Model Answer of (Third Week)
Final and Graduated Exams 2017

Question (1)

(A) The scientific expressions :

1- Indicators
2- standard solution
3- K_w (Ionic product of water)
4- PH value
5- Faraday
6- Faraday's second law
7- alkylation (Friedel – Craft's reaction)
8- Nitration
9- degree of solubility
10- detergents

(B) How can you obtain :

(1) $CH_3(CH_2)_4 - CH_{3(\ell)} \xrightarrow[\Delta]{pt}$  $_{(\ell)} + 4H_{2(g)}$

normal hexane

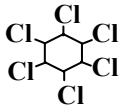
 $_{(\ell)} + 3H_{2(g)} \xrightarrow[\text{heat, pressure}]{Ni}$  $_{(\ell)}$

cyclo hexane

(2) $CaC_{2(s)} + H_2O_{(\ell)} \xrightarrow{\text{Drop wise}} Ca(OH)_{2(aq)} + C_2H_{2(g)}$

Calcium Carbide

$3C_2H_{2(g)} \xrightarrow[\text{tube}]{\text{Red hot Ni}}$  $_{(\ell)}$

 $_{(\ell)} + 3Cl_{2(g)} \xrightarrow{UV}$  $C_6H_6Cl_{6(\ell)}$

Gamixane

(3) $Fe(COO)_2$ $_{(s)} \xrightarrow[\text{in absence of air}]{\text{heat}} FeO_{(s)} + CO_{(g)} + CO_{2(g)}$

$4FeO_{(s)} + O_{2(g)} \xrightarrow{\text{heat}} 2Fe_2O_{3(s)}$

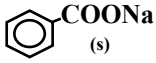
$3Fe_2O_{3(s)} + CO_{(g)} \xrightarrow{230\text{-}300} 2Fe_3O_{4(s)} + CO_{2(g)}$

(4) $(CH_3COO)_2Pb_{(aq)} + H_2S_{(g)} \rightarrow 2CH_3COOH_{(aq)} +$ $PbS_{(s)}$

$2AgNO_{3(aq)} + Na_2S_{(aq)} \rightarrow 2NaNO_{3(aq)} +$ $Ag_2S_{(s)}$

$CuSO_{4(aq)} + H_2S_{(g)} \xrightarrow{HCl} H_2SO_{4(aq)} +$ $CuS_{(s)}$

black ppt

(5)  $_{(s)} + NaOH_{(s)} \xrightarrow[\Delta]{CaO} Na_2CO_{3(s)} +$  $_{(\ell)}$

 $_{(\ell)} + CH_3Cl \xrightarrow[\text{heat}]{AlCl_3}$  $_{(\ell)} + HCl_{(g)}$

(6) $2CH_{4(g)} \xrightarrow[\text{Fast cooling}]{1500^\circ C} C_2H_{2(g)} + 3H_{2(g)}$

$3C_2H_{2(g)} \xrightarrow[\text{tube}]{\text{Red hot Ni}} C_6H_{6(\ell)}$

 $_{(\ell)} + HNO_{3\,Conc.\,(\ell)} \xrightarrow[\text{hot}]{H_2SO_4\ Conc.}$  $_{(\ell)} + H_2O_{(v)}$

 $_{(\ell)} + Cl_{2(g)} \xrightarrow[UV]{FeCl_3}$  $_{(\ell)} + HCl$

(7) $CH_3-\underset{\displaystyle CH_3}{CH}-CH_2-CH_2-CH_2-CH_{3(\ell)} \xrightarrow[\Delta]{pt}$  $_{(\ell)} + 4H_{2(g)}$

 $_{(\ell)} + CH_3Cl_{(g)} \xrightarrow[\text{heat}]{AlCl_3}$  $_{(\ell)} + HCl_{(aq)}$

(8) $2CH_{4(g)} \xrightarrow[\text{fast cooling}]{1500^{oC}} C_2H_{2(g)} + 3H_{2(g)}$

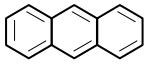
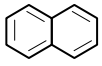
$HC \equiv CH_{(g)} + H_{2(g)} \xrightarrow{Ni} CH_2=CH_{2(g)}$

$CH_2=CH_{2(g)} + H_2O_{(\ell)} + (O) \xrightarrow[\text{alkaline medium}]{KMnO4} \underset{\displaystyle OH}{CH_2} - \underset{\displaystyle OH}{CH_2}$ $_{(aq)}$

(C)

(1) 4- bromo-1-chloro-2-nitro benzene	(2) 2- phenyl propane	(3) 1-chloro ehtene Or Vinyl chloride
(4) methyl cyclo hexane	(5) 1,1- diphenyl methane	(6) 4-bromo-1,2-dichloro benzene

(D) Name of organic compounds :

1- DDT
2- Anthracene 
3- T.N.T
4- P.V.C
5- Teflon
6- Vinyl alcohol
7- $CH_3 - O - CH_3$
8- C_2H_2
9- 2-butene
10-  (Naphthalene)

(E) 1- hydrated salt $\xrightarrow{\text{heat}}$ anhydrated salt + water

$BaCl_2.XH_2O$ → $BaCl_2$ + XH_2O

2.6903 gram → 2.2923 gram + 0.398 gram

$(137 + 35.5 \times 2)$ $X(1 \times 2 + 16)$

$$\text{(X) No. of water molecules} = \frac{0.398 \times 208}{18 \times 2.2923} = 2$$

∴ Molecular formula of salt : $BaCl_2 , 2H_2O$

$$\text{Percentage of water of crystallization of the hydrated salt (Practical)} = \frac{0.398}{2.6903} \times 100 = 14.7\% \text{ (Practical)}$$

$$\text{Percentage of water of crystallization of the hydrated salt (Theortical)} = \frac{2(2 \times 1 + 16)}{208 + 2(18)} \times 100$$

$$= \frac{36}{244} \times 100 = 14.7\ \% \text{ (theoretical)}$$

2- Mixture mass : one gram

Mixture contain $(NaOH + Na_2SO_4)$

$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

At end point

No. of moles (NaOH) = 2 (No. of moles (H_2SO_4))

$$\frac{\text{mass of NaOH}}{\text{Molar mass}} = 2 \text{ (Molarity} \times \text{Volume in Liter)}$$

$$\frac{\text{mass of NaOH}}{\text{Molar mass}} = 2\ (0.2 \times \frac{20}{1000})$$

Mass of NaOH = $40 \times 2\ (0.2 \times 0.02) = 0.32$ gram

$$\text{\% of NaOH in mixture} = \frac{\text{mass of NaOH}}{\text{Molar mass}} \times 100$$

$$\frac{0.32}{1} \times 100 = 32\%$$

(F) a) 6 moles b) 2 moles c) 7 moles d) 2 moles

Question (2)

(A)

(1) 2 , 3 (5) 2 , 3 , 4 (9) 6	(2) 5 , 6 (6) 6 (10) 5 , 6	(3) 2 , 1 (7) 1 (11) 1	(4) 4 (8) 4 (12) 2	(13) 6

(B) Choose the proper answer :

(1) d (4) b (7) d	(2) b (5) C (8) c	(3) b (6) a (9) b	(10) d

(C)

Alloy	Components of alloy	Types of alloys
Bronze	Cu + Tin	
Brass	Cu + Zn	
Steel	Fe + C	Interstitial
Cementite	Fe + C (Fe_3C)	Intermetallic
Galvanized iron	Fe + Zn	
Stainless steel	Fe + Cr	Substitutions

(D) Give reasons for :

1- This is because the cryolyte acts a solvent and the fluorspar decrease melting point of mixture from 2045^{oc} to 950^{oc} .

2- The bond angle in cyclo propane equal 60^{o} (small angle) lead to weak overlap between the atomic orbitals , there for the combination between carbon atoms are very weak, they are very active (for example) cyclo propane forms with air an extremely burning mixture .

3- Due to form hydrogen bonds with water molecules and prevent their combination with each other in the form of ice crystalses .

4- Because the conductor takes place through the movement of electrons , while $CuSO_4$ solution is electrolytic conductors because the conductor takes place through the movement of its ions .

5- Because the salt is derived from a strong (HCl) acid and weak alkali (NH_4OH)

$$NH_4Cl \longrightarrow NH_4^+ + Cl^-$$
$$HOH \rightleftharpoons OH^- + H^+$$
$$NH_4Cl + H_2O \rightleftharpoons NH_4OH + H^+ + Cl^-$$

weak alkali (strong acid)

Concentration of H^+ ions more than concentration of OH^- ions and the solution is acidic effect on litmus paper .

6- Because it attracts to the lone pair of electrons in oxygen atom of the water molecule and combines with water molecule by a coordinate bond this protons is called (hydrated proton) or hydronium ion (H_3O^+)

$$HCl \longrightarrow H^+ + Cl^-$$
$$H^+ + H_2\ddot{O} \longrightarrow (H_3O)^+$$
$$HCl_{(g)} + H_2O_{(l)} \longrightarrow (H_3O)^+_{(aq)} + Cl^-_{(aq)}$$

(7) $Fe_{(s)} + 2HCl_{(aq)} \xrightarrow{dil} FeCl_{2(aq)} + H_{2(g)}$

Due to presence hydrogen gas as reducing agent

$2Fe_{(s)} + 3Cl_{2(g)} \xrightarrow{heat} 2FeCl_{3(s)}$

Due to presence chlorine gas as oxidizing agent .

(E) 1- Compare between :

P.O.C	Blast Furnace	Midrex Furance
1- Source of reducing agent	Coke	Natural gas
2- Reducing agent	CO	$(CO + H_2)$ water gas
3- Equation to obtain iron	$Fe_2O_{3(s)} + 3CO_{(g)} \xrightarrow{700\text{-}900} 2Fe_{(s)} + 3CO_{2(g)}$	$2Fe_2O_{3(s)}\ 3CO_{(s)} + 3H_{2(g)} \xrightarrow{heat} 4Fe_{(s)} + 3CO_{2(g)} + 3H_2O_{(g)}$

2- Chemical equilibrium	Ionic equilibrium
It is a state of equilibrium in the reversible reaction at which the rate of forward reaction equals the rate of backward reaction.	It is the equilibrium arising between molecules of a weak electrolyte and the ions resulting from it .

3- Hydrolysis of salt solution	Neutralization
It is the reaction of the salt with water to form the acid and alkali from which the salt is dervied .	It is the reaction of an acid with an alkali to form a salt and water .

P.O.C	Mercury cell	Fuel cell
1. Type	Primary cell	Primary cell
2. Anode	Zinc electrode	Vessel contains hydrogen
3. Cathode	Mercury oxide electrode	Vessel contains oxygen
4. electolyte	Potassium hydroxide	Hydrated KOH
5. E.M.F	1.35 volt	1.23 volt
6. The total reaction	$Zn^0 + HgO \rightarrow ZnO + Hg^0$	$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O$

(F) 1- $Mg(OH)_2 \rightleftharpoons Mg^{+2} + 2(OH^-)$ ⟶ (1)

$K_{sp} = [Mg^{+2}]\,[OH^-]^2$ ⟶ (2)

From equation (1)

When $[Mg^{+2}] = X$, $[OH^-] = 2X$ ⟶ (3)

From 2 , 3

$K_{sp} = (X)\,(2X)^2$

$3.4 \times 10^{-11} = 4X^3$

$X^3 = \frac{0.32}{1} = 0.85 \times 10^{-11}$

$X = \sqrt[3]{0.85 \times 10^{-11}}$ $X = 2.04 \times 10^{-4}$

∴ $[Mg^{+2}] = X = 2.04 \times 10^{-4}$ mole/liter

While $[OH^-] = 2X = 2 \times 2.04 \times 10^{-4} = 4.08 \times 10^{-4}$ mole/liter

$POH = -\log 4.08 \times 10^{-4} = 3.39$

∵ PH + POH = 14 ∴ POH = 14 – 3.39 = 10.61

(2) Write chemical equation :

$BaCl_2 + Na_2SO_4 \longrightarrow 2NaCl + BaSO_4$

$(137 + 35.5 \times 2)$ $(137 + 32 + 16 \times 4)$

Each 208 gram ⟶ 233 gram

X gram ⟶ 2 gram

∴ Mass of $BaCl_2 = \frac{2 \times 208}{233} = 1.785$ grams

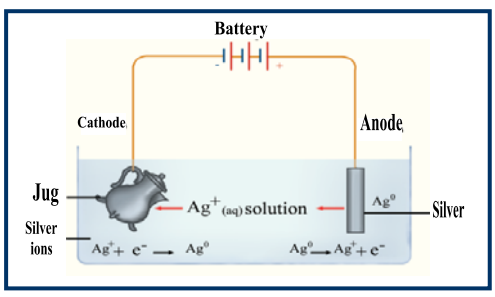
3- The electroplating of jug by a layer of silver :

(1) Clean the surface of the jug completely .

(2) Dip the jug into electrolyte solution that contains silver ions .

(3) Connect the jug with the (-ve) electrode of the battery (cathode) and a rod of silver metal with the (+ve) electrode (anode) .

(4) Switch on the circuit .



When the electric current passes through the circuit :

Oxidation process takes place at anode .

$Ag \longrightarrow Ag^+ + e^-$

- Reduction process takes place at cathode .

$Ag^+ + e^- \longrightarrow Ag$

So, silver atoms precipitate on the surface of the jug .

Finished answer