Periodicity Notes

Objective 1: List physical and chemical properties of Alkali Metals

- Physical
    - Soft, bright metals which can be cut easily
    - Melting Points decrease down the group when the metallic bonds become weaker
    - Li , Na, y K float in water due to their low densities
- Chemical
    - Kept in oil to prevent reaction with O_2 in the air
    - Reactivity increases down the group
    - Each reacts vigorously with H_2O to produce an Alkaline Solution and H_2 gas
        - $2Li\ (s) + 2H_2O\ (l) \rightarrow 2LiOH\ (aq) + H_2\ (g)$
        - All follow this model
    - Group One Metals react with Halogens to produce Salts
        - $2Na\ (s) + Cl_2\ (g) \rightarrow 2NaCl\ (s)$
        - All Alkaline Metal / Halogen combinations follow this model

Objective 2: Outline the bonding and acid-base properties of period 3 oxides

- Ionic Oxides: Na_2O, MgO, Al_2O_3 (solids)
- Gigantic Covalent (Net Covalent): SiO_2 (quartz)
- Molecular Covalent: $P4O_{10}$ (s), P_4O_6(s), SO_3 (l), SO_9(g), Cl_2O_7(l), Cl_2O(g)
- The change from Ionic to Molecular Covalent across the period follows the decrease in electronegativities between Oxygen and the other element.
- Acid-Base Properties

- Basic Oxides: Na_2O, MgO
- Amphoteric: Al_2O_3 (is like an acid or base depending on its env)
- Acidic Oxides: SiO_2(s) P_4O_{10} P_4O_6 SO_3 SO_2 Cl_2O_7 Cl_2O

- Reactions of Basic Oxides with H_2O
  - Na_2O (s) + H_2O (l) → 2NaOH (aq)
  - MgO (s) + H_2O (l) → $Mg(OH)_2$
- Reactions of Acidic Oxides with H_2O
  - P_4O_{10} (s) + $6H_2O$ (l) → $4H_3PO_4$ (aq)
  - SO_3 (l) + H_2O (l) → H_2SO_4 (aq) *Formation of Acid Rain
  - Cl_2O_7 (l) H_2O (l) → $HClO_4$
  - NO_2 (g) → H_2O (l) → HNO_3 (aq) + HNO_3 (aq) *Formation of Acid Rain (Not from period 3)

Objective 3: Outline the Chemical and Physical properties of Halogens

- Physical Properties
  - Fluorine: Pale yellow gas
  - Chlorine: Greenish-yellow gas
  - Bromine: Reddish-brown liquid
  - Iodine: Purple solid
  - These exist as diatomic molecules in nature
  - Melting Points decrease down the group. LDF Grows because the polarizability of the e^- cloud grows.
- Chemical Properties

- Reactivity decreases down the group
- Elements at the top are stronger Oxidizing Agents tan those at the bottom.
- The halogens closer to the top replace the ions of the halogens below them.
- Example: F_2 (g) + 2NaCl (aq) → 2NaF (aq) + Cl_2 (g)

Showing what that means:

F_2 (g) + ~~$2Na^+$ (aq)~~ + $2Cl^-$ (aq)→ ~~$2Na^+$ (aq)~~ + $2F^+$ (aq) + Cl_2 (g)

$F_2 + 2e^- \rightarrow 2F^-$

$2Cl^- \rightarrow Cl_2 + 2e^-$