

MARKING SCHEME

1. (a) The electron arrangement of ions A^{3+} and B^{2-} are 2.8 and 2.8.8 respectively. Write down the electron arrangement of the elements A and B. (2mks)

A 2.8.3

B 2.8.6

- (b) Study the information in the table below and answer the questions that follow. The letters are not the actual symbols of the elements.

Element	Atomic number	Boiling point (°C)
K	3	1333
L	13	2470
M	16	445
N	18	-186
P	19	774

- i. Which element;

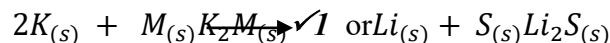
- a) Is a gas at room temperature? Explain, taking room temperature as 25°C. (1mk)

N, ✓½ Its boiling point is below 25°C

- b) Does not form an oxide? Explain. (1mk)

N, ✓1 Has stable electron configuration ✓1

- ii. Write down the equation for the reaction between elements K and M. (1mk)



- iii) What type of bond would exist in the compound formed when elements M and L react? Give a reason for your answer (1mk)

Ionic bond. ✓½ L reacted by losing electrons to M

- iv) Select the most electropositive element. Explain. (2mk)

P, has largest atomic radius

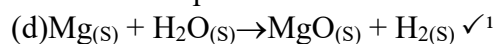
- v) Why the boiling point of element L is higher than that of element K. (1mk)

L has stronger metallic bonds than K, ✓½, has more delocalized electrons. ✓½

2. (a) Hydrogen gas ✓1.

- (b) Remove magnesium oxide layer ✓1 on the surfaces (1mk)

- (c) Bright white light ✓1 or
White powder ✓1



- (e) (i) Brick liners in furnaces. ✓1

(ii) Radio frequency shielding.

(f) (i) Volume of Gas X at s.t.p.

$$V_1 = 96 \quad V_2 = 2$$

$$P_1 = 1 \quad P_2 = 1$$

$$T_1 = 283 \text{ } \checkmark^{1/2} \quad T_2 = 273$$

$$V_2 = \frac{P_1 V_1 T_2}{P_2 T_1} = \frac{1 \times 96 \times 283}{1 \times 273} \checkmark^1 = 99.52 \text{ cm}^3 \checkmark^{1/2}$$

3.(a) Magnesium oxide



(c)(i) Sodium sulphate

(ii) Magnesium carbonate



(e) $\text{Na}^+_{(aq)}$ and SO_4^{2-} ions



4..a) (i) 2 – bromobutane $\checkmark^{1/2}$

(ii) Sulphuric (VI) acid $\checkmark$

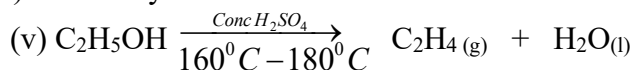
b) (i) X – Concentrated sulphuric (VI) acid $\checkmark^{1/2}$

Y – Concentrated sodium hydroxide / potassium hydroxide $\checkmark^{1/2}$

(ii) To absorb CO_2 / SO_2 formed during the reaction $\checkmark$

(iii) Heat $\checkmark$

(iv) Its density is almost the same as that of air $\checkmark$



c) (i) Nickel $\checkmark^1$

(ii) A – Ethane $\checkmark^1$

B – Chloroethene $\checkmark$

(iii) - Not biodegradable hence pollutants $\checkmark$

- Produce toxic gases when burnt $\checkmark$

(iv) III – Polymerisation $\checkmark^1$

IV – Substitution $\checkmark^1$

(v) By hydration of K $\checkmark$ at 900°C using phosphoric (V) acid as $\checkmark$ a catalyst

OR

Hydrolysis of K by adding $\checkmark$ conc H_2SO_4 followed by water and then distilled $\checkmark$

(d) C_3H_6

5..a) (i) U – CaCO_3 / calcium carbonate

Z – CaO / calcium (II) oxide

W – CO_2 / carbon (IV) oxide

M – CO/ carbon (II) oxide

(ii) Black solid changes colour to brown✓

(iii) As a drying agent/manufacture of tooth paste/increase pH in acidic soils✓

(iv) $\text{CO}_2(\text{g}) + \text{C}(\text{s}) \longrightarrow 2\text{CO}(\text{g})$

(v) CO is poisonous✓ so experiment be done in fume cupboard✓

6. (a) P – Sulphur (IV) oxide ✓ 1 mk

Q – Sulphuric (IV) acid ✓ ½ mk

R – Sulphur (VI) oxide ✓ ½ mk

S – oleum✓ ½ mk

T – Ammonium sulphate✓ 1 mk

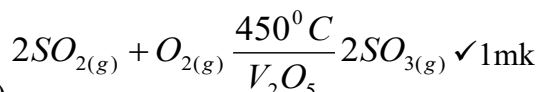
V – Carbon ✓ ½ mk

(b) (i) Increased pressure increases the yield due to increased collisions of molecules ✓ ½ mk

(ii) Removal of impurities such as dust ✓ ½ mk and water ✓ ½ mk

(c) Temperature 450°C
Pressure 2 – 3 atm
 V_2O_5 catalyst/platinum } 2 mk

(ii) V_2O_5 OR Pt



(iii)

Penalize ½ mk if no state symbols are indicated

Penalize ½ mk for unbalanced equation

(d) Mix a sample of P with acidified $\text{Cr}_2\text{O}_7^{2-}$ or MnO_4^- ✓ ½ mk decolourisation of MnO_4^- or turning of green of dichromate ion ✓ ½ mk

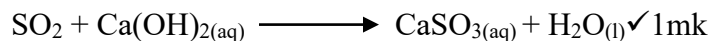
(e) Removal of the oxide coating from the metal ✓ 1mk

(f) (i) To prevent “sucking back” ✓ ½ mk this may be caused due to high solubility of SO_2 in water ✓ ½ mk

(ii) litmus paper turns red then white as SO_2 is an acidic gas ✓ 1mk

(g) White crystals of sucrose (sugar) will turn black and swell (✓ ½) it turns black due to removal of the elements of water to form carbon, and swells due to bubbling of gases ✓ ½

(h) SO_2 emitted in the process is neutralized by $\text{Ca}(\text{OH})_2$ in chimneys. This process is called scrubbing ✓ 1mk



7. a) i) To remove carbon (IV) oxide gas ✓ ½

ii) To dry the air ✓ ½

b) i) Black solid is formed ✓ ½

Volume of gas reduced because oxygen present combined ✓ ½ with copper to form CuO black ✓ ½

ii) $90 - 73.2 = 16.8\text{cm}^3$ ✓

iii) Gas is nitrogen

$$\frac{16.8}{90} \times 100 = 18.67\% \quad \checkmark 1$$

c) i) Nitrogen ✓ ½

ii) Impure ✓ 1 – it contains noble gases e.g. argon, neon e.t.c. ✓ 1

d) Mass of gas P = $188.942 - 184.257 = 4.685$ ✓ 1

Volume of gas P = $988.560 - 184.257 = 804.303$ ✓ 1

$P_1 = 733$

$P_2 = 760$

$$\begin{aligned}
 V_1 &= 804.303 & V_2 &= ? \\
 T_1 &= 296 & T_2 &= 273 \\
 V_2 &= \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{733 \times 804.303 \times 273}{296 \times 760} = 715.45 \checkmark 2 \\
 715.45 &\xrightarrow{\hspace{2cm}} 4.685\text{g} \\
 22400 &\xrightarrow{\hspace{2cm}} ? \\
 \frac{22400 \times 4.685}{715.45} &= 146.68 \checkmark 1
 \end{aligned}$$

8.

Fe	S	O	H ₂ O
20.2	11.5	23.0	45.3
56	32	16	18
0.36	0.36	1.44	2.52✓1mk
1	1	4	7

$$(\text{FeSO}_4 \cdot 7\text{H}_2\text{O}) = 278$$

$$278n = 278$$

$$n = 1 \checkmark 1\text{mk}$$

$$\text{Formula FeSO}_4 \cdot 7\text{H}_2\text{O} \checkmark 1\text{mk}$$

ii) No. of moles $\frac{6.95}{278} = 0.025 \text{ moles} \checkmark 1\text{mk}$

$$0.025 \text{ moles} \cdot 250 \text{ cm}^3$$

$$1000$$

$$\frac{0.025 \times 1000}{250} = \frac{25}{250} = 0.1 \text{ mole/litre} \checkmark 1\text{mk}$$

d)

- Add dilute HNO₃ acid to the carbonate ✓ 1mk
- Shake for the reaction to go to completion ✓ 1/2mk
- Add excess dilute HCl to the mixture ✓ 1/2mk
- Filter the residue is lead(ii) chloride ✓ 1/2mk
- Dry between filter paper to obtain solid PbCl₂ ✓ 1/2mk