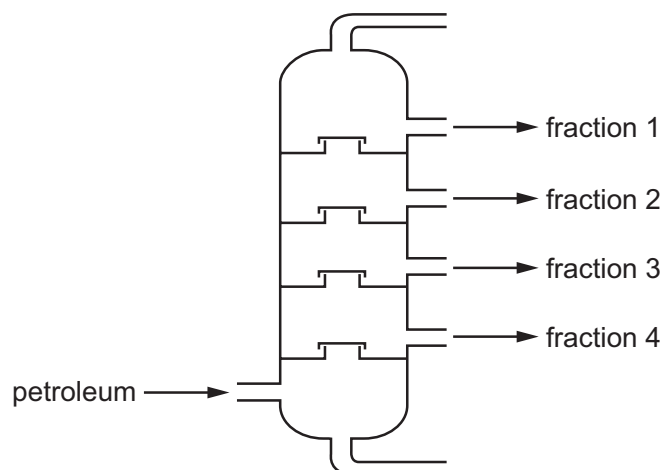
24 Which row describes the percentage composition of clean air?

	carbon dioxide	nitrogen	noble gases	oxygen
A	less than 1	78	less than 1	21
B	less than 1	78	21	less than 1
C	21	less than 1	less than 1	78
D	78	less than 1	less than 1	21

25 Which two gases cause an enhanced greenhouse effect when their concentrations in the atmosphere increase?

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

26 A simple fractionating column is shown.



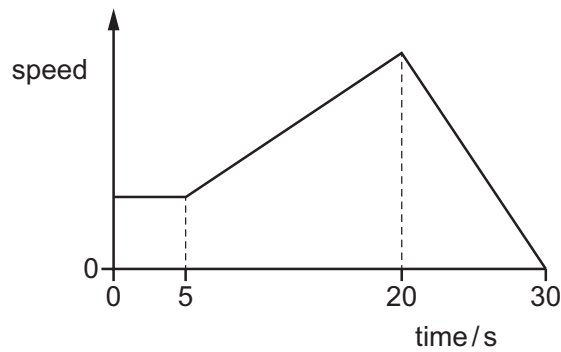
Which statement about the fractions is correct?

- A Fraction 1 contains compounds with the highest boiling points.
- B Fraction 2 contains larger hydrocarbon molecules than fraction 3.
- C Fraction 3 is more viscous than fraction 4.
- D Fraction 4 is the least flammable.

27 What is a typical property of alkanes?

- A They are catalysts.
- B They burn in air.
- C They can be neutralised.
- D They react endothermically.

- 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.

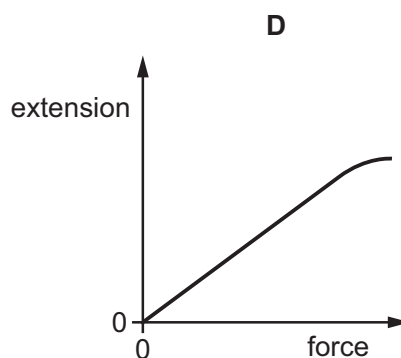
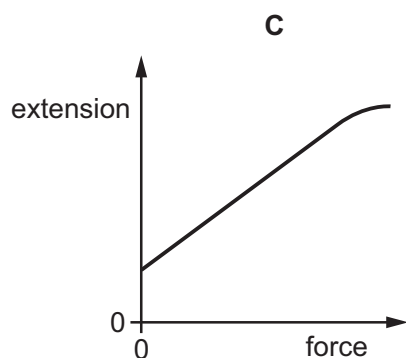
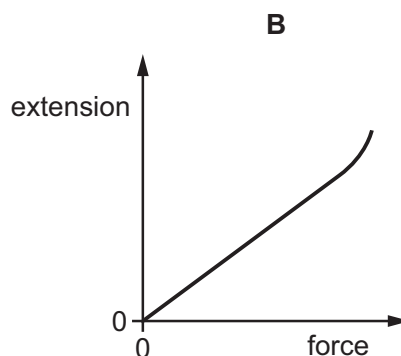
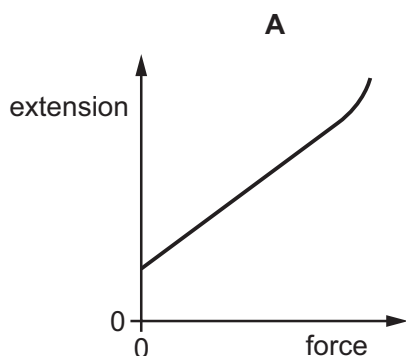
What is the average speed of the car while it is braking?

- A** 3.0 m/s **B** 4.0 m/s **C** 6.0 m/s **D** 12 m/s
- 29** Which of these bodies has a resultant force acting on it?
- A** a book at rest on a table
- B** a car travelling up a hill in a straight line at constant speed
- C** a football moving upwards freely after being kicked
- D** a parachutist descending vertically at constant speed

- 30 The force acting on a spring is gradually increased from 0 N.

The spring eventually passes its limit of proportionality.

Which graph shows how the extension of the spring changes as the force increases?



- 31 Some energy resources are less reliable than others.

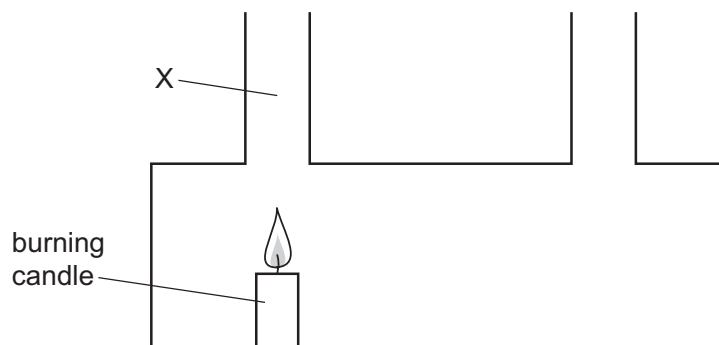
Which type of power station **cannot** produce electricity at all times?

- A coal-fired power station
- B geothermal power station
- C hydroelectric power station
- D solar power station

- 32 Which statement about the molecules in a gas is correct?

- A They are closer together than those in solids.
- B They are further apart than those in liquids.
- C They are **not** free to move around.
- D They are packed together in a regular pattern.

- 33** The equipment shown is used to demonstrate convection in air. Point X is labelled.



Which row describes and explains the movement of the 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

- 34** What type of wave is a sound wave and in which direction do air particles vibrate as the wave passes through the air?

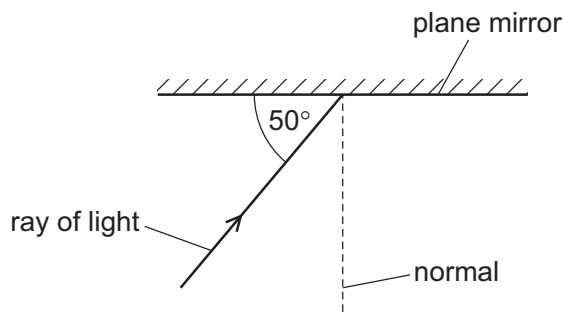
	type of wave	direction of vibration
A	longitudinal	parallel to wave direction
B	longitudinal	perpendicular to wave direction
C	transverse	parallel to wave direction
D	transverse	perpendicular to wave direction

- 35** A boy plays a series of musical notes of increasing frequency on a violin. As the frequency of the note increases, he plays the notes more loudly.

How do the amplitude and the wavelength of the sound waves change?

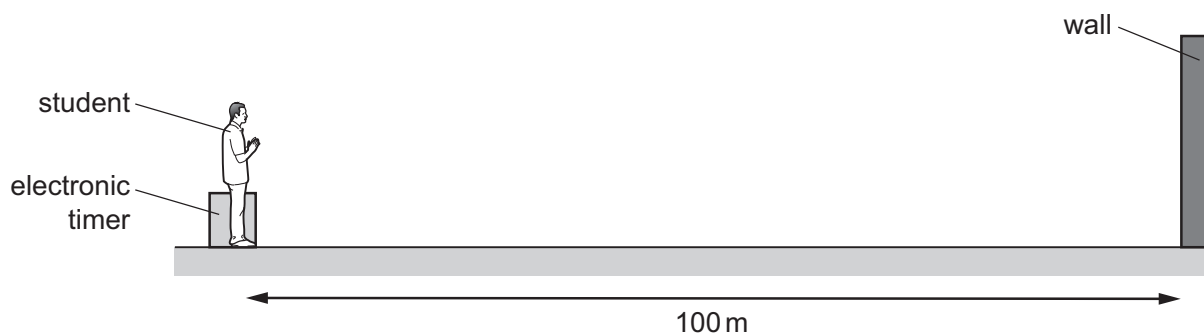
	amplitude	wavelength
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 36 The diagram shows light striking a plane mirror.



What is the angle of reflection of the ray when it is reflected from the mirror?

- A 40° B 50° C 80° D 100°
- 37 A student measures the speed of sound. He claps his hands and the sound reflects from a wall that is 100 m away from him.

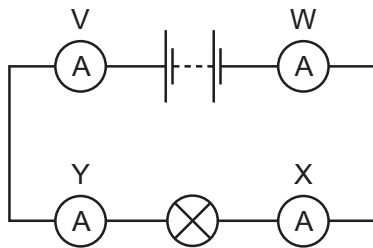


An electronic timer next to the student detects the echo of the sound 0.60 s after it is made.

Which calculation gives the speed of sound?

- A $\frac{200}{0.30}$ m/s B $\frac{200}{0.60}$ m/s C $\frac{100}{0.60}$ m/s D $\frac{100}{1.2}$ m/s
- 38 A piece of wire has a resistance of $8.0\ \Omega$.
- The length of the wire is doubled and the diameter of the wire is halved.
- What is the new resistance of the wire?
- A $2.0\ \Omega$ B $4.0\ \Omega$ C $8.0\ \Omega$ D $64\ \Omega$

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



Which ammeters have the same reading as each other?

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

40 There is a current I in a resistor and a potential difference V across it.

Which equation gives the energy E transferred by the resistor in a time t ?

- A $E = \frac{I}{Vt}$
- B $E = \frac{V}{It}$
- C $E = \frac{t}{VI}$
- D $E = IVt$

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The Periodic Table of Elements

Group																				
I	II											III	IV	V	VI	VII	VIII			
		Key atomic number atomic symbol name relative atomic mass										1 H hydrogen 1							2 He helium 4	
3 Li lithium 7	4 Be beryllium 9																5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16
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 Lv livermorium —	116 Ts tennessine —	117 Og oganesson —	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.).