Chem 1^{st} Term Summary

Saturday, December 10, 2022 5:09 PM

1. A+B $\xrightarrow{\quad}$ C+D

   Yields/ produces/ gives

2. Limiting reactants → reactants disappeared completely
   Excess reactants → reactants that stay at the end of the reaction

3. **Stoichiometric Mixture:**
   → Reactants consumed completely.
   → Reactants converted completely into products.
   → Ratio $R_A = \frac{n_A}{a} = R_B = \frac{n_B}{b}$
   → At the end of the reaction, reactants are consumed, products will be obtained only.
   → $\frac{n_{A reacted}}{a} = \frac{n_{B\ reacted}}{b} = \frac{n_{C\ formed}}{c} = \frac{n_{D\ formed}}{d}$

   Where:
   ✓ A and B are reactants
   ✓ C and D are products
   ✓ a, b, c, and d are coefficients
   ✓ → : gives or yields.

4. **Non- Stoichiometric Mixture:**
   → Ratios are not equal.
   → Limiting and excess.
   → At the end of the reaction, products= limiting + left.
   → $R_A = \frac{n_A}{a} = R_B = \frac{n_B}{b}$
   → If $R_A > R_B$, →A is excess → Part of A will remain.
   → →B is limiting →No B at the end of the reaction.
   → $n_{B\ reacted} = n_{B\ initial}$

5. **Molar Volume:**
   → $V_m = 24L/mol$
   → At S.T.P condition, $V_m = \frac{22{,}4L}{mol}$
   → Relation between V and V_m: $n_{gas} = \frac{V_{gas}}{V_m}$

6. **% Yield: (Products):**

   * Actual mass <theorotical mass
   * V or n or m

   % yield= $\frac{\text{actual mass of product}}{\text{theorotical mass of product}}$ x 100

   given

   From limiting reagant (St. ratio)

7. **Water**:
   → Solution: solute + solvent
   → Substance dissolved   does the dissolving

   → Aqueous solution → water is the solvent
   → Solubility: maximum amount of substance that can be dissolved.
   → Dissolubility: Concentration of saturated solution.

8. **Concentration:**
   → Molar concentration →C = $\frac{n_{solute}}{V_{sol'm}}$ (mol/L)

→ Mass Concentration → $C_m \frac{m_{solute}}{V_{sol'm}}$ (g/L)

→ Relation Between C and C_m:

C= $\frac{n_{solute}}{Vsol'm}$

= $\frac{\frac{m_{solute}}{M}}{V_{sol'm}}$ → C= $\frac{m_{solute}}{M \, x \, V_{sol'm}}$

↓

C= $\frac{C_m}{V_{sol'm}}$ → $C_m = C \times V_{sol'm}$

9. Dissolution (SOLID):

→ C= $\frac{n_{solute}}{V_{sol'm}}$

→ **Materials :**

i. Digital balance.
ii. Volumetric flask.

→ Essential materials.

iii. Watch glass.
iv. Spatula.
v. Funnel.

→ **Procedure:**

1st. Using a digital balance, a spatula, watch glass, weigh …. g of …. solid.
2nd. Transfer the solid through a funnel into a … ml volumetric flask, half filled with distilled water.
3rd. Rinse the funnel and the watch glass with distilled water .
4th. Add distilled to the line mark.
5th. Stopper, shake well to homogenize.

10. Dilution (LIQUID):

$\boxed{C_1 V_1} = \boxed{C_2 V_2}$ → flask

↓

Pipet

Upon dilution, number of electrons gained = number of electrons lost

$n_{before\ dilution} = n_{after\ dilution}$

$C_0 V_0 = C_1 V_1$

Materials:

i. Volumetric flask.
ii. Volumetric pipet (graduated pipet).
iii. Pipet filler (rubber safety bulb).
iv. Washing bottle.

Procedure:

1st. Withdraw … ml of sol'm (initial) using volumetric pipet provided with pipet filler or rubber safety bulb.
2nd. Transfer them into … ml volumetric flask half filled with distilled water.
3rd. Add distilled water to the line mark.
4th. Stopper shake well to homogenize.

11. Relation Between C, density, % by mass, M:

$C_{sol'm} = \frac{n_{solute}}{V_{sol'm}}$ density= $\frac{m_{solute}}{V_{sol'm}} \times 100$ % by mass= $\frac{m_{solute}}{m_{sol'm}} \times 100$

$$C_{sol'm} = \frac{n_{solute}}{V_{sol'm}} \rightarrow C_{sol'm} = \frac{\frac{m_{solute}}{M}}{V_{sol'm}}$$

$$\downarrow C_{sol'm} = \frac{\%by\ mass \times m_{sol'm}}{M \times V_{sol'm} \times 100} \rightarrow C_{sol'm} = \frac{\%by\ mass \times density}{M \times 100}$$

12. Dilution Factor:

$$F = \frac{C_0}{C_1} = \frac{V_1}{V_0}$$

★ Where:
- * C_0V_0 : pipet
- * C_1V_1 volumetric flask

13. **Redox reaction**

LEO

Oxidation → loss of electrons
Metal → ion + electron

GER

Reduction → gain of electrons
Ion + electron → metal

14. Oxidant and Reductant:
- ✓ Oxidant (oxidizing agent): undergoes reduction reaction
- ✓ Reductant (reducing agent): undergoes oxidation reaction.

15. Oxidized and Reduced:
- ✓ Oxidized: undergoes oxidation reaction.
- ✓ Reduced: undergoes reduction reaction.

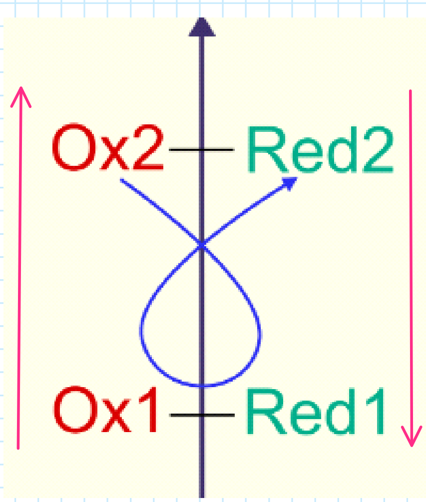
16. Redox Couples:

Oxidant / Reductant

17. Gains electrons → reduced→ reduction→ oxidizing agent→ oxidant →oxidation number decreases.
18. Loses electrons → oxidized→ oxidation→ reducing agent→ reductant →oxidation number increases.

19. Electrochemical Classification:

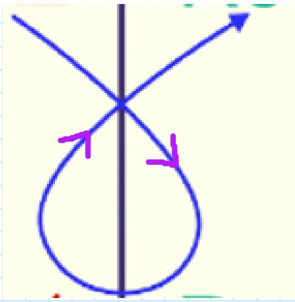
★ O.P increases



R.P decreases

★ As the O.P increases, the R.P decreases.
It occurs between S.O.P and S.R.P.

20. Gamma Rule:



To predict if there is reaction or no.

21. **Alloy:**
   - ✓ Mixture made up of metals that act as one unit.
   - ✓ Made up of 2 or more metals joined together.

22. %by mass= $\frac{m_x}{\boxed{m_{total\ alloy}}} \times 100$

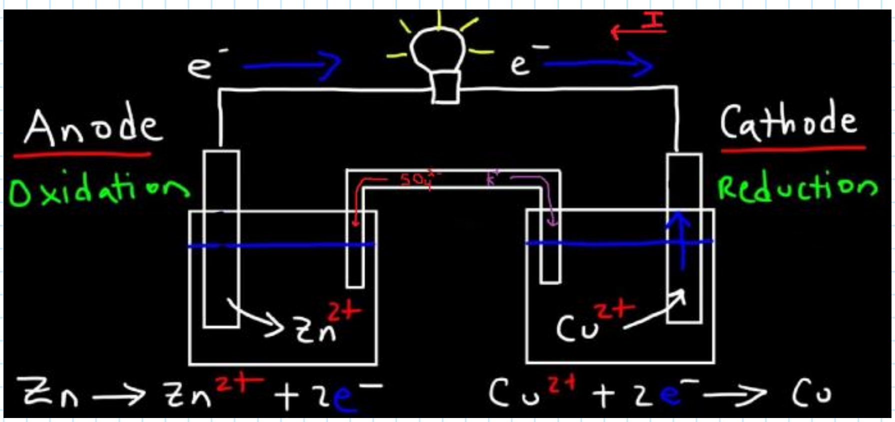
Sum of the mases in the alloy

23. The deposit id the metal formed at the end of the reaction.
24. Residue is the unreacted metal, or metal left at the end of the reaction.

25. Galvanic Cell:
   - ✓ Converts chemical energy into electrical energy.
   - ✓ Has 2 poles.

Anode(-) Cathode (+)

   - ✓ Electrons flow from the anode (-) to the cathode (+)



Materials:

i. ... strip
ii. .. Strip
iii. ... sol'm
iv. ... sol'm
v. 2 beakers
vi. Light bulb
vii. Connecting wire

26. Procedure:

1st. Dip ... strip into ... sol'm.
2nd. Dip ... strip into ... sol'm.
3rd. Connect the 2 strips with a connecting wire to a lamp
4th. Connect the s sol'ms by a salt bridge.

27. Salt Bridge:

- ✓ U-shaped tube.
- ✓ Contains ions (anions + cations).
- ✓ Contains electrolyte

★ Anions migrate towards the anode
★ Cations migrate towards the cathode

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28. Role of the salt bridge:

- ✓ Allows the flow of the electric current from the anode to the cathode.
- ✓ Provides the cell with electrical neutrality among the 2 half cells.
- ✓ Prevents the mixing of the 2 sol'ms.

29. Galvanic Circuits:

1. External Circuit: flowing of electrons from the anode to the cathode.
2. Internal Circuit: occurs in the salt bridge.

30. Anode and Cathode Half Cells:

- At the anode:
  The +ve charge of the sol'm becomes greater.
  Anions in the salt bridge will migrate towards the anode to balance and attain neutrality.

- At the cathode:
  The +ve charge of the sol'm becomes smaller.
  Cations in the salt bridge will migrate towards the cathode to balance and attain neutrality.

★ The galvanic cell is spontaneous, it occurs without any external help.

This means that, the cations in the salt bridge migrate towards the cathode and the anions in the salt bridge migrate towards the anode.

31. Concentration of the Solution:

- At the anode:
  Concentration increases.
  More ions are entering due to the loss of electrons
  Color becomes darker.

- At the cathode:
  Concentration decreases.
  Ions are leaving due to the gain of electrons
  Color becomes lighter.

32. Mass of the Electrodes:

- At the anode:
  undergoes oxidation, gets thinner.

- At the cathode:
  Undergoes reduction, gets thicker.

33. Electromotive Force of the Galvanic Cell:

- ✓ Maximum Voltage.
- ✓ $E^0\ cell = E^0\ cathode - E^0\ anode$

★ $E^0 > 0 \rightarrow$ spontaneous.

★ $E^0 \geq \rightarrow$ spontaneous and complete.

REMARK!!

* The larger E^0 value $\rightarrow$ $more\ O.P \rightarrow Oxidizing\ agent \rightarrow reuction \rightarrow placed\ at\ the\ cathode\ (+)$

* The smallerE^0 value $\rightarrow$ $\mathrm{more\ R.P \rightarrow Reducing\ agent \rightarrow Oxidation \rightarrow placed\ at\ the\ anode(-)}$

34. Standard Conditions:

- ✓ Temperature= 25^0C
- ✓ Pressure = 1 atm or 1 bar
- ✓ Concentration = 1mol/L

35. Variation of Mass:

- ✓ Reactant $\rightarrow$ reacted amount.
- ✓ Product $\rightarrow$ formed amount.

$\rightarrow$ FROM ST.RATIO

36. Final or new mass:

Reactant $\rightarrow m_{initial} - m_{reaacted}$

Product $\rightarrow \mathrm{m_{initial}} + \mathrm{m_{formed}}$

$m_{reaacted}$, $\mathrm{m_{formed}}$ $\rightarrow$ FROM ST.RATIO

$m_{initial}$ $\rightarrow$ FROM GIVEN

37. Charge:

Q = I x T

38. Number of Electrons:

Q = I x T

Q = $\mathrm{Ne}^- \times e^-$

Q=Q

I x T = $\mathrm{Ne}^- \times \mathrm{e}^-$

$$\rightarrow Ne^- = \frac{I\ x\ T}{e^-}$$

$e^- \rightarrow$ 1.6 x 10^{-19}

39. Number of Moles:

$$ne^- = \frac{Ne^-}{\ }$$

39. Number of Moles:

$$ne^- = \frac{Ne^-}{N_A}$$

$N_A \rightarrow 6 \times 10^{23}$