# Last Look One    Question (1)

**(A) Write the scientific expression for each of the following :**

1- Reaction of carboxylic acid with sodium carbonate or bicarbonate.
2- The number of carboxylic groups in an organic acid .
3- Armotaic acid has two different functional groups.
4- An organic compound is generated in human body as a result of hard effort.
5- An organic compound its lack in the human body leads to the infection by Escarpot disease and the decrease in the biological functions.
6- One of the iron ores which has a bloody red colour .
7- The minimum amount (quantity) of energy that must be gained by a molecule to react at collision .
8- The reagent of fifth analytical group .
9- At a constant temperature the degree of ionization ($\alpha$) increase by dilution.
10- A solution its concentration is known .
11- An alloy formed when its elements are chemically combined .

### The Answer

| | | |
|---|---|---|
| 1- Acidity test | 2- Basicity number | 3- Salicylic acid |
| 4- Lactic acid | 5- Ascorbic acid | 6- Hematite |
| 7- Activation energy | 8- Ammonium carbonate solution | 9- Ostwald Law |
| 10- Standard solution | 11- Inter metallic alloys | |

**(B) How can you differentiate between :**

1- Carbolic acid and acetic acid .
2- Sodium sulphite salt and sodium thiosulphate salt .
3- Pure acetic acid and dil acetic acid .
4- Ammonium hydroxide solution and sodium hydroxide solution .

### The Answer

| 1 | Experiment | Acetic acid | (Phenol) Carbolic acid |
|---|---|---|---|
| By adding $Na_2CO_3$ solution to each of them. | | Effervescence takes place and $CO_2$ evolves with turbids lime water. | No effect |
| Equation | | $2CH_3COOH_{(aq)} + Na_2CO_3 \rightarrow$ $2CH_3COONa_{(aq)} + H_2O_{(l)} + CO_{2(g)}$ | |
| By adding few drops of iron III chloride solution to each of them. | | No effect | A violet colour is produced . |

| 2 | Experiment | Sodium sulphite salt | Sodium thiosulphate salt |
|---|---|---|---|
| By adding dilute HCl acid | | Evolves ($SO_2$) irritating smell and turns paper wet with acidified $K_2Cr_2O_7$ (orange) to green . | Evolves ($SO_2$) irritating smell and yellow ppt as a result of suspend sulphur in solution |
| Equation | | $Na_2SO_{3(s)} + 2HCl_{(aq)} \rightarrow$ $2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)}$ | $Na_2S_2O_{3(s)} + 2HCl_{(aq)}$ $\rightarrow 2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)} + S_{(s)}$ |

| 3 | Experiment | Pure Acetic Acid | Dilute Acetic Acid |
|---|---|---|---|
| By passing electric current in each of them. | | Does not conducts electricity and the electric lamp does not illuminates | Conducts electricity and the electric lamp illuminates |

| 4 | Experiment | NH₄OH solution | NaOH solution |
|---|---|---|---|
| | By adding Aluminum sulphate solution to each of them | White gelatinous ppt of Al(OH)₃ soluble in acids . | White gelatinous ppt of Al(OH)₃ soluble in acids and excess sodium hydroxide forming (NaAlO₂) |
| | Equation | $Al_2(SO_4)_{3(aq)} + 6NH_4OH_{(aq)} \rightarrow$ $3(NH_4)_2SO_{4(aq)} + 2Al(OH)_{3(s)}$ | $Al_2(SO_4)_{3(aq)} + 6NaOH_{(aq)} \rightarrow$ $3Na_2SO_{4(aq)} + 2Al(OH)_{3(s)}$ (then) $Al(OH)_{3(aq)} + NaOH_{(aq)} \xrightarrow{Excess}$ $NaAlO_{2(aq)} + H_2O_{(l)}$ |

(C)1- Rearrangement the following compounds in ascending order with respect to increase in their acidity :

OH (benzene ring) , HCl , $CH_3COOH$ , COOH (benzene ring) , $C_2H_5OH$
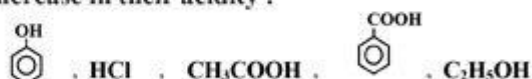
2- Rearrangement the following compounds in ascending order according to boiling point :
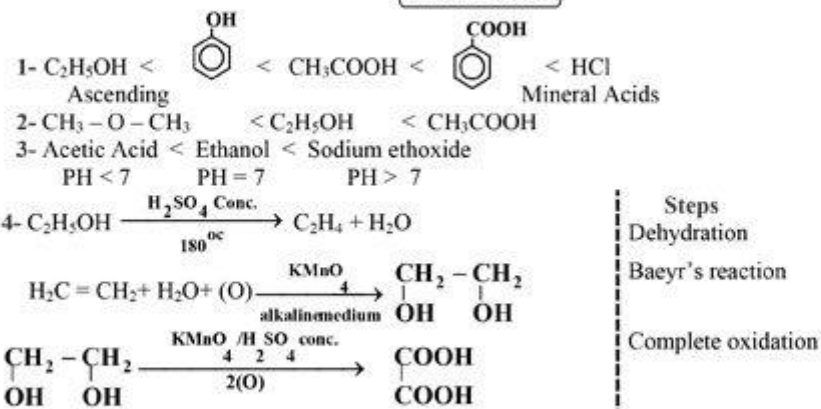
$C_2H_5OH$ , $CH_3 - O - CH_3$ , $CH_3COOH$

3- Rearrangement the following compounds in ascending order according to (PH) value : Aqueous solution for the following .

Sodium ethoxide , Acetic acid , Ethanol

4- Rearrangement the following steps to obtain oxalic acid from Ethanol :

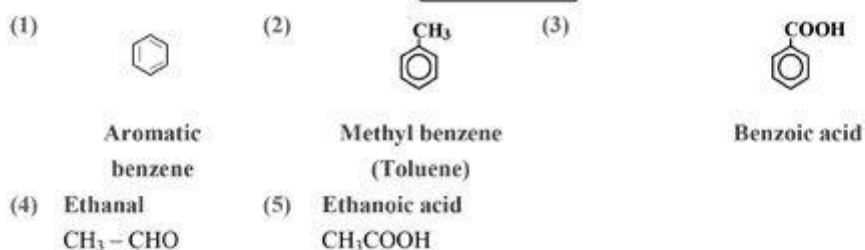(a) dehydration    (b) complete oxidation    (c) Baeyr's reaction

### The Answer

1- $C_2H_5OH <$ OH(benzene) $< CH_3COOH <$ COOH(benzene) $< HCl$
Ascending                                                    Mineral Acids

2- $CH_3 - O - CH_3 < C_2H_5OH < CH_3COOH$

3- Acetic Acid $<$ Ethanol $<$ Sodium ethoxide
   PH $< 7$        PH $= 7$        PH $> 7$

4- $C_2H_5OH \xrightarrow[180 ^{oc}]{H_2SO_4 \ Conc.} C_2H_4 + H_2O$

$H_2C = CH_2 + H_2O + (O) \xrightarrow[alkaline \ medium]{KMnO_4} \underset{OH \quad OH}{CH_2 - CH_2}$

$\underset{OH \quad OH}{CH_2 - CH_2} \xrightarrow[2(O)]{KMnO_4 / H_2SO_4 \ conc.} \underset{COOH}{COOH}$

Steps
Dehydration

Baeyr's reaction

Complete oxidation

②

**(D) Study the following diagram, then answer the following question :**
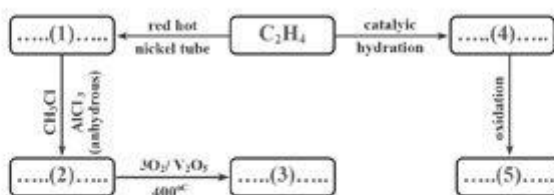


(a) Write the structural formula for compounds from (1) to (5).

(b) Mention the name of catalysts which used in converted (Ethyne) to compound number (4).

(c) Mention the oxidizing agent which used in converted the number (2) to compound number (3).

(d) Mention the oxidizing agent which used in converted the compound number (4) to compound number (5).

(e) From compound number (3) how can you obtain (Aliphatic cyclic hydrocarbon, foods preservating substance).
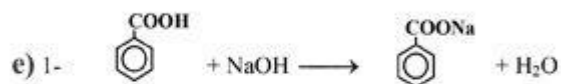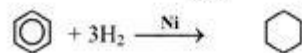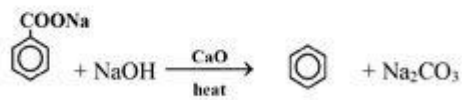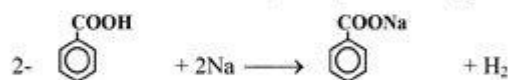
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**The Answer**
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(1) Aromatic benzene

(2) Methyl benzene (Toluene)

(3) Benzoic acid

(4) Ethanal $CH_3 - CHO$

(5) Ethanoic acid $CH_3COOH$

b) ($HgSO_4$ / $H_2SO_4$ 40%) as catalyst

c) atmospheric air

d) $KMnO_4$ / $H_2SO_4$ Conc. Or $K_2Cr_2O_7$ / $H_2SO_4$ Conc.



e) 1- [benzene-COOH] + NaOH ⟶ [benzene-COONa] + $H_2O$

sodium benzoate
(Foods preservating substance)

2- [benzene-COOH] + 2Na ⟶ [benzene-COONa] + $H_2$

[benzene-COONa] + NaOH $\xrightarrow[\text{heat}]{\text{CaO}}$ [benzene] + $Na_2CO_3$

[benzene] + $3H_2$ $\xrightarrow{Ni}$ [cyclohexane]

Aliphatic cyclo hydrocarbon (cycle hexane)

**(E)** Calculate the equilibrium constant $K_p$ for the reaction :

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \ , \ \ \Delta H = -92 \ kJ$$
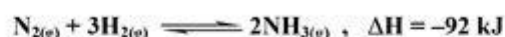
The pressure of the gases are : **2.3 atmosphere for $N_2$ , 7.1 atmosphere for $H_2$ and 0.6 atmosphere for $NH_3$** . Comment on the value of $K_p$ and How could the product of the reaction be increased and why ?

**The Answer**

$$K_p = \frac{(PNH_3)^2}{(P_{N2})(P_{H2})^3} \qquad\qquad K_p = \frac{(0.6)^2}{(2.3)\times(7.1)^3} = 4.373 \times 10^{-4}$$

The small value of equilibrium constant ($K_p < 1$) means that partial pressure of the products are less than the partial pressure of reactants .

Which reveal that the reaction is not proceed well towards the formation of the products and that the reversed reaction has an effective role .

* The product of the reaction can be increased by :

1- Increasing the pressure .

2- Increasing the concentration of the reactants .

3- Decreasing the temperature .

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**(F)** Explain with drawing how copper can be purified showing how from impurities are removed .

**The Answer**

**(F) Purification of copper by electrolysis :**



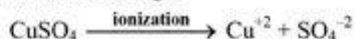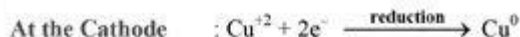Impure copper (Anode) — Pure copper (Cathode) — Copper Sulphate Solution
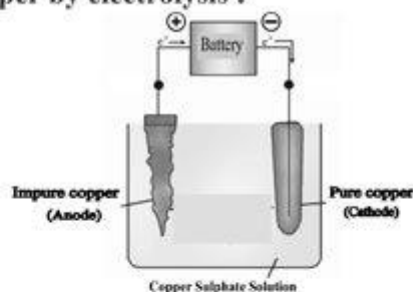
* The steps :

1- Dip the pure copper and the impure copper in copper sulphate .

2- Connect the pure copper to the negative pole of the battery.

(The pure copper acts as the cathode)

3- Connect the impure copper to the positive pole of the battery .

(The impure copper acts as the anode)

4- Pass the electric current in the solution .

* Observation :

Copper sulphate solution is ionized as following :

$$CuSO_4 \xrightarrow{ionization} Cu^{+2} + SO_4^{-2}$$

The ions will move towards the electrodes opposite to their charge .

At the anode         : $Cu \xrightarrow{oxidation} Cu^{+2} + 2e^-$

At the Cathode      : $Cu^{+2} + 2e^- \xrightarrow{reduction} Cu^0$

Therefore copper will dissolve from the impure copper (anode) as copper ions ($Cu^{+2}$) . Where as copper in the solution will deposit (precipitate) as pure (Cu) at the pure copper (Cathode).

* Remarks :

1- Some of the impurities in anode as (Zn and Fe) dissolve in the solution forming $Zn^{+2}$ and $Fe^{+2}$ due to they have high oxidation potential, but they do not precipitated on cathode because (they have low reduction potential) .

2- (Au and Ag) impurties do not dissolve in solution because they have low oxidation potential. So they sink below the anode and then removed as metals from the button .

3- In this process 99.95% pure copper can be obtained .
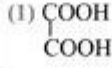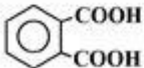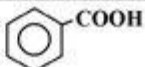
## Question (2)

(A)

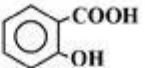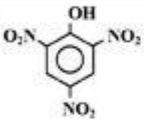| (1) Oxalic acid | (2) Phthalic acid | (3) Sodium acetate |
|---|---|---|
| (4) Benzoic acid | (5) Ethanoic acid | (6) Ascorbic acid |
| (7) Salicylic acid | (8) Lactic acid | (9) Alpha amino acetic acid |
| (10) Carbolic acid | (11) Picric acid | (12) Palmetic acid |

* From the previous table mention the compound or (Compounds) for each of the following questions :

1- The compounds which take a name according to IUPAC system.
2- The salts of the carboxylic acids .
3- Di carboxylic acids .
4- Fatty acids .                        5- Amino acids
6- Acids is used in the manufacture of explosives and treatment of burns.
7- An acid in which the no. of carboxylic groups equals the number of carbon atoms .
8- Acid reacts with formaldehyde in acidic or alkaline medium formed Bakelite .
9- Acid is sparingly soluble in water it is converted to its sodium or potassium salts to become soluble in water and more acidity than acetic acid .
10- Aliphatic hydroxylic acid contains two functional group and causes a constriction in muscles .
11- Aromatic hydroxylic acid contains two functional groups and used in preparation of Aspirin .

### The Answer

(A) How can you answer :

| Structural formula | (1) COOH \| COOH | (2) benzene-COOH, COOH | (3) $CH_3COONa$ |
|---|---|---|---|
| Name | Oxalic acid | Phthalic acid | Sodium acetate |
| Type | Aliphat dibasic acid | Aromatic di basic acid | Salt of carboxylic acid |
| Structural formula | (4) benzene-COOH | (5) $CH_3COOH$ | (6) ———— |

(5)

| Name | Benzoic acid | Ethanoic acid | Ascorbic acid |
|---|---|---|---|
| Type | Aromatic mono basic acid | Aliphatic mono basic acid | Carboxylic acid |
| Structural formula | (7) [benzene ring]–COOH / OH | (8) $CH_3 - \overset{OH}{\underset{}{CH}} - COOH$ | (9) $\overset{CH_2 - COOH}{\underset{NH_2}{|}}$ |
| Name | Salicylic acid | Lactic acid | Alpha amino acetic acid |
| Type | Aromatic carboxylic acid has two different functional groups | Aliphatic carboxylic acid has two different functional groups | Amino Acids has two different functional groups |
| Structural formula | (10) [benzene ring] OH | (11) $O_2N$–[benzene ring with OH, NO₂]–$NO_2$ / $NO_2$ | (12) $C_{15}H_{31} - COOH$ |
| Name | Carbolic acid | Picric acid | Palmetic acid |
| Type | Phenols | Derivative from phenol | Fatty acids |

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

**(B) Classify the following compounds :**

| (1) | $CH_3 - CHO$ | (2) | $CH_3CH_2 - \overset{O}{\underset{}{C}} - OH$ |
|---|---|---|---|
| (3) | $\overset{O}{\underset{}{HO - C - CH_2CH_3}}$ | (4) | $CH_3CH_2CH_2 - \overset{O}{\underset{}{C}} - CH_3$ |
| (5) | $CH_3 - CH_2 - \overset{O}{\underset{}{C}} - O - CH_3$ | (6) | $\overset{CH_2 - CH - OH}{\underset{CH_3 \quad CH_3}{}}$ |
| (7) | $C_2H_5 - O - C_2H_5$ | | |
| (8) | OH [benzene ring] | (9) | $\overset{CH_3}{\underset{CH_3}{CH_3 - C - OH}}$ |

**The Answer**

| (1) | Aldehyde (– CHO) | (2) | Carboxylic acid (–COOH) | (3) | Carboxylic acid (–COOH) |
|---|---|---|---|---|---|
| (4) | Ketone $\left( \overset{C}{\underset{O}{\parallel}} \right)$ | (5) | Ester (–COOR) | (6) | Secondary alcohol ($\rangle$CHOH) |
| (7) | Ether (–O–) | (8) | Phenol (–OH) | (9) | Tertiary alcohol ($\rangle$C–OH) |

6

**(C) Choose the proper answer :**

1- All these acids are mono carboxylic acid except ...... acid.
   a) propanoic
   b) phthalic
   c) ethanoic
   d) formic

2- Reduction of Acetic acid by hydrogen in the presence of copper II chromate gives .........
   a) copper acetate
   b) chromium acetate
   c) ethanol
   d) acetaldehyde

3- On exposing a salt on a platinum wire to Bunsen burner, the flame acquired a brick red colour, the salt contains ...
   a) copper II
   b) sodium
   c) calcium
   d) potassium

4- In Mercury cell the cathode is made of ……..
   a) zinc
   b) graphite
   c) lead
   d) mercury oxide

5- The solution of pure acetic acid in water ...........
   a) contains ions and illuminate a lamp which is connected to two poles dipped in the solution
   b) Does not contain ions and does not illuminate the lamp which is connected to two poles dipped in the solution
   c) Contains ions that decrease in number on dilution with water
   d) Both answer (a) and (c) are correct .

6- On heating iron III oxide in the presence of a mixture of carbon monoxide and hydrogen gas it is reduced to .......
   a) iron II oxide
   b) magnetic iron oxide
   c) iron
   d) mixture of iron II and iron III oxide

7- Iron is found in free state in ………..
   a) siderite
   b) meteorites
   c) earth crust rocks
   d) Alumina

8- Strong electrolyte solution is a completely ………
   a) reacted
   b) decomposed
   c) dissolved
   d) ionized

9- The chemical reaction at its equilibrium state is affected by all the following factors except ……….
   a) pressure
   b) concentration
   c) the catalyst
   d) temperature

10- 0.4 gram from a gas ..... at (stp) occupy volume equals 224 ml.
   a) $C_3H_6$
   b) $SO_2$
   c) $NO_2$
   d) $C_3H_4$

   Given that $(C = 12 , O = 16 , S = 32 , N = 14)$

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| The Answer |
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**(C) Choose the proper answer :**

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

**(D) Compare between each of the following :**

1- Complete ionization and weak ionization according to definition and give an example for each one .
2- Substitutional alloy and inter metallic alloy .
3- Irreversible and reversible reactions .
4- $K_c$ and $K_p$.
5- Qualitative analysis and quantitative analysis

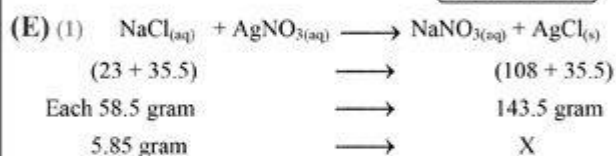**The Answer**

**(D) Comparison between :**

| (1) | Complete (strong) ionization | Incomplete (weak) ionization |
|---|---|---|
|  | 1- All molecules are ionized . $$AB \longrightarrow A^+ + B^-$$ Strong electrolyte    Dissociated ions | 1- A small fraction of molecules is ionized . $$AB \rightleftharpoons A^+ + B^-$$ Weak electrolyte    dissociated ion |
|  | 2- Happens in strong electrolytes. | 2- Happens in weak electrolytes. |
|  | 3- Ionization is not affected by dilution. | 3- Ionization increases by dilution . |

| (2) | Substitutional alloys | Inter-metallic alloys |
|---|---|---|
|  | 1- Some atoms of the crystalline lattice of the pure metal are replaced by the atoms of another metal that has the same atomic radius, the same chemical properties and the same crystalline structure . | 1- It is formed when the elements forming the alloys combine with each other chemically. The chemical formula of the formed compounds disobeys the laws of valency . |

| (3) | Complete (irreversible) reactions | Incomplete (reversible) reactions |
|---|---|---|
|  | 1- The reactions which proceed in one direction (forward) | 1- The reactions which proceed in both directions; forward and backward. |
|  | 2- One of the products escapes from the system as evolving of a gas or forming a precipitate. | 2- Both the reactants and products are always found in the reaction medium . |
|  | Example : $$NaCl_{(aq)} + AgNO_{3(aq)} \rightarrow NaNO_{3(aq)} + AgCl_{(s)}$$ $$Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$$ | Example : $$CH_3COOH_{(aq)} + C_2H_5OH_{(aq)} \rightleftharpoons CH_3COOC_2H_{5(aq)} + H_2O_{(\ell)}$$ |

| (4) | $K_c$ | $K_p$ |
|---|---|---|
|  | • The equilibrium constant by knowing concentrations. • The product of multiplication of the reactants concentrations; each is raised to the power of the number of molecules in the balanced chemical equation. | • The equilibrium constant by knowing pressures. • The product of multiplication of the reactants partial pressures; each is raised to the power of the number of molecules in the balanced chemical equation . |

| (5) | Qualitative analysis | Quantitative analysis |
|---|---|---|
|  | It is identification of the constituents of the substance. | It is determination of concentration of the constituents of the substance . |

(8)

(E) 1- Calculate the number of moles of silver chloride (AgCl) precipitated from the reaction of 5.85 gram sodium chloride (NaCl) with silver nitrate solution .

Given that (Na = 23 , Cl = 35.5 , Ag = 108)

2- Calculate quantity of electricity which is required to deposit 1/2 mole of silver from a solution of silver nitrate . (Given that Ag = 108)

| The Answer |

(E) (1)  $NaCl_{(aq)} + AgNO_{3(aq)} \longrightarrow NaNO_{3(aq)} + AgCl_{(s)}$

$(23 + 35.5) \longrightarrow (108 + 35.5)$

Each 58.5 gram $\longrightarrow$ 143.5 gram

5.85 gram $\longrightarrow$ X

Mass of AgCl = $\dfrac{143.5 \times 5.85}{58.5}$ = 14.35 gram

No. of moles of AgCl = $\dfrac{mass\ of\ substance}{Molar\ mass}$ = $\dfrac{14.35}{143.5}$ = 0.1 moles

(2) Quantity of Elelctricity = Faraday × Valency = 1 Farady

1 Faraday required to deposited 1 mole of Ag

X $\longrightarrow$ 1/2 mole of Ag

∴ Quantity of electricity = 1/2 Faraday

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(F) 1-What is the role of the following scientist in chemistry :

   a) Kekule          b) Faraday

2- Declare the reactions occurring inside each of :

   a) Mercury cell.
   b) The lead-acid buttery (Charge and discharge) .
   c) Fuel cell.

| The Answer |

(F) 1- What is the role (Contributions) of these scientists in chemistry field .

   (a) Kekule : He discovered the hexagonal cyclic shape of benzene in which single and double bonds are exchanged between the carbon atoms .

   (b) Faraday : He deduced the relation between quantity of electricity that passes in electrolytic solution and the mass of material which is liberated at poles and summarized this relation in two laws .

2-

| P.O.C. | Lead Acid Battery | Mercury Cell | Fuel Cell |
|---|---|---|---|
| Anode | $Pb_{(s)} + SO_{4(aq)}^{-2} \rightarrow PbSO_{4(s)} + 2e$ | $Zn_{(s)} \rightarrow Zn^{+2}_{(aq)} + 2e^-$ | $2H_{2(g)} + 4OH^-_{(aq)} \rightarrow 4H_2O_{(v)} + 2e^-$ |
| Cathode | $PbO_{2(s)} + 4H^+_{(aq)} + SO^{-2}_{4(aq)} + 2e \rightarrow PbSO_{4(s)} + 2H_2O_{(l)}$ | $Hg^{+2} + 2e^- \rightarrow Hg$ | $O_{2(g)} + 2H_2O_{(l)} + 4e^- \rightarrow 4(OH^-)_{(aq)}$ |
| Total reaction | $Pb_{(s)} + PbO_{2(s)} + 4H^+_{(aq)} + 2SO_{4(aq)}^{-2} \rightleftharpoons 2PbSO_{4(s)} + 2H_2O_{(l)}$ | $Zn + HgO \rightarrow Zn^{+2} + Hg$ | $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(v)}$ |
| $E_{cell}$ | 2 Volt × 6 = 12 Volt | 1.35 Volt | 1.23 Volt |

*Finished Answer*