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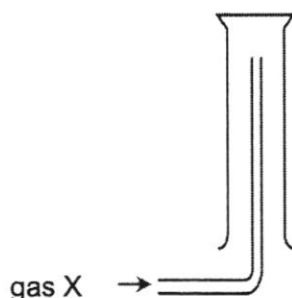


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- 1 Gas X is collected using the apparatus set-up shown below.



Based on this set-up, what can be inferred about gas X?

- A It is denser than air.
 - B It is less dense than air.
 - C It is insoluble in water.
 - D It is soluble in water.
- 2 Which instrument can most accurately measure 24.5 cm^3 of aqueous sodium hydroxide?
- A pipette
 - B gas syringe
 - C measuring cylinder
 - D burette
- 3 Which of the following separation methods is suitable for obtaining zinc nitrate from aqueous zinc nitrate solution?
- A crystallisation
 - B distillation
 - C evaporation
 - D filtration

- 4 The table shows information about the solubilities of three solids.

solid	solubility in water	solubility in ethanol
P	insoluble	insoluble
Q	soluble	insoluble
R	insoluble	soluble

Some or all of the following steps must be taken to obtain pure R from a mixture of P, Q and R.

1. filter
2. evaporate filtrate till dryness
3. add ethanol
4. add water

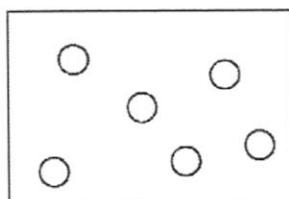
In what order should the required steps be taken to obtain pure R from a mixture of P, Q and R?

- A 3, 1, 2
- B 4, 1, 2
- C 3, 4, 1, 2
- D 4, 3, 1, 2
- 5 The particles in substance Z are widely spaced and able to move freely.
- Z changes to a state in which the particles are closely packed but still able to move freely.
- What is this change called?

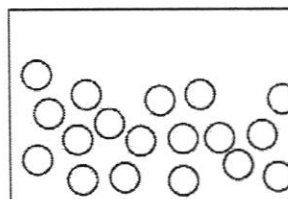
- A melting
- B freezing
- C evaporation
- D condensation

- 6 The melting point of a compound, acetone is -95°C and its boiling point is 56°C .

The diagrams show the arrangement of particles in acetone at two different temperatures: $X^{\circ}\text{C}$ and $Y^{\circ}\text{C}$.



$X^{\circ}\text{C}$



$Y^{\circ}\text{C}$

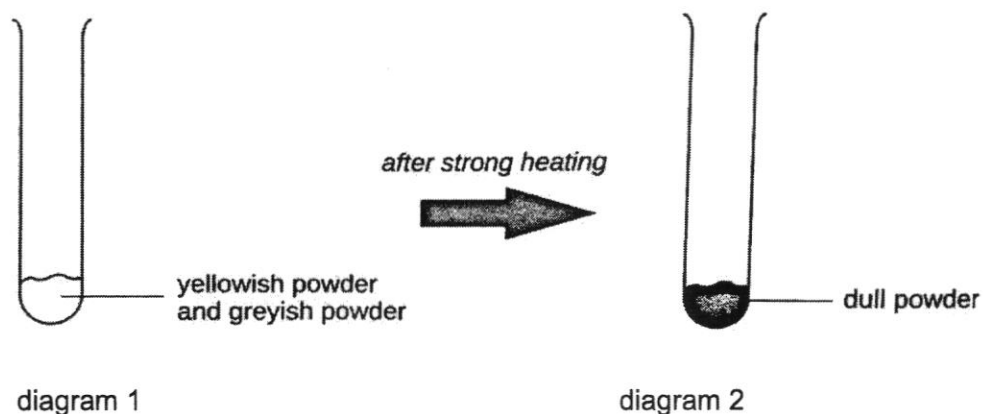
What could be the values of X and Y?

	X	Y
A	50	-100
B	50	-90
C	60	-100
D	60	-90

- 7 Which of the following is **not** a mixture?

- A** air
- B** bronze
- C** liquid nitrogen
- D** sea water

- 8 The diagrams below show the observations of the appearance of powdered iron and sulphur placed in a test tube before and after heating.



Which of the following description is correct?

	diagram 1	diagram 2
A	a mixture of compounds	a compound
B	a mixture of elements	a compound
C	a mixture of compounds	a mixture of elements
D	a mixture of elements	a mixture of elements

- 9 Four elements have the following electronic configurations.

W	2, 1
X	2, 4
Y	2, 5
Z	2, 8

Which statement is correct?

- A** All four elements are in the same group in the Periodic Table.
- B** All four elements are in Period 3 of the Periodic Table.
- C** Element W is a metal but X, Y and Z are non-metals.
- D** Element Z is a metal but W, X and Y are non-metals.

10 Which of the following pairs contains particles which have equal and opposite charges?

- A a proton and a hydrogen ion
- B a neutron and an electron
- C a neutron and a hydrogen nucleus
- D a proton and an electron

11 Which element in the table has atoms containing 24 neutrons each?

	atomic number	nucleon number
A	8	16
B	12	24
C	21	45
D	22	48

12 Which property best indicates that a substance is an ionic compound?

- A It is a crystalline solid at room temperature.
- B It is insoluble in water.
- C It can be synthesised from its element.
- D It conducts electricity in molten state.

13 The ion of metal X is represented by the symbol X^{3+} .

What will the formula of its chloride be?

- A XCl_3
- B X_2Cl_3
- C X_3Cl
- D X_3Cl_2

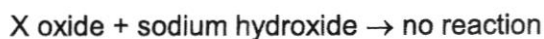
- 14 The table shows the number of particles present in the nuclei of four atoms or ions.

	protons	neutrons	electronic structure
1	18	22	2,8,8
2	19	20	2,8,8
3	19	21	2,8,8,1
4	20	20	2,8,8,2

Which two particles belong to the same element?

- A 1 and 2
 B 1 and 4
 C 2 and 3
 D 2 and 4
- 15 Which molecule contains single covalent bonds only?
- A NH_3
 B O_2
 C N_2
 D CO_2
- 16 The oxide of an element X is added separately to hydrochloric acid and aqueous sodium hydroxide.

The word equations for the reactions are shown.



Which row describes element X and its oxide?

	X	X oxide
A	metal	acidic
B	metal	basic
C	non-metal	basic
D	non-metal	acidic

17 Which compound can be used to reduce excess acidity in soil?

- A calcium chloride
- B calcium nitrate
- C calcium oxide
- D calcium sulfate

18 Bubbles of gas were observed when a piece of sodium carbonate was added to hydrochloric acid.

Which of the following correctly identifies the gas produced?

- A carbon dioxide
- B hydrogen
- C ammonia
- D oxygen

19 Which ions are present in chromium sulfate, $\text{Cr}_2(\text{SO}_4)_3$?

- A Cr^{2+} and SO_4^{2-}
- B Cr^{3+} and SO_4^{2-}
- C Cr^{2+} and SO_4^{3-}
- D Cr^{3+} and SO_4^{3-}

20 Which gas has the highest percentage composition in dry air?

- A argon
- B helium
- C krypton
- D neon

END OF PAPER 1

Section A

Answer **all** the questions in the spaces provided.

- 1 A student is measuring the volume of gas produced when a strip of magnesium ribbon is reacted with dilute hydrochloric acid using the set-up given in Fig 1.1. Apparatus **W** is attached to the side-arm of the test tube.

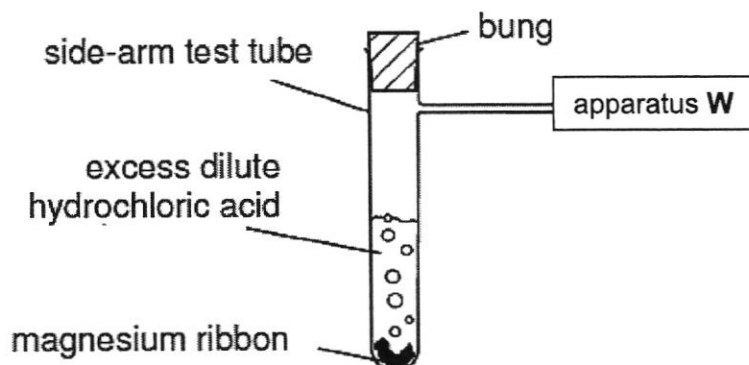


Fig 1.1

- (a) Name apparatus **W**.

..... [1]

- (b) During the reaction, he observed that the sides of the test-tube felt warm. He decided that he should carry out the experiment again to determine the temperature change that occurs.

State the apparatus that he would need to include in the set-up.

..... [1]

[Total: 2]

- 2 A student separates a mixture of pentane (boiling point: 36°C) and hexane (boiling point: 68°C) using the set-up shown in Fig. 2.1.

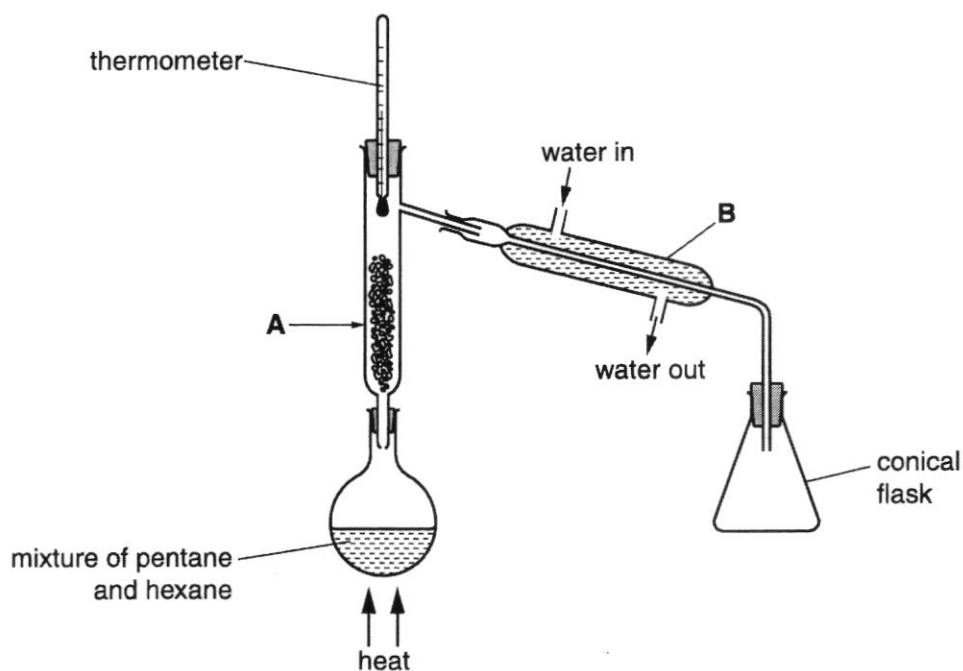


Fig. 2.1

- (a) (i) State the general name for this method of separation.

..... [1]

- (ii) Name apparatus A.

..... [1]

- (iii) State the purpose of apparatus B.

..... [1]

- (b) Identify **two** errors in the student's set-up.

1.

2. [2]

[Total: 5]

- 3 Some properties of four substances are shown in Table 3.1.

Table 3.1

substance	melting point /°C	boiling point /°C	density / g/cm ³
A	935	3130	8.4
B	180	1330	3.8
C	-95	10	0.003
D	84	115	1.8
E	-70	?	0.0025

- (a) Identify the substance (**A**, **B**, **C** or **D**) which

- (i) will melt if placed from room temperature to boiling water, [1]
- (ii) exists as a liquid over the greatest range of temperature [1]

- (b) In which substance(s) is/are the particles held in fixed position at 200°C?

..... [1]

- (c) Predict the boiling point of substance **E**. Give a reason to support your answer.

.....

..... [2]

[Total: 5]

- 4 (a) Fig. 4.1 shows the set-up for identifying the component dyes in 4 different types of pen ink, compared to a particular branded pen ink.

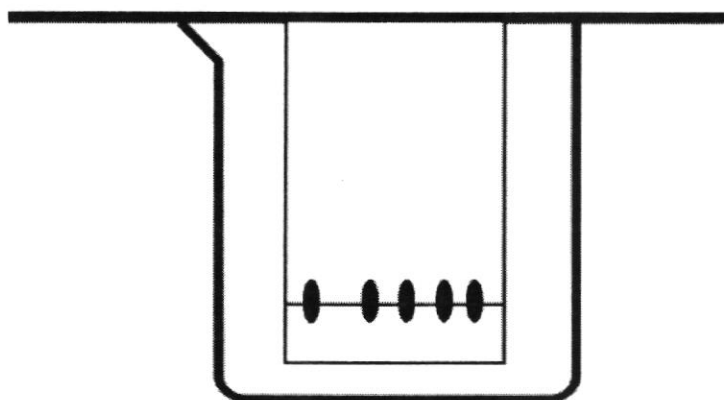


Fig. 4.1

- (i) Draw a line on Fig. 4.1 to indicate the appropriate volume of solvent to be added. [1]
- (ii) Suggest why the starting line is drawn using pencil.

..... [1]

.....

- (b) Fig. 4.2 below shows the chromatogram in **part (a)** one hour after the experiment has started. The solvent used is distilled water.

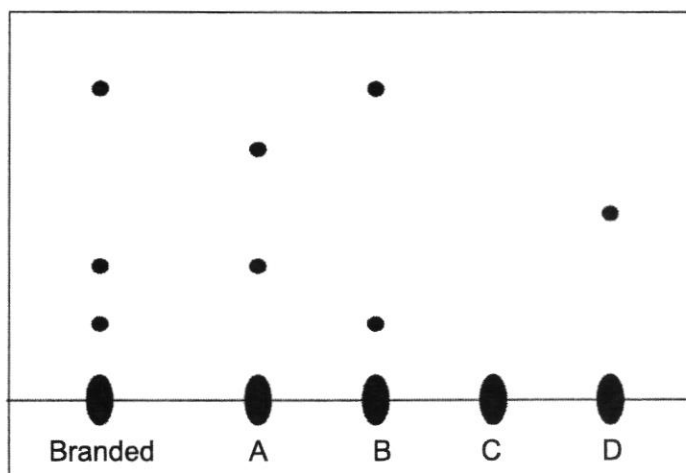


Fig. 4.2

- (i) State which ink(s) is/are pure. [1]
-
- (ii) State which ink(s) is/are found in the branded ink. [1]
-

- (iii) Explain why no result is observed for ink **C** on the chromatogram.

.....
 [1]

- (iv) Suggest how the experiment could be changed to determine the purity of ink **C**.

.....
 [1]

[Total: 6]

- 5 Fig. 5.1 shows part of the Periodic Table. The letters shown are not symbols of the elements.

- 6 Fig. 6.1 shows the electronic structures of five atoms.

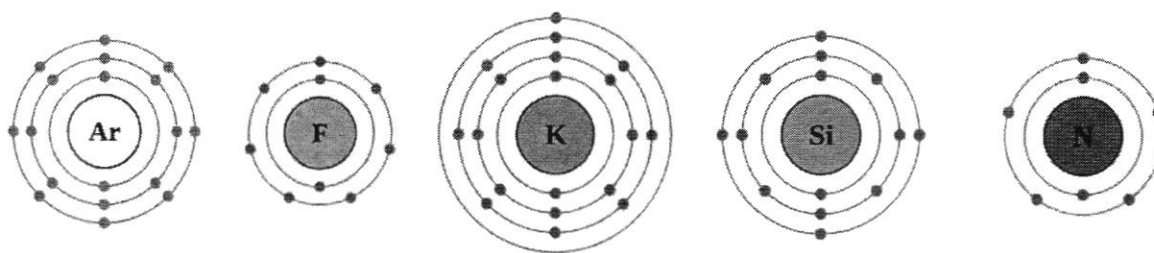


Fig 6.1

Identify the atom which

- (a) has a proton number of 14, [1]
 (b) forms an ion with a single negative charge, [1]
 (c) forms a molecule with the formula X_2O , [1]
 (d) forms a crystalline solid with sulfur. [1]

[Total: 4]

- 7 Hydrogen and helium have been used to fill balloons. Hydrogen is more reactive and less safe to use.

- (a) State the electronic structure of the atoms of these two elements and explain why hydrogen is more reactive than helium.

.....

 [3]

- (b) Deuterium is an isotope of hydrogen with a nucleon number 2 and tritium is another isotope with a nucleon number 3.

Compare the subatomic particles in the nuclei of these isotopes.

.....

 [3]

[Total: 6]

- 8 (a) Classify the following oxides according to the table.

Al_2O_3	SO_2	NO_2	CO
-------------------------	---------------	---------------	-------------

acidic oxide	neutral oxide	amphoteric oxide

[2]

- (b) Some oxides are found in our atmosphere and are considered pollutants.

- (i) State one major source for each of the gaseous pollutants in the table.

gas	source
carbon monoxide	
nitrogen oxides	
sulfur dioxide	

[3]

- (ii) Describe how carbon monoxide affects our health.

.....

[1]

- (iii) Name **one** other common atmospheric pollutant that is not mentioned above.

.....

[1]

[Total: 7]

- 9 The reaction scheme shown in Fig. 9.1 shows how crystals of a compound, commercially sold as Epsom Salts, can be prepared.

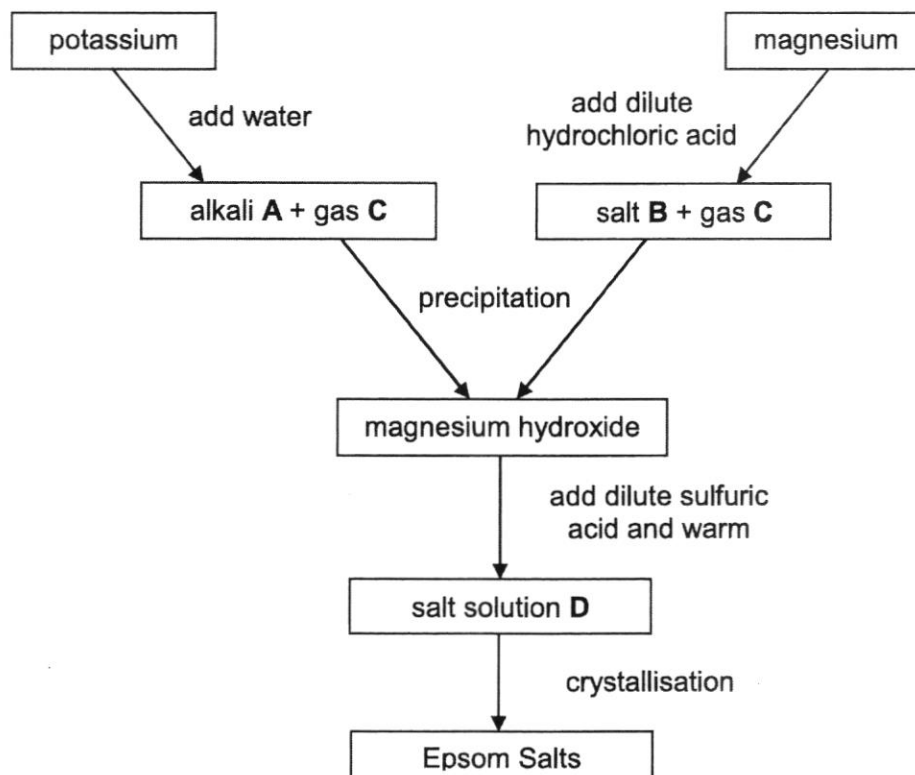


Fig. 9.1

- (a) Suggest the chemical name of Epsom Salts.

..... [1]

- (b) Identify the substances

(i) alkali A [1]

(ii) salt B [1]

(iii) gas C [1]

- (c) Write a balanced chemical equation for any one of these reactions.

..... [2]

[Total: 6]

Section B

Answer **both** questions in this section.
Write your answers in the spaces provided.

10 Chlorine is a non-metallic element.

(a) State the type of bond formed when chlorine reacts with sodium.

Explain your answer.

type of bond

explanation

..... [2]

(b) Draw 'dot and cross' diagrams to show the bonding of sodium with chlorine and hydrogen with chlorine. Show outermost electrons only.

sodium and chlorine

hydrogen and chlorine

[4]

- (c) Describe the differences in melting points between the compounds drawn in **part (b)**.

Explain, in terms of bonding, why this is so.

.....
.....
.....
..... [3]

- (d) Explain why both substances drawn in **part (b)** can conduct electricity when dissolved in water.

.....
..... [1]

[Total: 10]

- 11 (a) Zinc is a very common substance that occurs naturally, being one of the top 25 most abundant element found in the Earth's crust. The most common zinc ore is sphalerite (zinc blende), a mixture of zinc sulfide and iron sulfide.

Describe **two** differences between a *mixture* and a *compound*.

1.

 2.
 [2]

- (b) A useful zinc compound, zinc nitrate, can be made by reacting dilute nitric acid with either solid zinc oxide or zinc carbonate.

reaction 1: nitric acid + zinc oxide → zinc nitrate +

reaction 2: nitric acid + zinc carbonate → zinc nitrate + +

- (i) Define an *acid*.

.....
 [1]

- (ii) Describe the differences in observations made for the two reactions.

.....
 [1]

- (iii) State the other products formed for the two reactions.

reaction 1

reaction 2 and [2]

- (c) Both magnesium nitrate and sodium nitrate are soluble in water but require different preparation methods.

Describe how you would prepare either of these salts using nitric acid as one of the reagents.

.....

.....

.....

.....

.....

..... [4]

[Total: 10]

END OF PAPER 3

Paper 1 (20 marks)

1	B	11	C
2	D	12	D
3	A	13	A
4	A	14	C
5	D	15	A
6	D	16	B
7	C	17	C
8	B	18	A
9	C	19	B
10	D	20	A

A – 6, B – 4, C – 5, D – 5

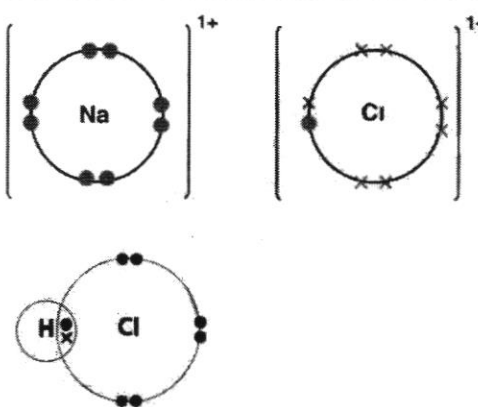
Paper 3**Section A (45 marks)**

1(a)	gas syringe	1
(b)	thermometer	1
		Total: 2
2(a)(i)	distillation, fractional distillation (reject: simple distillation, factional)	1
(ii)	fractionating column / fractional column	1
(iii)	cool surface for <u>condensation</u> (reject: if water / water vapour is written)	1
(b)	<u>water in and out</u> should be switched conical flask should not be stoppered	1 1
		Total: 5
3(a)	(i) D (ii) A	1 1
(b)	A	1
(c)	any temperature below 25°C as its <u>low density</u> indicates that it is a <u>gas at room temperature</u>	1 1
		Total: 5
4(a)	(i) Below the starting line but above the lower end of the chromatography paper. (ii) Pencil lead <u>does not contain dyes</u> and will <u>not interfere</u> with the results of chromatography. Or: Pencil lead is <u>insoluble</u> in the solvent	1 1
(b)	(i) D (ii) B (iii) C is <u>insoluble</u> in distilled water (iv) Use a <u>different solvent</u> (Accept replace solvent with alcohol/ethanol)	1 1 1 1
		Total: 6

5(a)	E and F (both must be correct)	1									
(b)	B	1									
(c)	C ⁺ / Li ⁺ / Lithium ion	1									
(d)	ED ₃ / A/F ₃	1									
		Total: 4									
6(a)	Si	1									
(b)	F	1									
(c)	F	1									
(d)	K	1									
		Total: 4									
7(a)	Hydrogen : 1 and Helium: 2 Helium atom already has <u>a completely filled valence shell</u> whereas hydrogen need to <u>share / lose / gain electrons</u> to form a <u>noble gas structure / complete electronic configuration / completely filled valence shell</u>	1 1 1									
(b)	<u>Both</u> nuclei has <u>1 proton</u> <u>Deuterium</u> has <u>1 neutron</u> whereas <u>tritium</u> has <u>2 neutrons</u>	1 2									
		Total: 6									
8(a)	<table border="1"> <thead> <tr> <th>acidic Oxide</th><th>neutral Oxide</th><th>amphoteric Oxide</th></tr> </thead> <tbody> <tr> <td>NO₂</td><td>CO</td><td>Al₂O₃</td></tr> <tr> <td>SO₂</td><td></td><td></td></tr> </tbody> </table>	acidic Oxide	neutral Oxide	amphoteric Oxide	NO ₂	CO	Al ₂ O ₃	SO ₂			Any 2 – 1
acidic Oxide	neutral Oxide	amphoteric Oxide									
NO ₂	CO	Al ₂ O ₃									
SO ₂											
(b)(i)	carbon monoxide - <u>incomplete</u> combustion of carbon-containing substances/ <u>incomplete</u> combustion of petrol nitrogen oxide – lightning activity / during thunderstorm / very high temperature car engine or chemical factory sulfur dioxide – burning fossil fuel / volcanic activity	3									
(ii)	<u>reduce the ability of the blood from transporting oxygen / breathing excessive amount of the gas leads to death. / respiratory problems</u>	1									
(iii)	Methane; ozone; or unburned hydrocarbons	1									
		Total: 7									
9(a)	Magnesium sulfate	1									
(b)	(i) potassium hydroxide (ii) magnesium chloride (iii) hydrogen gas	1 1 1									
(c)	Mg + 2 HCl → MgCl ₂ + H ₂ Or	2									

$2K + 2H_2O \rightarrow 2KOH + H_2$ Or $2KOH + MgCl_2 \rightarrow Mg(OH)_2 + 2KCl$ Or $Mg(OH)_2 + H_2SO_4 \rightarrow MgSO_4 + 2H_2O$ 1M – Chemical equation, 1M – balanced	Total: 6
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Section B (20 marks)

10(a)	sodium and chlorine – ionic explanation – sodium being a <u>metal</u> will tend to lose its valence electron and chlorine, a <u>non-metal</u> will <u>gain this electron</u> to form an ionic bond	1 1
(b)	 Marking scheme 1 mark – correct number of electrons for all atoms 1 mark – correct charges on sodium and chloride ion 1 marks – correct sharing in hydrogen chloride accept drawing that include all electrons	4
(c)	<u>Sodium chloride</u> has a very <u>high melting point</u> and <u>hydrogen chloride</u> has a very <u>low melting point</u> . <u>Ions</u> in sodium chloride are <u>held by very strong electrostatic attraction</u> whereas <u>molecules</u> of hydrogen chloride are <u>held by weak forces of attraction</u> . Hence <u>a lot more energy</u> is required to <u>overcome the electrostatic /</u> Hence <u>very little energy</u> is required to <u>overcome the weak forces of attraction</u> . Allow ECF from (b)	1 1 1
(d)	<u>Both</u> substances when dissolved <u>in water</u> produces <u>mobile ions</u> that can carry electric current.	1
Total: 10		
11(a)	Compound melts at a fixed temperature but mixture melts over a range of temperature.	Any 2 – 2

	Components of a mixture can be separated by physical processes but a compound can only be broken down by chemical processes. The components of a mixture can be mixed in any ratio but the elements in a compound are always combined in a fixed ratio. Chemical properties of a mixture are the same as its components but the properties of a compound is different from its constituent elements.	
(b)(i)	Acid <u>will produce hydrogen ions</u> when dissolved in water,	1
(b)(ii)	Bubbles of gas is observed when zinc carbonate is added to the acid but no bubbles of gas observed when zinc oxide was added.	1
(b)(iii)	1) water 2) carbon dioxide and water	1 1
(c)	<u>magnesium sulfate</u> excess magnesium/magnesium oxide/magnesium carbonate filter to remove residue crystallise filtrate OR <u>sodium sulfate</u> • sodium hydroxide • burette, pipette • using indicator 1st time, without indicator 2nd time • add until colour change • crystallise (Any 4 points)	1 1 1 1
		Total: 10