233/2
CHEMISTRY MARKING SCHEME

1. i) y has a higher mpt than R ✓ ½
Due to increase in metallic bond strength✓ ½ from R to y as the No. of valency e^- increases

ii) Element Q✓ ½

iii) a) Giant atomic (Giant covalent) ✓ ½
b) Molecular ✓ ½
c) Giant ionic✓ ½

iv) a) Basic ✓ ½
b) Acidic ✓ ½

v) a) M✓ ½
b) D ✓ ½

vi) a) Mg_3A_2 ½
b) $Mg_3A_{2(s)} + 6H_2O_{(l)} \quad 3Mg(OH)_{2(aq)} + 2AH_{3(g)}$

vii) a) Diamond and graphite ✓ ½
b) Graphite ✓ ½
c) Diamond ✓ ½

viii) They are unreactive ✓ ½ /
They have filled up outermost energy levels ✓ ½

ix) Group 4, period 4 on the diagram ✓

x) a) x = 2.1

b) Atomic radius is greater than its ionic radius due to loss of one energy✓ ½

2. a) i) What are allotropes? (1mk)

these are different crystalline forms of an element that can exist at the same physical state.

ii) Name **two** main allotropes of sulphur.
(1mk)

Rhombic sulphur
Monoclinic sulphur

b)

i) Write an equation for the reaction taking place at:-

I. Burner or roasting furnace

(1mk)

$$4FeS_{(s)} + 7O_{2(s)} \longrightarrow 2Fe_2O_3 + 4SO_{2(g)}$$

II. Absorption tower

(1mk)

$$SO_{3(g)} + H_2SO_{4(l)} \longrightarrow H_2S_2O_{7(l)}$$

i) The reaction taking place in chamber K is:

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad DH = -96kJmol^{-1}$$

I. Explain why it is necessary to use excess air in chamber K.

(1mk)

To ensure that all the expensive sulphur (IV) oxide has been reacted completely o form sulphur (VI) oxide.

II. Name the catalyst used in chamber K.

(1mk)

- **Platinised asbestos/platinum**
- **Vanadium (V) oxide**

ii) Why is sulphur (vi) oxide dissolved in concentrated sulphuric (VI) acid instead of water.

(1mk)

Sulphuric (VI) acid dissolves in water producing a lot of heat which can change the acid into vapour which is injurious to the skin/pollutant/poisonous.

iii) State and explain the observation made when concentrated sulphuric acid is added to:-

I. Hydrated copper (II) sulphate.

(1mk)

The blue crystals turns into white after losing water molecules/conc. H_2SO_4 dehydrates hydrated copper (II) sulphate.

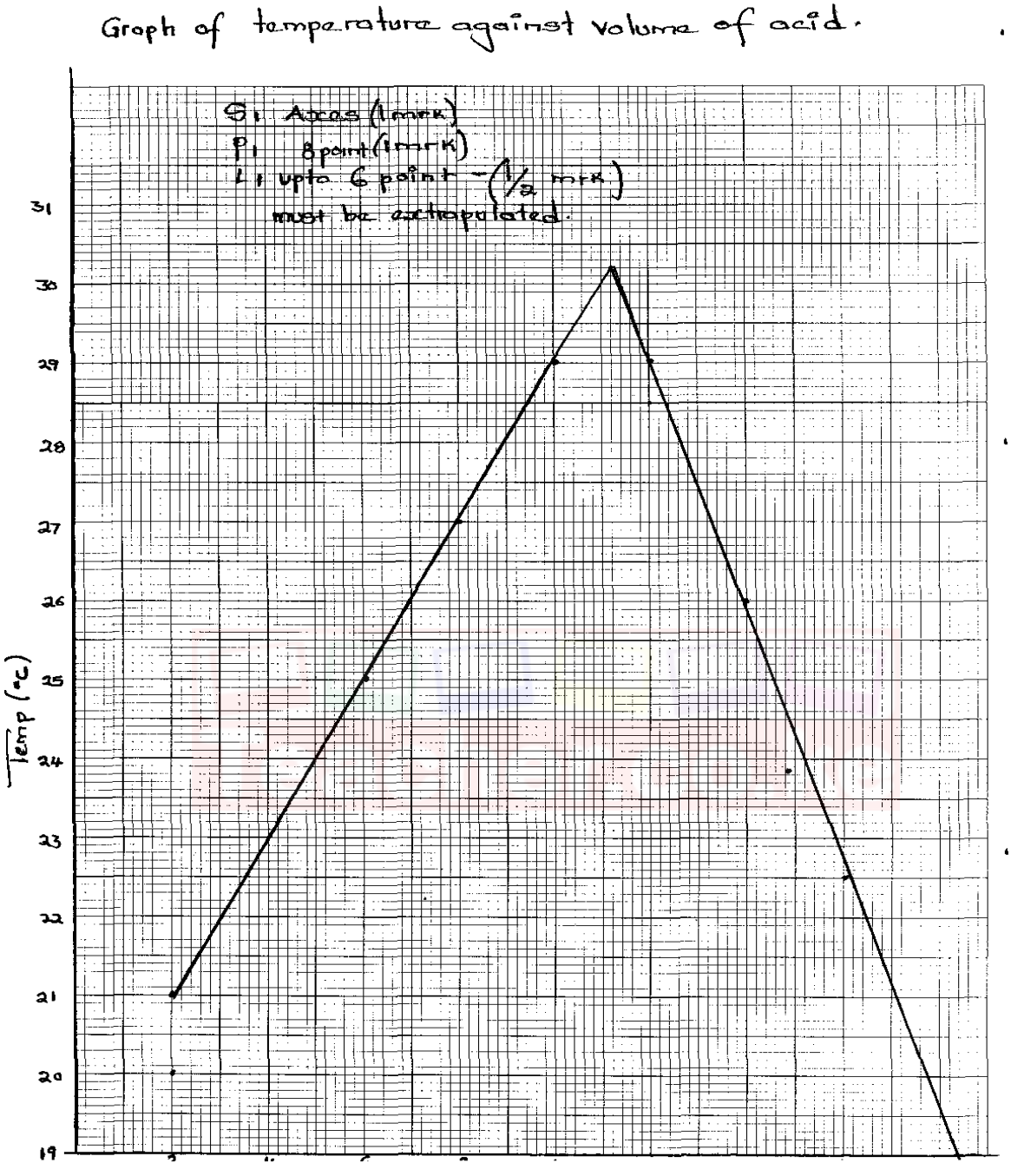
II. White sugar (1mk)

White sugar turns into a black mass. Conc H_2SO_4 removes elements of water (Hydrogen and oxygen) in the ratio 2:1.

iv) Give **two** uses of sulphuric (VI) acid. (1mk)

- **It is used in car batteries**
- **It is used to manufacture sulphate fertilizers.**
- **Used in manufacturing detergents**
- **Used in the manufacture of plastics.**

3.



(a) Labelling of both axis with the same intervals in each axis (1mk)

- 8 points correctly plotted (1mk)
- up to 6 point correctly plotted (½ mk)
- Below 6 points correctly plotted 0 mark
- Extra plotted lines of Best fit (1mk)

S = Scale – 1mk
P = points = 1mk

L = Line = 1mk must be extrapolated

(b) (i) 11.2 cm^3 $\pm$ 0.2 (1mk)

(ii) 30.1 ^0C – 19.0^0C = 11.1 $^0C \pm 0.2$ (1mk)

(c) (i) $\frac{20x2}{1000}$ ½ mk = 0.04 moles ½ mk

(ii) $\frac{11.2x2}{1000}$ (½ mk) = 0.224 moles ½ mk

(d) Mole ratio:

Base	:	Acid
0.04	:	0.0224
$\frac{0.04}{0.0224}$ = 1.78 ½ mk		$\frac{0.0224}{0.0224}$ = 1mk

Basicity of acid = 2 1mk

(e) ΔH = MCDT

= 31.2 x 4.2 x 11.1 (1mk)

= 1454.544J (½ mk)

0.04 moles produces 1454.544 J

1 mole produces ? x

X = $\frac{1454.544}{0.04}$ (1mk)

= $\frac{36363.6}{1000}$

= 36.3636 $KJmol^{-1}$ (½ mks)

If the negative sign is missing penalize ½ mk

(f) Heat loss to the apparatus // surrounding (1mk)

4.

$$F^{\theta}_{cell} = E\,reduction - E\,oxidation$$

(a) $= -0.13 - (-0.44)_2$ $\frac{1}{2}$

$= +0.31V$ $\frac{1}{2}$

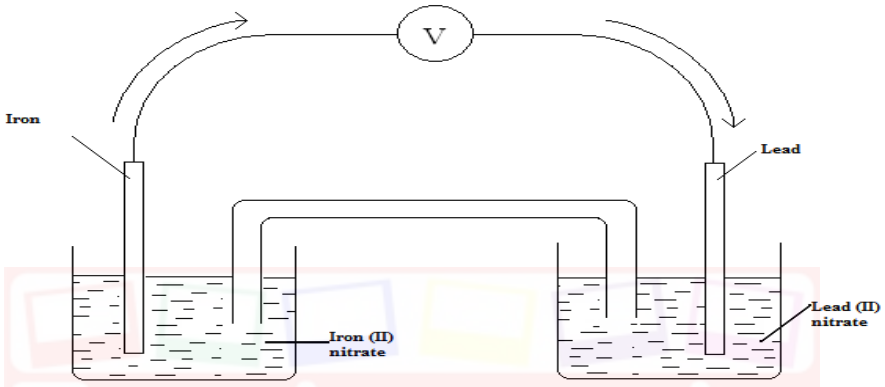
1

(b) (i) It competes the circuit by allowing ions carrying charge to move from one half-cell to the other; ✓ 1

(ii) It provides cations and anions which replace those consumed at the electrodes which balance the charges on any ions formed from electrodes;✓

1

(c)



(d) The e.m.f. will reduce with time because the ions/ same ions in the half –cells would have reduced ;✓ 1

(e)

(ii) $4OH^-_{(aq)} \rightarrow 2H_2O_{(l)} + O_2 + 4e$ ✓

oxygen gas formed at anode ✓

2

$2H^+_{(aq)} 2e \rightarrow H_{2(g)}$ ✓

Hydrogen gas formed at cathode✓

2

(iii)At Anode

$4OH^-_{(aq)} \rightarrow 2H_2O_{(l)} + O_2 + 4e$

1mole of electron carry 96,500 coloumbs

4 moles of electrons carry 4 x 96, 500 coloumbs

4x96,500 at s.t.p will liberate 22.4 litre of oxygen

$\therefore 0.025A \times 4 \times 60 \times 60$ *liberates*

$$= \frac{0.025 \times 4 \times 60 \times 22.4}{4 \times 96500}$$

$= 0.0209dm^3$ *or* $20.9cm^3$

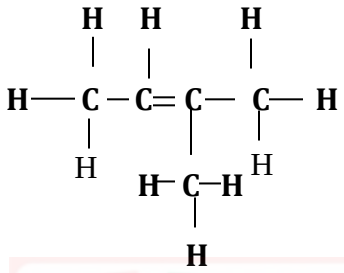
At cathode
1 mole of electron carry 96 500 coloumbs,
1mole of hydrogen when 0.025A were passed yielded

$$0.0209 \times 2$$

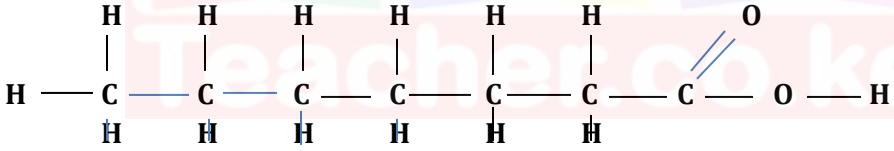
$$= 0.0418 dm^3 \ or \quad 41.8 \ cm^3.$$

5. a) Draw the structure of the following compounds:

i) 2-methylbut-2-ene
(1mk)



ii) Heptanoic acid (1mk)



b) i) What observation will be made in step I.
(1mk)

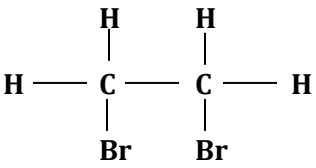
$KMnO_4/H^+$ turns from purple to colourless

i) Describe a chemical test that can be carried out to show the identity of compound C. (2mks)
It produces an effervescence of a colourless gas after addition of sodium carbonate or sodium hydrogen carbonate.

ii) Give the names of the following
(2mks)

I. E -**Polyethene**
II. Substance D -**Sodium ethoxide**

iii) Give the structural formula of the substance B.
(1mk)



iv) Name the type of reaction that occurs in:

I. Step II (1mk)

Dehydration

II. Step IV (1mk)

Hydrogenation

v) Give the reagent and conditions necessary for step (VI)

(2mks)

Reagent = Methanoic acid

Condition = Presence of conc. Sulphuric (VI) acid

= Warm

vi) State one application of the process represented by step (IV) (1mk)

Manufacture of margarine – hardening oils to fats.

6. a) i) The tube from a gas generator must be dipped in conc. Sulphuric acid 1mk

ii) I $Fe_{(s)} + 2HCl_{(g)} \longrightarrow FeCl_{2(s)} + H_{2(g)}$ 1mk

II $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}$ ✓ 1mk

iii) Experiment should be carried out in the fume chamber / in the open since $HCl_{(g)}$ Is poisonous✓ 1mk

A mixture of air and hydrogen gas explodes : air should be expelled before burning hydrogen gas at x ✓ 1mk

b) i) $Fe_{(s)} + 2HCl_{(g)} \longrightarrow FeCl_2 + H_{2(g)}$

56g - 2 x 24000

? 300

= $\frac{300 \times 56}{2 \times 24000}$ = 035 $_{(g)}$✓ ½

✓ ½. ✓ ½.

Mass remaining = 7.0 – 0.35g = 6.65

ii) $Fe(s) + H_2SO_{4(g)} \longrightarrow FeSO_4(ag) + H_{2(g)}$

56(g) - 1mole

6ts

No of moles of acid required = $\frac{6.65 \times 1}{56}$✓

= 0.1187 moles✓

$100cm^3$ —— 2moles

$\frac{0.11875}{2}$ x 1000 ← 0.11875 2mks

= **59.375cm^3**✓

7.

a) (i) Bauxite ✓ ½

(iv) P_ steel ✓ ½ Q graphite ✓ ½

Q is replaced frequently because it wears out / reacts with oxygen to form carbon 1 ½

(IV) oxide or carbon (II) oxide ✓ ½

1 ½

(v) It is heated ✓ so that ions one formed cryolite ✓ is added to lower the meting point of the aluminium (II)oxide (lower cost)

(b)

(i) Zinc – zinc blende ✓ ½

Pb – galena ✓ ½

1

(ii) Carbon ✓ ½

Carbon II oxide ✓ ½

1

(iii) $ZnO_{(s)} + CO_{(g)} \xrightarrow{heat} Zn_{(s)} + CO_{2(g)}$

or

$PbO_{(s)} + CO_{(g)} \xrightarrow{heat} Pb_{(s)} + CO_{2(g)}$

(c) Dipping of Iron (Iron sheets) in molten Zinc.