Shelf Life and Storage of Chemicals

Applications for Chemical Inventory Management

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Flinn Scientific Catalog and Reference Manual

• Responsibilities under the duty of care
• The Laboratory Standard and Chemical Hygiene Plan
• Reducing chemical exposure
• Chemical spill control
• Chemical storage system
• Managing the chemical storeroom
• Understanding MSDS
• Solution preparation
• Special topics
  Flammable liquid safety, acid safety, dissection and sterilization guidelines
Reliable shelf-life information for chemicals can help teachers manage their chemical inventory and improve safety in school science labs.

- *Flinn Scientific Catalog and Reference Manual* provides an accessible summary of safety information for chemicals, including their physical and chemical properties and health hazards.

- Estimated shelf-life data for 1300 commonly used chemicals in the high school science laboratory.
Chemical Life Cycle Management

Disposal → Purchasing → Storage → Handling and Use

It all begins with planning!
Sodium Metal

reagent grade, lumps

★ HAZARD ALERT: A flammable, corrosive solid; dangerous when exposed to heat or flame; dangerous by reaction with moist air, water or any oxidizer. Spontaneously flammable when heated in air; reacts violently with water, producing very dangerous hydrogen gas and a solution of corrosive sodium hydroxide.

Storage: Inorganic #1 under dry mineral oil and inside a Flinn Saf-Stor™ Can. Sodium metal must always be stored under dry mineral oil to prevent contact with moist air.

Disposal: #3

Shelf Life: Good, if stored safely.


Odor: Metal itself is odorless but is usually stored under an oil or kerosene, either of which may have an odor.

CAS No. 7440-23-5

Technical Note: As you handle sodium be particularly attentive to the use of dry utensils and an entirely dry work surface. Use all appropriate personal safety apparel, i.e., gloves, apron, face shield, etc. Sodium would be the better choice to demonstrate the characteristics of an alkali metal than potassium. Potassium may develop potentially explosive peroxides.
Evaluation Criteria for Determining Shelf Life

- Reactivity with air (oxygen and carbon dioxide) and water
- Sensitivity to light and photochemical reactions
- Moisture-sensitive (hygroscopic and deliquescent chemicals)
- Peroxide formation
- Flammability
- Oxidizing and reducing agents
- Vapor pressure and boiling point (volatility)
Shelf life of a chemical depends on storage conditions.

- Ventilation
- Environmental controls
- Use of secondary containment
General guidelines for shelf life determination

• Excellent (>5 years)
• Good (3–5 years)
• Fair (1–3 years)
• Poor (<1 year)
Chemicals with Fair to Poor Shelf Lives

• Reactions with air and water
  – Alkali and alkaline earths metals and finely divided metal powders (aluminum, iron, zinc dust)
  – Acid anhydrides and acid chlorides
  – Alkaline earth metal hydroxides and oxides
  – Acetaldehyde, benzaldehyde, and oxidizable organic compounds
  – Low-valent transition metal salts [tin(II), iron(II), copper(I)]

• Peroxide formation
  – Diethyl ether, tetrahydrofuran, dioxane, sec-butyl alcohol
Chemicals with Fair to Poor Shelf Lives

• **Light-sensitive chemicals**
  – Potassium iodide, iodine, iron(II) and iron(III) citrates and oxalates
  – Benzoyl peroxide

• **Moisture-sensitive compounds**
  – Anhydrous salts
    • Aluminum chloride, calcium chloride, copper(II) chloride, phosphorus pentoxide; potassium acetate, bisulfate, bicarbonate, bromide, and thiocyanate; sodium bisulfite and meta-bisulfite
Chemicals with Fair to Poor Shelf Lives

• **Deliquescent and Low-Melting Hydrates**
  – Iron(III) chloride hexahydrate and iron(III) nitrate nonahydrate

• **Volatile and flammable solvents**

• **Oxidizing agents**
  – Avoid contamination with organic compounds!

• **Biological reagents**
  – Enzymes
  – DNA, ATP, etc.
Practical Solutions for Improving Chemical Management in School Science Labs

• Maintain an accurate inventory of all chemicals
• Review and plan lab activities
• Date-label all chemicals upon receipt
  – Record in inventory
• Incorporate shelf-life characterization into inventory
  – Incorporate into purchasing decisions
• Store chemicals in chemical-compatible families
• Develop and implement three-year action plan for science department safety improvements
Greening the School Science Lab

• Use lower concentrations and less hazardous forms of chemicals
  – Purchase lowest concentrations needed of strong acids
  – Substitute solutions for pure solids
  – Avoid finely divided metals

• Incorporate applications-oriented experiments into the curriculum wherever possible

Call or write to obtain a free copy of our Flinn Scientific Safety Note publication!
Awareness of shelf-life information for chemicals can be used to inform chemical storage guidelines and reduce the costs associated with the disposal of contaminated, unused and unwanted chemicals.

Thank you!

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