UNNASE CHEM-2 (S·4) - 2019

Subject ..... Paper code (1) ...../..... Personal Number

CORRECT ANSWER / ~~SCHEME~~ MARKS ALLOWED SCORE

a) White ~~solid~~ turns yellow and then back to white on cooling. 1½

b) ~~Brown~~ Black crystals turn to purple vapour/violet and a ~~brown~~ black sublimate is observed in the cooler parts. 2

c) White crystals melt, produce brown fumes and shiny grey solid formed. 1½

5

a) (i) W ½
(ii) Y ½

b) (i) X_2Z_3 1
(ii) YZ_2 1

c) (i) YZ_2 will not conduct electricity ½

(ii) It is a covalent compound. 1

4½

a) (i) White crystals produce crackling ~~sound~~ / decrepitation, melt, produce ~~brown~~ fumes and a reddish-brown ~~residue~~ when hot and ~~yellow~~ on white powder. reddish-brown residue when hot and yellow on ~~cooth~~ cooling

Paper code ..... / ..... Personal Number

(2)

cooling remained.

$PbCO_3(s) \longrightarrow PbO(s) + CO_2(g)$ 1½

i) White powder dissolved with effervescence of a colourless gas. white precipitate insoluble in excess. 1

$PbCO_3(s) + 2HNO_3(aq) \rightarrow Pb(NO_3)_2(aq) + CO_2(g) + H_2O(l)$ 1½

How: $Pb^{2+}(aq) + 2\bar{O}H(aq) \rightarrow Pb(OH)_2(s)$

(5½)

An allotrope is one of the physical forms of an element which is in the same physical state other forms of the same element. Isotope is an atom of an element it has same atomic number as other atoms of the element but has different mass number.

(i) $^{14}_{6}C$ 1

(ii) 8 neutrons 1

i) Graphite conducts electricity. 1

Subject ..... Paper code ...../..... (3) NO. Personal Number

(ii) It is radioactive ✓ 1

(5)

5 (a) (i) $BaCl_2$ ✓ ½

(ii) It is soluble. ✓ ½

(b) A white precipitate ✓ soluble in excess ✓ carbon dioxide. 1

(c) (i) Precipitation ✓ method. / double decomposition 1

(ii) $Ba^{2+}(aq) + 2\bar{O}H(aq) \longrightarrow Ba(OH)_2(s)$ ✓ ✓ ½

(d) A white precipitate. ✓ ½

(5)

6 (a) ~~Name~~

(i) Fermentation ✓ ½

(ii) Concentrated sulphuric ✓ acid ½

(b) (i) $n H_2C=CH_2 \longrightarrow -(CH_2CH_2)_n-$ ✓ 1

(ii) RFm of $C_2H_4 = (12\times2) + (1\times4)$

$= 28$ ✓

No of ethene molecules $= \frac{16800}{28}$ ✓ 2

$= 600$ ✓

ject ..... Paper code (A) ...../..... Personal Number

1. J pollutes environment. 1

(5)

1 % of oxygen in T is 100-70=30% ✓✓

Element	Fe	O
% by mass	70	30
umber of moles ; atoms	$\frac{70}{56}$	$\frac{30}{16}$ ✓✓
	(1·25 ✓	1·875 ✓✓
Ratio of moles	$\frac{1·25}{1·25}$:	$\frac{1·875}{1·25}$
	1 :	1·5
mplest ratio	2 :	3 ✓

$3\frac{1}{2}$

implest formula is Fe_2O_3 ✓✓

$(Fe_2O_3)_n = 160$

$[(56\times2) + (16\times3)]_n = 160$

$160n = 160$ ✓

$n = 1$ ✓

Formula of the oxide is Fe_2O_3. ✓

2(i) Haematite ✓ OR Limonite

Reject Fe_2O_3

(ii) $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$ ✓✓

(iii) Iron(III) sulphate ✓✓

(5)

Subject ..... Paper code ..... / ..... Personal Number

(5)

3 (a) (i) Nitric acid. ✓ 1

(ii) Nitrate ion, OR NO_3^- ✓ 1

(iii) Freshly prepared iron(II) sulphate and concentrated sulphuric acid. ✓ 1

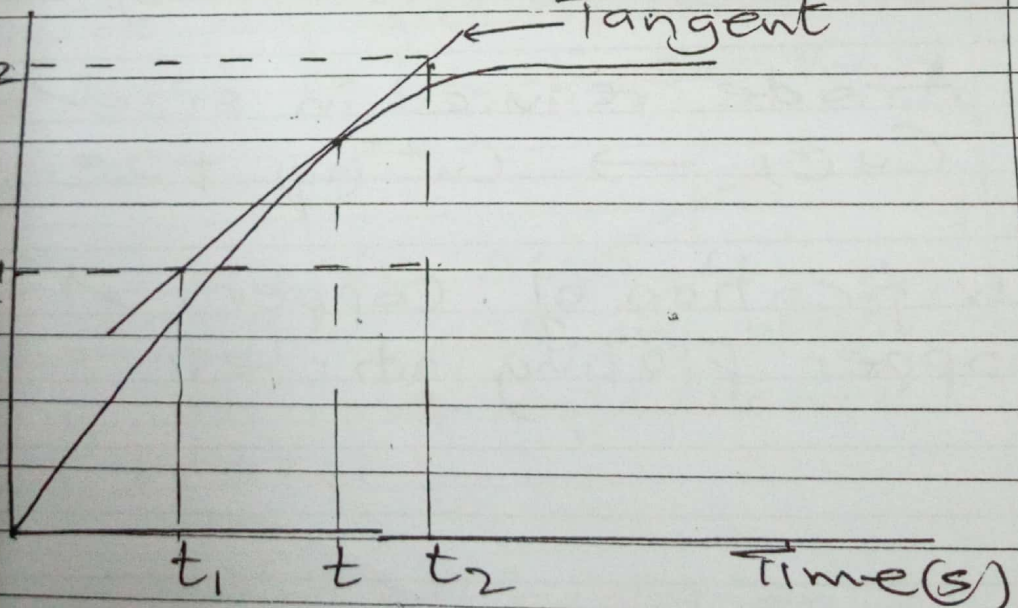
(iv) Brown ring ✓ ½

(b) $4HNO_{3(g)} \rightarrow 4NO_{2(g)} + 2H_2O_{(l)} + O_{2(g)}$ ✓ ✓ 1½

(5)

7 (a) The higher the concentration of the acid, the faster is the rate and vice-versa ✓ 1

(b)



(i) The gradient / slope / area under the curve, would be determined ✓ 1

$= V_2 - V_1 / t_2 - t_1$ OR EQUIVALENT

Subject ..... Paper code: 6 ..... Personal Number

ii) Rate of reaction at t seconds $= \frac{V_2 - V_1}{t_2 - t_1}$ $cm^3 s^{-1}$ 1

(OR EQUIVALENT)

c). Using a powdered Magnesium or ground magnesium instead of ribbon
• Heat the reaction mixture. 1

4

a)(i) Bubbles of colourless gas ½
(ii) Brown solid deposit ½

b) $4\bar{O}H(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e$ 1½

c) (i) Anode reduced in size ½
(ii) $Cu(s) \rightarrow Cu^{2+}(aq) + 2e$ 1

d). Purification of copper. ½
Copper plating articles.

5

Subject ..... Paper code 77...../..... NO. Personal Number

in this margin

(a) Concentrated sulphuric acid which is a liquid is added from a tap funnel onto solid sodium chloride in a flask fitted with a delivery tube. Heat the mixture gently to increase the rate of evolution of the gas according to the equation: 5½

$$NaCl_{(s)} + H_2SO_{4(l)} \rightarrow NaHSO_{4(s)\ (aq)} + HCl_{(g)}$$

Pass the gas through concentrated sulphuric acid, which dries it and shows the rate at which the gas is evolved.
Collect the dry gas by downward delivery since it is denser than air.

(b)(i) Hydrochloric acid ½
(ii) Absorb the gas in water using an inverted funnel in a beaker. 1½

(c) For a solution of hydrogen chloride in:
* Water; bubbles of a colourless gas. This is because water

Signature .....

Subject ..... Paper code ...../..... Personal Number

(8)

being a polar solvent enabled ionisation of hydrogen chloride to give hydrogen ions among others that reacted with magnesium to produce hydrogen gas.

$Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$

* Methylbenzene, No observable change. 4

Methylbenzene is a non-polar solvent so does not cause ionisation of hydrogen chloride leading to no reaction of the solution with magnesium.

(d) $HCl(g) + Ag^+(aq) \rightarrow AgCl(s) + H^+(aq)$ 1½

(e)(i) $MnO_2(s) + 4HCl(aq) \rightarrow MnCl_2(aq) + Cl_2(g) + 2H_2O(l)$ 1½

(ii) Laboratory preparation of chlorine. ½

(15)

12 (a)(i) Sodium chloride Reject Brine 1

(ii) A mixture of sodium chloride and calcium chloride is

Subject ..... Paper code (9) ...../..... No. Personal Number

melted and the molten is introduced into a downs cell. Sodium (molten) is formed at the iron cathode; by electron gain.

$Na^+_{(l)} + e \longrightarrow Na_{(l)}$

While chlorine is produced at the graphite anode

$2Cl^-_{(l)} \longrightarrow Cl_{2(g)} + 2e$ 6

NB: Calcium chloride helps to lower the melting point of sodium chloride.

(b)(i) Sodium burns in dry chlorine to form a white solid.

$2Na_{(s)} + Cl_{2(g)} \longrightarrow 2NaCl_{(s)}$ 2

(ii) In limited oxygen supply, sodium burns to form sodium oxide. (white solid)

$4Na_{(s)} + O_{2(g)} \longrightarrow 2Na_2O_{(s)}$

In plentiful supplify of oxygen, sodium burns with yellow flame to form a yellow solid. 4

$2Na_{(s)} + O_{2(g)} \longrightarrow Na_2O_{2(s)}$

Subject ..... Paper code ...../..... Personal Number

10

(iii) Sodium melts into a silvery ball that darts about on water surface producing hissing sound, heat and leaves a soapy solution 2

$2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

15

13 (a) (i) Black solid dissolved to form a blue/green solution. 1

(ii) $CuO_{(s)} + 2HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + H_2O_{(l)}$ 1½

$CuO_{(s)} + 2H^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + H_2O_{(l)}$

(iii) Filter off excess copper(II) oxide. Heat the filtrate until it is saturated. Allow the solution to cool so that the crystals of copper(II) nitrate can form. Filter off the crystals and wash them with a little distilled water. Dry the crystals between filter paper. 4

in this margin

Subject ..... Paper code (11) /..... Personal Number NO.

(b) (i) Lead(II) ion ✓ ½

(ii) Copper(II) ion ✓ Magnesium (II) ions ½

(c) (i) Potassium iodide solution. Yellow precipitate is formed ✓ 1½

(ii) $Pb^{2+}(aq) + 2I^{-}(aq) \rightarrow PbI_2(s)$ ✓ 1½

(d) Aqueous ammonia solution is added to the cation residue. Blue precipitate soluble in excess ammonia solution to form a deep blue solution. 4½

$Cu^{2+}(aq) + \bar{O}H(aq) \rightarrow Cu(OH)_2(s)$

$Cu(OH)_2(s) + 4NH_3(aq) \rightarrow Cu(NH_3)_4^{2+}(aq) + 2\bar{O}H(aq)$

Aqueous ammonia solution was added to the solution of the residue white precipitate insoluble in excess

$Mg^{2+}(aq) + 2\bar{O}H(aq) \rightarrow Mg(OH)_2(s)$

45

Signature .....

Subject ..... Paper code ...../..... Personal Number

12

(a)(i) A substance which when burnt in oxygen, releases heat energy. 1

(ii) Filling thermometers, beverage OR making drugs. OR EQUIVALENT. 1

(iii) When a substance is burnt, chemical energy stored in it is converted into heat energy, which is released to the surroundings. This energy is known as combustion energy. If however the heat energy change is a result of burning of one mole of the substance completely, then the energy term is called enthalpy of combustion 2

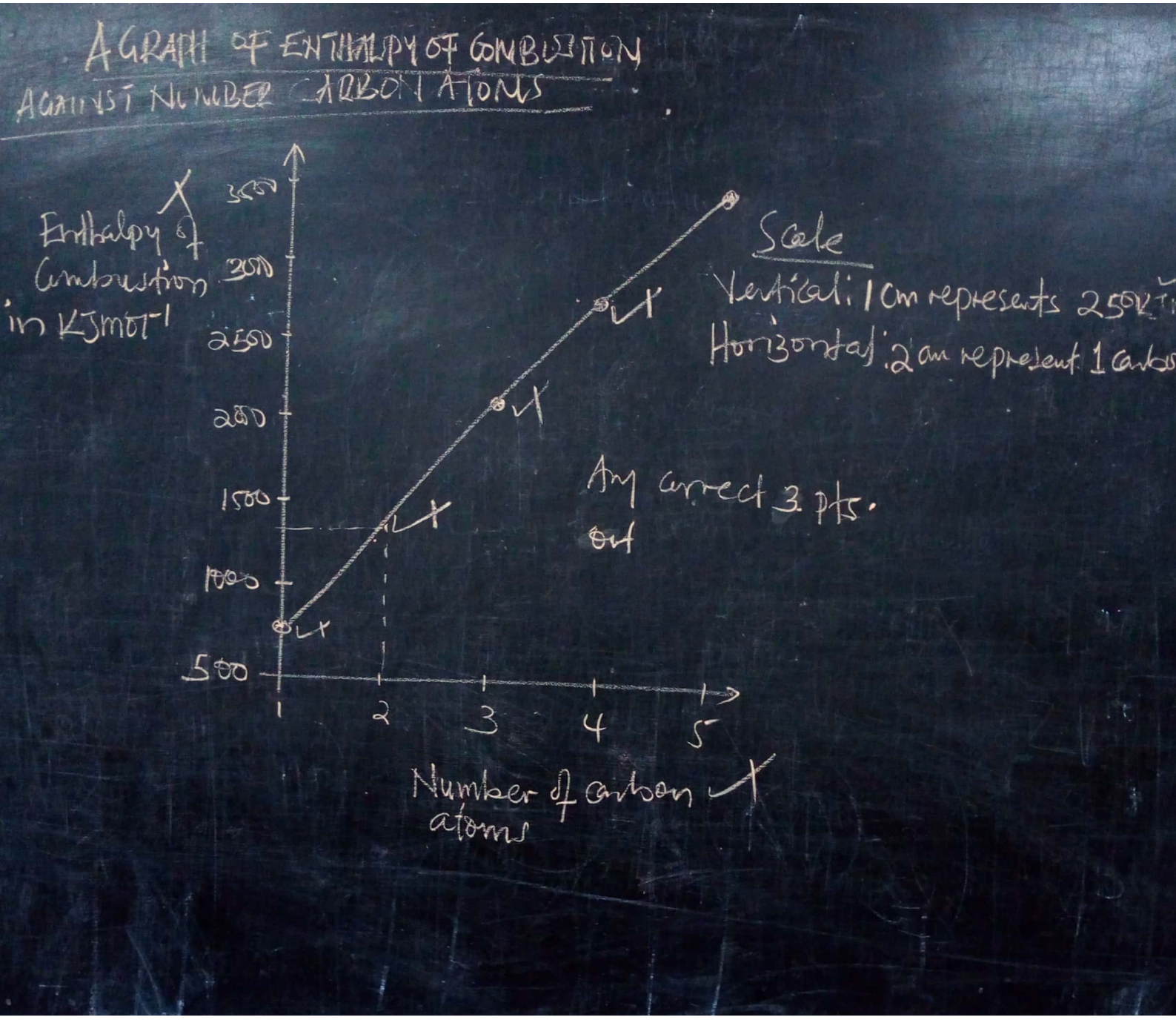
(iv) $C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(l)}$
or (aq)

(b)(i) SEE GRAPH: AXES = 1 ✓ scales 1 ✓
Plots = 1 ✓ shape = 1 ✓ 4

(ii) $-1360\ kJ\ mol^{-1}$

(iii) Since 3C = $-2020\ kJ$, ✓ ½

A GRAPH OF ENTHALPY OF COMBUSTION AGAINST NUMBER CARBON ATOMS



$6C = 2x - 2020$

$= -4040 \text{ kJ mol}^{-1}$ ½

NB: (Accept any CORRECT value, which corresponds to that of any one of the alcohols given in the table)

(c)(i) Heat lost by EtOH = heat gained by water

$= \frac{200 \times 4.2 \times 20}{1000}$ ✓

Mass of 1 mole of EtOH = (2×12)+6+16

= 46. ✓1

Let $\frac{m}{46}$ be moles ethanol used

where m is mass of ethanol

Since 1 mole produces 1 BOK 2

∴ $\frac{m}{46}$ mole of EtOH produced $\frac{200 \times 4.2 \times 20}{1000}$

1 mole " " $\frac{200 \times 4.2 \times 20}{1000} \times \frac{46}{m}$

$\Rightarrow \frac{200 \times 4.2 \times 20 \times 46}{1000 m} = 1360$

$m = 0.57\text{g}$ ✓1

Allow $= 0.6\text{g}$

Signature ....

Subject ..... Paper code ...../..... Personal Number

14

(ii) Determination of calorific value of a food item.
OR Determination of energy content of fuels.

15