Model Answer of UEC TRIAL EXAMINATION (2010)
CHEMISTRY

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

SECTION A COMPULSORY QUESTIONS (24%)

1. 3,1,4,2 2. F,T,F,F

3 a. $3\ Cl_2 + 6$ conc.NaOH $\xrightarrow{heat}$ $5\ NaCl + NaClO_3 + 3\ H_2O$

b. $2\ F_2(g) + 2\ H_2O \rightarrow 4\ HF + O_2$

c. $2\ HClO \xrightarrow{sunlight} 2HCl + O_2$

d. $2\ NaBr + 2$ conc. $H_2SO_4 + MnO_2 \xrightarrow{heat} Br_2 + Na_2SO_4 + MnSO_4 + 2\ H_2O$

4.

Structural formula of organic compound	Reagent	observation
C_6H_5OH	Iron (III) chloride solution	Violet solution is formed
$CH_3COCH_2CH_3$	Sodium hydroxide and iodine solution	CH_3CH_2COONa and yellow precipitate of iodoform, CHI_3 is observed. Moleuclar formula of the organic compound is C_4H_8O.
CH_3COOH	Sodium carbonate	Limewater turns milky.
$CH_3CH{=}CHCH_3$	Bromine in tetrachloromethane	Reddish brown of bromine is decolorized.

5. a. Compare experiment 2 and 3, concentration of A is increased by 4 times, initial reaction rate is approximately equal, hence the order of reaction is zero order with respect to A.

b. Compare experiment 1 and 2, concentration of B is increased by 4 times, initial reaction rate is increased by 16 times , hence the order of reaction is second order with respect to B.

c. rate = $k[B]^2$

d. $$\frac{Y}{1.07\times10^{-2}} = \left(\frac{0.233}{0.136}\right)^2$$

$$Y = 0.0314(molL^{-1}\sec^{-1})$$

6. a. Potassium oxide will dissolve in water to produce an alkaline solution, so it turns the solution to pink, because the indicator phenolphthalein gives pink in basic solution. The equation of reaction is $K_2O\ (s) + H_2O(l) \rightarrow 2\ KOH(aq)$

$$n(N_2) = \frac{1.4}{28} = 0.05mol$$

b. $$n(He) = \frac{4}{40} = 0.1mol$$

$$v = \frac{nRT}{P} = \frac{0.15(8.314)(473)}{1.01\times10^5} = 5.84\times10^{-3}(m^3) = 5.84L$$

Section B Elective Questions (36%)

1(a) (i) C_4H_9Br

B is $CH_2=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH_3$ (iv) C is $CH_3-\underset{\displaystyle Br}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3$

(iii) $CH_3-\underset{\displaystyle Br}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3 + NaOH(aq) \longrightarrow CH_3-\underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3 + NaBr$

1(b) CH_3CH_2CHO being an aldehyde, reduces Tollen's reagent to give a silver mirror but CH_3COCH_3 being a ketone is unable to. Equation is:

$3\ OH^- + CH_3CH_2CHO + 2Ag(NH_3)_2^+ \rightarrow CH_3CH_2COO^- + 2\ Ag + 4\ NH_3 + 2H_2O$

1(c) (i) 4- bromobenzoic acid

(ii) step I : warm with bromine in the presence of $AlBr_3$ as catalyst

step II: warm with acidified $KMnO_4$ solution

(iii) G is Br—  —CH_3

2(a)

P is $H-C(=O)-O-C(=O)-H$ Q is $H-C(=O)-ONa$

R is $H-C(-H)(-H)-O-H$

(ii) P and Q will reduce Tollen's reagent.

2(b).

$$\text{step I}: CH_3CH_2OH \xrightarrow{KMnO_4, H^+} CH_3CHO$$

$$\text{step II}: CH_3-C(=O)-H + HCN \longrightarrow CH_3-C(-OH)-CN$$

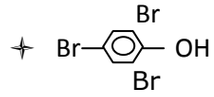
$$\text{step III}: CH_3-C(-OH)-CN + 2H_2O \xrightarrow{H^+} CH_3-C(-OH)-COOH + 2NH_3$$

2(c) (i) condensation polymer

(ii)

2(d) $CH_3CH_2OCH_2CH_3$

$(CH_3)_2CHOH$



3(a) (i) Order of increasing boiling point is

HCl < HBr< HI< HF

(ii) The order of increasing thermal stability is HI< HBr< HCl < HF because the bond strength of H-X becomes weaker down the group as size of halogen becomes larger, thus thermal stability of hydrogen halides is decreasing down the group.

(iii) HI is the strongest acid.

(iv) white fumes is formed because hydrogen chloride will dissolve in moisture in air to give tiny droplets of hydrochloric acid.

(b)(i) concentrated sulphuric acid

(ii) $NaCl + H_2SO_4 \rightarrow HCl + NaHSO_4$

(c) HCl is the limiting reagent , volume of chlorine gas is 24L.

4. a. chlorine gas

b. $4\,HCl + MnO_2 \rightarrow Cl_2 + MnCl_2 + 2\,H_2O$

c. (i) turns red then bleached it.

(ii) Purple color of I_2 in CCl_4 will be seen. Chlorine will oxidize I^- ions in KI to I_2 which dissolve readily in CCl_4. The equation of reaction is

$2KI + Cl_2 \rightarrow 2\,KCl + I_2$

(iii) White precipitate is formed. It will dissolve when an excess amount of gas is continuously passed through it because soluble complex ion, $PbCl_4^{2-}$ ion is formed.

(i) No observable change

(ii) $Cl_2 + Na_2SO_3 + H_2O \rightarrow 2\,NaCl + H_2SO_4$

Oxidising agent is Cl_2 ; reducing agent is Na_2SO_3

5. a.

$$(i)K_p = \frac{P_{co}^{\ 2}}{P_{co_2}}$$

(ii) initial total pressure = 5.0 atm

$$n = \frac{PV}{RT} = \frac{5(2)}{0.0821(1160)} = 0.105mol$$

$$(iii)P_T = P_{CO} + P_{CO_2}$$

$$P_{CO} = 8.37 - 1.63 = 6.74atm$$

$$(iv)K_p = \frac{6.74^2}{1.63} = 27.9$$

b. $CaSO_4(s) \rightleftharpoons Ca^{2+}(aq) + SO_4^{\ 2-}(aq)$

$$(i)K_{sp} = [Ca^{2+}][SO_4^{\ 2-}]$$

$$(ii)S = \sqrt{K_{sp}} = \sqrt{2.0\times10^{-5}} = 4.47\times10^{-3}(mol/L)$$

$$(iii)ionic\ \ product = [Ca^{2+}][SO_4^{\ 2-}]$$

$$= \left(\frac{50\times0.08}{350}\right)\left(\frac{300\times0.05}{350}\right)$$

$$= 4.90\times10^{-4}$$

Because ionic product > K_{sp}, *precipitate will form.*

$$5(c)k_a = c\alpha^2$$

$$\alpha = \sqrt{\frac{K_a}{c}} = \sqrt{\frac{1.8\times10^{-5}}{0.06}} = 0.01732 = 1.73\%$$

deg*ree of ionisation is* 1.73%

6.

$(a)(i)Ag^+ + e \longrightarrow Ag$

(ii) $1\,F$ 108 Q = It

Q 0.5 $\therefore 446.8 = 0.5t$

$Q = \frac{0.5\times96500}{108} = 446.8C$ t = 893.5 seconds

(iii) $4\,OH^-(aq) \rightarrow O_2(g) + 2\,H_2O(l) + 4e$

(iv) $4\,AgNO_3 + 2\,H_2O \rightarrow 4\,Ag + O_2 + 4\,HNO_3$

(v) Electrode D becomes smaller as copper electrode dissolved. Equation of reaction is $Cu(s) \rightarrow Cu^{2+}(aq) + 2e$

b. (i) The order of increasing reducing strength is Z<X<Y

(ii) metal Y and Z

(ii) $(iii)Y \longrightarrow Y^{2+} + 2e$ $\varphi = 2.89V$

$Z^{3+} + 3e \longrightarrow Z$ $\varphi = 1.50V$

Equation of reaction is $3Y + 2\,Z^{3+} \rightarrow 3Y^{2+} + 2Z$

$E^\circ = 2.89 + 1.50 = 4.39(V)$
