# Hydroxide Solutions
# Sodium & Potassium

Properties & Hazards

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# Presentation Overview

- General Information
- Physical & Chemical Properties
- Health Hazards

# General Information

Hydroxide Solutions – Sodium & Potassium

# Common Applications

## Sodium Hydroxide

- Rayon and nylon production
- Textiles
- Pulp and paper
- Foods and pharmaceuticals
- Metals (especially aluminum)
- Photographic products
- Water and wastewater treatment
- Many other organic and inorganic products
- pH adjustment

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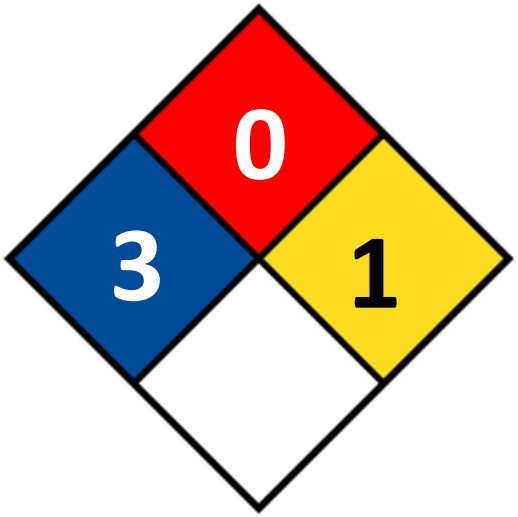
# Sodium Hydroxide Basics

**NFPA Diamond**




**UN Placard**


**GHS Pictogram**

# Common Applications

## Potassium Hydroxide

- De-icing fluids
- Agriculture (fertilizers, herbicides)
- Alkaline batteries
- Photo chemicals
- Food additives (low sodium requirements)
- Soaps and detergents
- Potassium carbonate
- Phosphates
- Sodium substitute

# Properties – Physical & Chemical

Hydroxide Solutions – Sodium & Potassium

# Physical Properties

## Sodium Hydroxide

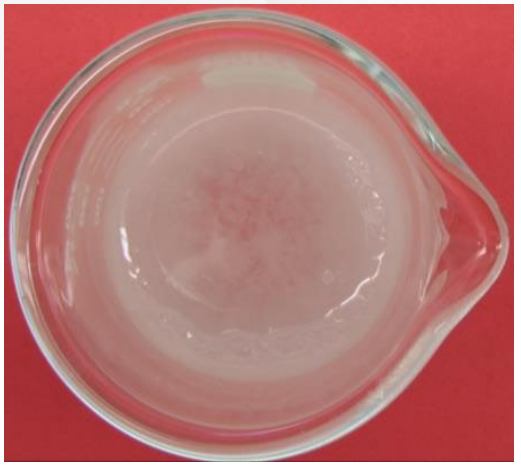
- **Could be called**
  - Sodium Hydroxide = NaOH = Caustic Soda = Caustic = Lye = Caustic Lye
- **Solution**
  - Hazy to clear and colorless
  - Spills dry ‘white’
- **Solid**
  - White, crystalline solid

# Physical Properties

## Density – Sodium Hydroxide

- **50% Solution**
  - 12.7 pounds/gallon @ 60°F
- **30% Solution**
  - 11.1 pounds/Gallon @ 60°F
- **20% Solution**
  - 10.65 pounds/gallon @ 60°F

# Physical Properties



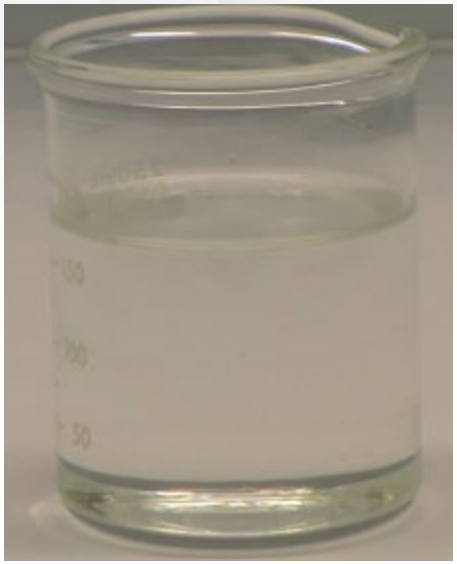
## Freezing Points – Sodium Hydroxide

- **50% Solutions**
  - Freeze at 52°F (11°C)
  - Crystallization begins below 65°F (18°C)
- **Diluted Solutions**
  - Freezing points will vary by concentration
    - 20% solution will freeze at approximately -18.4° F
    - 30% solution will freeze at approximately 32° F

# Physical Properties

## Potassium Hydroxide

- Names
  - Potassium Hydroxide = KOH = Caustic Potash
- Solution
  - Clear
  - Spills dry ‘hazy clear’
- Solid
  - Clear/slight haze



# Physical Properties

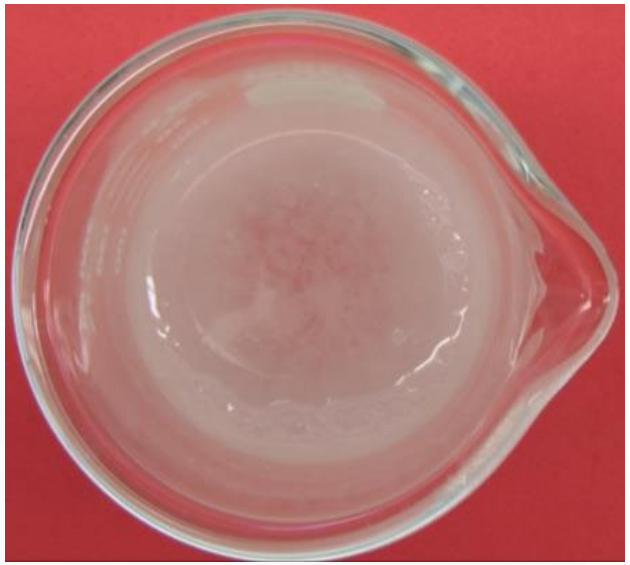
## Density – Potassium Hydroxide

- 50% Solution
  - 12.15 pounds/gallon @ 60°F
- 45% Solution
  - 12.0 pounds/gallon @ 60°F

# Physical Properties

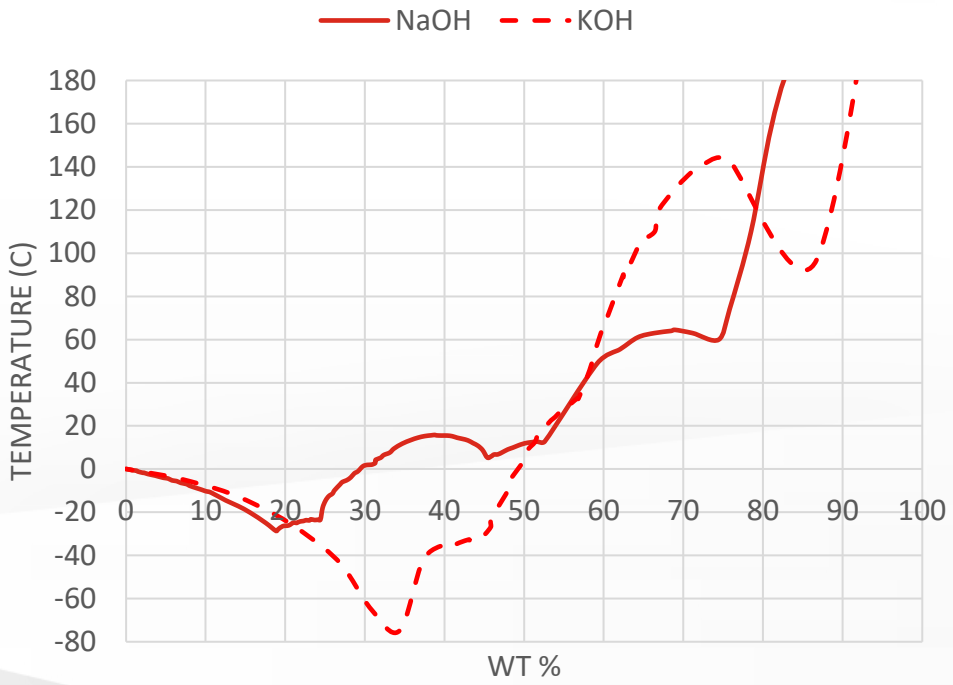
## Freezing Points – Potassium Hydroxide

- 50% Solution
  - Freeze at 36°F (2°C)
- 45% Caustic Potash Solution
  - Freeze at -22°F (-30°C)



# Physical Properties

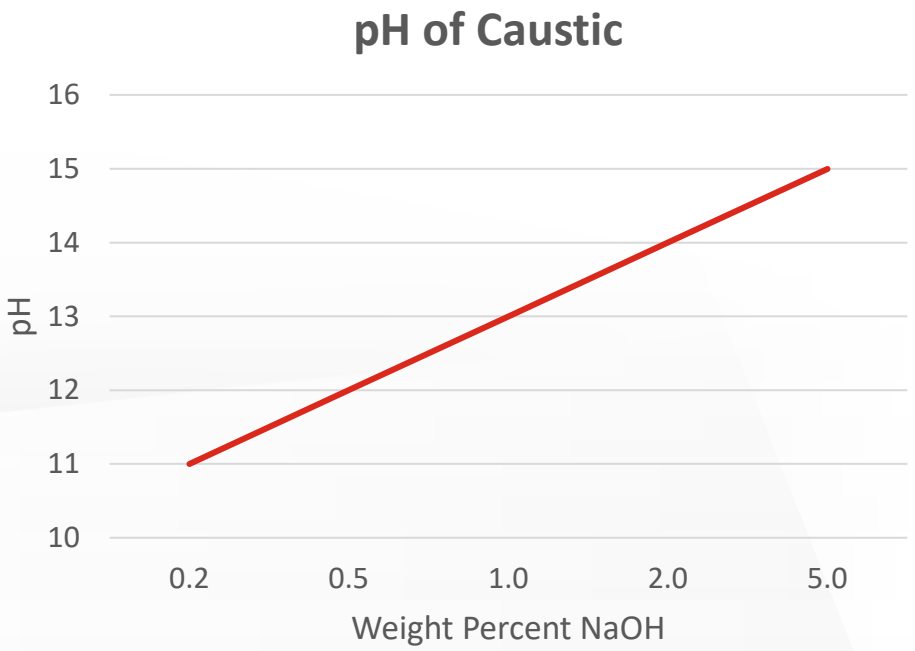
Freezing Point Comparison – Sodium and Potassium Solutions



# Chemical Properties

## pH

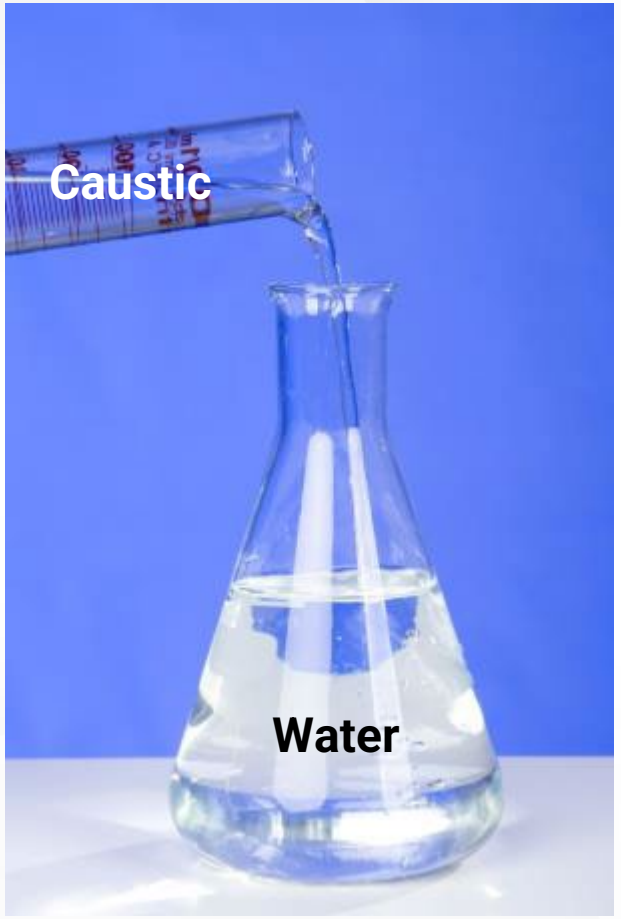
- Caustic is a strong base
  - 3.7% caustic solution:  pH = 14
  - 0.1% caustic solution:  pH > 11
  - Water (neutral): pH = 7



# Chemical Properties

## Dilution

- Highly exothermic
  - To prevent:
    - Splattering
    - Dangerous mist
    - Surface eruptions
  - ALWAYS:
    - Add caustic to water
    - Add caustic slowly
    - Use lukewarm water 80-100°F (27-38°C)
    - Mix or circulate to dissipate heat and hot spots

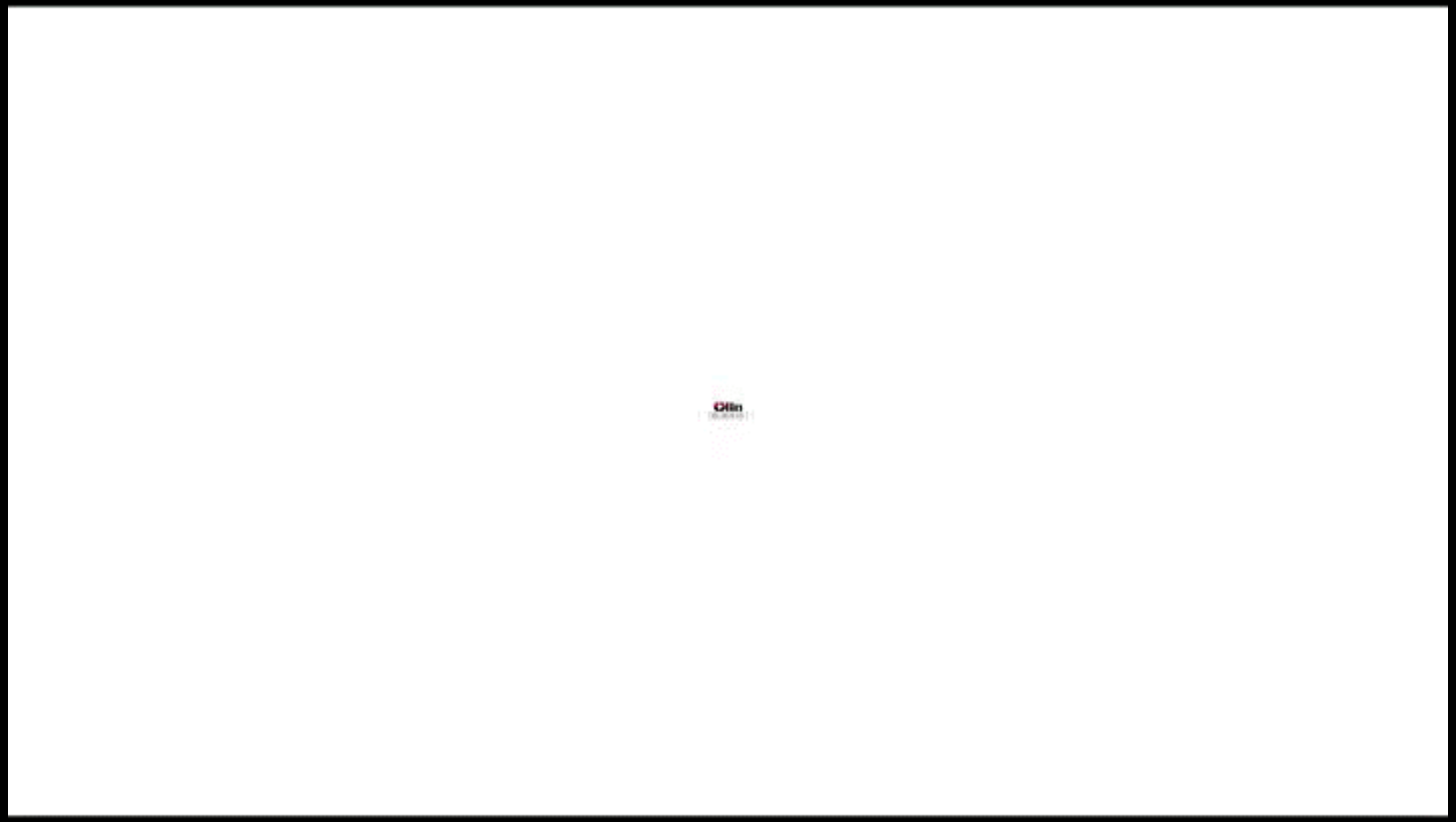


# Chemical Properties

## Reactivity

- Keep separate from acids
- Avoid other reactive materials:
  - Nitrogen containing organics
  - Carbohydrates
  - Phosphorous
  - Explosives
  - Organic peroxides
  - Hydrocarbons
  - Some metals (Aluminum, Copper, Zinc,  Tin)
  - Leather

# What Are Hydroxide Solutions?



# Health Hazards

Hydroxide Solutions – Sodium & Potassium

# Health Hazards

**Sodium/Potassium Solutions are Strong, Corrosive Alkalis and Attack:**

- Eyes
- Skin
- By inhalation
- By ingestion

# Health Hazards

## Eye Exposure

- Sodium/Potassium Solutions
  - Cause immediate pain, severe burns, and corneal damage, which may result in blindness

# Health Hazards

## Recommended Treatment for Eye Exposure

- Wash hands before touching face or eyes
- Flush with running water for at least 15 minutes
- Hold eyelids apart to ensure rinsing of the entire eye surface and lids
- DO NOT attempt to neutralize with chemical agents
- Seek advice for treatment, immediately

# Health Hazards

## Skin Exposure

- Sodium/Potassium Solutions
  - May cause deep and severe burns.
  - Burns may not be immediately painful as pain may be delayed for minutes or hours.

# Health Hazards

## Recommended Treatment for Skin Exposure

- Flush with running water for at least 30 minutes
- Remove contaminated clothing
- DO NOT attempt to neutralize with chemical agents
- Seek advice for treatment, immediately

# Health Hazards

## Inhalation

- Sodium/Potassium Solutions
  - Mists/dry residue may cause irritation to the nose, mouth, throat, and lungs

# Health Hazards

## Recommended Treatment for Inhalation

- Remove victim from area
- If breathing is difficult, oxygen may be beneficial
- If breathing has stopped, administer artificial respiration
- Seek advice for treatment, immediately

# Health Hazards

## Ingestion

- Caustic Soda/Caustic Potash
  - If ingested, may cause severe pain, burning of the mouth, throat, and esophagus, vomiting, diarrhea, and possible death

# Health Hazards

**Recommended Treatment for Ingestion**

- DO NOT INDUCE VOMITING
- Rinse mouth
- Give large amounts of water
- If vomiting occurs spontaneously, keep airway clear
- If person is unconscious, do not administer anything by mouth
- Seek advice for treatment, immediately

# Key Points to Remember

- Hydroxide Solutions are hazardous materials that can cause severe skin and eye irritation and/or chemical burns.
- Understand physical and chemical properties
  - Freeze points
  - Heating requirements
  - Dried caustic residue

# Questions?

# Useful References - Hydroxides

**Pamphlet № 65:**

Personal Protective Equipment for Chlor-Alkali Chemicals

**Pamphlet № 87:**

Recommended Practices for Handling Sodium Hydroxide Solution and Potassium Hydroxide Solution (Caustic) Tank Cars

**Pamphlet № 88:**

Recommended Practices for Handling Sodium Hydroxide Solution and Potassium Hydroxide Solution (Caustic) Cargo Tanks

**Pamphlet № 94:**

Sodium Hydroxide Solution and Potassium Hydroxide Solution (Caustic) Storage Equipment And Piping System