

Combined Science A (Gateway Science) (J250)

Chemistry Paper 1 - 100 MCQs Challenge

Beal High School

Mr Ahmad

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:

Additional resources may be supplied with this paper.

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 100 mins

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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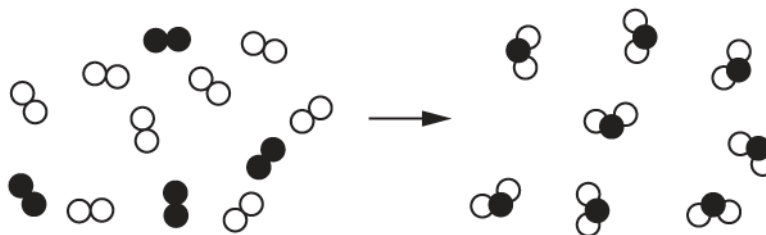
INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **100**.
- The total number of marks may take into account some 'either/or' question choices.

- 1 The diagram represents the particle model for a change in the arrangement of some particles.



Which row describes this change?

	Type of change	Explanation
A	chemical	The particles break up and then join together in a different way.
B	chemical	The particles stay the same but are arranged in a different way.
C	physical	The particles break up and then join together in a different way.
D	physical	The particles stay the same but are arranged in a different way.

Your answer

[1]

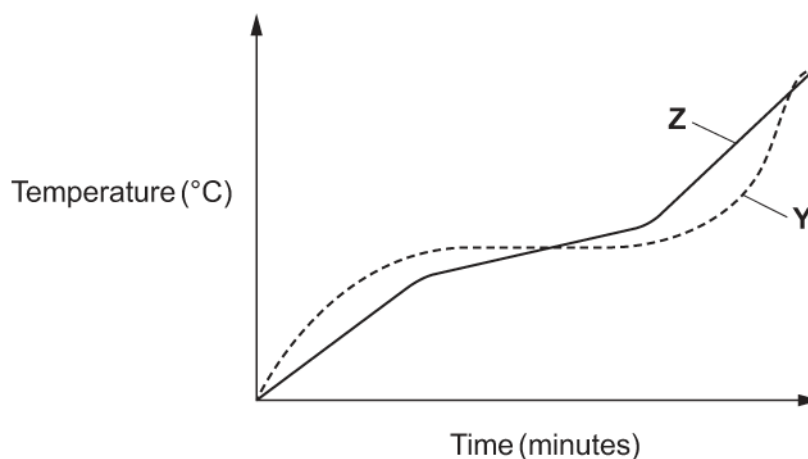
- 2 Which element in the table is a non-metal?

	Appearance at room temperature	Melting point (°C)	Electrical conductivity
A	silver liquid	-39	high
B	orange-red solid	1083	high
C	yellow solid	113	low
D	silvery-white	3422	high

Your answer

[1]

- 3 The graph shows how the temperature of two samples of a substance, Y and Z, changes as they melt from solids to liquids.



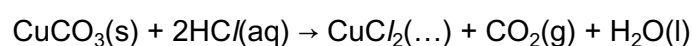
Which row describes Y and Z?

	Y	Z
A	impure	impure
B	impure	pure
C	pure	impure
D	pure	pure

Your answer

[1]

- 4 This is the equation for the reaction between copper carbonate and dilute hydrochloric acid:



What is the state symbol for CuCl_2 ?

- A aq
- B g
- C l
- D s

Your answer

[1]

- 5 Boron, B, is in Group 3 of the Periodic Table and chlorine, Cl, is in Group 7 of the Periodic Table.

What is the formula of the compound formed when boron reacts with chlorine?

- A BC/
- B BCl_3
- C B_3Cl
- D B_3Cl_7

Your answer

[1]

- 6 The equation shows the reaction of zinc carbonate when it is heated.



- 5.0 g of zinc carbonate is heated in a test tube for 10 minutes.
- The mass of the test tube decreases by 0.6 g.

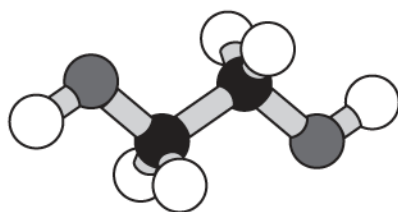
How does the law of conservation of mass explain this decrease in mass?

- A 0.6 g of carbon dioxide is produced.
- B 0.6 g of zinc oxide is produced.
- C 4.4 g of carbon dioxide is produced.
- D 5.6 g of zinc oxide is produced.

Your answer

[1]

7 What is the empirical formula of this compound?



Key:

-  = Carbon
-  = Hydrogen
-  = Oxygen

- A CHO
- B CH₃O
- C C₂H₆O₂
- D HOCH₂CH₂OH

Your answer

[1]

8 Fluorine gas reacts with sodium to form sodium fluoride.

What is the **balanced half equation** for the reaction of fluorine when it reacts with sodium?

- A $F + e^- \rightarrow F^-$
- B $F \rightarrow F^- + e^-$
- C $F_2 + 2e^- \rightarrow 2F^-$
- D $F_2 \rightarrow 2F^- + 2e^-$

Your answer

[1]

9 Carbon reacts with copper oxide to produce copper.

copper oxide + carbon → copper + carbon dioxide

What is the role of the carbon?

- A It is a catalyst.
- B It neutralises the copper oxide.
- C It oxidises the copper oxide.
- D It reduces the copper oxide.

Your answer

[1]

10 Acid rain is a **dilute** solution of a **weak** acid.

What is the pH of acid rain?

- A 1–2
- B 4–5
- C 8–9
- D 13–14

Your answer

[1]

11 When iron reacts with dilute hydrochloric acid, bubbles of hydrogen are produced.

Which state symbol describes these bubbles?

- A aq
- B g
- C l
- D s

Your answer

[1]

12 Magnesium reacts with oxygen to make magnesium oxide.

magnesium + oxygen → magnesium oxide

Which type of reaction is shown by the equation?

- A Displacement
- B Electrolysis
- C Neutralisation
- D Oxidation

Your answer

[1]

13 Which gas turns limewater cloudy?

- A Carbon dioxide
- B Chlorine
- C Hydrogen
- D Oxygen

Your answer

[1]

14 Zinc chloride is an ionic compound made from Zn^{2+} and Cl^- ions.

What is made at the **negative** electrode during the electrolysis of molten zinc chloride?

- A Chlorine
- B Hydrogen
- C Oxygen
- D Zinc

Your answer

[1]

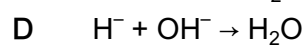
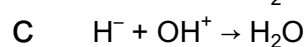
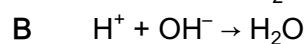
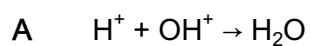
15 Which row describes a **formulation**?

	Description	Amount of chemicals
A	compound	exact
B	mixture	exact
C	compound	random
D	mixture	random

Your answer

[1]

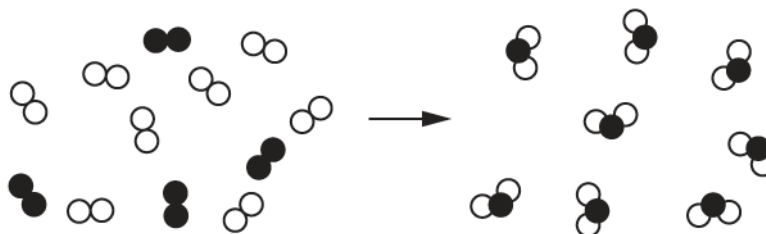
16 What is the ionic equation for an aqueous neutralisation reaction?



Your answer

[1]

17 The diagram represents the particle model for a change in the arrangement of some particles.



Which row describes this change?

	Type of change	Explanation
A	chemical	The particles break up and then join together in a different way.
B	chemical	The particles stay the same but are arranged in a different way.
C	physical	The particles break up and then join together in a different way.
D	physical	The particles stay the same but are arranged in a different way.

Your answer

[1]

18 The energy change in a reaction is 30000 J.

What is the energy change in kJ?

- A 3
- B 30
- C 300
- D 3000

Your answer

[1]

19 Which element in the table is a non-metal?

	Appearance at room temperature	Melting point (°C)	Electrical conductivity
A	silver liquid	−39	high
B	orange-red solid	1083	high
C	yellow solid	113	low
D	silvery-white solid	3422	high

Your answer

[1]

20 The word equation shows how iron is extracted from iron oxide.

iron oxide + carbon → iron + carbon dioxide

The table shows the masses of the reactants and products.

	Iron oxide	Carbon	Iron	Carbon dioxide
Mass (tonnes)	3200	360		1320

What is the mass of iron produced?

- A 1880 tonnes
- B 2240 tonnes
- C 2840 tonnes
- D 4880 tonnes

Your answer

[1]

21 Carbon reacts with copper oxide to produce copper.

copper oxide + carbon → copper + carbon dioxide

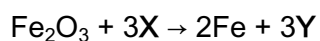
What is the role of the carbon?

- A It is a catalyst.
- B It neutralises the copper oxide.
- C It oxidises the copper oxide.
- D It reduces the copper oxide.

Your answer

[1]

22 Iron, Fe, can be extracted from iron oxide, Fe₂O₃, in a blast furnace, by the reaction shown in the equation.



What are the formulae of X and Y?

	X	Y
A	C	CO ₂
B	CO	C
C	CO	CO ₂
D	CO ₂	CO

23 Copper carbonate reacts with dilute hydrochloric acid to form copper chloride, water and a gas.

What is the formula of the gas?

- A C
- B CO
- C CO₂
- D CO₃

Your answer

[1]

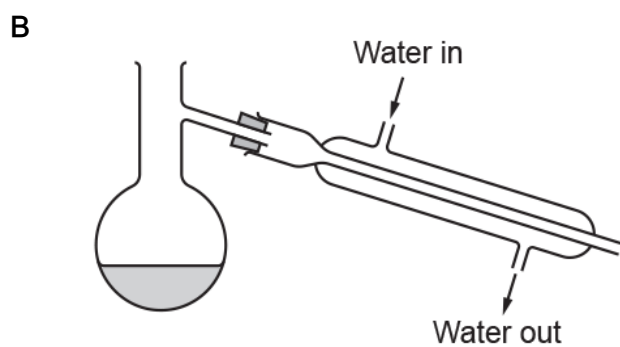
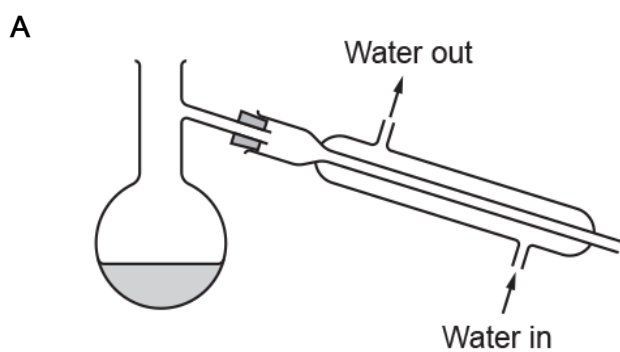
24 Which row lists the material that has the weakest **intermolecular** forces?

Material	Structure	Melting point (°C)
A	giant covalent	1713
B	ionic compound	801
C	metal	98
D	polymer	105

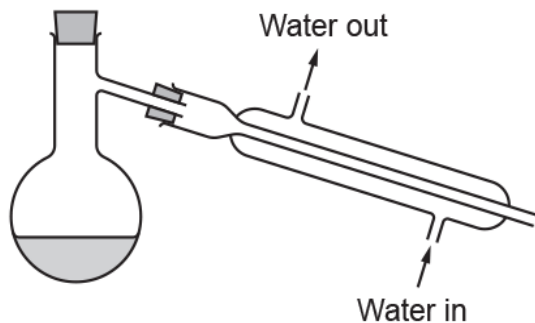
Your answer

[1]

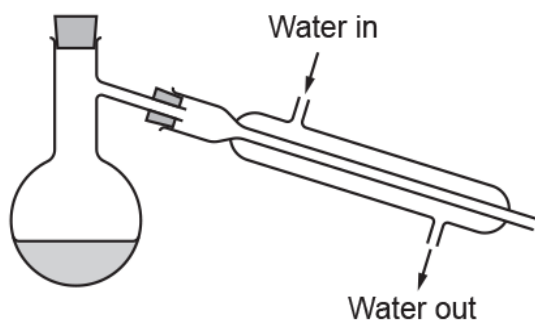
25 Which diagram shows the correct equipment diagram for simple distillation?



C



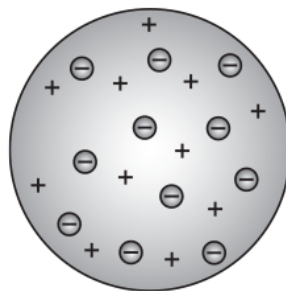
D



Your answer

[1]

26 Which scientist developed this model of the atom?

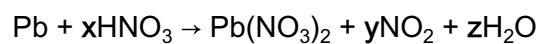


- A Bohr
- B Dalton
- C Rutherford
- D Thomson

Your answer

[1]

27 Lead, Pb, and dilute nitric acid, HNO₃ react.



Which row correctly balances the equation?

	x	y	z
A	2	4	2
B	4	2	4
C	4	2	2
D	4	4	2

Your answer

[1]

28 This is the symbol for helium.

2
He
4.0

What is the mass of one atom of helium?

The Avogadro constant = 6.02×10^{23}

- A 3.32×10^{-24} g
- B 6.64×10^{-24} g
- C 1.51×10^{23} g
- D 3.01×10^{23} g

Your answer

[1]

29 Which substance is described as **pure** by a scientist?

- A A solution of sodium chloride
- B An alloy
- C Dilute sulfuric acid
- D Distilled water

Your answer

[1]

30 A metal oxide has the formula X_2O , where X is a Group 1 metal.

The relative formula mass of the metal oxide is 94.2.

Relative atomic mass (A_r): O = 16.0

What is the name of X ?

- A Lithium
- B Potassium
- C Rubidium
- D Sodium

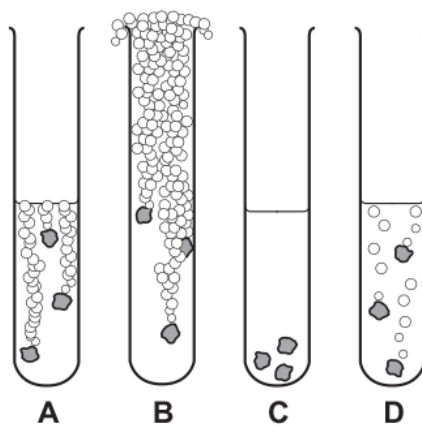
Your answer

[1]

31 The list is part of the reactivity series of metals.

Calcium	most reactive
Magnesium	↑
Zinc	↓
Lead	least reactive

The diagram shows these four metals reacting with dilute hydrochloric acid.



Which test tube shows the reaction of calcium?

Your answer

[1]

32 The table shows the boiling points of three Group 1 elements.

Element	Boiling point (°C)
caesium	669
potassium	760
rubidium	686

How many of these elements are gases at 700 °C?

- A 0
- B 1
- C 2
- D 3

Your answer

[1]

33 The table shows the properties of four different substances.

Which substance is a metal?

Substance	Appearance at room temperature	Melting point and boiling point	Conducts heat?
A	green gas	low	no
B	colourless solid	high	no
C	shiny red-orange solid	high	yes
D	white solid	high	no

Your answer

[1]

34 Which is an example of a **neutralisation** reaction?

- A A metal reacting with an acid
- B A non-metal reacting with oxygen
- C A salt dissolving in water
- D An acid reacting with an alkali

Your answer

[1]

35 Lead has a melting point of 328 °C. Mercury has a melting point of –39 °C.

Which row describes the state of lead and mercury at 100 °C?

	State of lead	State of mercury
A	liquid	liquid
B	liquid	solid
C	solid	liquid
D	solid	solid

Your answer

[1]

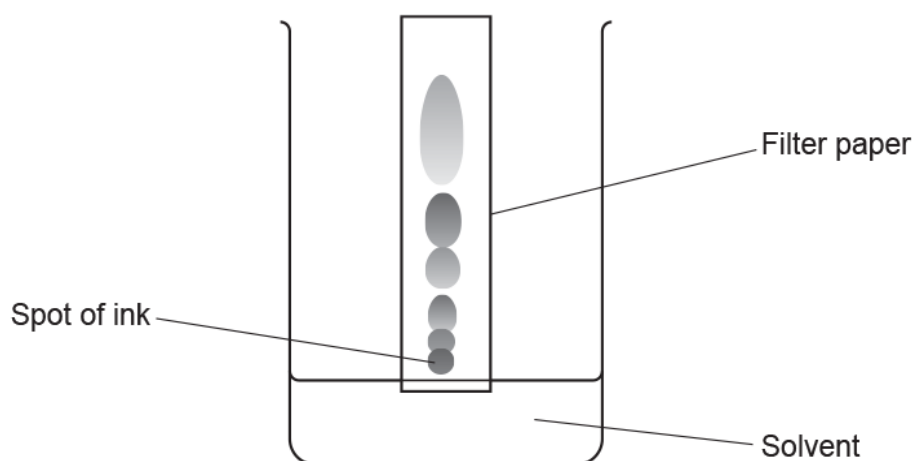
36 Which element forms compounds with covalent molecules consisting of chains and rings?

- A Argon
- B Carbon
- C Hydrogen
- D Oxygen

Your answer

[1]

37 The diagram shows how paper chromatography can be used to separate the colours in an ink.



What is the **solvent** called?

- A The baseline
- B The mobile phase
- C The reference phase
- D The stationary phase

Your answer

[1]

38 Which substance is described as **pure** by a scientist?

- A A solution of sodium chloride
- B An alloy
- C Dilute sulfuric acid
- D Distilled water

Your answer

[1]

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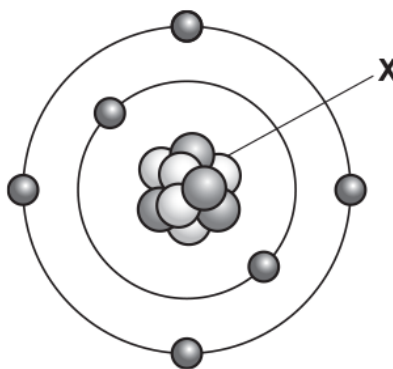
What is the name of X?

- A Lithium
- B Potassium
- C Rubidium
- D Sodium

Your answer

[1]

40 What is the part of the atom labelled X called?



- A Core
- B Ion
- C Nucleus
- D Shell

Your answer

[1]

41 Sodium sulfite contains Na^+ ions and SO_3^{2-} ions.

What is the **formula** of sodium sulfite?

- A NaSO_3
- B $\text{Na}(\text{SO}_3)_2$
- C Na_2SO_3
- D $\text{Na}_2(\text{SO}_3)_2$

Your answer

[1]

42 Which statement describes the **isotopes** of an element?

- A Atoms that have different numbers of protons but the same number of electrons.
- B Atoms that have different numbers of protons but the same number of neutrons.
- C Atoms that have the same number of protons but different numbers of electrons.
- D Atoms that have the same number of protons but different numbers of neutrons.

Your answer

[1]

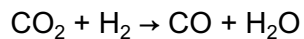
43 Which substance is an example of a **formulation**?

- A A macromolecule
- B A metal
- C An alloy
- D An ionic compound

Your answer

[1]

44 The equation shows the reaction between carbon dioxide, CO_2 , and hydrogen, H_2 .



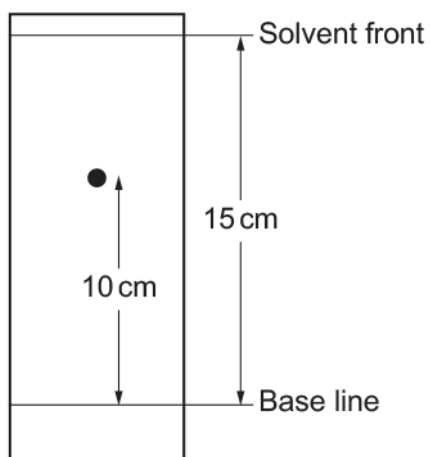
What has been **reduced** in this reaction?

- A CO
- B CO_2
- C H_2
- D H_2O

Your answer

[1]

45 The diagram shows a chromatogram produced by paper chromatography.



What is the R_f value?

- A -10
- B -5
- C 0.67
- D 1.5

Your answer

[1]

46 The table shows some information about four different acids.

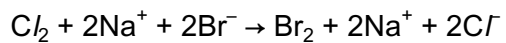
Acid	Number of particles per cm ³ of acid solution	Degree of ionisation (%)
A	high	1
B	low	1
C	high	100
D	low	100

Which acid is a **dilute** solution of a **strong** acid?

Your answer

[1]

47 The ionic equation shows the reaction of chlorine, Cl₂, with sodium bromide, NaBr.



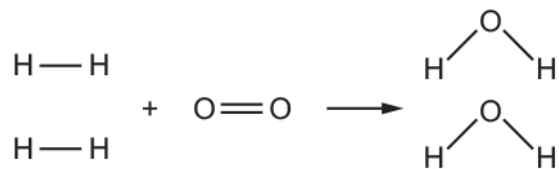
What is the **simplest** ionic equation for this reaction?

- A $\text{Cl}_2 + 2\text{NaBr} \rightarrow \text{Br}_2 + 2\text{NaCl}$
- B $\text{Cl}_2 + \text{Na}^+ + \text{Br}^- \rightarrow \text{Br}_2 + \text{Na}^+ + \text{Cl}^-$
- C $\text{Cl}_2 + \text{Br}^- \rightarrow \text{Br}_2 + \text{Cl}^-$
- D $\text{Cl}_2 + 2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{Cl}^-$

Your answer

[1]

48 The diagram shows the reaction of hydrogen, H_2 , and oxygen, O_2 , to make water, H_2O .



The energy required to break all the $\text{H}-\text{H}$ and $\text{O}=\text{O}$ bonds is 1368 kJ / mol .

The energy change for the reaction is -484 kJ / mol .

What is the bond energy for the $\text{O}-\text{H}$ bond?

- A 463 kJ / mol
- B 884 kJ / mol
- C 926 kJ / mol
- D 1852 kJ / mol

Your answer

[1]

49 A solution has a pH of 3.

The solution is diluted with water by a factor of 1000.

What is the pH of the solution **after** dilution?

- A 2
- B 4
- C 5
- D 6

Your answer

[1]

50 What is the definition of the **mole**?

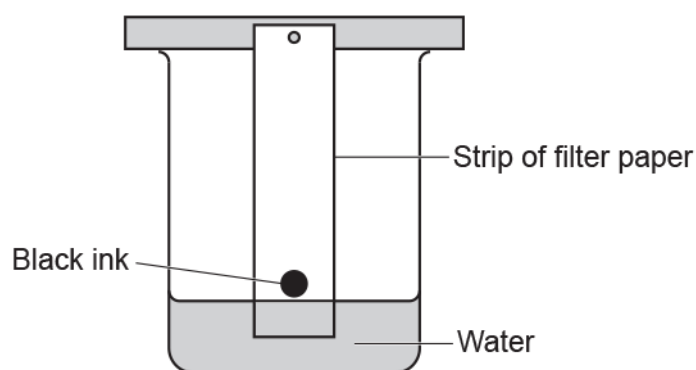
- A One mole contains 1 g of atoms.
- B One mole contains 6.022×10^{23} particles.
- C One mole is equal to the relative atomic mass of an element.
- D One mole is the number of atoms contained in one molecule.

Your answer

[1]

51 A black ink is a mixture of different colours.

The diagram shows how the colours in the black ink can be separated.



What is the name of this method of separation?

- A Chromatography
- B Crystallisation
- C Distillation
- D Filtration

Your answer

[1]

52 The table shows the start and end temperatures of four different reactions.

Reaction	Start temperature (°C)	End temperature (°C)
A	-3	9
B	14	37
C	20	16
D	23	23

Which reaction is **endothermic**?

Your answer

[1]

53 Which particles in an aqueous solution of sodium hydroxide, NaOH(aq), make it alkaline?

- A H^+
- B H_2O
- C OH^-
- D Na^+

Your answer

[1]

54 The table shows the colours of universal indicator in solutions of different pH.

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Colour	red		orange		yellow		green	blue			purple			

A sample of water has a pH of 7. A small amount of dilute hydrochloric acid is added to the water.

Which colour does universal indicator turn in this solution?

- A Blue
- B Green
- C Orange
- D Purple

Your answer

[1]

55 Which of these is the best explanation of what is meant by a strong acid?

- A There is a large amount of acid and a small amount of water.
- B There is a small amount of acid and a large amount of water.
- C The acid is completely ionised in solution in water.
- D The acid is partially ionised in solution in water.

Your answer ☐

[1]

56 The empirical formula of a compound Y is CH_2O .

Compound Y has a relative formula mass of 90.

What is the molecular formula of compound Y?

- A $\text{C}_2\text{H}_2\text{O}_4$
- B $\text{C}_3\text{H}_6\text{O}_3$
- C $\text{C}_4\text{H}_{10}\text{O}_2$
- D $\text{C}_6\text{H}_{12}\text{O}_6$

Your answer ☐

[1]

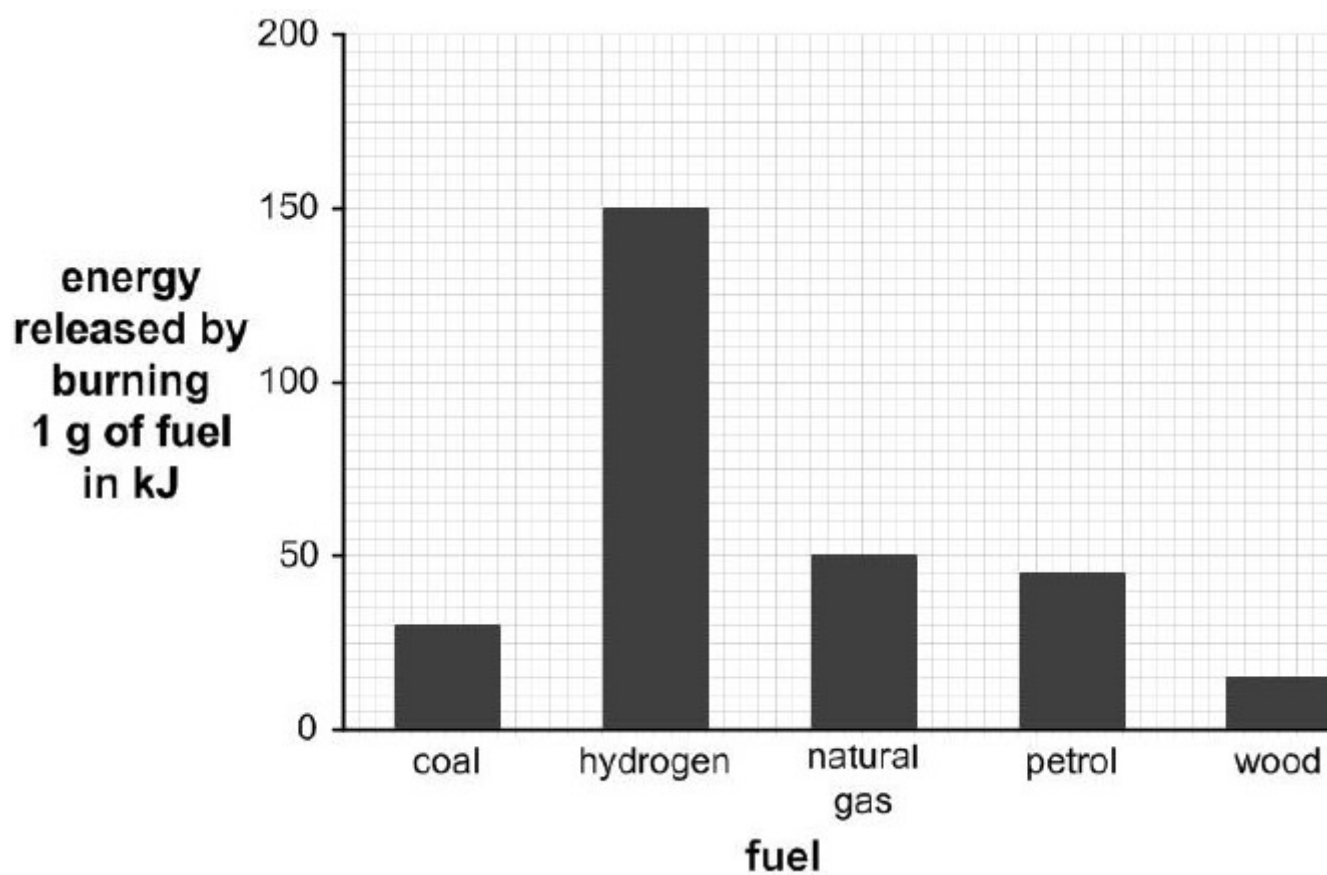
57 Which row in the table shows the correct results for an ionic compound?

	Solid compound	Compound dissolved in water	Molten compound
A	conducts	does not conduct	conducts
B	conducts	conducts	conducts
C	conducts	conducts	does not conduct
D	does not conduct	conducts	conducts

Your answer ☐

[1]

58 The bar chart shows the amount of energy released when 1.0 g of each fuel is completely combusted.



What mass of natural gas is needed to release the same amount of energy as 1.0 g of hydrogen?

- A 3.0 g
- B 3.3 g
- C 6.0 g
- D 10.0 g

Your answer

[1]

59 A solution of lead nitrate, $\text{Pb}(\text{NO}_3)_2(\text{aq})$ has a concentration of 66.2 g/dm^3 .

The relative formula mass, M_r , of lead(II) nitrate is 331.

What is the concentration, in mol/dm^3 , of this solution?

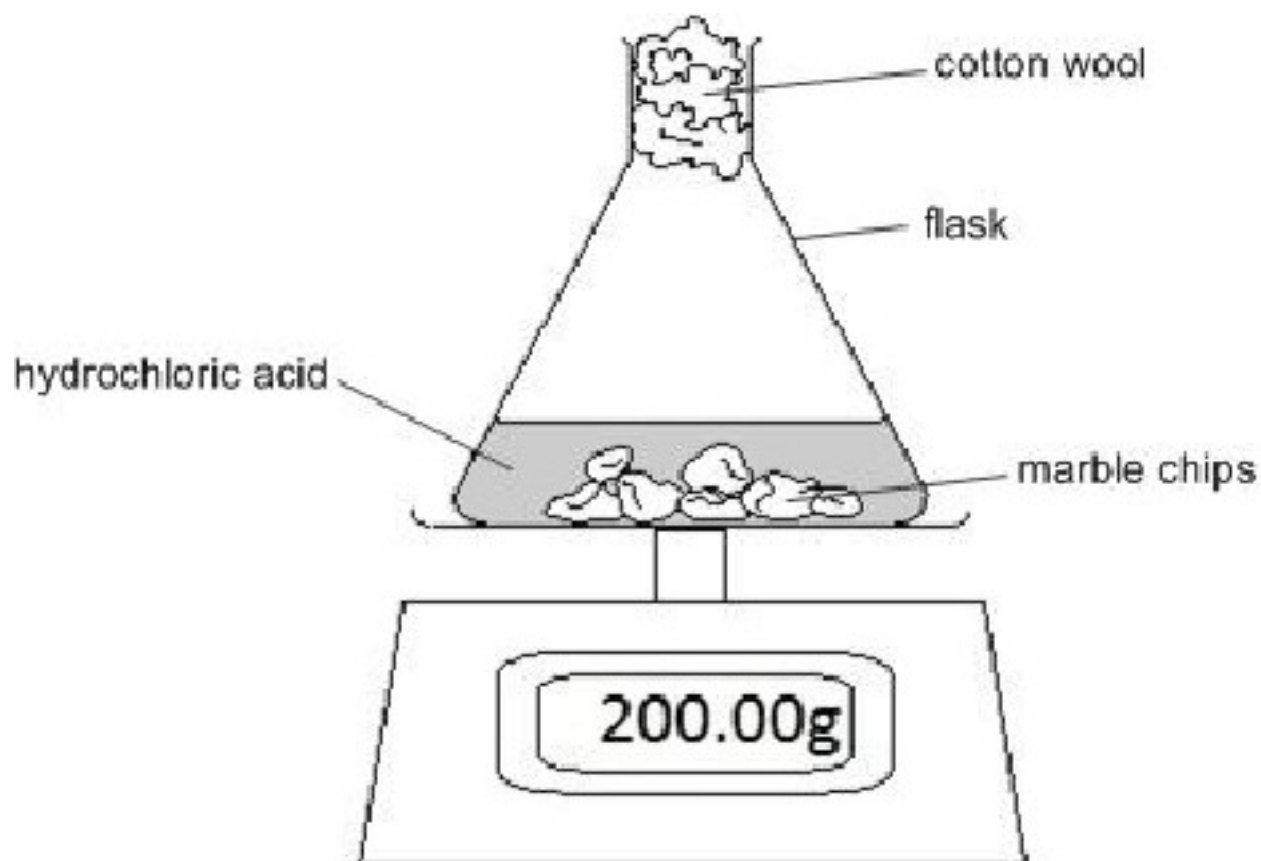
- A $2.0 \times 10^{-4} \text{ mol/dm}^3$
- B $2.0 \times 10^{-2} \text{ mol/dm}^3$
- C $2.0 \times 10^{-1} \text{ mol/dm}^3$
- D $5.0 \times 10^{-1} \text{ mol/dm}^3$

Your answer

[1]

60 Look at the diagram.

It shows how the reaction between hydrochloric acid and marble chips (calcium carbonate) can be monitored.



The reading on the balance **decreases** during the reaction.

Which of these statements is the **best** explanation?

- A Acid escapes from the flask.
- B A gas called hydrogen is made which leaves the flask.
- C A gas called carbon dioxide is made which leaves the flask.
- D The temperature in the laboratory changes.

Your answer ☐

[1]

- 61 100 cm³ of a solution of 1 mol/dm³ sodium hydroxide is added to 100 cm³ of a solution of 1 mol/dm³ hydrochloric acid.

The maximum rise in temperature recorded was T₁.

The experiment is repeated with 50 cm³ of each solution.

The maximum rise in temperature recorded was T₂.

Which of these statements about temperatures T₁ and T₂ is true?

- A T₁ is equal to T₂
- B T₁ is half the value of T₂
- C T₂ is half the value of T₁
- D T₂ is a quarter the value of T₁

Your answer

[1]

- 62 Hydrogen reacts with fluorine to make hydrogen fluoride.



Look at these bond energies.

Bond	Bond energy in kJ/mol
H—H	436
F—F	142
H—F	568

What is the energy change for the reaction between hydrogen and fluorine?

- A -558 kJ/mol
- B -10 kJ/mol
- C +10 kJ/mol
- D +558 kJ/mol

Your answer

[1]

63 What is the approximate radius of an atom in metres?

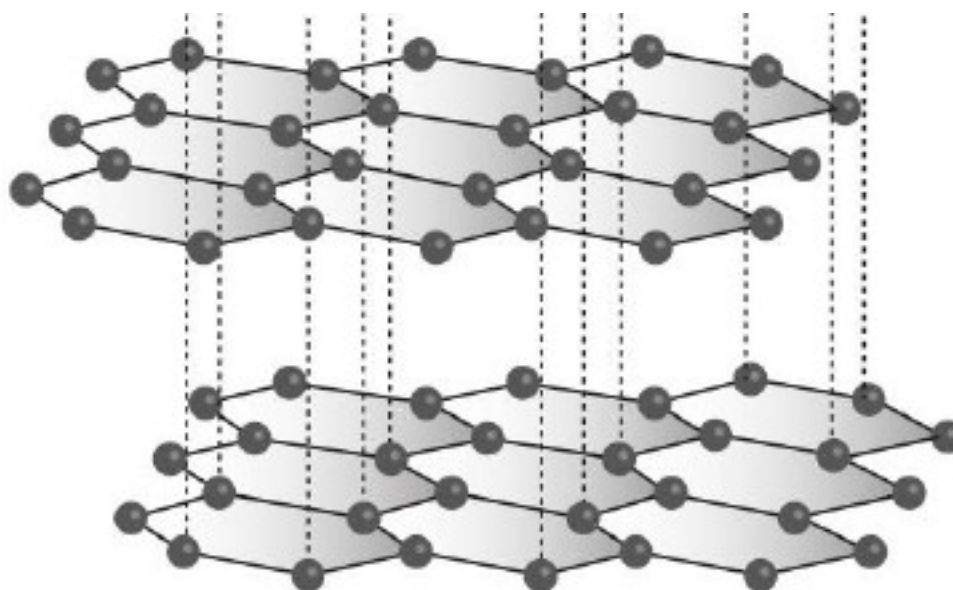
- A 300×10^{-1}
- B 30×10^{-5}
- C 3000×10^{-7}
- D 3×10^{-13}

Your answer

[1]

64 Look at the diagram.

It shows a structure of carbon.



Which structure of carbon is shown in the diagram?

- A diamond
- B fullerene
- C graphene
- D graphite

Your answer

[1]

- 65 Rubidium is found in Group 1 of the Periodic Table. Bromine is found in Group 7. They react together to form an ionic compound.

Which row shows the electron change that occurs for rubidium and the correct formula of a rubidium ion?

	Electron change	Formula of ion
A	Electron gained	Rb^+
B	Electron gained	Rb^-
C	Electron lost	Rb^+
D	Electron lost	Rb^-

Your answer ☐

[1]

- 66 Fractional distillation is used to separate crude oil into a range of other substances. The process uses a fractionating column.

Which of these statements about fractional distillation is / are correct?

- 1 propane, C_3H_8 , is found in the fraction obtained from the top of the column
- 2 crude oil is heated before it enters the bottom of the column

- A 1 only
- B 2 only
- C both 1 and 2
- D neither 1 nor 2

Your answer ☐

[1]

67 A metal carbonate reacts with an acid.

What products are made?

- A Salt and carbon dioxide
- B Salt and water
- C Salt, carbon dioxide and water
- D Salt, hydrogen and carbon dioxide

Your answer

[1]

68 A student wants to make solid ammonium sulfate from the solution of ammonium sulfate.

What should the student do first?

- A Distil the solution.
- B Evaporate the solution.
- C Filter the solution.
- D Use chromatography.

Your answer

[1]

69 A student wants to re-crystallise a solute from a solution.

What type of apparatus should she use?

- A An evaporating dish, wire gauze, tripod and Bunsen burner
- B A filter funnel, filter paper and conical flask
- C A round-bottomed flask connected to a condenser
- D A separating funnel

Your answer

[1]

70 Ethanoic acid is a **weak** acid.

What is the pH of ethanoic acid?

- A 1
- B 5
- C 7
- D 12

Your answer

[1]

71 An element has a **relative atomic mass** of 19.0.

Find this element on the Periodic Table.

How many protons does this element contain?

- A 9
- B 10
- C 19
- D 28

Your answer

[1]

72 In 1808 John Dalton published his theory about matter.

Which of Dalton's ideas is now known to be **incorrect**?

- A A chemical reaction is a rearrangement of atoms.
- B All matter consists of atoms.
- C Atoms cannot be subdivided.
- D When elements react, their atoms combine in simple, whole-number ratios.

Your answer

[1]

73 What is the chemical formula for sodium chloride?

- A Na_2Cl
- B NaCl
- C NaCl_2
- D Na_2Cl_3

Your answer

[1]

74 Which statement is correct about a **chemical** change?

- A A solid changes to a liquid.
- B No new substances are formed.
- C The change is irreversible.
- D The change is reversible.

Your answer

[1]

75 Atoms can form ions.

Which statement is **correct**?

- A All metal ions are negatively charged.
- B Ions are always smaller than the atom they are made from.
- C Negative ions are formed when an atom gains electrons.
- D Positive ions are formed when an atom gains electrons.

Your answer

[1]

76 Which statement about phosphorus is **correct**?

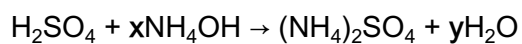
Use the Periodic Table to help you answer this question.

- A A phosphorus atom has 15 protons and 16 electrons.
- B The phosphorus-31 isotope has 16 neutrons.
- C Phosphorus is a metal.
- D The symbol for phosphorus is Po.

Your answer

[1]

77 Look at the equation.



Which values of **x** and **y** balance the equation?

- A **x** = 1 and **y** = 1
- B **x** = 1 and **y** = 2
- C **x** = 2 and **y** = 1
- D **x** = 2 and **y** = 2

Your answer

[1]

78 Which of the following happens at a **cathode**?

- A Gain of electrons by anions
- B Gain of electrons by cations
- C Loss of electrons by anions
- D Loss of electrons by cations

Your answer

[1]

79 What is meant by an **alloy**?

- A A compound substance
- B A metal used in car wheels
- C A mixture of metals
- D An element

Your answer

[1]

80 The relative formula mass of NaOH is 40.

What mass of sodium hydroxide, NaOH, is found in 100 cm³ of a 0.5 mol / dm³ solution of NaOH?

- A 0.2 g
- B 0.4 g
- C 2.0 g
- D 4.0 g

Your answer

[1]

81 How many atoms of an element does **one mole** contain?

A $6.02214086 \times 10^{23}$

B $6.02214086 \times 10^{-23}$

C $9.02214086 \times 10^{23}$

D $9.02214086 \times 10^{26}$

Your answer

[1]

82 The Group 0 elements are unreactive.

Why are they unreactive?

A They all exist as single atoms.

B They are all gases.

C They have a full outer electron shell.

D They need one electron to gain a full outer electron shell.

Your answer

[1]

83 Look at the table.

	State at room temperature	Electronic structure
A	Gas	2.7
B	Gas	2.8.7
C	Liquid	2.8.7
D	Solid	2.7

Which row in the table has the correct information about chlorine?

Your answer

[1]

84 Fluorine is the most reactive element in Group 7 (Group 17).

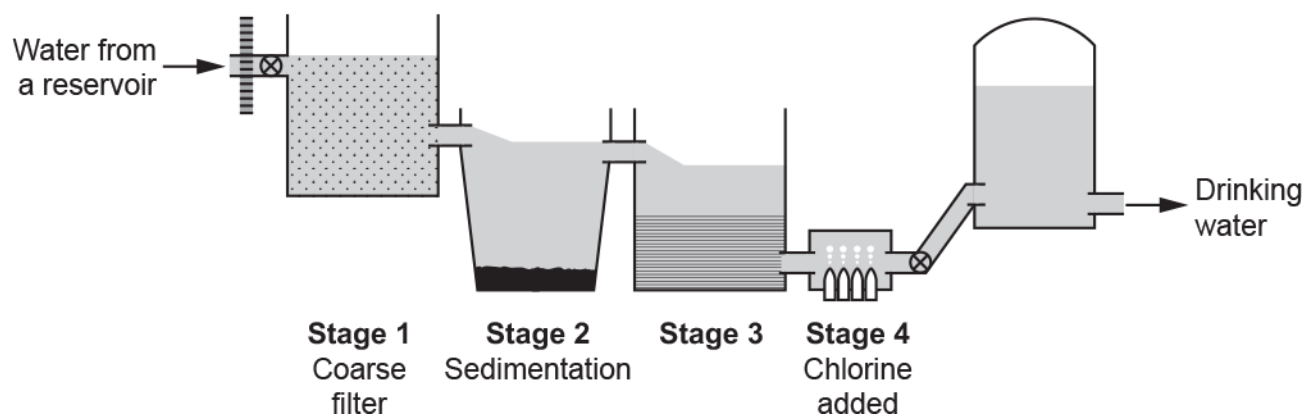
Why?

- A Fluorine atoms gain an electron more readily than the other Group 7 elements.
- B Fluorine is a gas.
- C Fluorine exists as diatomic molecules.
- D Fluorine atoms lose electrons more readily than the other Group 7 elements.

Your answer

[1]

85 The diagram shows how drinking water can be produced from water from a reservoir.



What happens at **Stage 3**?

- A Any remaining solids are removed.
- B Bacteria are used to break down sludge.
- C Harmful bacteria are killed.
- D The pH of the water is checked and corrected.

Your answer

[1]

86 The table shows the melting and boiling points of bromine.

Melting point (°C)	Boiling point (°C)
-7	59

Which change of state happens when bromine is cooled from 65 °C to -5 °C?

- A Condensation
- B Evaporation
- C Freezing
- D Melting

Your answer

[1]

87 Look at the information about a nitrogen atom.



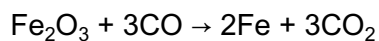
How many **electrons** are in a nitride ion, N^{3-} ?

- A 4
- B 10
- C 11
- D 17

Your answer

[1]

88 Iron can be made from the reaction of iron(III) oxide with carbon monoxide.



What is the **reducing agent** in this reaction?

- A CO
- B CO_2
- C Fe
- D Fe_2O_3

Your answer

[1]

89 Which ionic equation is balanced correctly?

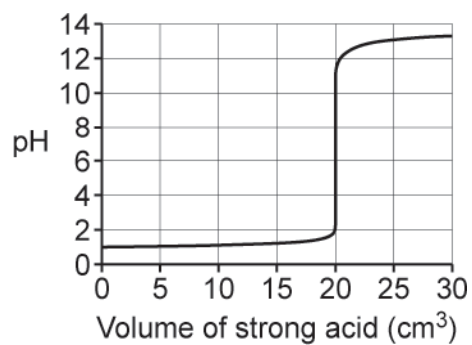
- A $2\text{Ag}^+ + \text{CO}_3^{2-} \rightarrow \text{Ag}_2\text{CO}_3$
- B $\text{Al}^{3+} + 3\text{OH}^- \rightarrow \text{Al(OH)}_3$
- C $\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{Ba}_2(\text{SO}_4)_2$
- D $2\text{Pb}^{2+} + \text{NO}_3^- \rightarrow \text{Pb}_2\text{NO}_3$

Your answer

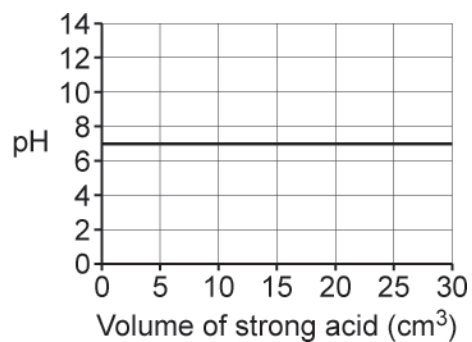
[1]

90 Which curve shows how the pH of a strong alkali changes when a strong acid is added?

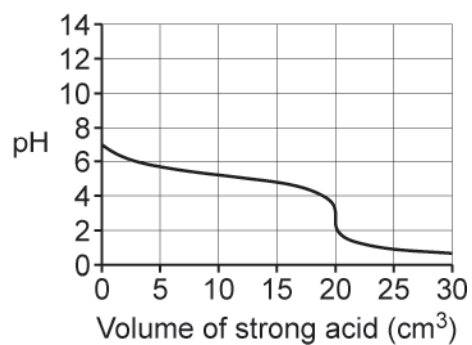
A



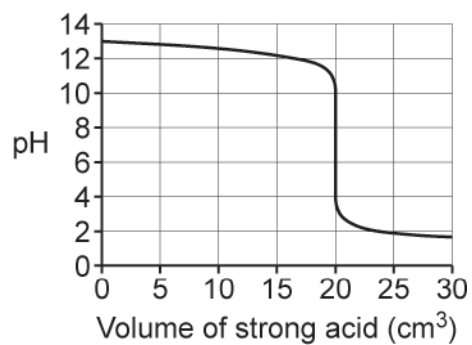
B



C



D



Your answer

[1]

91 What is the number of atoms in 0.0485 moles of carbon?

The Avogadro constant = 6.02×10^{23} .

- A 8.05×10^{-26}
- B 2.92×10^{22}
- C 6.02×10^{23}
- D 1.24×10^{25}

Your answer

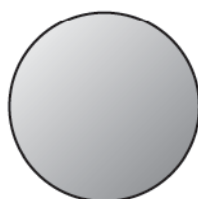
[1]

92 The atomic model has changed over time.

Look at the diagrams.

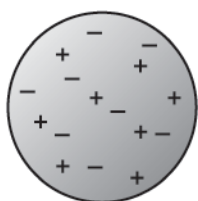
They show four different atomic models and the years they were developed.

A



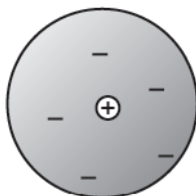
1803

B



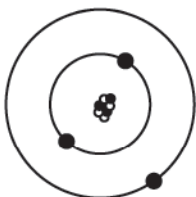
1897

C



1909

D



1913

Which atomic model was developed by Niels Bohr?

Your answer

[1]

93 Which statement describes a covalent bond?

- A A shared pair of electrons.
- B The electrostatic attraction between oppositely charged ions.
- C The electrostatic attraction between delocalised electrons and positive ions.
- D The forces of attraction between molecules.

Your answer

[1]

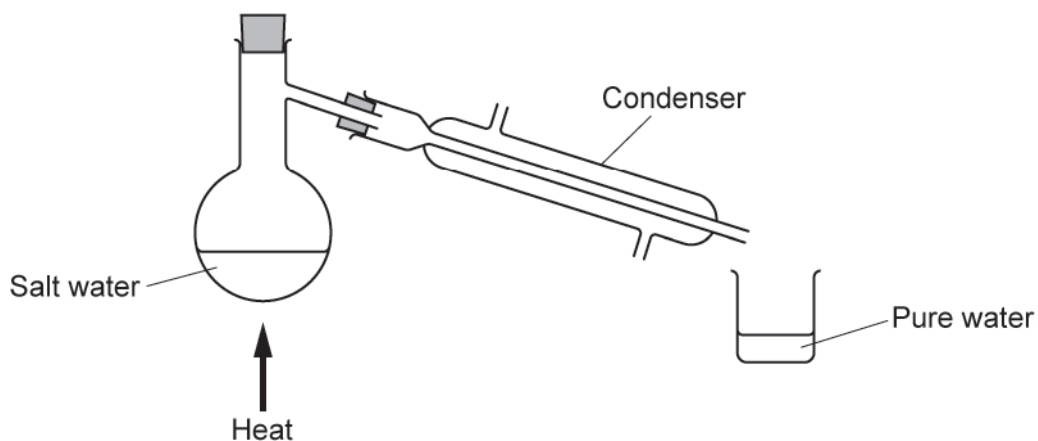
94 Relative atomic mass compares the average mass of an atom to which element?

- A Carbon
- B Hydrogen
- C Nitrogen
- D Oxygen

Your answer

[1]

95 The diagram shows how pure water can be separated from salt water by simple distillation.



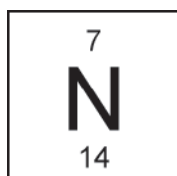
Which **two** changes of state happen during simple distillation?

- A Condensation and freezing
- B Evaporation and condensation
- C Freezing and evaporation
- D Melting and freezing

Your answer

[1]

96 Look at the information about a nitrogen atom.



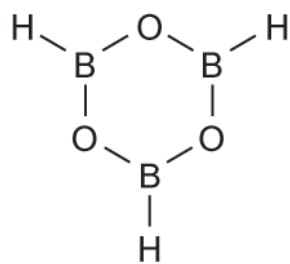
How many **electrons** are in a nitride ion, N^{3-} ?

- A 4
- B 10
- C 11
- D 17

Your answer

[1]

97 Look at the molecule below.



What is the **empirical formula** of the molecule?

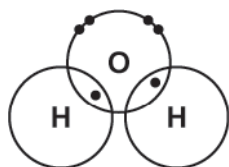
- A BHO
- B BHO₂
- C B₃(OH)₃
- D B₃H₃O₃

Your answer

[1]

98 The bonding in a water molecule, H_2O , can be shown by a dot and cross diagram.

A



B



C



D



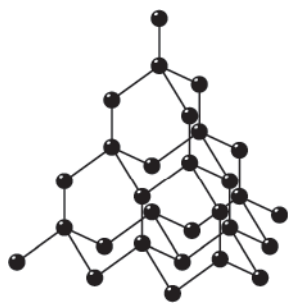
Which is the correct dot and cross diagram for water?

Your answer

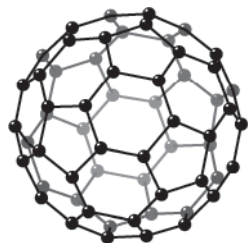
[1]

99 The diagrams show different structures of carbon.

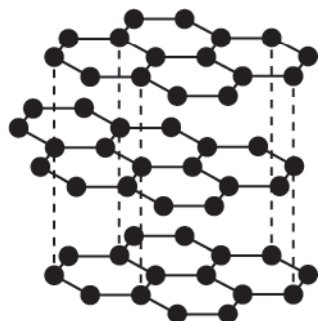
A



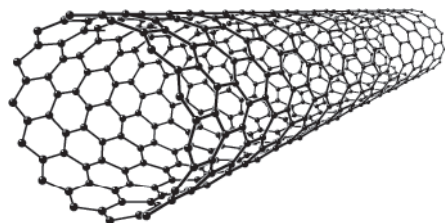
B



C



D



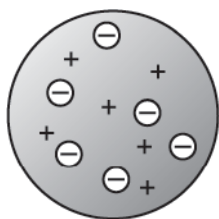
Which structure is Buckminsterfullerene?

Your answer

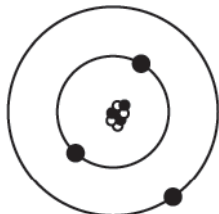
[1]

100 The diagrams show three different models of the atom.

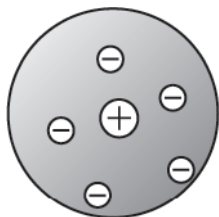
1



2



3



What is the correct order for the development of the three models, starting with the **earliest**?

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

Your answer

[1]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			A	1 (AO 1.1)	<u>Examiner's Comments</u> The common misconception here was the type of change that was taking place. Incorrect responses generally chose C rather than the correct response of A, showing they lacked the understanding of physical and chemical changes.
			Total	1	
2			C	1 (AO 2.1)	<u>Examiner's Comments</u> This question was very well answered.
			Total	1	
3			C	1 (AO 2.1)	<u>Examiner's Comments</u> Only the highest achieving candidates scored here, with candidates mostly choosing B as their incorrect response. This showed they understood that one substance was pure and one was impure but could not identify which was which on the graph.
			Total	1	
4			A	1 (AO 1.2)	<u>Examiner's Comments</u> This question was well answered.
			Total	1	
5			B	1 (AO 1.2)	<u>Examiner's Comments</u> This question was well answered.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
6			A	1 (AO 1.1)	<u>Examiner's Comments</u> This question was well answered.
			Total	1	
7			B	1 (AO 2.1)	<u>Examiner's Comments</u> This question was generally well answered, with candidates able to understand the model and relate that to the molecular formula.
			Total	1	
8			C	1 (AO 2.1)	
			Total	1	
9			D	1 (AO 1.2)	
			Total	1	
10			B	1 (AO 2.1)	
			Total	1	
11			B	1 (AO 2.1)	ALLOW g <u>Examiner's Comments</u> Around half of candidates knew that bubbles were a gas; a common wrong answer was aqueous.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
12			D	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates knew that this was oxidation; the most common wrong answer was neutralisation.
			Total	1	
13			A	1 (AO 1.2)	<u>Examiner's Comments</u> Some candidates knew that this was carbon dioxide, but more thought it was chlorine.
			Total	1	
14			D	1 (AO 2.2)	<u>Examiner's Comments</u> Some candidates knew that this was zinc; the majority chose chlorine and a few selected hydrogen .
			Total	1	
15			B	1 (AO 1.1)	<u>Examiner's Comments</u> The definition of a formulation was not well known, with a range of answers seen.
			Total	1	
16			B	1 (AO 1.1)	<u>Examiner's Comments</u> Around half of candidates were able to identify the correct equation but many got the charges on the ions the wrong way round so selected C.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17			A	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates understood that during a chemical reaction the particles break up and then join together in a different way. However, many incorrectly identified this as a physical change rather than a chemical change.
			Total	1	
18			B	1 (AO 1.2)	<u>Examiner's Comments</u> Many candidates calculated the correct answer, especially those that showed their working. Incorrect answers were mainly A and C.
			Total	1	
19			C	1 (AO 2.1)	<u>Examiner's Comments</u> Many candidates answered correctly. However, some were distracted by the low melting point of A or the orange-red colour of B and didn't realise that low electrical conductivity was a key indicator of a non-metal.
			Total	1	
20			B	1 (AO 1.2)	<u>Examiner's Comments</u> Just over half of candidates calculated the mass correctly. All other responses were seen in approximately equal numbers.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
21			D	1 (AO 1.2)	<u>Examiner's Comments</u> All responses were seen in approximately equal numbers.
			Total	1	
22			C	1 (AO 2.2)	
			Total	1	
23			C	1 (AO 1.1)	ALLOW CO₂ <u>Examiner's Comments</u> Most responses successfully identified the formula of carbon dioxide.
			Total	1	
24			D	1 (AO 2.1)	<u>Examiner's Comments</u> Candidates understood that weak intermolecular forces lead to lower melting points, however there was a lack of understanding that metals do not exhibit this type of force. This gave a common incorrect response of C rather than the correct response of D.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
25			C	1 (AO 1.2)	<u>Examiner's Comments</u> Candidates could identify the need for a bung in the top of the round bottom flask. The majority of candidates demonstrated a misconception of the direction of water flow within the condenser. An incorrect response of D was seen, rather than the correct response of C, with water going in at the bottom and out of the top of the condenser.
			Total	1	
26			D	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of responses identified the scientist responsible for this model.
			Total	1	
27			C	1 (AO 2.2)	<u>Examiner's Comments</u> Most responses successfully balanced the equation and gave the correct response of C.
			Total	1	
28			B	1 (AO 2.2)	<u>Examiner's Comments</u> This question required a calculation. Only a small number of responses successfully calculated the mass of one atom using the information given.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
29			D	1 (AO 2.1)	<u>Examiner's Comments</u> The majority of responses to this question were correct. The most common incorrect response was B, showing a lack of understanding of an alloy.
			Total	1	
30			B	1 (AO 2.2)	<u>Examiner's Comments</u> This required a calculation from the data and an understanding of chemical formula. It was pleasing to see that most responses were correct here.
			Total	1	
31			B	1 (AO 2.2)	
			Total	1	
32			C	1 (AO 2.2)	<u>Examiner's Comments</u> Candidates found this more challenging with many choosing B.
			Total	1	
33			C	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates correctly selected C. Common incorrect answers were B and D.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
34			D	1 (AO 1.1)	<u>Examiner's Comments</u> Many candidates recognised an acid reacting with an alkali as neutralisation, but a range of other answers were seen.
			Total	1	
35			C	1 (AO 2.1)	<u>Examiner's Comments</u> Many candidates correctly chose C, with B as a common incorrect answer.
			Total	1	
36			B	1 (AO 1.1)	<u>Examiner's Comments</u> Many candidates knew that carbon was correct, but others gave a range of different answers.
			Total	1	
37			B	1 (AO 1.2)	<u>Examiner's Comments</u> Only a minority of candidates could name the mobile phase, with many selecting A or D instead.
			Total	1	
38			D	1 (AO 2.1)	<u>Examiner's Comments</u> Many candidates chose D, with B as a common incorrect choice.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
39			B	1 (AO 2.2)	<u>Examiner's Comments</u> Those candidates who showed their working mostly identified potassium. However, a range of incorrect choices were seen.
			Total	1	
40			C	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of the candidates could name the nucleus, but a few selected core or ion.
			Total	1	
41			C	1 (AO 2.1)	<u>Examiner's Comments</u> A minority of candidates were able to work out the correct formula, with a range of incorrect answers seen.
			Total	1	
42			D ✓	1 (AO1.1)	<u>Examiner's Comments</u> Candidates had been well trained to identify the similarities and differences in the number of protons and neutrons in isotopes.
			Total	1	
43			C ✓	1 (AO1.1)	<u>Examiner's Comments</u> Roughly half of candidates could define a formulation as an alloy.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
44			B ✓	1 (AO2.1)	<u>Examiner's Comments</u> A large number of candidates could determine that carbon dioxide had been reduced.
			Total	1	
45			C ✓	1 (AO2.2)	<u>Examiner's Comments</u> D was commonly incorrectly given as a response, perhaps because candidates had divided the numbers the wrong way around. An R_f value should be less than 1 and cannot be a negative number.
			Total	1	
46			D ✓	1 (AO2.1)	<u>Examiner's Comments</u> Understanding the difference between concentration and strength was assessed here. Around half of candidates identified acid D as the one with a low concentration and a high strength. There was no obvious pattern in the incorrect responses.
			Total	1	
47			D ✓	1 (AO2.2)	<u>Examiner's Comments</u> Candidates found this question on ionic equations challenging. The majority of candidates chose equation C (an unbalanced ionic equation) or equation A (a balanced equation that is not ionic).
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
48			A ✓	1 (AO2.2)	<u>Examiner's Comments</u> The majority of candidates found this question a challenge. Often C was chosen suggesting that some candidates calculated the bond energy for each molecule or didn't remember that 1852 kJ / mol was associated with the production of 2 water molecules.
			Total	1	
49			D ✓	1 (AO2.2)	<u>Examiner's Comments</u> The majority of candidates found this question challenging.
			Total	1	
50			B ✓	1 (AO1.1)	<u>Examiner's Comments</u> Where candidates gave an incorrect response, there was no real pattern in their answers. Around half of candidates correctly identified B as the definition of a mole.
			Total	1	
51			A ✓	1 (AO 1.2)	<u>Examiner's Comments</u> The majority of candidates could identify this as chromatography, with common incorrect answers being filtration or distillation.
			Total	1	
52			C ✓	1 (AO 2.2)	<u>Examiner's Comments</u> Candidates found this difficult with less than half choosing C. Common wrong answers were B and D.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
53			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Candidates struggled to identify hydroxide ions with only about a third choosing response C. D was a popular choice.
			Total	1	
54			C ✓	1 (AO 2.2)	<u>Examiner's Comments</u> Around a third of candidates realised this produced a weak acid so chose orange, with a range of other responses given.
			Total	1	
55			C	1	
			Total	1	
56			B	1	
			Total	1	
57			D	1	
			Total	1	
58			A	1	
			Total	1	
59			C	1	
			Total	1	
60			C	1	
			Total	1	
61			A	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
62			A	1	
			Total	1	
63			C	1	
			Total	1	
64			D	1	
			Total	1	
65			C	1	
			Total	1	
66			C	1	
			Total	1	
67			C ✓	1 (AO1.2)	Examiner's Comments Some candidates correctly chose C. Many forgot that water was also produced and chose A.
			Total	1	
68			B ✓	1 (AO1.2)	Examiner's Comments Some candidates correctly chose evaporation. Distillation and filtration were common wrong choices.
			Total	1	
69			A ✓	1 (AO1.2)	Examiner's Comments This question was well answered with most candidates choosing A. The most common wrong answer was B with very few choosing C or D.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
70			B ✓	1 (AO1.1)	ALLOW 5 <u>Examiner's Comments</u> Many candidates knew the answer was pH 5, but some selected pH 1. A number of candidates wrote the pH number in the box rather than A, B, C or D.
			Total	1	
71			A ✓	1 (AO2.1)	ALLOW 9 <u>Examiner's Comments</u> Most candidates correctly selected A, but a few thought that the relative atomic mass indicated the number of protons so chose C.
			Total	1	
72			C ✓	1 (AO1.1)	<u>Examiner's Comments</u> Some candidates correctly selected C, but more candidates chose D.
			Total	1	
73			B ✓	1 (AO1.1)	<u>Examiner's Comments</u> Some candidates correctly chose NaCl, but many selected A.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
74			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Candidates could generally recall this information with a large percentage identifying a chemical change as an irreversible reaction. Lower ability candidates tended to choose D as their incorrect response.
			Total	1	
75			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> This was the highest scoring multiple choice answer and has clearly been well taught in centres.
			Total	1	
76			B ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Approximately half of the candidates could use the periodic table as directed in the question to identify the isotope of phosphorous 31 as having 16 neutrons. The most commonly seen incorrect response was the imbalance of protons and electrons for an isotope, showing a misconception in the understanding of atomic mass and atomic number.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
77			D ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Approximately half the candidates could balance the equation using the correct selection of numbers. There were no common selections in the remaining answers perhaps showing an area centres can work on for future examination series. Candidates who were credited this mark often used the space at the side of the question to count the number of atoms of each element present in the formula to help them correctly balance the equation.
			Total	1	
78			B ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Less than half of candidates could identify the correct statement explaining the process that takes place at the cathode. The most common incorrect response was 'D' showing a lack of understanding of the charges on cations. There is often a misconception regarding the charge on the ions and whether there has been an initial loss or gain of electrons to create the ion.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
79			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> A large proportion of candidates could recall that an alloy is a mixture of metals. The most common error was selecting B, suggesting an everyday misconception of the use of the word 'alloy'.
			Total	1	
80			C ✓	1 (AO 2.2)	<u>Examiner's Comments</u> Only higher ability candidates correctly identified 2.0 grams as the correct response. Those who did gain credit here often used the space at the side of the question for calculations.
			Total	1	
81			A ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Simple recall of Avogadro's constant proved difficult for lower ability candidates with the 'minus sign' before the '23' causing some candidates to select 'B'. Others selected the correct standard form number of 23 but chose 'C' with the incorrect value.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
82			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> B and D were popular incorrect responses. Less than half of candidates chose the correct response.
			Total	1	
83			B ✓	1 (AO 1.1)	<u>Examiner's Comments</u> A large number of candidates thought chlorine to be a liquid, incorrectly selecting C as their response.
			Total	1	
84			A ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates answered this correctly.
			Total	1	
85			A ✓	1 (AO2.1)	
			Total	1	
86			A ✓	1 (AO2.1)	
			Total	1	
87			B✓	1 (AO2.1)	
			Total	1	
88			A✓	1 (AO2.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
89			A✓	1 (AO2.2)	
			Total	1	
90			D✓	1 (AO1.1)	
			Total	1	
91			B✓	1 (AO2.2)	
			Total	1	
92			D✓	1 (AO1.1)	
			Total	1	
93			A✓	1 (AO1.1)	
			Total	1	
94			A✓	1 (AO1.1)	
			Total	1	
95			B ✓	1 (AO1.2)	Examiner's Comments Almost all candidates knew that distillation involved evaporation and condensation.
			Total	1	
96			B ✓	1 (AO2.2)	Examiner's Comments Many candidates correctly chose B, but some deducted 3 electrons rather than adding them so wrote A.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
97			A ✓	1 (AO2.1)	<u>Examiner's Comments</u> Very few candidates could identify the empirical formula. Most chose C, the molecular formula.
			Total	1	
98			C ✓	1 (AO2.1)	<u>Examiner's Comments</u> Candidates could identify the bonding pairs correctly, but many forgot that Oxygen should have 6 outer electrons so chose B instead of C.
			Total	1	
99			B ✓	1 (AO1.1)	<u>Examiner's Comments</u> Only a few candidates could identify Buckminsterfullerene from diagrams of the structures of carbon allotropes. Many candidates confused it with the carbon nanotube, which is also a fullerene.
			Total	1	
100			A ✓	1 (AO1.1)	<u>Examiner's Comments</u> A few candidates correctly chose A, but the majority selected C. Although they realised model 2 was the most recent, they could not interpret the difference between models 1 and 3.
			Total	1	