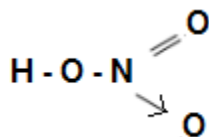


Study of Compounds – Nitric Acid

Nitric Acid

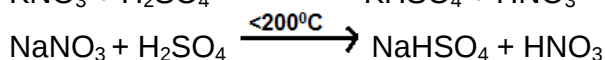
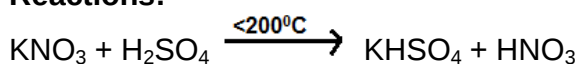
Molecular formula: HNO_3

Relative molecular mass: 63



Laboratory Preparation of Nitric Acid

Reactions:



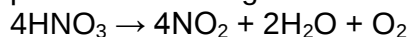
Properties of Nitric Acid

(A) Physical Properties

- Pure acid (98% conc.) is colourless, suffocating and sour to taste.
- It is heavier than water, with a specific gravity of 1.54.
- Boiling point is 86°C , and freezing point is -42°C

(B) Chemical Properties

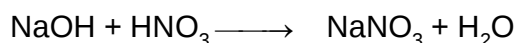
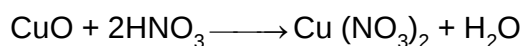
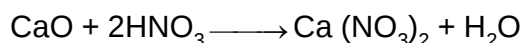
- Pure nitric acid is colourless, unstable and decomposes slightly even at room temperature and in the presence of sunlight.



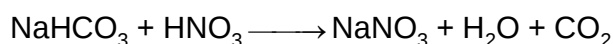
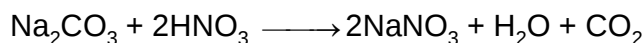
- Nitric acid is a very strong monobasic acid and ionises almost completely in aqueous solution.



- Nitric acid neutralises alkalis to form salt and water.



- Nitric acid reacts with carbonates and bicarbonates to produce salt, water and carbon dioxide.



- Nitric acid oxidises carbon, sulphur and phosphorus to their highest oxides or oxy-acids such as carbon dioxide, sulphuric acid and phosphoric acid.



- Cold and dilute nitric acid oxidises metals to their nitrates and liberates nitric oxide.

$$3\text{Cu} + 8\text{HNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$$

$$3\text{Zn} + 8\text{HNO}_3 \longrightarrow 3\text{Zn}(\text{NO}_3)_2 + 4\text{H}_2\text{O} + 2\text{NO}_2$$
- Concentrated nitric acid liberates nitrogen dioxide.

$$\text{Cu} + 4\text{HNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$$

$$\text{Zn} + 4\text{HNO}_3 \longrightarrow \text{Zn}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$$
- Nitric acid (1 part by volume) mixed with conc. hydrochloric acid (3 parts by volume) produces a mixture called aqua regia.

$$\text{HNO}_3 + 3\text{HCl} \longrightarrow \text{NOCl} + 2\text{H}_2\text{O} + 2[\text{Cl}]$$

Aqua regia contains nascent chlorine and reacts with noble metals such as gold and platinum to produce chlorides.

$$\text{Pt} + 4[\text{Cl}] \longrightarrow \text{PtCl}_4$$

$$\text{Au} + 3[\text{Cl}] \longrightarrow \text{AuCl}_3$$

Uses of Nitric Acid

- To etch designs on copper and brassware because it acts as a solvent for several metals except the noble metals.
- To purify gold with impurities of Cu, Ag and Zn which dissolve in nitric acid.
- It acts as a rocket fuel oxidant.
- In preparation of fertilisers such as $\text{Ca}(\text{NO}_3)_2$ and NH_4NO_3 .
- In the preparation of aqua regia, which dissolves noble metals.