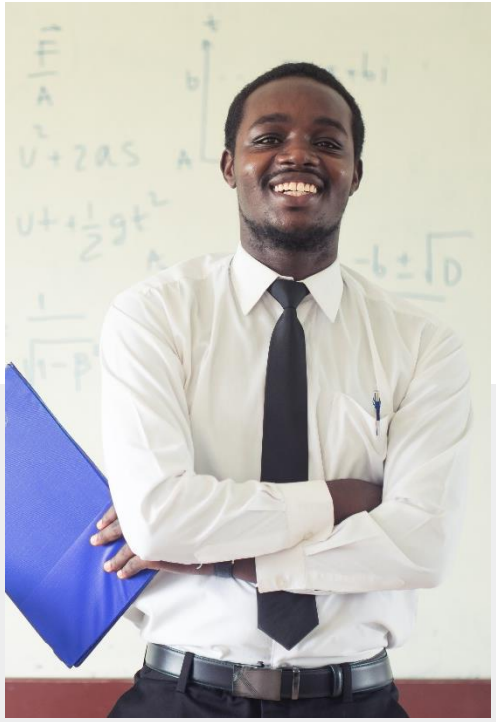
SCIENCE LAB & PREP AREA SAFETY GUIDANCE RESOURCE

FLINN SCIENTIFIC

COMMON SAFETY QUESTIONS AND ANSWERS INVOLVING SCIENCE LABORATORY LEGAL SAFETY STANDARDS AND PROFESSIONAL SAFETY PRACTICES IN SECONDARY SCHOOL ENVIRONMENTS ACROSS THE USA

- JAMES PALCIK, DIRECTOR OF EDUCATION, SAFETY AND COMPLIANCE, FLINN SCIENTIFIC INC.

Council of State Science Supervisors



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Guidance on Common science lab safety concerns in the secondary schools across the USA based on legal safety standards and better professional safety practices.

Many science teachers and supervisors have asked for an updated safety resource to use in their laboratories and in their prep room (storeroom) to raise the level of awareness, and compliance in an effort to prevent any potential unsafe situation in the science department proactively.

FLINN and the CSSS understands the situation that you are in currently and we have compiled a listing of common concerns and remedies for them which you can use in your school.

James Palcik, Director of Education, Safety and Compliance, & Tom Trapp, Director of National Accounts.

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These materials contain content provided by third parties and are being distributed for your convenience only. We make no representations about the accuracy of these materials and urge you to consult federal, state, and local public health and safety guidelines for the most up-to-date information on laboratory safety.

OVERVIEW OF THIS RESOURCE

A very special acknowledgement to Dr. Ken Roy for the professional guidance and safety review of these CSSS documents for use in K-12 schools across the USA. We appreciate your experience and direction.

Dr. Ken Roy
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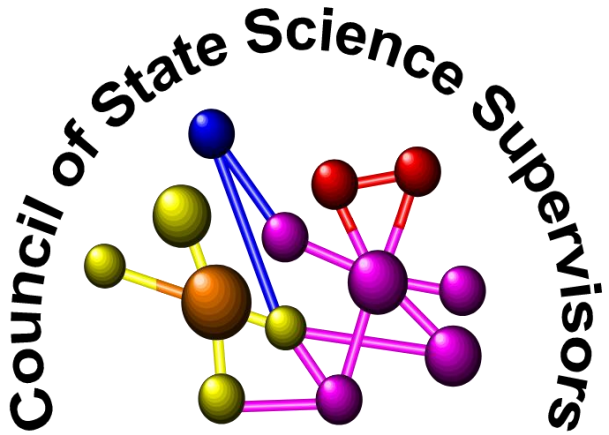


Our mission is to sustain and nurture a dynamic learning community that empowers its members to be effective and articulate advocates for quality science education at the local, state and national levels.

Council of State Science Supervisors

"The voice and vision of science education for the states"

CSSS is the only professional science organization whose members have direct accountability to the government agencies given the constitutional authority for education. Within their own jurisdictions, each of these supervisors plays a key role in directing efforts at improving school science and to ensure excellence and equity in science education.

CSSS can offer state and national organizations a direct science education link to every school building in their state or territory. These science supervisors can provide information on the types of science programs their schools are using and how well each of the programs are working in their state. Most of the members serve on the state science teacher's organizational boards and are on a first name basis with their leaders. The Council members are proactive change agents in science for their state. Their responsibilities link the Council members by leadership and service to a broad constituency.

1. http://cosss.org/
2. http://cosss.org/page-18148

Science & Safety: Making the Connection

With the increasing emphasis on hands-on, minds-on inquiry instruction at all grade levels in the multiple science education frameworks that exist across the various states as a baseline for scientific investigation and courses of study, it becomes more incumbent upon science teachers to be as knowledgeable as possible about laboratory safety issues and their own responsibilities and accountabilities.

As recognized science supervisors/specialists, the members of the Council of State Science Supervisors (CSSS) are constantly receiving questions from teachers and administrators about safety issues, responsibilities, and liability. This resource document, which addresses some of the most commonly asked questions, is one response to those frequent inquiries.

The objective of this document is to provide a handy, concise reference for science teachers, primarily at the secondary (9–12) level. They can refer to it for information and resources on some of the most commonly asked questions that concern science teachers. Resources cited are in paper, electronic, and web accessible forms. It should be clear that this document cannot be comprehensive because of limitations of the format and purpose. It is hoped that the most important information needed about the topics is incorporated.

1. http://cosss.org/
2. http://cosss.org/page-18148

Special Notice to the Reader About this Resource

No implication of endorsement or lack of omission of any referenced material within this document. For more information about specific questions in the document as they pertain to a particular locale or state, contact your local or state fire marshal, building commission, health department/poison control center, environmental regulatory and state/federal Occupational Safety and Health Administration (OSHA) agency, or science specialist at the local or state board of education/education agency (DOE).

The Council of State Science Supervisors, an organization of state science supervisors/specialists throughout the United States, has a long history of working collaboratively with other science education organizations and professional groups to improve science education on a national scale.

For more information about CSSS and its membership, direct your browser to **http://cosss.org/**

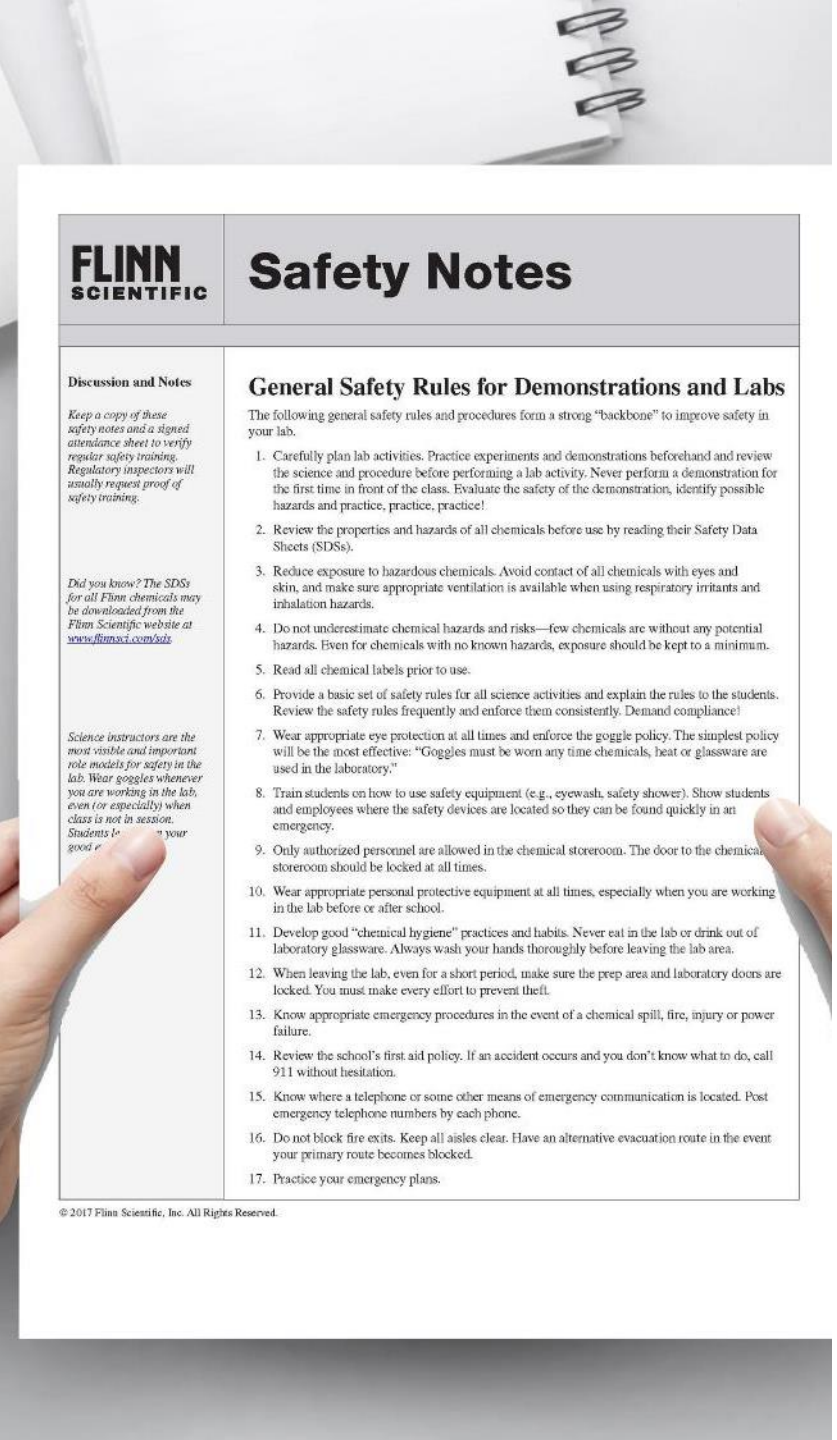
1. http://cosss.org/
2. http://cosss.org/page-18148

Legal Disclaimer

DISCLAIMER: The materials contained in this safety resource document have been compiled using sources believed to be reliable and to represent the best opinions on the subject. As stated above, the goal of this document is to provide a handy, concise reference that science teachers, primarily at the secondary (9–12) level, can refer to for information and resources on some of the most commonly asked questions that concern science teachers working in science departments in schools.

The document as a whole does not purport to specify minimal legal standards. No warranty, guarantee, or representation is made by the Council of State Science Supervisors or its consulting partners as to the accuracy or sufficiency of the information contained herein, and the Council and its supporting partners assume no responsibility in connection therewith. The document is intended to provide basic guidelines for safe practices and facilities.

Therefore, it cannot be assumed that ALL necessary warnings and precautionary measures are contained in this document and that other or additional information or measures may not be required. It is advised that users of this document should also consult pertinent local, state, and federal laws pertaining to their specific jurisdictions, as well as legal counsel, prior to initiating any safety program. Registered names and trademarks, etc., used in this publication, even without specific indication thereof, are not to be considered unprotected by law.



What are my legal responsibilities as a science teacher relating to negligence?

The **legal definition** of "negligence" and "recklessness" are important for every teacher to know. Negligence, as defined by the courts today, is conduct that falls below a standard of care established by law or profession to protect others from an unreasonable risk of harm, or the failure to exercise due care. "Recklessness" involves conduct that is short of actual intent to cause harm, but greater than simple negligence. Unlike negligence - recklessness means to knowingly take a risk.

It should be noted that in the absence of specific laws or local policies, the standard of care expected is set by the profession, e.g., position statements adopted by the National Science Teaching Association (NSTA), the National Association of Biology Teachers (NABT), the American Chemical Society (ACS), or the Council of State Science Supervisors (CSSS).

The science teacher has three basic duties relating to the modern concept of negligence:

- **Duty of instruction.**
- **Duty of supervision.**
- **Duty to properly maintain facilities and equipment.**

Failure to perform any duty may result in a finding that a teacher and/or administrator within a school system is/are liable for damages and a judgment and award against him/them.

1. http://cosss.org/
2. http://cosss.org/page-18148
3. https://static.nsta.org/pdfs/LegalImplicationsOfDutyOfCareForScienceInstruction.pdf
4. https://www.flinnsci.com/api/library/Download/a47ceee857f44684bf2bd43a5e5fb930

DUTY OF INSTRUCTION

DUTY OF INSTRUCTION includes adequate instruction before a laboratory activity (preferably in writing) that:

- Is accurate; is appropriate to the situation, setting, and maturity of the audience; and addresses reasonably foreseeable dangers.
- Identifies and clarifies any specific risk involved, explains proper procedures/techniques to be used, and presents comments concerning appropriate/inappropriate conduct in the lab.
- The use of a lab safety contract or safety acknowledgement form is a better professional safety practice technique used to demonstrate safety rules for students in the laboratory

- Instruction must follow legal, professional and district guidelines.
- Teachers who set bad examples by not following proper laboratory procedures may be sued if injury results from students following the teacher's bad examples.

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DUTY OF SUPERVISION

DUTY OF SUPERVISION includes adequate supervision as defined by professional, legal, and district guidelines to ensure students behave properly in light of any foreseeable dangers. Points to remember:

- Misbehavior of any type must not be tolerated in the science department.
- Failure to act or improper action is grounds for liability.
- The greater the degree of danger, the higher the level of supervision should be.
- The younger the age of students or the greater the degree of inclusion of special population students, the greater the level of supervision should be.
- Students must never be left unattended, except in an emergency where the potential harm is greater than the perceived risk to students. Even then, risk should be minimized or responsibility transferred to another authorized person if the situation allows.
- Remote / Distance education involves safety concerns involving supervision and your duty of care obligations.

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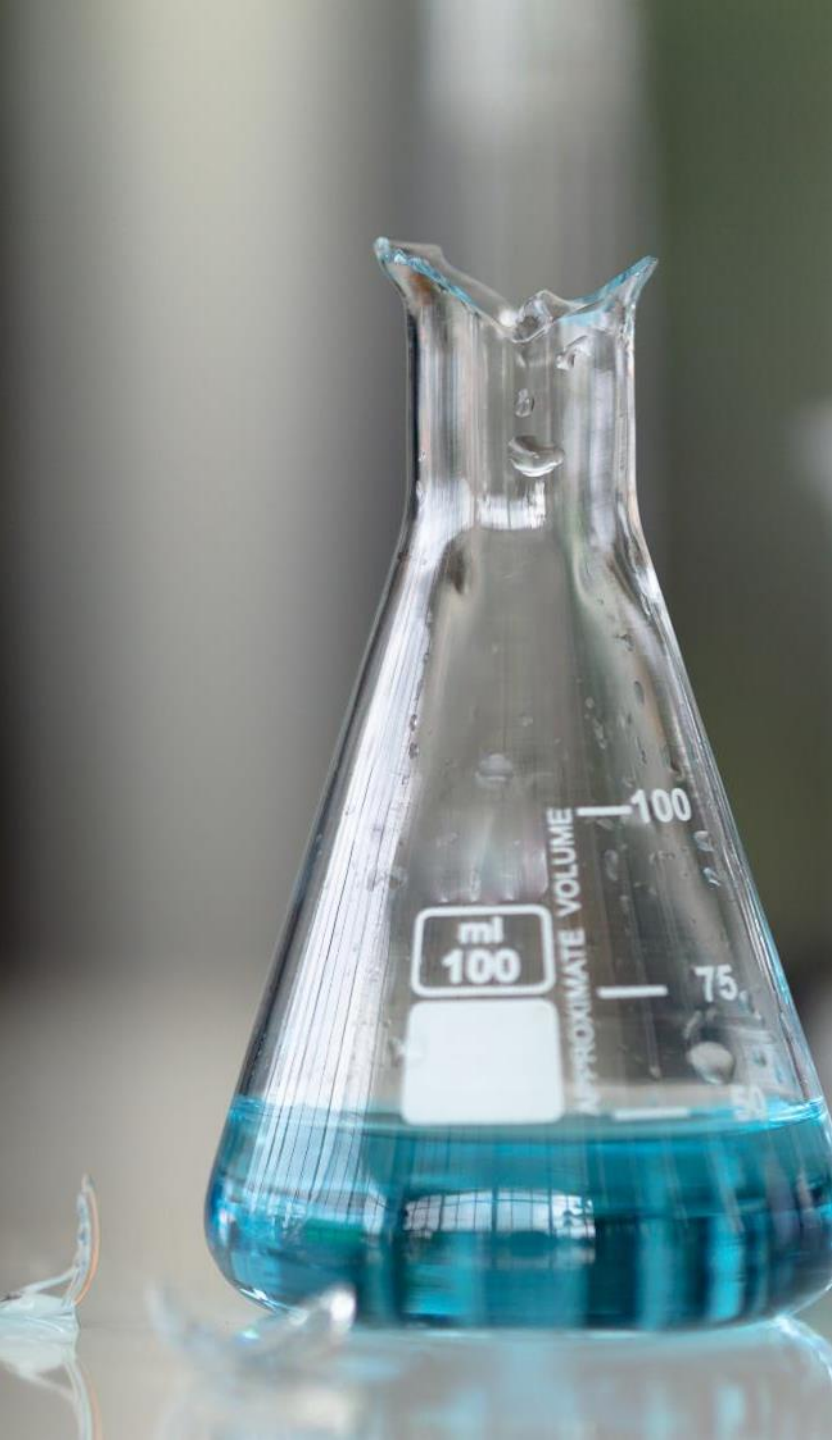

DUTY OF MAINTENANCE

DUTY OF MAINTENANCE includes ensuring a safe environment for students and teachers. This requires that the teacher:

- Never use defective equipment for any reason.
- File written reports for maintenance/correction of hazardous conditions or defective equipment with responsible administrators.
- Establish regular inspection schedules and procedures for checking safety equipment and first-aid equipment.
- Follow all safety guidelines concerning proper labeling, storage, handling (use) and disposal of chemicals according to your local, state or federal legislation and better professional safety practices.

- By keeping files of all hazard notifications and maintenance inspections, teacher liability in the event of an accident is minimized in cases where no corrective actions were subsequently made.

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Science Safety Checklists

- Have appropriate personal protective equipment, (PPE) e.g., American National Standards Institute (ANSI) Z87 or Z87.1, D3 coded indirectly vented chemical splash goggles, chemical aprons, non-allergenic gloves (nitrile), dust masks, eyewash, shower(s), ABC fire extinguisher(s), sand bucket(s), fire blanket(s), in easily accessible locations. (General rule is accessibility within 15 seconds or 30 steps from any location in the room.) Make certain that the instructor and students wear adequate protective equipment, including indirectly vented, approved, chemical splash resistant safety goggles and lab aprons, when experiments involving hazardous chemicals or procedures are conducted. *This will include the activity set-up, hand-on, and take-down phases of the investigation.

- Notify supervisors immediately of hazardous or potentially hazardous conditions, such as lack of Ground-Fault Interrupters (GFIs) near sinks, inadequate ventilation, or potential hazards, e.g., study halls and non-science classes scheduled in laboratories or tile floors not waxed with non- skid wax.
- Check the fume hood regularly for efficiency and never use the hood as a storage area. Ensure that the hood is vented properly through the roof.

1. http://cosss.org/
2. https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/hazard-assessment/table-f-1-traditional-laboratory-safety-checklist.docx
3. https://education.mn.gov/mdeprod/idcplg?IdcService=GET_FILE&dDocName=MDE046284&RevisionSelectionMethod=latestReleased&Rendition=primary
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Science Safety Checklists Continued

- Use only equipment in good condition (not broken) and efficient working order.
- Have a goggle sanitation plan for goggles used by multiple classes per day.
- Have separate disposal containers for broken glassware or flammables.
- Discuss and post emergency/escape and notification plans/numbers in each room/laboratory. Clearly mark fire exits, and keep exits (preferably two from laboratories) unobstructed.
- Have and enforce a safety contract or safety acknowledgement form with students and parents/guardians.
- Identify medical and allergy problems for each student to foresee potential hazards.
- Model, post, and enforce all safety procedures. Display safety posters.

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Science Safety Checklists Continued

- Know district and state policies concerning administering first aid and have an adequately stocked first-aid kit accessible at all times.
- Know and follow district and state policies/guidelines for use of hazardous chemicals, live animals, and animal and plant specimens in the classroom/lab.
- Report all injuries, including animal scratch- es, bites, and allergic reactions, immediately to appropriate supervisors.
- Keep records on safety training and laboratory incidents.
- Provide the number of accessible lab stations having sufficient workspace (60 square feet or 5.6 square meters) workspace per student; 5 foot or 1.5 meters wide aisles and low lab table sections for wheelchair accessibility that can be supervised by the num- ber of qualified teachers/aides present (maximum 24:1).
- Have master cut-off switches/valves within each laboratory (preferably in one secure location); know how to use them; and keep water, gas, and electricity turned off when not in use.

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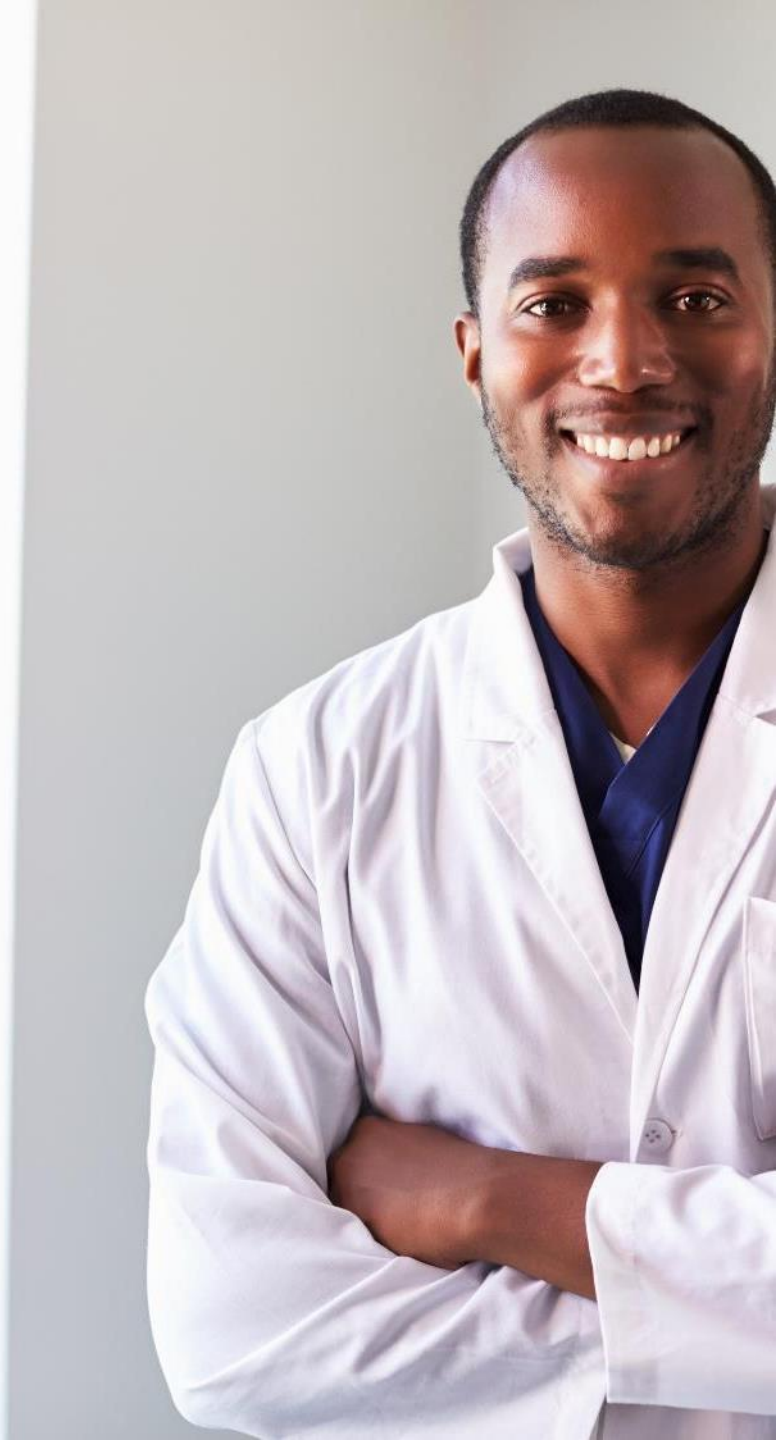

Science Safety Checklists Continued

- Maintain up-to-date chemical and equipment inventories, including Safety Data Sheet (SDS) files. *keep older MSDS files for 30 years for regulatory compliance.*
- Label equipment and chemicals adequately with respect to hazards and other needed information.
- Post the National Fire Protection Association (NFPA) "diamond" at all chemical storeroom entrances denoting the most hazardous chemical in each category within. Regularly send an updated copy of the inventory to the local fire department.
- Organize chemical storerooms properly. Arrange chemicals by National Institute for Occupational Safety and Health (NIOSH)/ Occupational Safety and Health Administration (OSHA) compatibility classes, with special storage available for oxidizers, non-flammable compressed gases, acids, and flammables.

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Science Safety Checklists Continued

Store chemicals in appropriate places—e.g., below eye level, large containers no higher than 2 feet (.6 meters) above floor, acids in corrosives cabinets, and solvents in OSHA/NFPA approved flammables cabinets—with acids physically separated from bases and oxidizers physically separated from organics within secure, limited access, adequately ventilated storerooms. Chemical shelving should be wooden, with a front lip and without metal supports.

Have appropriate materials in a readily accessible location for accidental chemical spills, ample supplies of PPE (goggles, gloves, aprons, lab coats, respirators) as well as mercury sponges and a solution to use for the safe disposal of chemical and biological *materials (many schools us a 10% Clorox solution or a 5% Lysol solution)*.

Prohibit the use of pathogens or materials that have a BioSafety Level 1 or above identifier as outlined by the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health protocols.

Ensure that you are able to keep animals and students isolated from one another in the laboratory.

1. http://cosss.org/
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General Safety & Compliance Checklist Criteria for Annual Inspections / Audits

Have appropriate personal protective equipment, (PPE) e.g., American National Standards Institute (ANSI) Z87 or Z87.1, D3 coded goggles, chemical aprons, non-allergenic gloves, dust masks, eyewash, shower(s), ABC fire extinguisher(s), sand bucket(s), fire blanket(s), in easily accessible locations. (General rule is accessibility within 15 seconds or 30 steps from any location in the room.) Make certain that instructor and students wear adequate protective equipment, including indirectly vented, approved, chemical splash safety goggles and aprons, when experiments involving hazardous chemicals or procedures are conducted.

Notify supervisors immediately of hazardous or potentially hazardous conditions, such as lack of Ground-Fault Interrupters (GFIs) near sinks, inadequate ventilation, or potential hazards, e.g., study halls scheduled in laboratories or tile floors not waxed with non-skid wax.

Check the fume hood regularly for efficiency and never use the hood as a storage area. Ensure that the hood is vented properly through the roof.

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General Safety & Compliance Checklist Criteria

- Check the fume hood regularly for efficiency and never use the hood as a storage area. Ensure that the hood is vented properly through the roof.
- Use only equipment in good condition (not broken) and efficient working order.
- Have a goggle sanitation plan for goggles used by multiple classes per day. *(UV goggle sanitation cabinet; wipes; Lysol dip method of disinfection)*
- Have separate disposal containers for broken glassware or flammables.
- Discuss and post emergency/escape and notification plans/numbers in each room/laboratory. Clearly mark fire exits and keep exits (preferably two from laboratories) unobstructed.
- Have and enforce a safety contract with students and parents.
- Identify medical and allergy problems for each student to foresee potential hazards.
  Model, post, and enforce all safety procedures. Display safety posters.
- Keep laboratory uncluttered and locked when not in use or when a teacher is not present.

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General Safety & Compliance Checklist Criteria

- Know district and state policies concerning administering first aid and have an adequately stocked first-aid kit accessible at all times.
- Know and follow district and state policies/guidelines for use of hazardous chemicals, live animals, and animal and plant specimens in the classroom/lab.
- Report all injuries, including animal scratches, bites, and allergic reactions, immediately to appropriate supervisors.
- Keep records on safety training and laboratory incidents.
- Provide the number of accessible lab stations having sufficient workspace (60 square feet or 5.6 square meters) workspace per student; 5 foot or 1.5 meters wide aisles and low lab table sections for wheelchair accessibility that can be supervised by the number of qualified teachers/aides present (maximum 24:1).
- Have master shut-off switches/valves within each laboratory (preferably in one secure location); know how to use them; and keep water, gas, and electricity turned off when not in use.
- Maintain up-to-date chemical and equipment inventories, including Safety Data Sheet (SDS) files. *keep older MSDS files for 30 years for regulatory compliance.*

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General Safety & Compliance Checklist Criteria

- Label equipment and chemicals adequately with respect to hazards and other needed information.
- Organize chemical storerooms properly. Arrange chemicals by National Institute for Occupational Safety and Health (NIOSH)/ Occupational Safety and Health Administration (OSHA) compatibility classes, with special storage available for oxidizers, non-flammable compressed gases, acids, and flammables.
- Store chemicals in appropriate places—e.g., below eye level, large containers no higher than 2 feet (.6 meters) above floor, acids in corrosives cabinets, and solvents in OSHA/NFPA approved flammables cabinets—with acids physically separated from bases and oxidizers physically separated from organics within secure, limited access, adequately ventilated storerooms. Chemical shelving should be wooden, with a front lip and without metal supports.

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General Safety & Compliance Checklist Criteria

- Provide in a readily accessible location appropriate materials and procedures for clean-up of hazardous spills and accidents, e.g., aspirator or kit for mercury spills, vermiculite and baking soda for acids, and 10% Clorox bleach solution or 5% Lysol solution for body fluids, and appropriate procedures for disposal of chemo- and bio- hazardous materials.
- Prohibit the use of pathogens or any procedures or materials in any school laboratory above Biosafety Level 1 as outlined by Centers for Disease Control/National Institutes of Health protocols.
- Keep live animals and students adequately protected from one another.

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What do I need to know about GHS chemical labelling and SDS

A Safety Data Sheet (SDS) should be kept on file and be easily accessible for ALL chemicals. SDS sheets should be referenced for proper storage and for appropriate personal protective equipment (PPE). Refer to your school district and state policies for local storage requirements and mandates (print copy vs electronic copy)

These are available online in multiple locations for free as a searchable index or whole library download. Visit www.flinnsci.com/SDS and you can search through 2500+ current, valid, SDS files available for free.

You are required to maintain the records of the chemicals used in your school science departments for 30 years – so please do not discard the old binders with MSDS information as these are necessary for contact tracing and reference.

1. https://unece.org/about-ghs
2. https://www.ccohs.ca/oshanswers/chemicals/ghs.html
3. https://www.flinnsci.com/required-ghs-training---the-right-to-understand/vsc0678/

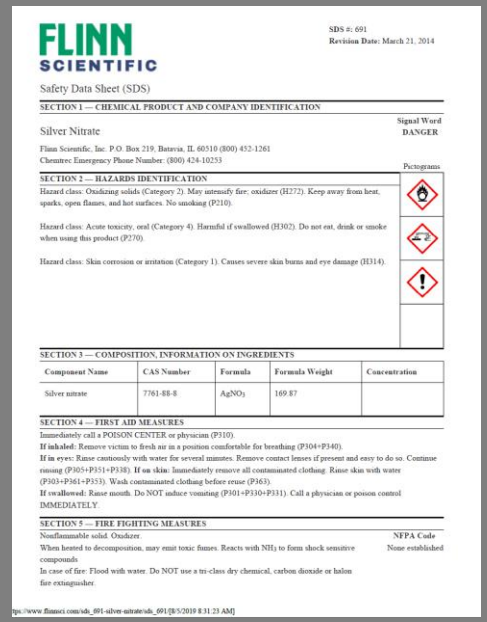
SDS

The Safety Data Sheet (SDS), formerly known as the Material Safety Data Sheet (MSDS), is provided by the manufacturer, distributor, or importer of a chemical to provide information about the substance and its use.

The SDS, unlike the MSDS, is required to present the information in a uniform manner. The information includes the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, disposing of, and transporting the chemical. There are 16 sections on every SDS in the same sequence.

The GHS provides standard language or “building blocks” for communicating the hazards of chemicals in the SDS, just as on chemical labels. These “building blocks” include the use of specific signal words, pictograms, hazard statements, and precautionary statements.

1. How to Read a Safety Data Sheet



FLINN SCIENTIFIC

SDS #: 691
Revision Date: March 21, 2014

Safety Data Sheet (SDS)

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Silver Nitrate

Signal Word
DANGER

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261
Chemtrec Emergency Phone Number: (800) 424-10253

Pictograms

SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Oxidizing solids (Category 2). May intensify fire; oxidizer (H272). Keep away from heat, sparks, open flames, and hot surfaces. No smoking (P210).

Hazard class: Acute toxicity, oral (Category 4). Harmful if swallowed (H302). Do not eat, drink or smoke when using this product (P270).

Hazard class: Skin corrosion or irritation (Category 1). Causes severe skin burns and eye damage (H314).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Silver nitrate	7761-88-8	$AgNO_3$	169.87	

SECTION 4 — FIRST AID MEASURES

Immediately call a POISON CENTER or physician (P310).
If inhaled: Remove victim to fresh air in a position comfortable for breathing (P304+P340).
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338). **If on skin:** Immediately remove all contaminated clothing. Rinse skin with water (P303+P361+P353). Wash contaminated clothing before reuse (P363).
If swallowed: Rinse mouth. Do NOT induce vomiting (P301+P330+P331). Call a physician or poison control IMMEDIATELY.

SECTION 5 — FIRE FIGHTING MEASURES

Nonflammable solid. Oxidizer.
When heated to decomposition, may emit toxic fumes. Reacts with NH_3 to form shock sensitive compounds
In case of fire: Flood with water. Do NOT use a tri-class dry chemical, carbon dioxide or halon fire extinguisher.

NFPA Code
None established

https://www.flinnsci.com/sds_691-silver-nitrate/sds_691/[8/5/2019 8:31:23 AM]

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Do not allow solid to become airborne. Ventilate area and wipe up with wet toweling. Place in sealed bag or container and dispose. Wash spill site after material pickup is complete. See Sections 8 and 13 for further information.

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Inorganic #3. Store with amides, nitrates, nitrites and azides.
Light sensitive. Store in a Flinn Chem-Saf™ bag, and lock up in a poison cabinet.
Keep away from combustible materials (P220). Take any precautions to avoid mixing with combustibles (P221).

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective gloves, protective clothing, and eye protection (P280). Wash hands thoroughly after handling (P264).
Exposure guidelines: PEL/TLV 0.01 mg/m^3 (OSHA, ACGIH)

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Colorless, transparent, rhombic crystals; turns color on exposure to light in presence of organic materials. Faint nitric acid odor.
Soluble: Water and hot alcohol

Boiling point: 440 °C (decomposes)
Melting point: 210 °C
pH: 6
Specific gravity: 4.35

SECTION 10 — STABILITY AND REACTIVITY

Oxidizer. Avoid contact with strong reducers, ammonia, strong bases, alcohols, magnesium.
Shelf life: Indefinite, but light sensitive.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Diarrhea, cyanosis
Chronic effects: Argyrosis
Target organs: N.A.

ORL-RAT LD_{50}: 1173 mg/kg
IHL-RAT LC_{50}: N.A.
SKN-RBT LD_{50}: N.A.

SECTION 12 — ECOLOGICAL INFORMATION

Toxic to aquatic species.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding.
Flinn Suggested Disposal Method #11 is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Silver nitrate. Hazard class: 5.1, Oxidizer. UN number: UN1493.

SECTION 15 — REGULATORY INFORMATION

TSCA-listed, EINECS-listed (231-853-9), RCRA code D001, D011.

SECTION 16 — OTHER INFORMATION

This Safety Data Sheet (SDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific, Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. The data should not be confused with local, state, federal or insurance mandates, regulations, or requirements and CONSTITUTE NO WARRANTY. Any use of this data and information must be determined by the science instructor to be in accordance with applicable local, state or federal laws and regulations. The conditions or methods of handling, storage, use and disposal of the product(s) described are beyond the control of Flinn Scientific, Inc. and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THIS PRODUCT(S).

How To Read a Globally Harmonized System (GHS) Label

Product Name or Identifier identify the chemical formula. If a mixture or alloy, the label should include all chemical identities of all ingredients that contribute to the acute toxicity, skin corrosion, serious eye damage, germ cell mutagenicity, carcinogenicity, reproductive toxicity, skin or respiratory sensation, or Target Organ Systemic Toxicity (TOST) when these hazards appear on the label.

Hazard Pictograms are graphical compositions with characteristic symbols to convey specific hazard information.

Signal Word indicates the relative level of severity of the hazard and alerts the reader to potential risks. The GHS signal words are "Danger" (more severe hazards) and "Warning" (less severe hazards).

Hazard Statement
A phrase assigned to a hazard class and category that describes the nature of the hazards of a hazardous product, including, where appropriate, the degree of hazard. (These may also be found in the Hazard Alert section.)

Precautionary Statements describe recommended measures to minimize or prevent the adverse effects resulting from exposure to a hazardous product, or improper storage or handling of hazardous products. (These may also be found near the hazard statements.)

Flame Over Circle
Oxidizer

Skull and Crossbones
Acute Toxicity (Fatal or Toxic)

Corrosion
Skin Corrosion/Burns
Eye Damage
Corrosive to Metals

Flame
Flammable
Pyrophoric
Self-Heating
Emits Flammable Gas
Self-Reactive
Organic Peroxide

Exclamation Mark
Irritant (Skin & Eye)
Skin Sensitizer
Acute Toxicity (harmful)
Narcotic Effects
Respiratory Tract Irritant

Health Hazard
Carcinogenicity
Mutagenicity
Reproductive Toxicity
Respiratory Sensitizer
Target Organ Toxicity
Aspiration Toxicity

Exploding Bomb
Explosives
Self-Reactive
Organic Peroxide

Environment
Aquatic Toxicity (Non-Mandatory)

Gas Cylinder
Gas Under Pressure

1. https://unece.org/about-ghs
2. https://www.ccohs.ca/oshanswers/chemicals/ghs.html
3. https://www.flinnsci.com/required-ghs-training---the-right-to-understand/vsc0678/

FLINN SCIENTIFIC, INC
"Your Safer Source for Science Supplies"

AP7650

Introducing the GHS Pictograms

Exploding bomb
(for explosion or reactivity hazards)

Flame over circle
(for oxidizing hazards)

Corrosion
(for corrosive damage to metals, as well as skin, eyes)

Health hazards
(may cause or suspected of causing serious health effects)

Environment*
(may cause damage to the aquatic environment)

Flame
(for fire hazards)

Gas cylinder
(for gases under pressure)

Skull and crossbones
(can cause death or toxicity with short exposure to small amt)

Exclamation mark
(may cause less serious health effects or damage ozone layer)

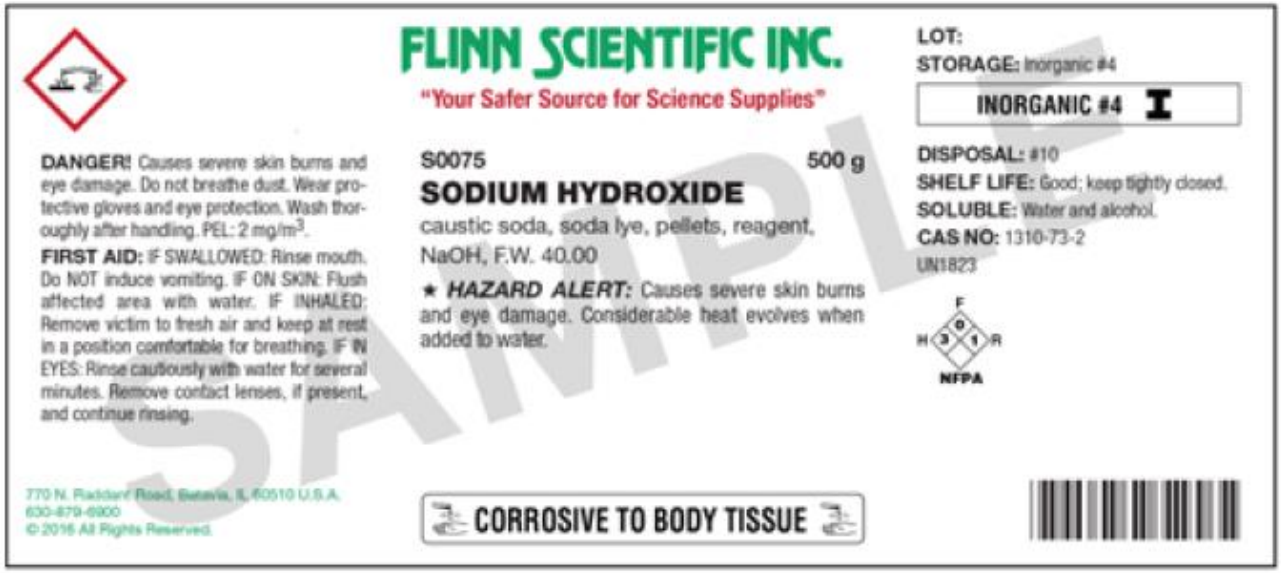
Biohazardous infectious material**
(for organism or toxins that can cause disease)

Labelling Requirements

- New bottles of chemicals ordered from trusted suppliers will already have compliant GHS labelling on the bottles.
- There is a prescribed format for labelling chemicals from the United Nations (GHS) and for updating existing older bottles in your lab.
- Different options exist to retrofit the labels on the bottles

Chemical Product Labels

Always read the label on a chemical bottle to obtain and review basic safety information concerning the properties of a chemical. It is the responsibility of teachers to be fully aware of the hazards and risks of all chemicals they are using.



https://unece.org/about-ghs

https://www.ccohs.ca/oshanswers/chemicals/ghs.html

https://www.flinnsci.com/required-ghs-training---the-right-to-understand/vsc0678/

Typical Manufacturer Label for Sodium Hydroxide Pellets (NaOH)

PICTOGRAM in RED DIAMOND

DANGER! Causes severe skin burns and eye damage. Do not breathe dust. Wear protective gloves and eye protection. Wash thoroughly after handling. PEL: 2 mg/m^3.

FIRST AID: IF SWALLOWED: Rinse mouth. Contact POISON CENTER or physician if you feel unwell. IF ON SKIN: Flush affected area with water. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present, and continue rinsing.

770 N. Raddant Road, Batavia, IL 60510 U.S.A.
630-879-6900

FLINN SCIENTIFIC "Your Safer Source for Science"

S0076 2 kg

SODIUM HYDROXIDE

caustic soda, soda lye, pellets, reagent, NaOH, F.W. 40.00

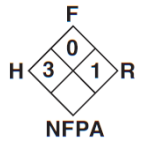
★ ***HAZARD ALERT:*** Causes severe skin burns and eye damage. Considerable heat evolves when added to water.

CORROSIVE TO BODY TISSUE

LOT: 999999
STORAGE: Inorganic #4

INORGANIC #4 I

DISPOSAL: #10
SHELF LIFE: Good; keep tightly closed.
SOLUBLE: Water and alcohol.
CAS NO: 1310-73-2
UN1823



Precautionary Statement

https://unece.org/about-ghs

https://www.ccohs.ca/oshanswers/chemicals/ghs.html

https://www.flinnsci.com/required-ghs-training---the-right-to-understand/vsc0678/

Labelling Requirements

- Existing bottles of chemicals require a GHS compliant label – 30mL dropper bottles or a 2.5L bottle. **No exemptions!**
- You can create an overlay label and adhere it over the existing supplier label. This is to standardize communication on the chemical labels.
- Solutions made in the lab require a label as well. *Ex Made a 0.1M HCl solution from a 3M stock bottle.* Both vessels require a current GHS label for compliance and adherence to the CHP & OSHA.

DANGER! Flammable liquid and vapor. Causes severe skin burns and eye damage.

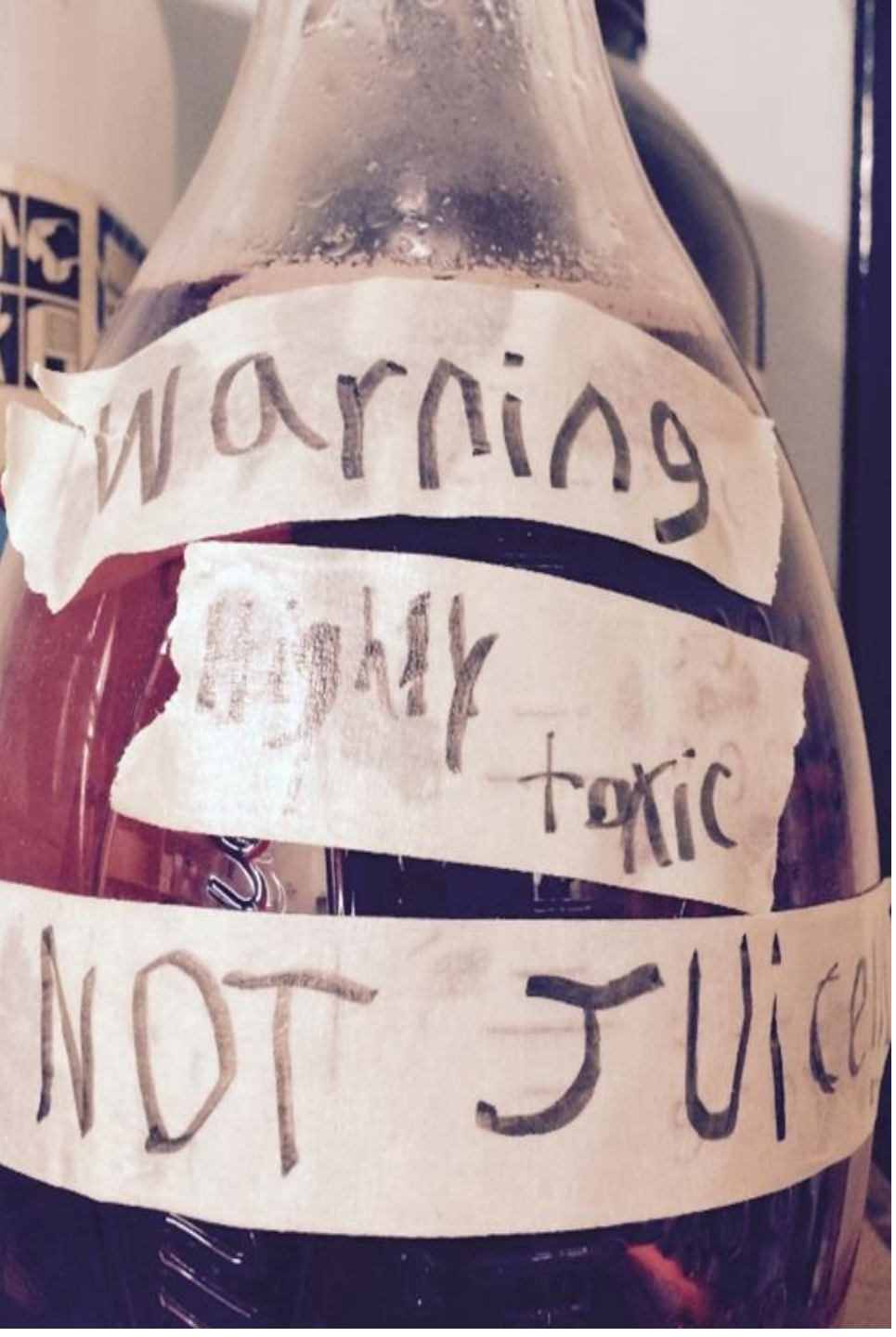
Acetic Acid, Glacial
Catalog #: **A0005**
Chemical Grade: **Reagent**
Amount: **250 mL**
Purchased: **03/11/2014**
Family: **O 1**
Disposal: **24a**

https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Labelling Older Chemicals in the School Prep Area & Storage Cabinets

- You must have a current chemical inventory of the products in your lab. **Including OLD chemicals!!!**
- You need to have a GHS label on EVERY Chemical in the lab including dropper bottles and student learning kits. **Period.**
- There is no exemption for small bottles – even dropper bottles should have a proper label with the necessary information printed in color (Red diamond if needed)

1. https://unece.org/about-ghs
2. https://www.ccohs.ca/oshanswers/chemicals/ghs.html
3. https://www.flinnsci.com/required-ghs-training---the-right-to-understand/vsc0678/



Chemical Labelling Requirements

Labeling Chemicals

Include the following minimum essential information on chemical labels:

- Chemical manufacturer or supplier (including address and telephone number).
- Chemical name and/or trade name of the product (same as SDS when applicable).
- Date received or date placed in the container.
- Molarity or Concentration of the chemical.
- Precautions to be observed in the safe handling or mixing the chemical.
- Appropriate hazard symbol pictogram in a red diamond if applicable.

1. This is not an acceptable chemical label. This is a dangerous situation with no identifiers such as chemical name, concentration, date, lab activity or and hazard information present. Not from a Flinn certified school. This is a serious concern in prep rooms when you cannot identify these orphan chemicals on the shelf.
   James Palcik, Flinn Scientific Inc.

Chemical Storage

Store chemicals according to the following minimum storage requirements:

- Separate chemical storage area from the classroom area. Use appropriate warning symbols to identify the chemical storage areas.
- Make certain that storage area is properly ventilated.
- Make certain that fire door or adequate exits
- extinguisher(s) or extinguishing systems.
- Make certain that storage shelves are securely attached to wall (each shelf with a front one-inch or 2.5 centimeters lip to pre- vent bottles from sliding off shelves).
- Separate inorganic chemicals from organic chemicals.
- Use a reputable guide, e.g., National Institute for Occupational Safety and Health/ Occupational Safety and Health Administration (NIOSH/OSHA), to help you properly separate incompatible chemical families.
- Do not store chemicals past the manufacturer suggested shelf life. Dispose of old chemicals in a timely manner.
- Make certain that chemicals are labeled and stored in appropriate containers.
- Store flammables and corrosives separately in appropriate cabinets

1. https://www.cdc.gov/niosh/npg/default.html
2. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
3. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
4. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Best-in-Class Chemical Storage (NIOSH approved system)

FLINN SCIENTIFIC Chemical Storage Pattern

Organic Storage Codes

- Acids, Amino Acids, Anhydrides, Peracids
- Alcohols, Glycols, Sugars, Amines, Amides, Imines, Imides
- Hydrocarbons, Esters, Aldehydes, Oils
- Ethers, Ketones, Ketenes, Halogenated Hydrocarbons, Ethylene Oxide
- Epoxy Compounds, Isocyanates
- Peroxides, Hydroperoxides, Azides
- Sulfides, Polysulfides, Sulfoxides, Nitriles
- Phenols, Cresols
- Dyes, Stains, Indicators
- Organic Miscellaneous

Inorganic Storage Codes

I1 – Metals, Hydrides
I2 – Acetates, Halides, Iodides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens
I3 – Amides, Nitrates (except Ammonium Nitrate, store as I8), Nitrites, Azides
I4 – Hydroxides, Oxides, Silicates, Carbonates, Carbon
I5 – Sulfides, Selenides, Phosphides, Carbides, Nitrides
I6 – Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Perchloric Acid, Peroxides, Hydrogen Peroxide
I7 – Arsenates, Cyanides, Cyanates
I8 – Borates, Chromates, Manganates, Permanganates
I9 – Acids (except Nitric) (Nitric Acid is isolated and stored by itself.)
I10 – Sulfur, Phosphorus, Arsenic, Phosphorous Pentoxide
IM – Inorganic Miscellaneous

Chemical Families and Corresponding Storage Codes

tates — I2
ls, Inorganic (except Nitric) — I9
itric Acid is isolated and stored by itself.)
ls, Organic — O1
ohols — O2
ehydes — O3
ides (inorganic) — I3
ides (organic) — O2
ines — O2
ino Acids — O1
ydrides — O1
enates — I7
enic — I10
des (inorganic) — I3
des (organic) — O6
ates — I8
mates — I6
Carbides — I5
Carbon — I4
Carbonates — I4
Chlorates — I6
Chlorites — I6
Chromates — I8
Cresols — O8
Cyanates — I7
Cyanides — I7
Dyes — O9
Epoxy Compounds — O5
Esters — O3
Ethers — O4
Ethylene Oxide — O4
Glycols — O2
Halides — I2
Halogenated Hydrocarbons — O4
Halogens — I2
Hydrides — I1
Hydrocarbons — O3
Hydrogen Peroxide — I6
Hydroperoxides — O6
Hydroxides — I4
Hypochlorites — I6
Imides — O2
Imines — O2
Indicators — O9
Iodates — I6
Iodides — I2
Isocyanates — O5
Ketenes — O4
Ketones — O4
Manganates — I8
Metals — I1
Miscellaneous (inorganic) — IM
Miscellaneous (organic) — OM
Nitrates — I3
(except Ammonium Nitrate, store as I8)
Nitrides — I5
Nitriles — O7
Nitrites — I3
Oils — O3
Oxides — I4
Peracids — O1
Perchlorates — I6
Perchloric Acid — I6
Permanganates — I8
Peroxides (inorganic) — I6
Peroxides (organic) — O6
Phenols — O8
Phosphates — I2
Phosphides — I5
Phosphorus — I10
Phosphorous Pentoxide — I10
Polysulfides — O7
Selenides — I5
Silicates — I4
Stains — O9
Sugars — O2
Sulfates — I2
Sulfides (inorganic) — I5
Sulfides (organic) — O7
Sulfites — I2
Sulfoxides — O7
Sulfur — I10
Thiosulfates — I2

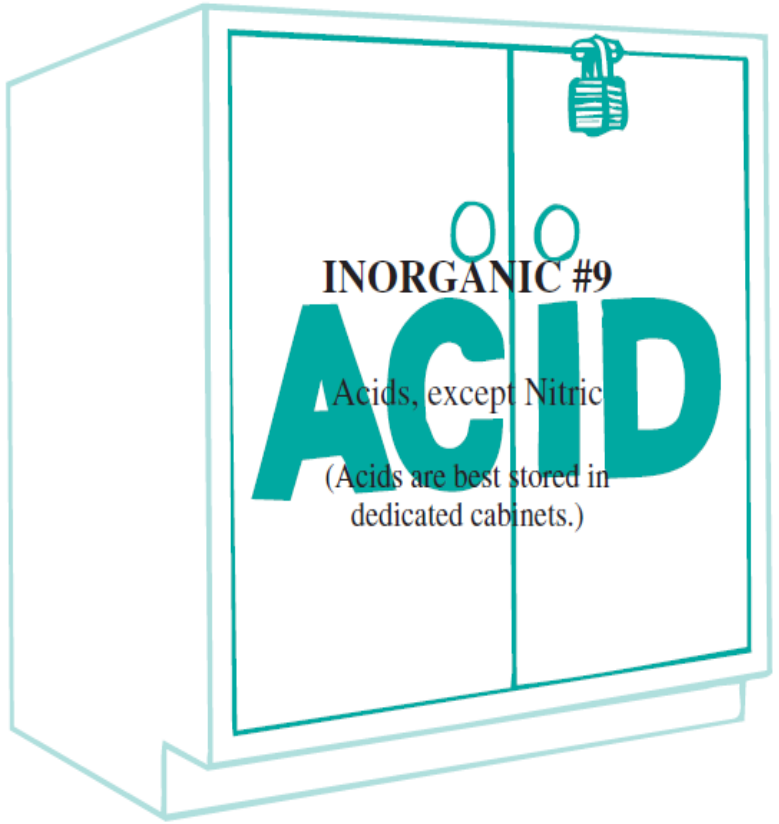
"Your Safer Source for Chemicals"

P.O. Box 219, Batavia, IL 60510 • 800-452-1261 • flinn@flinnsci.com • www.flinnsci.com
AP6196

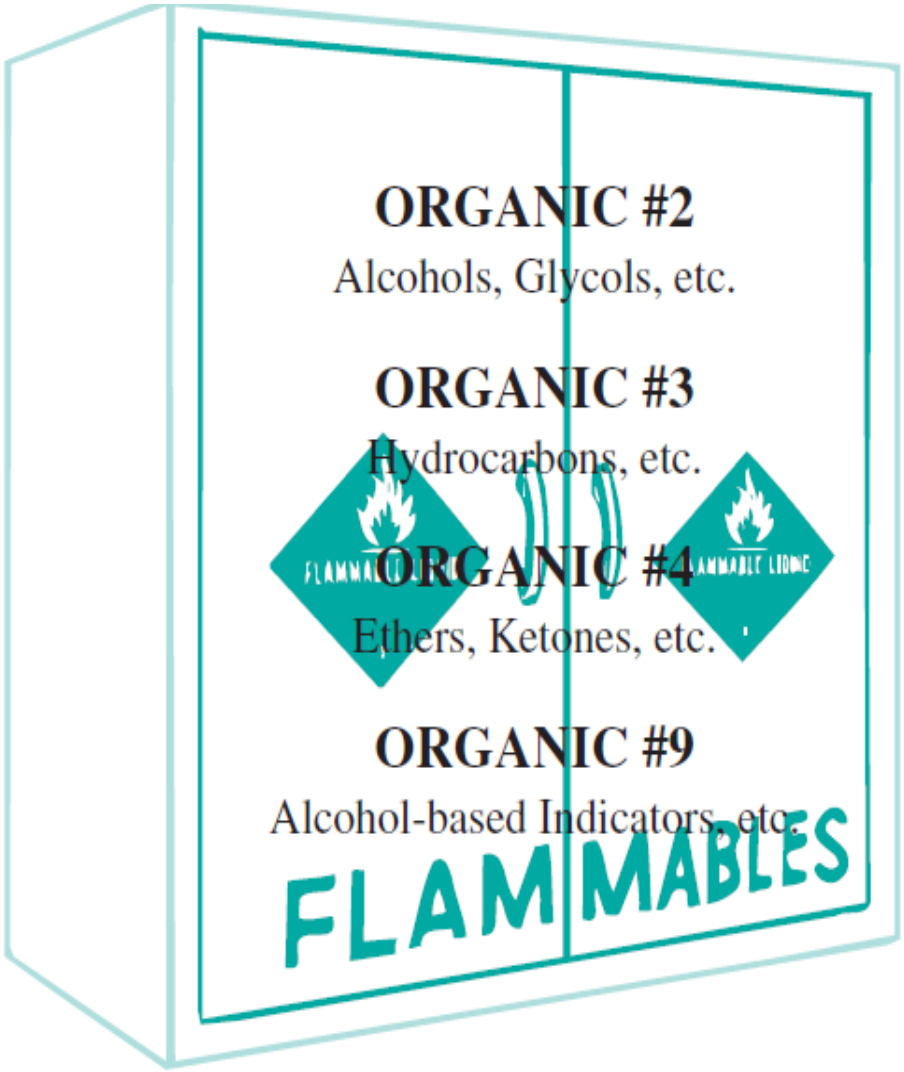
1. https://www.cdc.gov/niosh/npg/default.html
2. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
3. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
4. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

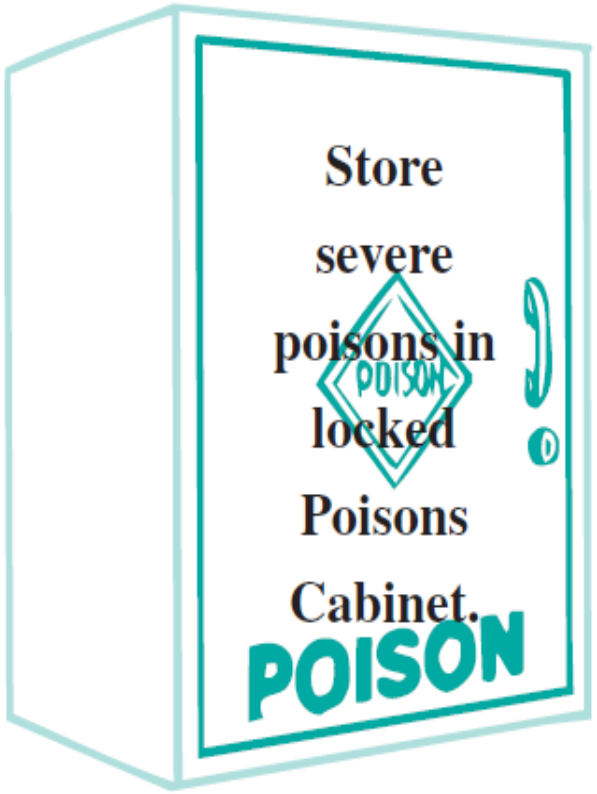
Storage Suggestions

1. Avoid storing chemicals on the floor (even temporarily).
2. No top shelf chemical storage.
3. No chemicals stored above eye level.
4. Shelf assemblies are firmly secured to walls. Avoid island shelf assemblies.
5. Provide anti-roll-off lips on all shelves.
6. Ideally, shelving assemblies would be of word construction.
7. Avoid adjustable metal shelf supports and clips. Better to use fixed, wooden supports.
8. Store acids in a dedicated acid cabinet. Store nitric acid in the same cabinet only if isolated from other acids. Store both inorganic and some organic acids in the acid cabinet.
9. Store flammables in a dedicated flammables candidate.
10. Store sever poisons in a dedicated poisons cabinet
11. Maximize Storage Space: If shelf space is a problem, you are permitted to place more than one compatible chemical family on a shelf. Make sure you either have a physical divider or leave 3" space between each family. This will maximize your tight shelf space while keeping each compatible chemical family separate from one another.



Store Nitric Acid away from other acids unless your acid cabinet provides a separate compartment for nitric acid.





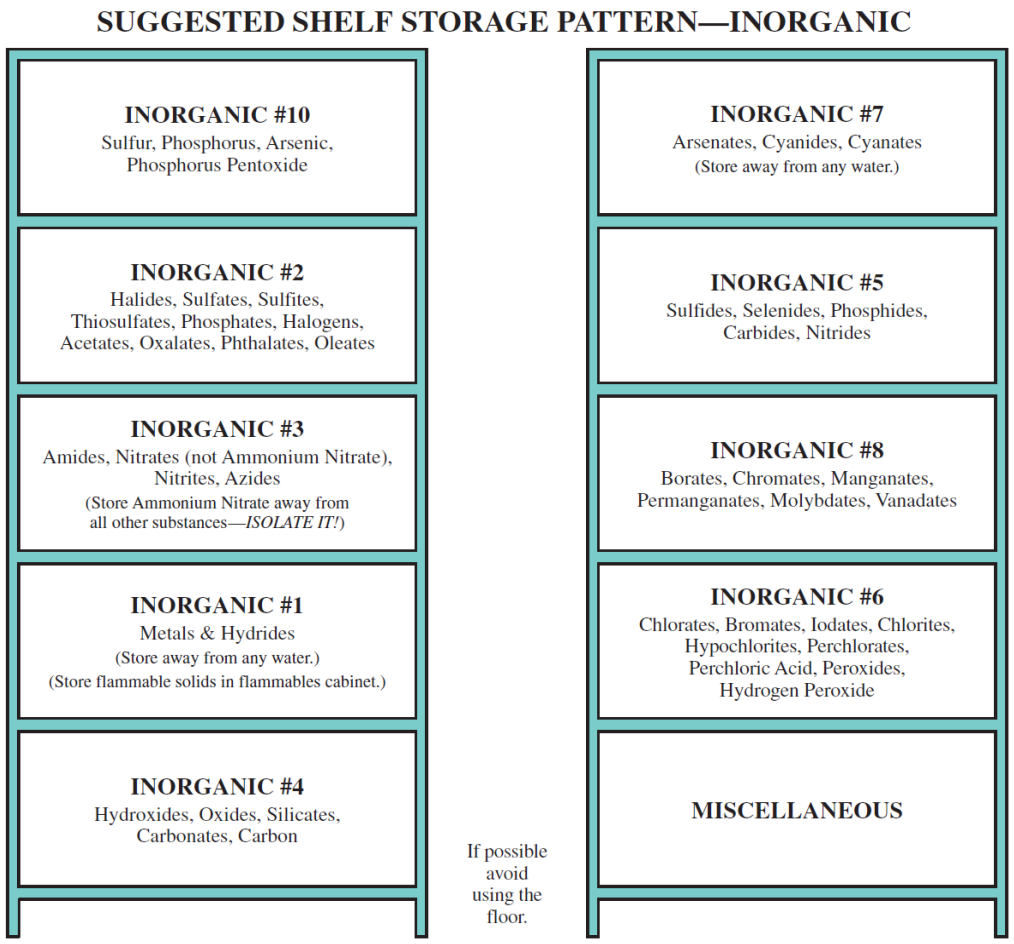
https://www.cdc.gov/niosh/npg/default.html

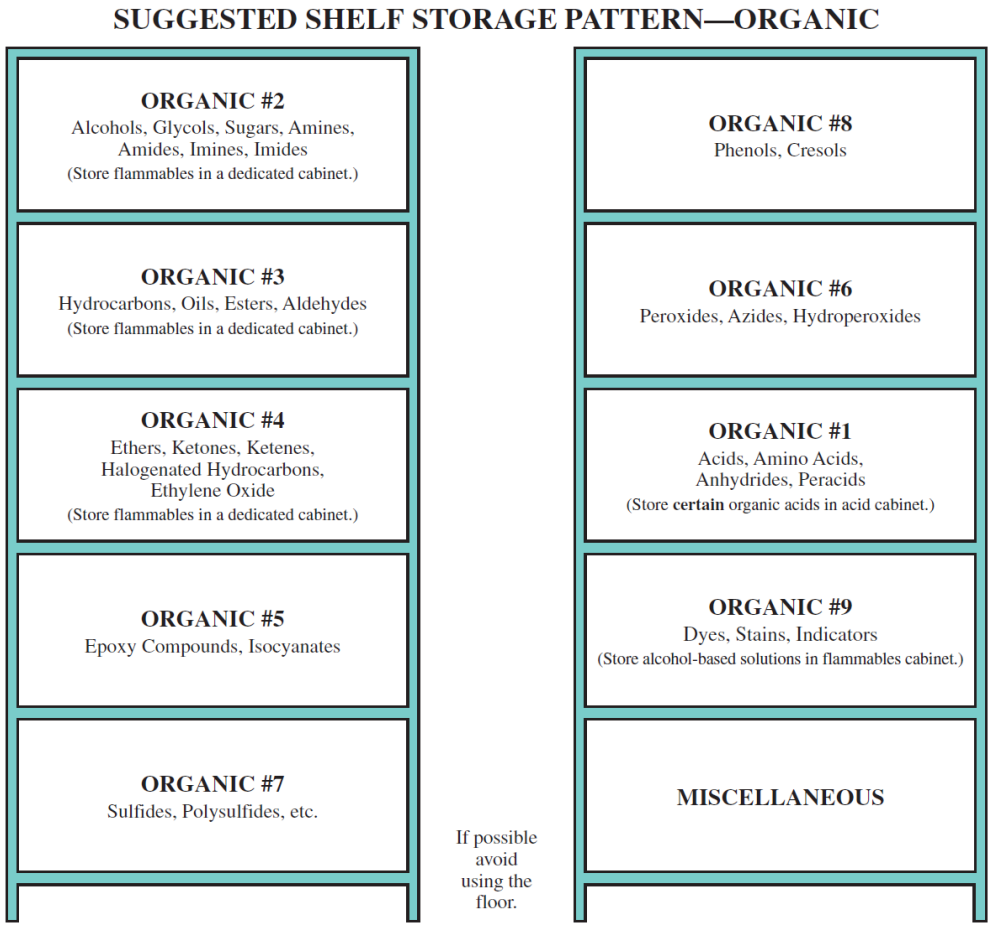
https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf

https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf

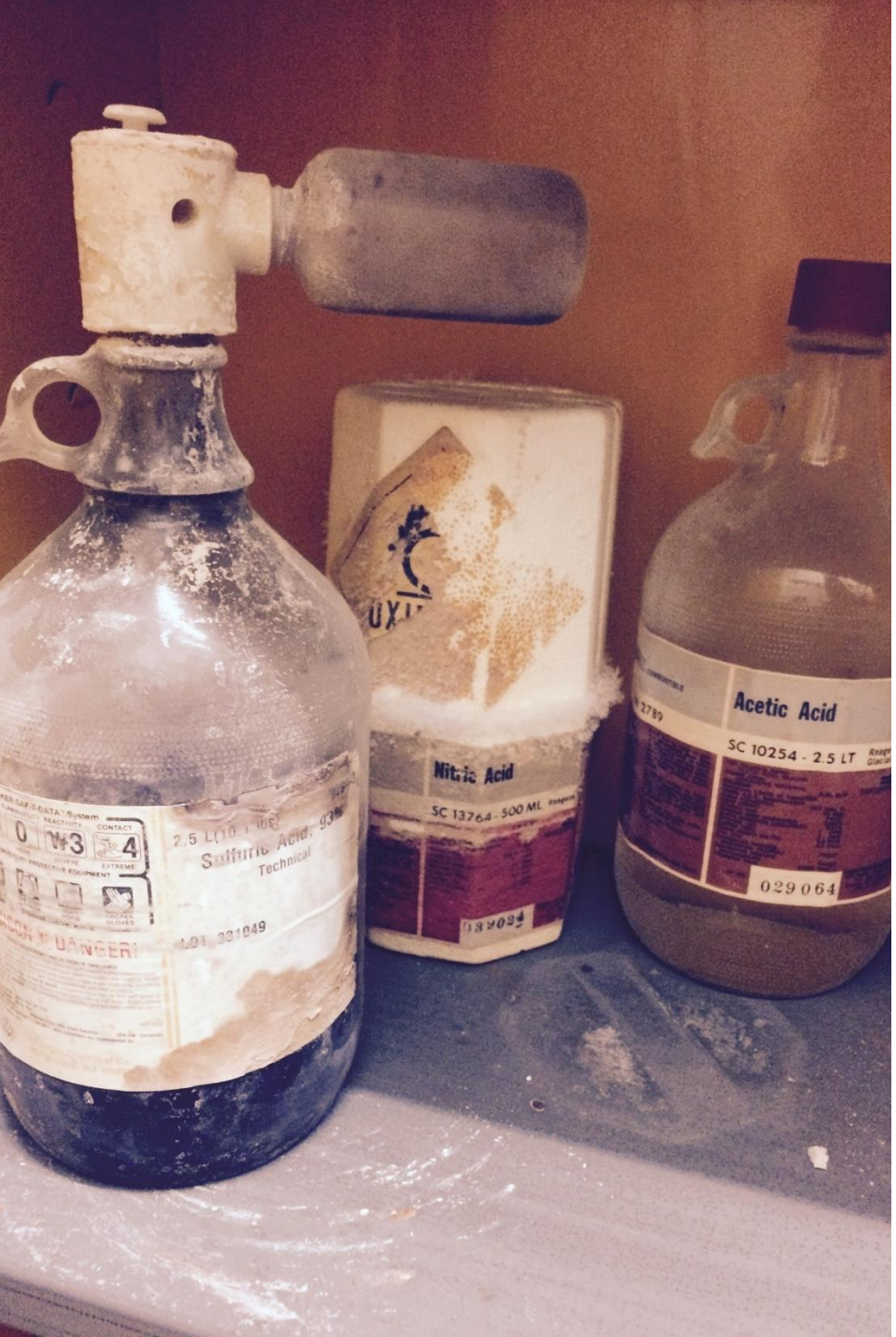
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Inorganic and Organic Chemical Storage Guidance





1. https://www.cdc.gov/niosh/npg/default.html
2. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
3. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
4. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/



Chemical Storage Concerns

End of semesters or prior to the summer vacation offer school science departments the perfect opportunity to do an audit of your chemical storage.

Here's what you need to do:

Yearly audits are recommended to ensure school labs and prep areas (chemical storerooms) are safety compliant. Audits also offer the perfect opportunity for you to take stock of what your classroom will need and what you should dispose of before students arrive back in the classroom.

Incompatible chemical storage of chemicals typically results in odors, precipitates forming, or chemical bottle failures. Many chemicals when stored incorrectly will create tell-tale smells in the room and these are usually hydrocarbons from alcohols and solvents in the flammables cabinet; or corrosives that are mixing (vapors) creating a pungent smell.

The fine white precipitate that forms in a corrosive cabinet that is storing both acids and bases (improper storage method) is the chemical result of an acid + base = salt + water.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Proper Chemical Storage is Easy to Achieve: Nitric Acid

Make sure to separate out your acids from your bases and safely dispose of unsafe bottles and chemicals as needed.

Here's what you need to do:

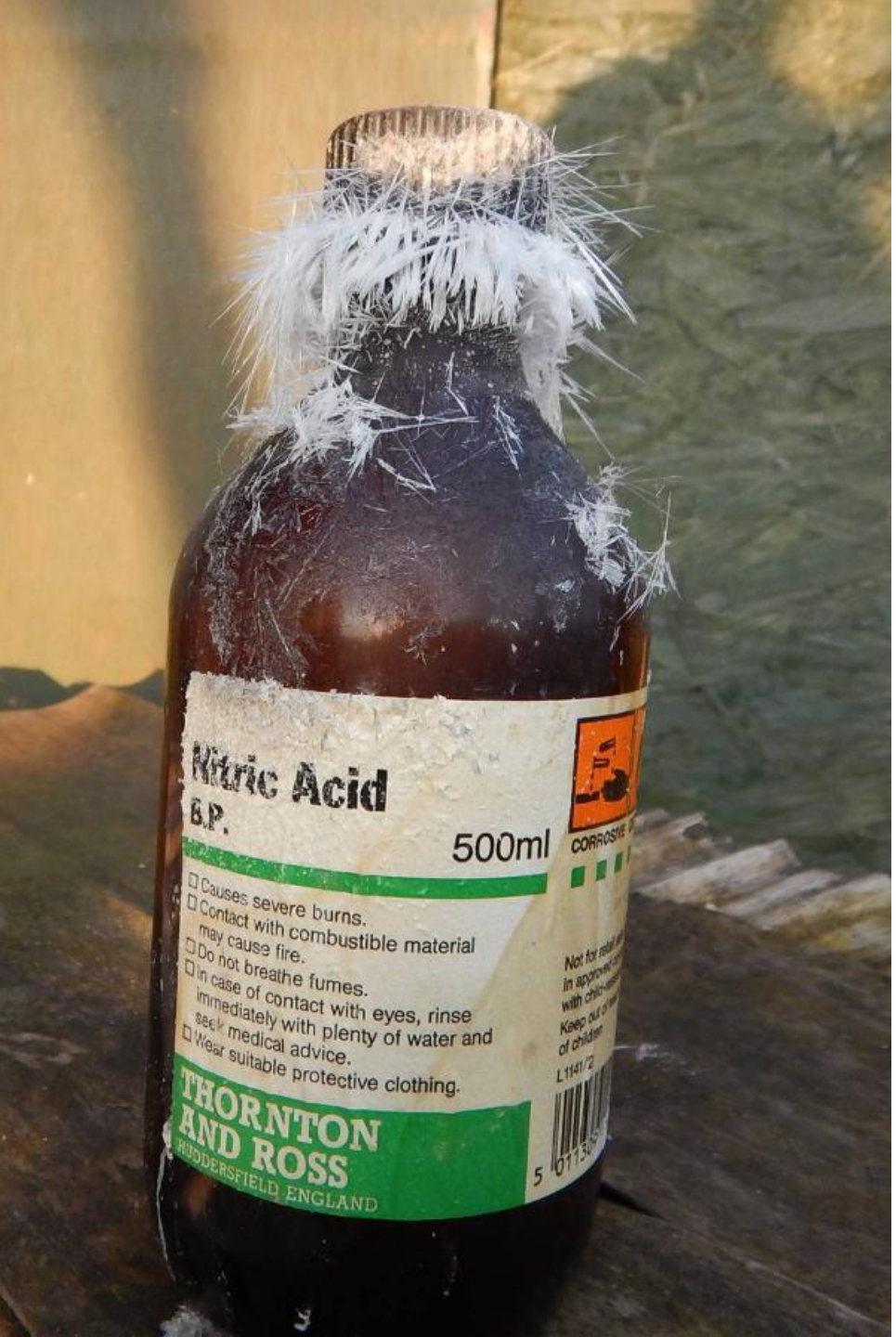
Isolate your Nitric acid – it is very noxious and the primary reason for smells and issues in a prep room. Most people are unaware that you cannot store all acids together in the same cabinet. **Scimatco Cabinets are a great solution.**

Nitric acid and Acetic acid are combustible when in proximity to each other (just the vapors alone are enough to cause a flash fire/explosion).

Keep Nitric acid stored away from ALL other chemicals in an isolation chamber or its own locked cabinet.

Use your nose – odors are telling you that there is incompatible chemical storage occurring or that there is inadequate ventilation in your prep area. Many odors are the result of chemical interactions (reactions) occurring and these need to be resolved.

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/



Proper Chemical Storage is Easy to Achieve: Nitric Acid

If you have a deteriorating nitric acid bottle with crystalline structures on it, the cap has broken or see a crack in the bottle then you can dispose of this chemical by following the protocol established from the Science Safety Manual, Chemical Hygiene Plan, DOE, or local school district.

Flinn Scientific also has a disposal plan (24b) which is recognized as a safe method. To see our disposal information, **visit flinnsci.com.**

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Proper Chemical Storage is Easy to Achieve: Hydrogen Peroxide

Hydrogen Peroxide is one of the most frequently used chemicals in chemistry labs. 30% Hydrogen Peroxide has special properties that are important to remember.

Here's what you need to do:

Concentrated hydrogen peroxide needs to be stored properly as it typically expands. Older, "accordion-style" bottles allow for the safe expansion due to the decomposition of the H2O2 over time. These bottles allow the volume of the gas to safely expand up to 3 times the size of the original vessel and are generally considered safe.

Today, Flinn provides concentrated hydrogen peroxide in a durable, high density bottle with a pressure cap for safety. Be aware that there will be approximately 0.5% reduction in the concentration per year at room temperature of this substance. It will still effectively work for your demonstration but might take a few extra seconds to perform as expected. We recommend you dispose of and replace after a year or two if you have any remaining liquid in the bottle.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Proper Chemical Storage is Easy to Achieve: Hydrogen Peroxide

We recommend only ordering the amount that you will use in a typical school year to minimize storage and disposal costs, and store this in accordance with the protocol established from the Science Safety Manual, Chemical Hygiene Plan, DOE, or local school district.

Flinn Scientific also has a disposal plan (22a) which is recognized as a safe method. To see our disposal information, **visit flinnsci.com.**

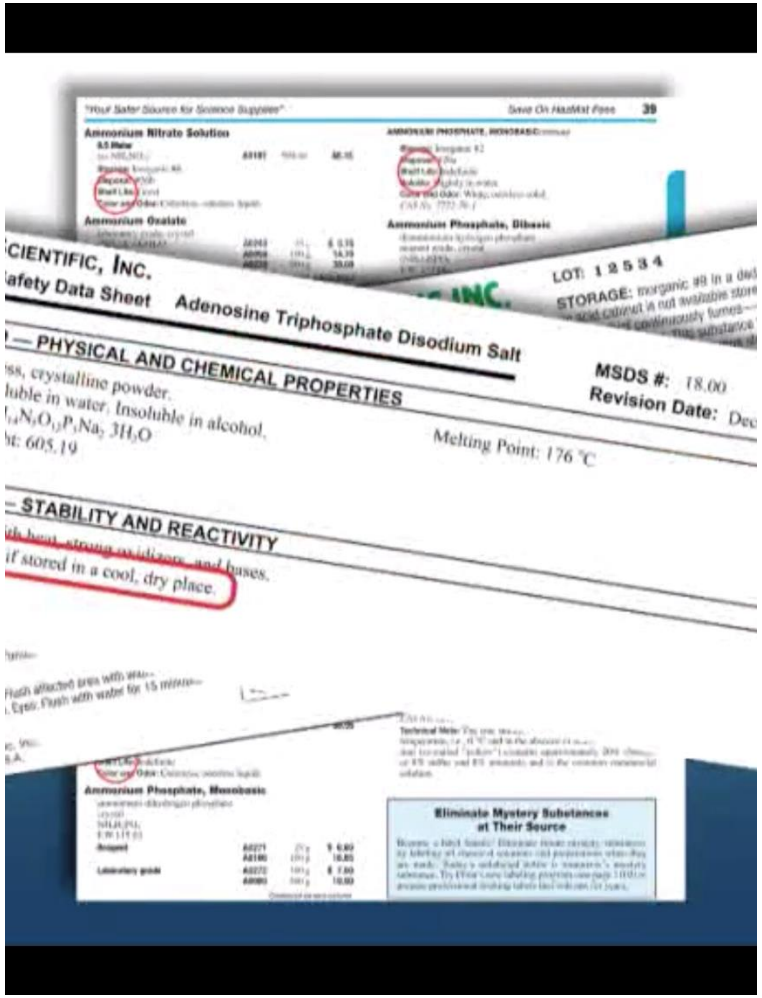
https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Common Incompatible Chemicals

Many chemicals are incompatible and need to be stored separately from each other.

Here's a sample of what you need to know:

- Acetic acid with chromic acid, ethylene glycol, hydroxyl compounds, nitric acid, perchloric acid, permanganates, peroxides
- Acetone with concentrated sulfuric and nitric acid mixtures, hydrogen peroxide
- Acetylene with copper (tubing), bromine, chlorine, fluorine, iodine, silver, mercury and their compounds
- Alkali metals with carbon dioxide, carbon tetrachloride, chlorinated hydrocarbons, flammable liquids, oxidizers, salt, sulfur, water
- Ammonia (anhydrous) with mercury, halogens, calcium hypochlorite, hydrogen fluoride
- Ammonium nitrate with acids, metal powders, flammable fluids, chlorates, nitrates, sulfur, and finely divided organics or combustible materials



Watch our Shelf Life of Chemicals Video to see how Flinn provides information to help you safely manage your chemicals.

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Common Incompatible Chemicals

- Aniline with nitric acid, hydrogen peroxide, inorganic acids, oxidizers
- Bromine with ammonia, acetylene, benzene, butadiene, butane, petroleum gases, hydrogen, sodium carbide, turpentine, and finely divided metals
- Chlorates with ammonium salts, acids, metal powders, sulfur, finely divided organics or combustible materials
- Chromic acid with acetic acid, naphthalene, camphor, alcohol, glycerol, turpentine, and other flammable liquids
- Chlorine with ammonia, acetylene, butadiene, benzene, and other petroleum fractions, hydrogen, sodium carbide, turpentine, and finely divided powdered metals
- Cyanides with acids
- Hydrocarbons, generally with fluorine, chlorine, bromine, chromic acid, sodium peroxide
- Hydrogen peroxide with copper, chromium, iron, most metals or their respective salts, flammable fluids, and other combustible materials, aniline, and nitromethane.

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Common Incompatible Chemicals

- Hydrogen sulfide with nitric acid, oxidizing gases
- Iodine with acetylene, ammonia (anhydrous or aqueous)
- Mercury with acetylene, ammonia, fulminic acid, hydrogen
- Nitric acid with acetic, chromic, and hydrocyanic acids, aniline, hydrogen sulfide, flammable liquids or gases and substances which are readily nitrated
- Oxalic acid with silver, mercury and their salts
- Oxygen with oils, grease, hydrogen, flammable liquids, solids and gases
- Perchloric acid with acetic anhydride, bismuth and its alloys, alcohol, paper, wood and other organic materials
- Phosphorous pentoxide with water, alcohols, strong bases
- Potassium permanganate with glycerol, ethylene glycol, benzaldehyde, sulfuric acid
- Sodium peroxide with any oxidizable substances (e.g. ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerol, ethylene glycol, ethyl acetate, methyl acetate, furfural)
- Sulfuric acid with chlorates, perchlorates, permanganates, and water

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Chemical Waste Concerns

Waste chemicals often find themselves taking up space in prep areas and store rooms. Proper and timely disposal is paramount to a safe lab and learning environment.

Here's what you need to know:

If you will not be returning to on-site learning for the fall, try to get permission to go into your lab and go through your chemicals now.

If you are returning to onsite learning for the fall, we suggest putting a small dot sticker on the bottle every time you pull it out for use which will allow you to visualize how often that particular bottle is used during the year. You will find that there about 15-20 chemicals that are very commonly used – and 40 more that are used periodically.

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Chemical Waste Concerns

Here's what you need to know:

Having too many chemicals in the prep room (chemical storeroom) – even common inert substances such as sugars, starch, salts, sodium bicarbonates etc., will contribute to the smells in the room. **Going forward, teachers should be mindful of the volumes of the substances they procure and keep.**

We suggest putting a small dot sticker (*The kind from the Dollar Store that are red, blue, white, yellow….*) which will allow you to visualize how often that particular bottle is used during the year. You will find that there about 15-20 chemicals that are very commonly used – and 40 more that are used periodically. You could offer a robust, comprehensive program with 60 -75 chemicals and meet the curricular expectations.

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

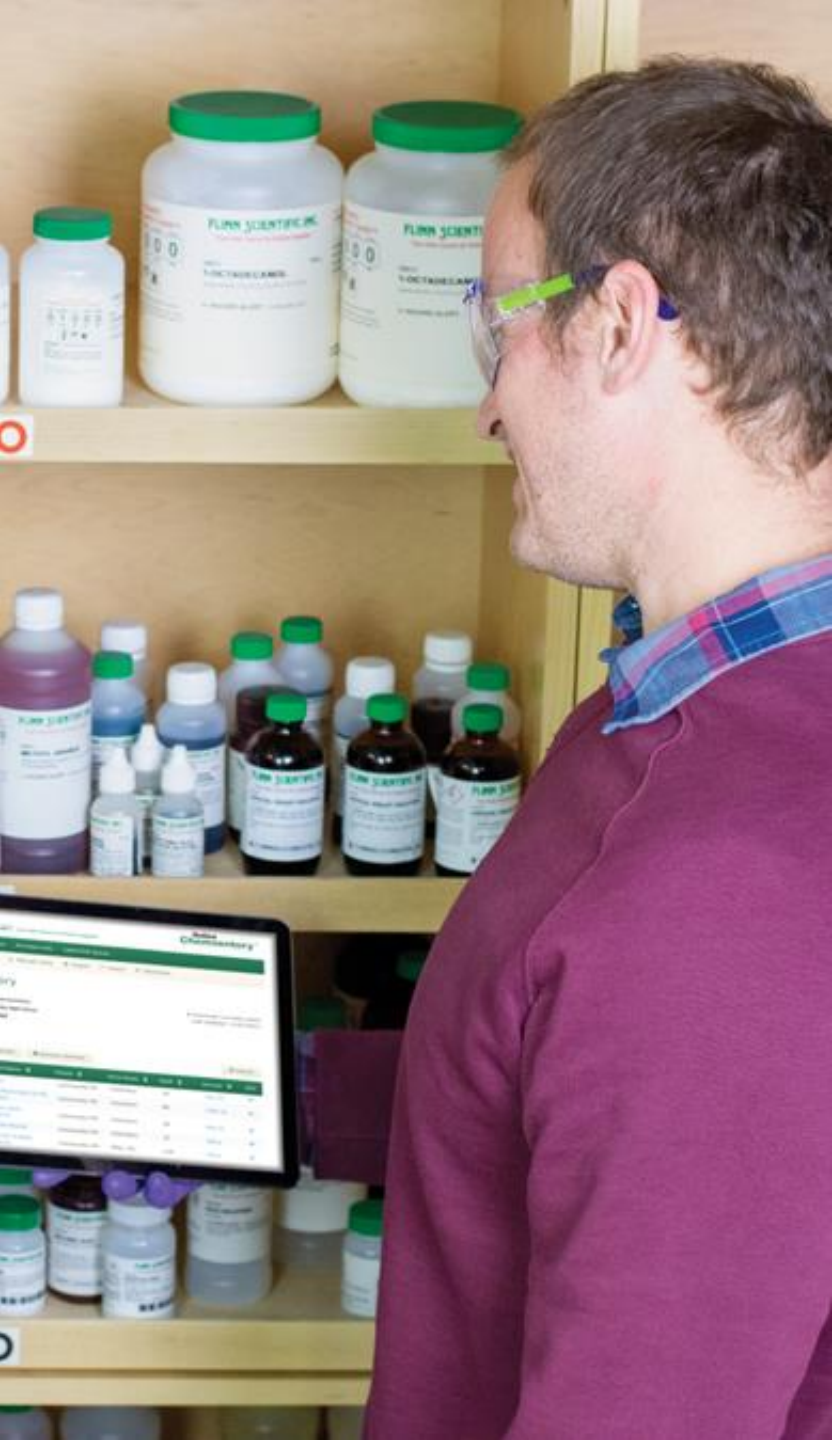
Chemical Waste Concerns

There will be some that are used for only one lab activity per year, and there will also be some chemicals that have no dots on their lids after a school year. That is indicative of an inventory that should be purged out to be disposed of since they are not being used and taking up space and could be contributing to chemical interactions.

We encourage you to be mindful of the volumes of the substances you are procuring and storing. While it may feel like purchasing a larger quantity for a lower price will save you money, in the long run, having to get rid of excess chemicals is more costly and can be harmful to the environment.

If you can, use this time to “clean house. “

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/



Chemical Waste Concerns

Chemical security is important all year round, but especially when you aren't there to monitor things daily. Long stretches of time where labs are unused require special precautions.

Here's what you need to know:

Please make sure that the prep room/chemical storeroom and the chemical cabinets are all LOCKED properly and that there are extra keys for the locks with administration and maintenance.

It is essential to have an updated inventory of chemicals in your school storage and prep rooms/chemical storeroom, and if often a requirement. Need help? The Flinn Online Chemventory™ is a cloud-based laboratory chemical inventory system that allows multiple users access to the database from multiple locations and devices! The program comes fully loaded with updated GHS pictograms, hazard codes, and signal word information for over 2,400 Flinn chemicals. **Learn more at Chemventory.flinnsci.com.**

Keep a print copy of our catalog with disposal information handy and easily accessible.

Are your locks broken or you don't have proper storage? We have cabinets especially designed for different school needs.

How should I purchase new chemicals and dispose of old chemicals?

A purchasing policy should be developed by the school/district. Before purchasing a new chemical, review the Safety Data Sheet (SDS) that will provide important information on physical properties, toxicology, storage, and handling for the chemical.

Consider these factors **BEFORE** purchasing:

- **Will amounts be used within 1–2 years?**
- **Can the chemical be stored properly?**
- **Is the facility properly designed to use the material safely?**
- **Can the chemical be easily disposed of safely and will it be disposed of as a hazardous waste product?**
- **Does the facility have proper personal protective equipment (PPE)?**
- **Are facility personnel aware of any hazards associated with this product?**
- **Are facility personnel properly trained in the use and handling of the material?**
- **Does the budget allow for disposal of the chemical or by-products?**
- **Is there a less harmful/hazardous alternative to this chemical that could be used to provide the same experience?**

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Should I Purchase This Chemical?

Are you prohibited from using certain chemicals in your science laboratory? This is a growing problem! Banning chemicals from the school science laboratory without giving thought to how often the chemical is used, or its educational value and hazard level, is similar to banning a textbook from the classroom. Teaching professionals must have available to them every teaching tool possible to educate our nation's young people. Flinn Scientific Canada has adopted the philosophy that:

"Chemicals in any form can be safely stored, handled or used if the physical, chemical and hazardous properties are fully understood and the necessary precautions, including the use of proper safeguards and personal protective equipment, are observed."

Important Questions Should Be Asked Before Purchasing a Chemical.

Flinn's Big 6 Considerations…

1 What is the relative hazard level of the chemical?

Is the chemical water- or air-reactive? Is it corrosive, flammable or hazardous by inhalation? Is the chemical irritating to body tissue or carcinogenic? In other words, how can this chemical hurt me?

2 How often is the chemical used in laboratory activities such as experiments and/or demonstrations?

Is the chemical commonly used in a high school setting?

3 What is the educational value of using the chemical?

What specific topic or lesson does the chemical help teach or illustrate? If the chemical is commonly used in other laboratory activities, you can generally say it has educational value. If the chemical is infrequently used and extremely hazardous, then we suggest you review the specific laboratory activity to judge its educational value for yourself. Further investigation may identify a less hazardous substitute. Only you, the teaching professional, can ultimately decide the chemical's educational value.

4 Have I used this substance before?

Am I familiar with the use of the chemical? Have I tried the experiment before? Do I feel comfortable using this chemical?

Remember, try all experiments and demonstrations first before using them in the classroom.

5 Is my laboratory facility equipped for the safe use of this chemical?

Do I have the correct type and size fire extinguisher? Do I have an eyewash? Is my room properly ventilated, etc.?

6 How will I dispose of this chemical?

Will this chemical require special disposal procedures and does my school have a waste disposal program in place? Will the chemical have to be disposed of properly by a licenced hazardous waste disposal company?

If you have trouble answering one or more of these six questions, call us. Our technical staff of chemists will be more than happy to give you expert advice!

Online Chemventory™

Organize Your Labs

Keep a clean organized lab and you will be much safer, and your lab will operate significantly smoother.

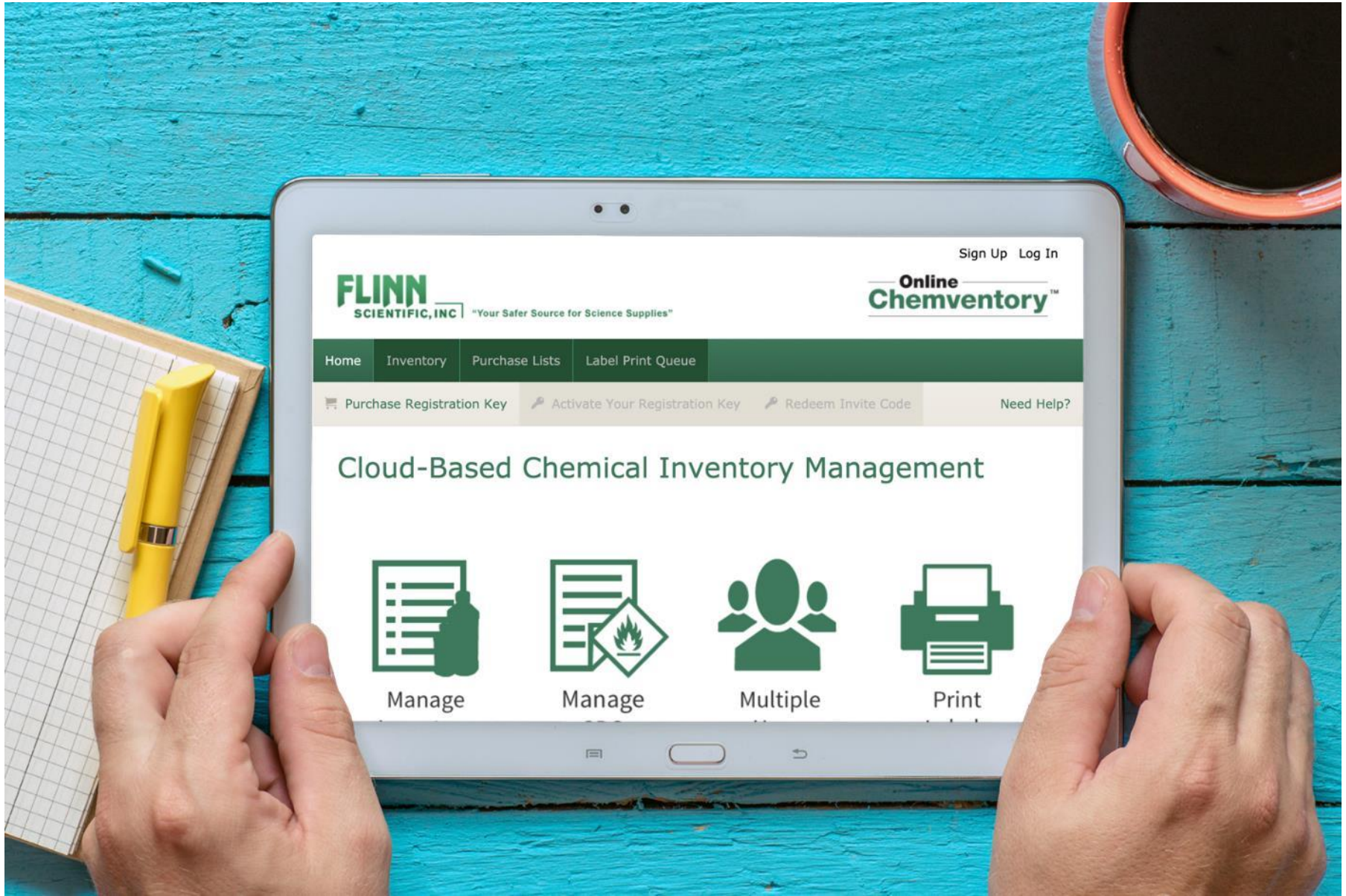
Be mindful of your purchases and think about the full cradle-to-grave costs with your selection (remember to factor in disposal costs).

Accurate chemical inventory is critical for organizing and managing safety in the science department.

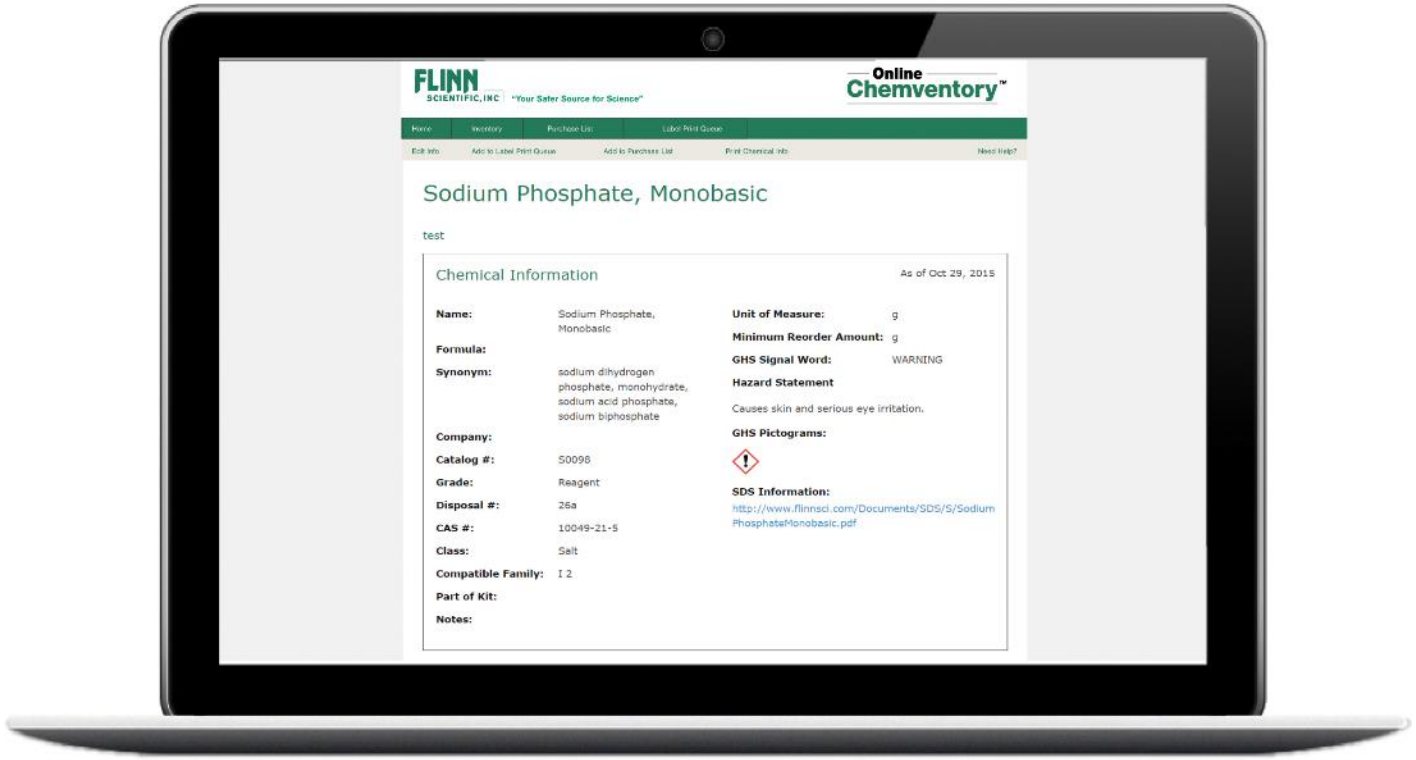
This is a legal requirement that is needed in case of vandalism, fire, flood, or other emergency in the school and as a legal safety standard and better professional safety practice so you know what chemicals are in your storeroom.

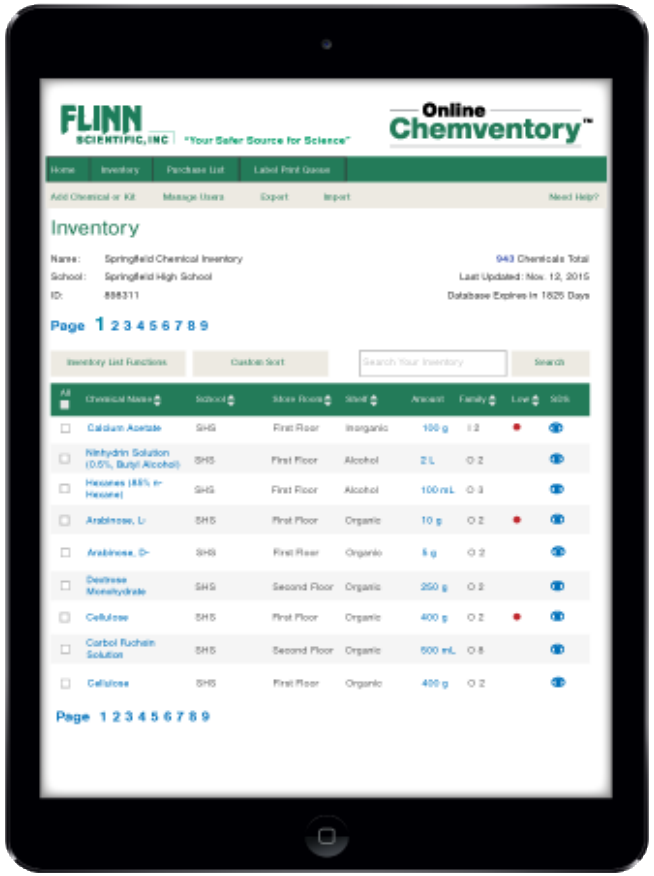
1. Flinn Chemventory

Chemventory Online Chemical Management Software Service



Chemventory Online Chemical Management Software Service





Chemical inventory management programs must be able to simply manage the SDS for the chemicals on-hand, print GHS labels, be accessible 24/7, be searchable easily, and allow for easy record keeping. These are critical aspects to having a comprehensive chemical inventory management software system.

Chemical Disposal & Waste Management

The Environmental Protection Agency (EPA) and the American Chemical Society (ACS) list the following possible disposal methods:

- Sanitary landfills.
- Hazardous waste landfills.
- Sewer system (regulations differ for different locations).
- Thermal treatment (incineration).
- Recycling or reuse.
- Chemical, physical, or biological treatments, including neutralization, oxidation, precipitation, and solidification.

For safer disposal of materials, consult the appropriate SDS sheet. If an SDS is not available, request one from the manufacturer or obtain one freely online at http://www.flinnsci.com

Disposing of wastes in landfills is not environmentally recommended; neutralizing products, reducing wastes, recycling, and destruction are preferable.

If you are not sure if a waste is hazardous, con tact a local/state hazardous waste management agency or your state or regional EPA office, fire marshal's office, or state department of education.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Overview of a Chemical Hygiene Plan (CHP) or Environmental Hygiene Plan (EHP)

Most states and the Occupational Safety and Hazard Administration (OSHA) require work environments, including schools, to have a safety plan that reduces risks and ensures a safer workplace for employees (OSHA Laboratory Standard—29 CFR 1910.1450). This is referred to as the Chemical Hygiene Plan (CHP) and includes policies, procedures, and responsibilities designed to develop an awareness of potentially harmful chemicals in the workplace.

It is important that laboratory chemicals be used only with knowledge of possible risks involved and within acceptable limits of exposure. The CHP must stress that everyone in the school has the right to know and understand what hazards he or she will be exposed to and is responsible for implementing safety procedures and policies.

Immediate supervisors have the responsibility to provide continuing education on safety guidelines and procedures to those under their direction. The CHP should be reviewed annually and revised as needed with commentary and updated legal safety standards and better professional safety practices.

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Chemical Hygiene Plan Main Points

The science department chairperson, Chemical Hygiene Officer or the chemistry teacher is usually responsible for developing the CHP for the school and may share this task with the facility supervisor. Since care and supervision of the science room are primarily the responsibilities of the classroom teacher, the CHP should serve as a guide to safer science instruction. ***The CHP is also known as an Environmental Hygiene Plan in non-OSHA states and covers essentially the same topics and criteria***

- **Development of a statement that includes clearly defined responsibilities of the superintendent, Chemical Hygiene Officer, principals, department chairs, classroom teachers, students, and parents.**

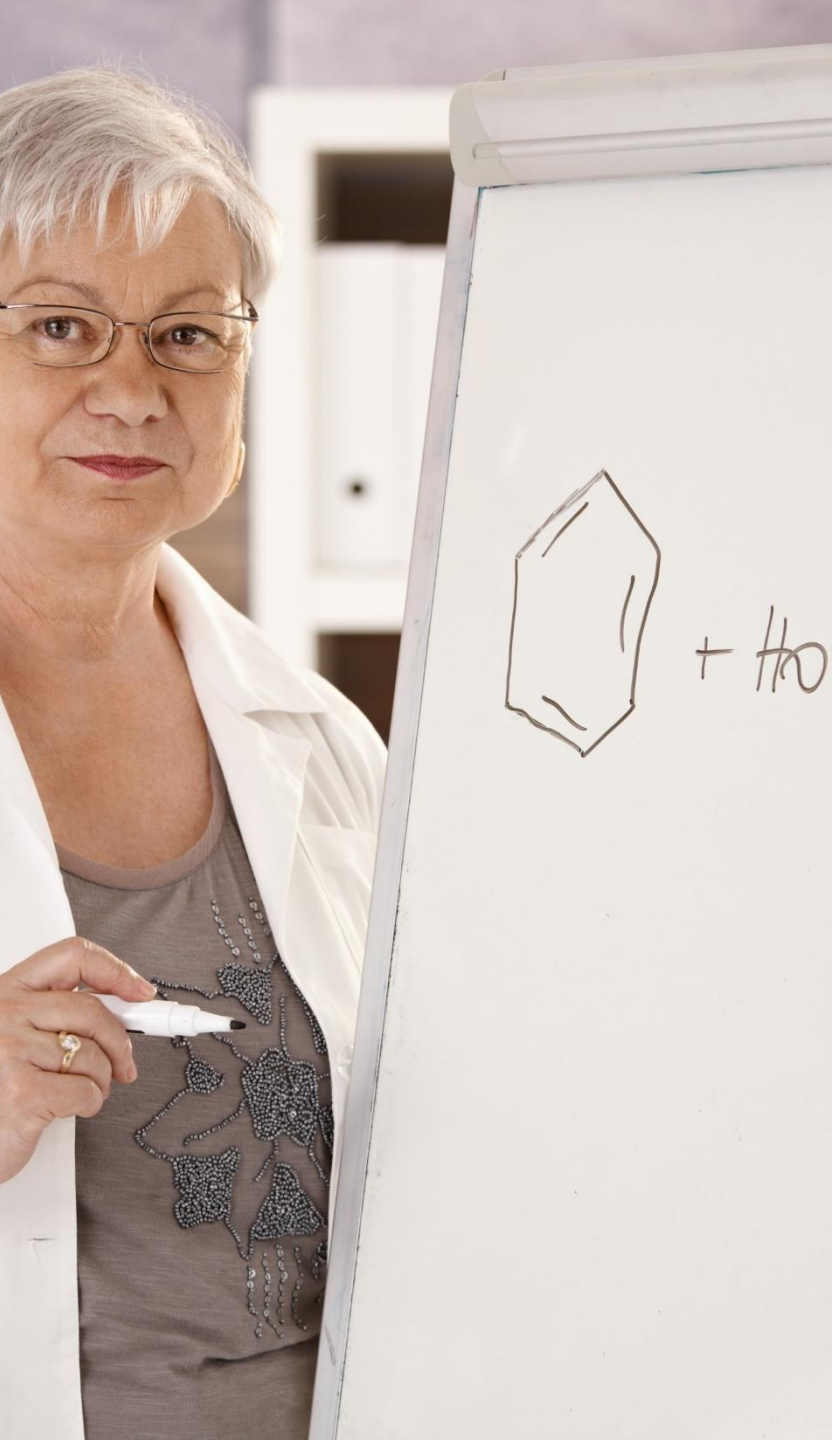
Inclusion of a laboratory safety program as part of the curriculum and instruction. Regular training for all staff on safety policies, record keeping, and other procedures.

Evaluation/inspection of laboratory facilities and procurement of equipment. Development and enforcement of a plan for monitoring safety equipment and storage areas for compliance.

https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html

https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf

https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc



CHP Main Points Continued…

- Preparation and storage of safety records, i.e., inventories, Safety Data Sheets (SDS), accident/incident reports, hazard notification reports.
- Identification of hazardous chemicals and minimizing exposure to students and teachers, e.g., computerized/written inventory.
- Development of safety policies and procedures for procurement, distribution, storage, handling, usage and disposal of chemicals, e.g., using chemical inventory management system like Chemventory.
- Development of a written emergency plan and practiced procedures for spills or accidents involving chemicals.
- Implementation of a plan for posting signs and labels.
- Criteria for reducing employee exposure to hazardous chemicals;
- Use of personal protective equipment;
- Requirements that ensure fume hoods and other protective equipment are functioning properly;
- Provisions for employee training;
- Circumstances requiring employer approval of certain laboratory operations, procedures, or activities before implementation;
- Provisions for medical consultation;
- Measures to protect employees from particularly hazardous substances; and
- Assignment of a Chemical Hygiene Officer- a qualified employee who by training or experience can provide technical guidance in developing and implementing the chemical hygiene plan.

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Chemical Hygiene Plan Summary

The CHP is a manual that describes your laboratory regulations, proper lab procedures, and how to respond to emergency situations. The listing of rules and procedures are your Standard Operating Procedures.

These rules and procedures must be well thought out with the principal goal of always minimizing the exposure of employees and students to hazardous chemicals.

And this must be managed by the Chemical Hygiene Officer at the school district level. *If there is not a designated chemical hygiene officer at the school district level, that responsibility automatically falls on the superintendent or director of education in that jurisdiction.*

1. https://www.osha.gov/Publications/laboratory/OSHAfactsheet-laboratory-safety-chemical-hygiene-plan.html

Chemical Hygiene Plan Summary must include the following criteria and more:

- General laboratory rules and procedures (SOP's)
- Personal protective equipment requirements
- Accidental Spill and accident prevention procedures
- Chemical storage rules and procedures
- Safety equipment requirements and inspection procedures
- Employee safety training (topical, practical, on-going)
- Exposure and medical evaluations
- Emergency evacuation plan
- Designation of a Chemical Hygiene Officer (CHO)
- **refer to the OSHA CHP guidance document link below:*

1. https://www.osha.gov/Publications/laboratory/OSHAfactsheet-laboratory-safety-chemical-hygiene-plan.html

Chemical Hygiene Plan / Right to Know / Understand Laws

The various state 'Right to Know' laws are all very similar. The major requirements or provisions discussed above are always included, along with minor modifications concerning who must be trained and how or to whom you will have to send lists of the actual SDS and hazardous materials on-site and how often those lists are populated and sent. **The paperwork requirements (SDS and reporting lists) can be overwhelming, but are mandated by the state and federal laws.**

In 2012, HazCom was updated and is now known as the "Right to Understand Law."
https://www.usequantum.com/hazcom-1983-right-to-know-vs-hazcom-2012-right-to-understand/

Schools including Science Classrooms and labs will look much different from the way we remember them prior to the pandemic

Many new routines and safety protocols are in place already for schools . Most schools will have a variation of the following hygiene, safety disinfection and prevention protocols in place due to the pandemic for staff, support workers and students on-site in schools:

Health Check at Main Entrance potentially or home assessment prior to arrival at school / school bus

Hand Hygiene (washing and sanitizer use)

Directional arrows & messaging to encourage circulation and hygiene protocol reminders

Acrylic partition dividers in office and some teacher desks

Possibility of face masks (All Grades K-12 & Staff)

Possibility of nitrile gloves used

Possibility of isolation gowns used

Possibility of face shields for teachers / support workers

Possibility of REMOTE / DISTANCE learning for K12

1. https://www2.gov.bc.ca/gov/content/education-training/k-12/administration/program-management/safe-caring-and-orderly-schools

COVID-19 SCHOOL **SAFETY** GUIDE

Recommended PPE

SHARED RESOURCE ROOM

Concerns: Social Distancing, Shared Items, Cleanliness,

Recommended Products:

- Hand Sanitizing Station
- Disinfectant Wipes
- Multi-Surface Spray Sanitizer/Disinfectant
- Designated "Contamination" Area for Anything Touched that Needs to be Cleaned
- Acrylic Dividers where 6' Cannot be Maintained

LIBRARY MEDIA CENTER

Concerns: Social Distancing, Shared Items, Cleanliness,

Recommended Products:

- Hand Sanitizing Station
- Disinfectant Wipes
- Multi-Surface Spray Sanitizer/Disinfectant
- Designated "Contamination" Area for Anything Touched that Needs to be Cleaned
- Acrylic Dividers where 6' Cannot be Maintained

CAFETERIA

Concerns: Social Distancing, Shared Items, Cleanliness, Increased Spread of Saliva. Students should be encouraged to bring food from home, and disposable materials and pre-packaged food items used. Rigid cleaning protocols must be enforced.

Recommended Products:

- Masks
- Hand Sanitizing Station
- Disinfectant Wipes
- Multi-Surface Spray Sanitizer/Disinfectant
- Designated "Contamination" Area for Anything Touched that Needs to be Cleaned
- Acrylic Dividers where 6' Cannot be Maintained
- Staff: Full PPE including Aprons or Isolation Gowns, Shoe Coverings, Gloves,

CLASSROOMS

Concerns: Social Distancing, Shared Items, Cleanliness,

Recommended Products:

- Disinfectant Wipes
- Multi-Surface Spray Sanitizer/Disinfectant
- Designated "Contamination" Area for Anything Touched that Needs to be Cleaned
- Acrylic Dividers where 6' Cannot be Maintained

GYMNASIUM

Concerns: Social Distancing, Shared Items, Cleanliness.

Recommended Products:

- Sanitizing Stations at Each Entrance and Exit
- Designated Entrance and Exit Signage
- Limited Space and Social Distance Signage
- Disinfectant wipes
- Soapy water and rags

HALLWAYS

Concerns: Social Distancing, Shared Items, Cleanliness,

Recommended Products:

- Signage
- Hand Sanitizer Station at Points of Congruence

BATHROOMS

Concerns: Social Distancing, Cleanliness.

Recommended Products:

- Acrylic Dividers for Sinks
- Signage

CLASSROOMS

Concerns: Social Distancing, Shared Items, Cleanliness,

Recommended Products:

- Disinfectant Wipes
- Multi-Surface Spray Sanitizer/Disinfectant
- Designated "Contamination" Area for Anything Touched that Needs to be Cleaned
- Acrylic Dividers where 6' Cannot be Maintained

LOCKER ROOM

Concerns: Social Distancing, Increased Saliva, Cleanliness. Mark lockers to be closed every 4 lockers.

Recommended Products:

- Hand Sanitizing Station
- Multi-Surface Spray Sanitizer/Disinfectant
- Designated "Contamination" Area for Anything Touched that Needs to be Cleaned
- Acrylic Dividers for Sinks
- Signage

ART & MUSIC ROOMS

Concerns: Social Distancing, Increased Saliva, Cleanliness. All items must be 1-1 use—no shared equipment.

Recommended Products:

- Disinfectant Wipes
- Multi-Surface Spray Sanitizer/Disinfectant
- Designated "Contamination" Area for Anything Touched that Needs to be Cleaned
- Acrylic Dividers where 6' Cannot be Maintained

MAIN ENTRANCE

Concerns: Social Distancing, Shared Items, Cleanliness

Recommended Products:

- Hand Sanitizer Station
- Infrared Thermometer Station
- Signage for Designated Point of Entry
- Directional Arrows for 1-way Movement
- Social Distance Signage
- Masks

SCHOOL TRANSPORTATION

Concerns: Social Distancing, Shared Items, Cleanliness

Recommended Products:

- Masks
- Multi-surface Hand Sanitizer
- Disinfectant Wipes
- Infrared Thermometer
- Staff: Face Shield and Mask

FLINN SCIENTIFIC

Increased Disinfection of Surfaces and Apparatus in the Science Lab

Make sure that ALL LAB EQUIPMENT such as microscopes, hot plates, digital balances, autoclaves, dissection tools and other apparatus are cleaned vigilantly before and after each use.

PPE including goggles should be cleaned appropriately after use with an approved liquid disinfectant solution and/or UV sanitation cabinet.

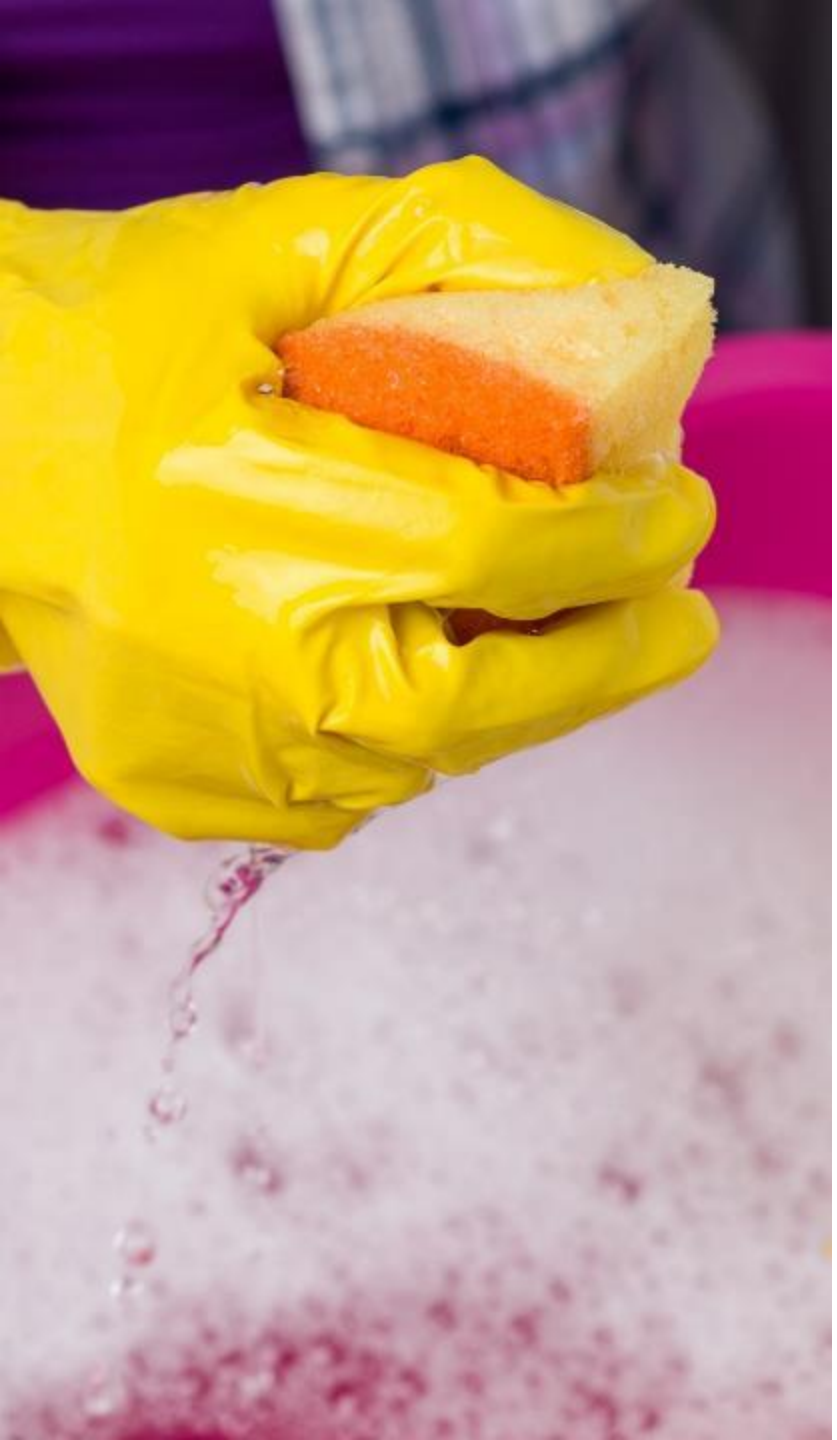
Disposable gloves are for one-time use only and follow procedures to remove them safely – and ensure they are discarded appropriately according to local protocols.

Make sure that hygiene protocols are followed from the CDC, WHO, UNESCO and the Federal, State/Provincial officers of health and safety.

EPA Disinfectants for Use Against SARS-CoV-2

CDC Considerations for Schools

https://www.cdc.gov/coronavirus/2019-ncov/community/disinfecting-building-facility.html



Recommendations to Sanitize Science Equipment & Safety Items in the Lab

The WHO, CDC, OECD, Unicef and other large authorities are **recommending that high-use items be sanitized pre and post usage. Lab equipment would be considered a high-touch item.** Others in this category are art supplies, math manipulatives, toys, sports equipment and other tactile learning products.

The recommendation is to use warm soapy water when possible, and to use disinfectant or sanitizer when appropriate such as on electronic and delicate instrumentation.

The Lysol Dip method will be used based on adding an amount of disinfectant to warm water, and then using that to clean the lab instruments or apparatus and letting it air dry.

Safety glasses or goggles can be disinfected in the Lysol solution (1-1/4 ounces Lysol with one gallon of soft or DI water) for 15 minutes, rinsed with water, and allow to air dry. There is absolutely no damage or discoloration to any of the products. Water spots remaining on the lenses are easily removed using lens paper or a paper towel and leave no scratches or marks.

1. EPA Disinfectants for Use Against SARS-CoV-2
2. CDC Considerations for Schools
3. https://www.cdc.gov/coronavirus/2019-ncov/community/disinfecting-building-facility.html

Cleaning and Disinfection – Continued

How should I clean?

- **Disinfect commonly used fixtures and equipment often, or when visibly soiled.**
- **Clean and disinfect other fixtures, furniture and equipment on a regular basis.**
- **Disinfect waste baskets as needed.**

An easy way to prepare a disinfectant solution is to mix 1 part bleach to 100 parts water (e.g., 10 ml bleach in 1 liter of water). It's better to prepare a solution with the disinfectant, dip your cloth or sponge into the solution, and then wipe it onto the surfaces you want to disinfect.

Spraying products may damage expensive furniture or expensive equipment, like computers. Some cleaning products will damage surfaces – when in doubt, check with a janitorial supply store. And always wear rubber gloves when handling disinfectants.

1. Public Health Authority of Canada Guidelines on Disinfection in the Workplace

Recommendations to Sanitize Science Equipment & Apparatus

The use of a disinfectant on a cloth which is then used to clean the surfaces is encouraged. Some people will prefer to use a disinfectant wipe and dispose of it accordingly after use.

Many recommendations are based on the use of a disinfectant wipe on science equipment both pre and post usage. Ensure that all products used for cleaning and disinfection are FDA / EPA approved. Only use 1 wipe per item – no cross-contamination from using it on multiple items.

Pump sprayer bottle tops allow for the alcohol-based sanitizer to be accurately aimed towards the surface being cleaned with minimal overspray or waste.

DO NOT spray alcohol-based sanitizer on any lab equipment that is hot or warm such as a hot plate, recently used Bunsen burner or soldering iron.

1. EPA Disinfectants for Use Against SARS-CoV-2
2. CDC Considerations for Schools
3. https://www.cdc.gov/coronavirus/2019-ncov/community/disinfecting-building-facility.html

Recommendations to Sanitize Science Equipment & Apparatus Continued

USE LYSOL DIP METHOD FOR THESE ITEMS:

Glassware including beakers, test tubes, cylinders, flasks, stirring rods, dissection instruments, goggles, safety glasses, metric weights, funnels, burets, etc.

SPRAY OR WIPE THESE ITEMS:

Microscopes, balances, instrumentation, hot plates, data loggers and probes, electronic equipment, VDG, physics apparatus, etc.

Only use ONE DISINFECTANT WIPE PER OBJECT OR WORK SURFACE AREA. Then dispose of it accordingly to eliminate the potential for cross-contamination.

1. EPA Disinfectants for Use Against SARS-CoV-2
2. CDC Considerations for Schools
3. https://www.cdc.gov/coronavirus/2019-ncov/community/disinfecting-building-facility.html

Suggestions on Dealing with Physical Distancing in Science Laboratories

With the expectation that there is a 3 foot (1m) distance between students, this will be difficult to implement in schools and in science labs in particular. The small lab stations used cannot be used to accommodate more than one student. School districts are being encouraged to use the 3 feet/1m rule from Sick Kids Hospital and the CDC.

Lab work in science is typically a team effort, and without being able to have a lab partner physically present, the activities may need to be modified to suit the new single-person observation mode. You may be able to use PPE as a mechanism to allow for lab activities…. Follow guidance from the CDC on this issue.

Offset seating, all facing in one direction, and with minimal social interaction can contribute to increased anxiety and stress while at school.

Traditional lab layouts are not conducive to this separation model and require considerable time and energy to devise a plan for student learning that provides a robust platform for growth.

1. http://www.oecd.org/coronavirus/policy-responses/youth-and-covid-19-response-recovery-and-resilience-c40e61c6/
2. http://www.sickkids.ca/AboutSickKids/Newsroom/Past-News/2020/joint-statement-school-reopening.html
3. http://www.sickkids.ca/PDFs/About-SickKids/81407-COVID19-Recommendations-for-School-Reopening-SickKids.pdf

Suggestions for Biology Lessons

Teaching biology concepts such as physiology and anatomy systems are greatly enhanced with dissections, the use of a microscope to investigate, and models to illustrate various biotic processes.

Having students perform lab investigations is essential to their overall understanding and application of these fundamental concepts.

Capturing the activity being performed from an angle and perspective from the student will increase their grasp of the activity (dissection, microscopy, anatomy, etc.)

The use of narration over the images can be valuable as a teaching tool for many students and allows for review of the concept.

Consider the application of some digital biology programs to enhance learning such as digital dissections and other solutions for teaching.

1. Flinn Scientific Inc. Professional Learning Series Summer 2020

Suggestions for Chemistry Lessons

Teaching chemistry involves the use of multiple chemicals, glassware, and apparatus in the science laboratory. Chemistry involves the observation and understanding of multiple chemical interactions, processes, and reactions in a controlled environment. This can be a challenge in a traditional school setting.

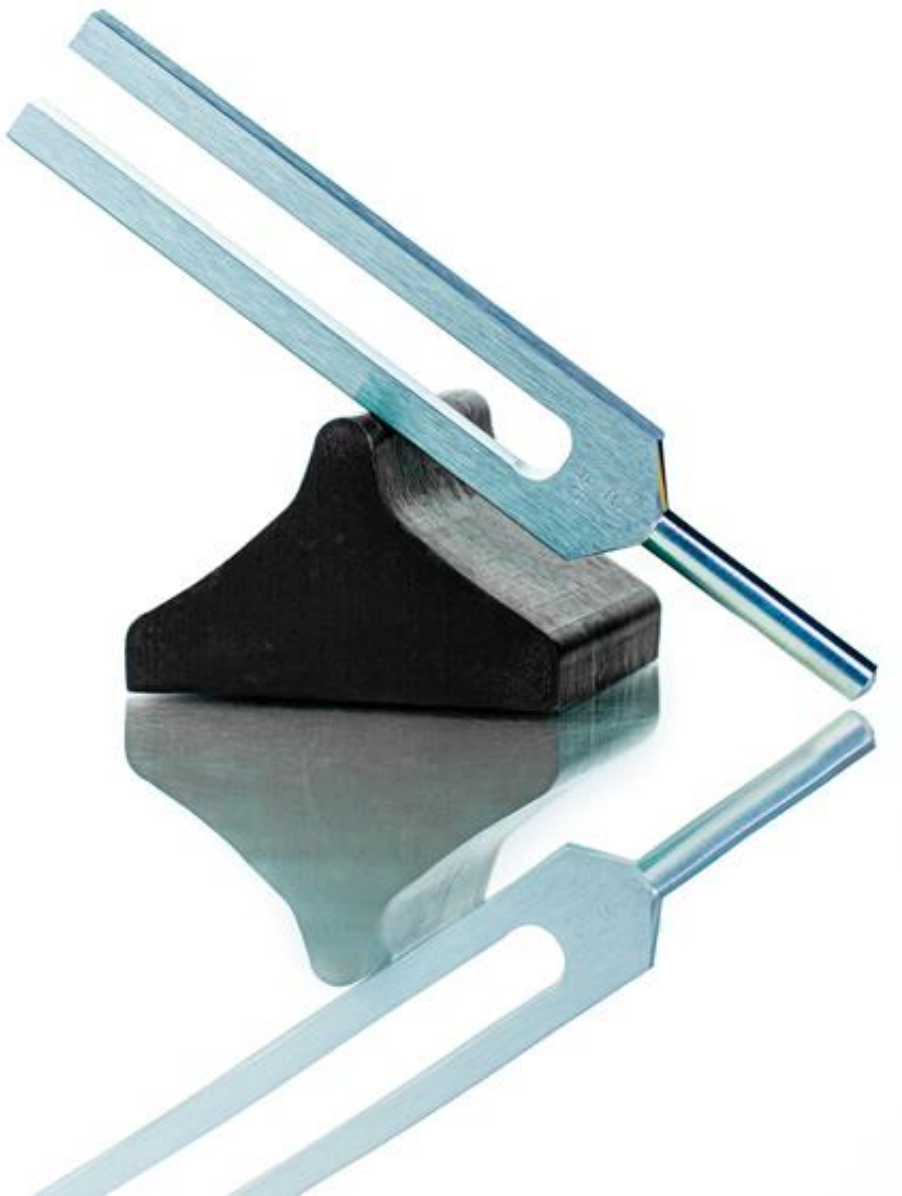
Having students perform lab investigations is essential to their overall understanding and application of these fundamental concepts.

Capturing the activity being performed from an angle and perspective from the student will increase their grasp of the activity (dilution, titrations, heating, mixing etc.)

The use of narration over the images can be valuable as a teaching tool for many students and allows for review of the concept.

Opportunity to engage some online learning solutions for chemistry such as digital labs, chemical interactions and periodic table interactions are possible.

1. Flinn Scientific Inc. Professional Learning Series Summer 2020



Suggestions for Physical Science Lessons

Teaching physics can be challenging in a traditional setting. The understanding from the combination of various scientific laws and their application to society are essential to engineering, technology and science advancement overall.

Having students perform lab investigations is essential to their overall understanding and application of these fundamental concepts.

Capturing the activity being performed from an angle and perspective from the student will increase their grasp of the activity (motion, magnetism, density, thermodynamics, optics, waves etc.)

The use of narration over the images can be valuable as a teaching tool for many students and allows for review of the concept.

Integration of some physics simulation software may be useful for demonstrating various models to students and benefit their learning continuum.

1. Flinn Scientific Inc. Professional Learning Series Summer 2020

General Guidance for Student Accidental Injury?

In the event of accident, teachers should act promptly and decisively, following a preexisting, approved local emergency plan that has been previously practiced! This plan might include the following general steps:

- Check the scene, assess the general situation, and take whatever immediate action is necessary to remove the hazard and prevent students from being further exposed to injury.
- Check the injured party with a quick scan to assess the severity of the injury and decide on a course of action.
- Notify school authorities (school principal and school nurse) and call 911 or other predetermined emergency or medical personnel, if injury appears to make that necessary.
- Have a properly trained person appropriately care for the injured party. Some schools have trained ‘first-responders’ for these situations

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Accidental Injury - First Aid Procedures

- Ensure that a parent, guardian, or designated alternate person and/or the family physician have been contacted.
- After the emergency has passed, record the facts and obtain witness reports. Provide copies of records (accident reporting forms) to an administrator and keep records on file in a safe place.

The following actions are recommended for specific emergencies. Remember, you must assess the situation and determine what is appropriate to the immediate situation. Always refer to the appropriate Safety Data Sheet (SDS) for information regarding health hazards, reactivity, disposal, and personal protective equipment before using a chemical for personal or class use as a preventative measure and proactive approach.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Eye Safety

Chemical Accidentally splashed in the Eye:
Call 911 and send someone to notify the school nurse and an administrator. Flush the eye immediately with potable, aerated 60°F–90°F (15.5º– 32.2ºC) water at a rate of 3–5 gallons/minute (11.4–18.9 liters/minute).

Hold eyelids apart as wide as possible and flush for at least 15 minutes or until emergency personnel arrive. Do NOT try to neutralize acids or bases, but wash the offending chemical out of the eye as quickly as possible to prevent further potential ocular damage.

If contact lenses are being worn, the water should wash them away. If the lens chemically adheres to the eye, do NOT try to remove it. Let a medical professional do that in a controlled environment safely.

Employing the proper PPE such as chemical splash resistant approved goggles will virtually eliminate the possibility of a chemical getting into an eye in the laboratory. Wearing goggles is a requirement when using chemicals.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Fire in the Laboratory

Student or Chemical/Material on Fire:

Remember a panicky student on fire will probably not be cooperative! You may need assistance from other students or faculty. If you are near an emergency shower, obtain assistance in getting the student under the drench shower and douse flames with water.

If not near an emergency shower, drop and roll the student and smother the flames with a retardant-treated wool fire blanket. (Never wrap a standing student in the blanket, because this creates a "chimney" effect.)

For materials on fire, obtain the nearest ABC fire extinguisher, remove safety pin, and approach the fire. Only when 5–6 feet (1.5–1.8 meters) from the fire should you begin to discharge the extinguisher. Remember, the average fire extinguisher only operates 8–10 seconds at maximum efficiency. Take care to smother, not scatter, the burning chemical material.

Smother burning alkali metals with clean, dry sand. Keep a covered sand bucket for that purpose.

Note - combustible metal fires (e.g. magnesium, sodium, lithium, etc.) require use of a type D fire extinguisher or powder.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Fire in the Lab Overview Procedures

- Remain Calm.
- Ensure Students leave the lab in an orderly fashion.
- Designate one student to pull Fire Alarm if directed.
- Evaluate the fire and decide on measures to take personally or have the fire department called.
- Fire Extinguisher usage. Do you know how to safely and properly use a fire extinguisher?
- **P**ull **P**in. **A**im **N**ozzle. Squeeze handle. Sweep bottom on fire (don't aim above it) **PASS** Acronym for fires.
- Keep yourself between fire and a clear exit. If fire grows, or you feel unsafe, please close the door and exit school.
- Report to Principal and Emergency Services immediately.

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

After the Rainbow—Chemical Safety Board Video

Here are some often referenced accidents involving chemicals and fires with students that were all preventable with some safety awareness and proper training.

Calais Webber Injury in 2006 (Ohio)

Alonzo Yanes Injury 2014 (NYC)

Malachi McFadden 2019 (DeKalb County GA)

Flinn Catalog Methanol Call-out about its dangerous properties and offers suggestions for alternative chemicals to use for scientific investigations safely.

After the Rainbow

Fire Safety

- Fire Extinguisher – type / location / PASS / training (local FD involvement)
- Fire Blanket – location / type / training
- Fire Detection – smoke alarm in lab / prep area (NFPA rules)
- Fire Alarm – location / functional
- Fire Suppression System – sprinkler vs powder vs carbon dioxide
- Emergency Signage posted and practice drills documented

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Chemical Spill Management and Control

You should have a comprehensive chemical spill kit in the science department that has everything you need to handle most laboratory spill emergencies in one convenient location.

You cannot handle all spills the same way. You need to be prepared to deal with the three main types of hazardous chemical spills appropriately.

Acid Spills

Bases (Caustic) Spills

Flammable Spills (solvents)

1. Flinn Chemical Spill Control Center

Acid / base accidental spill management

Acid/Base Spills:

Neutralize spilled acids with powdered sodium hydrogen carbonate (sodium bicarbonate/baking soda) and bases with powdered citric acid to neutralize the spill. Avoid breathing vapors. Spread diatomaceous earth to absorb neutralized chemicals, sweep up, and dispose of properly.

If the spill is directly on skin, flush the area as soon as possible with copious amounts of cold water from faucet or drench shower for at least 5 minutes. If the spill is on clothing, drench with water and cut/remove the clothing to remove the chemical from contact with the skin as soon as possible. If the skin appears acid-burned, daub a paste of sodium hydrogen carbonate on the affected area and obtain medical attention as soon as possible. If the skin appears burned by a strong base, daub vinegar on the affected area and obtain medical attention as soon as possible. **Do NOT cover with bandages.**

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Acid Spills

Ensure that the spill has not mixed with another substance. **DO NOT ADD WATER TO DILUTE!**

Put on protective gloves, goggles, and apron and use the provided materials from the Spill Kit.

Use the Acidic Spill Powder from the Spill Kit to absorb / neutralize the spill. If you do not have this available, just use powdered sodium carbonate or sodium bicarbonate to neutralize the spill.

Gather the neutralized substance and put it into the vinyl bags supplied in the kit. Label and date the bag. Follow local guidance on disposal protocols and alignment with information on the SDS.

1. Responding to Laboratory Chemical Spills

Caustic (Basic) Spills

Ensure that the spill has not mixed with another substance. **DO NOT ADD WATER TO DILUTE!**

Put on protective gloves, goggles, and apron and use the provided materials from the Spill Kit.

Use the Caustic Spill Powder from the Spill Kit to absorb / neutralize the spill. If you do not have this available, just use powdered citric acid to neutralize the spill.

Gather the neutralized substance and put it into the vinyl bags supplied in the kit. Label and date the bag. Follow local jurisdiction protocols on safe chemical disposal and alignment with the information on the SDS.

1. Responding to Laboratory Chemical Spills

Flammable Spills

Remove and turn off ALL sources of heat or possible ignition.(electrical, hotplates, burners)

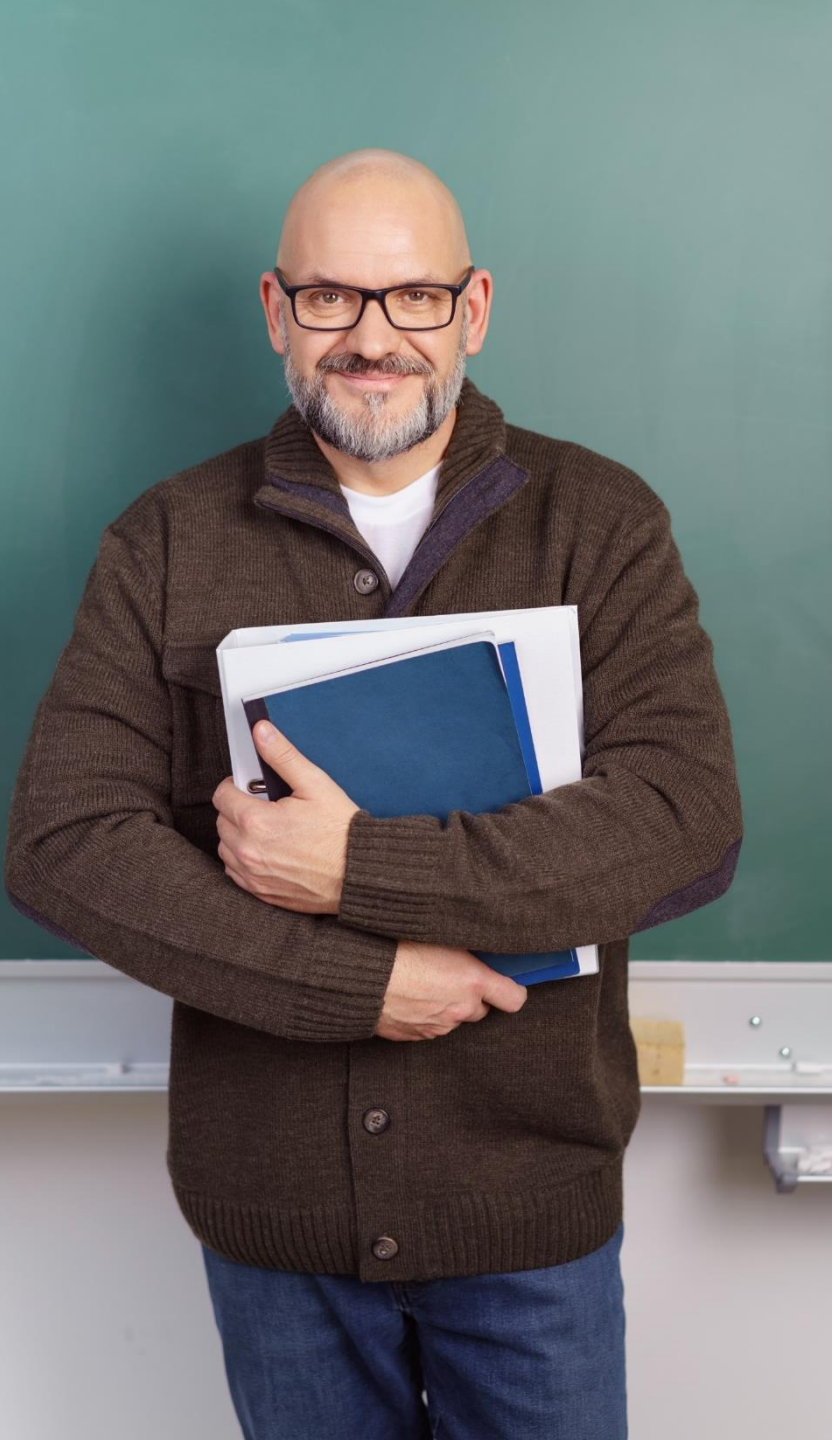
Do not add water to dilute the solution.

Ensure that the spill is not mixed with another chemical. Gather and wear appropriate protective equipment from Spill Kit.

Use the Solvent / Flammable mixture from the Spill Kit to absorb and contain the spill. If you do not have any available, you can substitute for vermiculite, kitty litter, or diatomaceous earth powder to contain and absorb the spill.

Gather the flammable spill and absorbant materials in a vinyl bag which should be labelled and identified for hazardous waste pick-up according to the chemical disposal guidelines on the SDS.

1. Responding to Laboratory Chemical Spills



How to deal with bodily fluids, pathogens, DNA and Mercury in the Lab

Release of Body Fluids, Pathogenic Bacteria, or DNA Samples:

For cleanup of body fluids, pathogenic bacteria, or spilled DNA samples, it is imperative that gloves be worn during the cleanup. A diluted disinfectant, such as 5% Lysol, Zephiran, Wescodyne, or similar disinfectant or 10% Clorox bleach solution should be poured on the spill and worked toward the center with paper towels. The paper towels should be dis- posed of in biohazard bags. Contaminated glass- ware should be sterilized in an autoclave for at least 30 minutes at 15 p.s.i. and temperatures above 248ºF (120ºC).

Mercury Spills:

Retrieve mercury with an aspirator bulb or mercury vacuum device. Cover droplets with sulfur to reduce volatility.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

The Safe Use of Plants & Animals in the Lab

Animals:

Before using animals, teachers should establish guidelines to avoid any intentional or unintentional abuse, mistreatment, or neglect of animals and to promote humane care and proper animal husbandry practices. Whenever animals are to be used in science activities with students, it is imperative that care be exercised to protect both the animals and the students. If animals are to be kept for any time in the room in cages, be certain that adequately sized and clean cages are provided to all animals. Keep cages locked and in safer, comfortable settings.

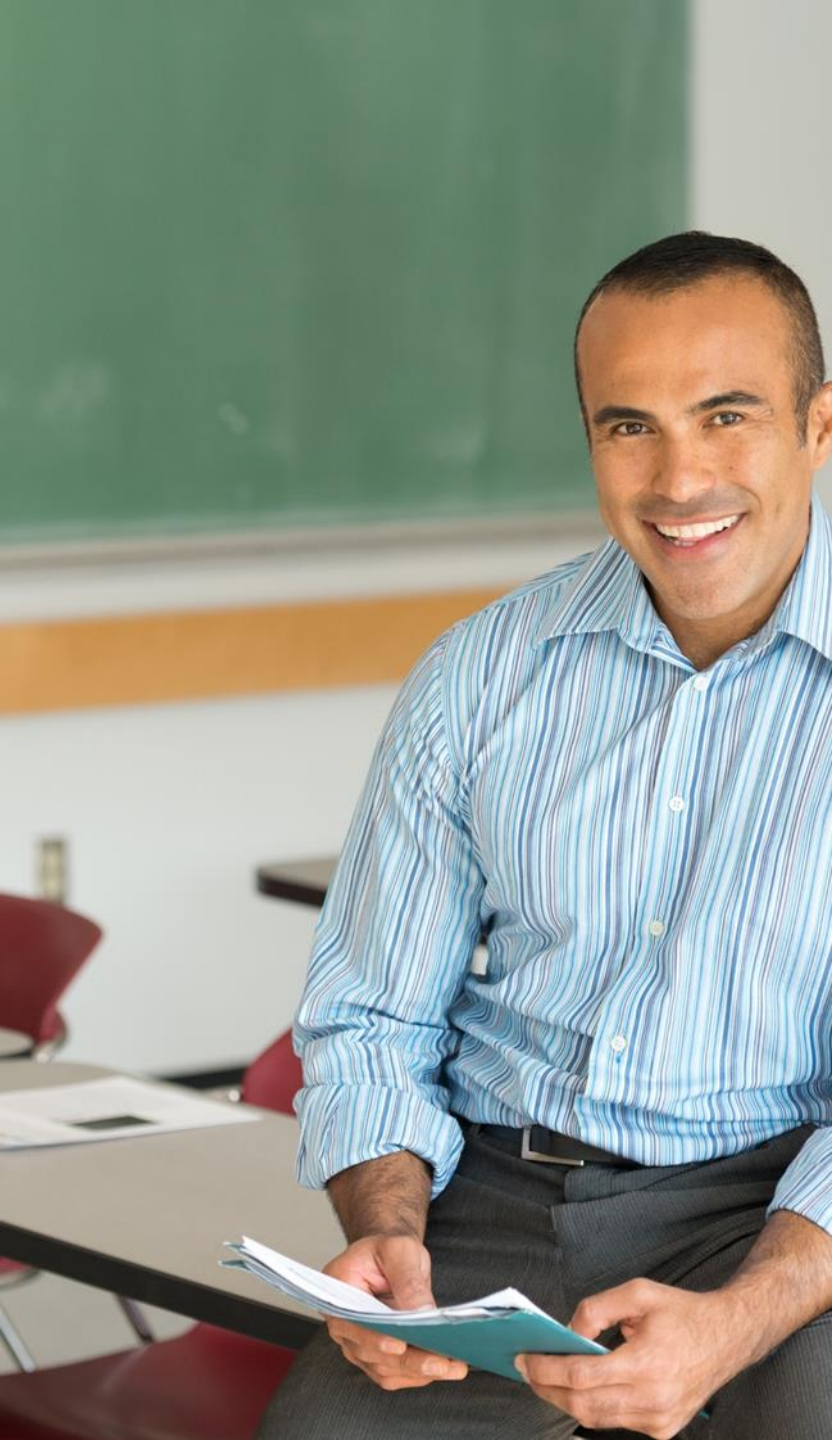
Animals can stimulate and enhance learning and should be used safely in the laboratory/class- room. Because increased activity and sudden movements can make animals feel threatened, ALL student contact with animals should be highly organized and supervised. Teachers should keep the following precautions in mind to ensure an enjoyable and comfortable experience for their students.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Safe Use of Animals / Insects in the Lab

- Inquire beforehand about student allergies associated with animals.
- Allow students to handle/touch animals only after proper directions and demonstrations have been given. *This is a voluntary action and not mandatory for all students.*
- Have students use gloves while handling vertebrates and appropriate invertebrates and wash hands afterward to prevent the potential spread of disease and contamination.
- Report to the school nurse and notify the school administration immediately if any student or staff member has been scratched or bitten by an animal.
- Have a veterinarian evaluate all animals that die unexpectedly in the lab.
- Never dispose of fecal matter in sinks or using commonly used lab apparatus or equipment
- Never use wild animals. Only obtain classroom animals from a reliable, registered, reputable pet supplier or science supplier.
- Never allow poisonous animals or insects in the lab.
- Never allow students to tease animals or touch animals to their mouths.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/



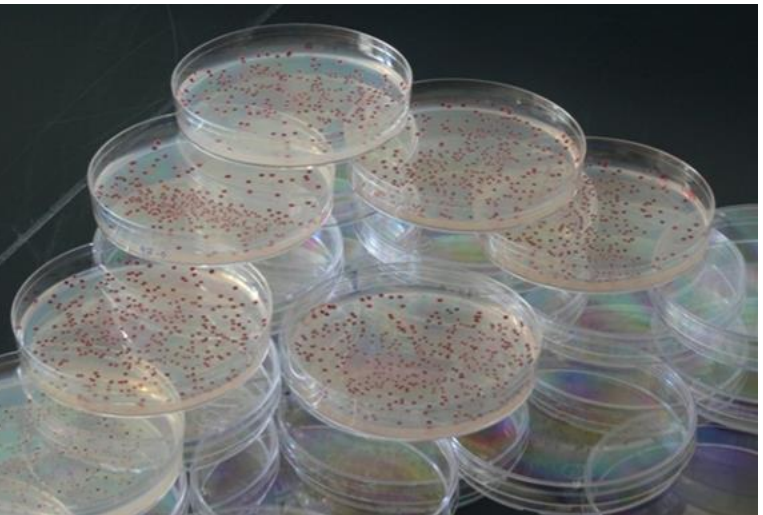
Safe Use of Plants in the Lab

Plants:

While plants produce the oxygen necessary for animal life, provide us with food, and beautify our surroundings, some produce very toxic substances. Teachers should familiarize themselves thoroughly with any plants they plan to use in the classroom.

- Inquire beforehand about student allergies associated with plants.
- Never use poisonous or allergy-causing plants in the classroom.
- Never burn plants that might contain allergy- causing oils, e.g., poison ivy.
- Make a clear distinction between edible and non-edible plants.
- Never allow plants to be tasted without clear direction from the teacher.
- Have students use gloves while handling plants and wash hands afterward.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/



Live Plants, Animals & Cultures at School

Here's what you need to know during holidays or closures.

Live plants and animals will need to be removed from school during the extended school closings and properly cared for if possible. Animals that are not native to your area or animals that have been purchased (even if they are thought to be native to your area) should not be released into the wild. They may suffer and die or they may become established and cause ecological damage

NSTA safety paper titled - TIPS FOR THE SAFER HANDLING OF MICROORGANISMS IN THE SCIENCE LABORATORY - https://static.nsta.org/pdfs/TipsForSafeHandlingOfMicroorganisms20160412.pdf

This safety paper provides bacteria and fungi considered safer for advanced high school level science laboratory course activities following appropriate legal safety standards and better professional safety practices (American Society for Microbiology). Culturing and use of live bacteria is not recommended at the elementary/middle schools and introductory level high school science courses.

Are there any petri dish cultures at school? Were these dealt with prior to school closing or are these growing wildly on the lab bench / incubator oven in the prep area? Before disposing of dishes in the trash or cleaning for future use, the bacteria should be destroyed. **Pour a small amount of household bleach over the colonies while holding the dish over sink. Caution - do not allow bleach to touch your skin, eyes or clothes. Wash all petri dishes with quality lab detergent and dry thoroughly before storage.**

https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

What protective equipment should be kept/provided in a laboratory for teacher and student use?

The following list is excerpted from Total Science Safety System software (JaKel, Inc., 1998), with the approval of the authors.

Master shut-off valves/switches should be located within each laboratory, preferably in one secure location accessible only to the instructor. Water, gas, and electricity should be turned off when not in use.

- Adequate numbers of tri-class ABC fire extinguishers should be strategically placed within 30 steps or 15 seconds of any location in the room. These should be checked and certified as fully charged and in working order at least every six months.
- Multiple faucet-type portable eyewash stations should be strategically placed within 30 steps or 15 seconds of any location in the room. Eyewash stations should be forearm or foot operated for hand-free operation. Flow rate of potable water at 1.5 gallons/minute (5.7 liters/minute) at pressure below 25 p.s.i. is recommended if a standard eyewash unit is installed.
- Forearm or foot-operated face/body sprayers, with adequate flexible hoses and water pressure, should be strategically placed within 30 steps or 15 seconds of any location in the room. If a standard plumbed safety shower unit is used, it should provide potable water at a flow rate of 30–60 gallons/minute (113.6–227.2 liters/minute) at a pressure of 20–50 p.s.i.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Necessary Safety Infrastructure Items

An appropriate fume hood, vented through the roof to at least 8 feet (2.4 meters) above the roof line, should have a face velocity of 60–100 feet/minute (18.3–30.5 meters/minute) of air through the hood. The hood should not be within 10 feet (3.1 meters) of an exit or on a main aisle.

All electrical outlets within 6 feet (1.8 meters) of sinks and serving delicate electrical equipment should be fitted with Ground- Fault Interrupters (GFI). Where thunderstorm activity is a regular meteorological phenome- non, it is essential that outlets be equipped with GFIs. Outlets should be capped when not in use and placed along walls or counters at intervals of 6–8 feet (1.8–2.4 meters).

Retardant-treated wool fire blankets, free of friable asbestos, should be prominently labeled and strategically placed within 30 steps or 15 seconds of any location in the room.

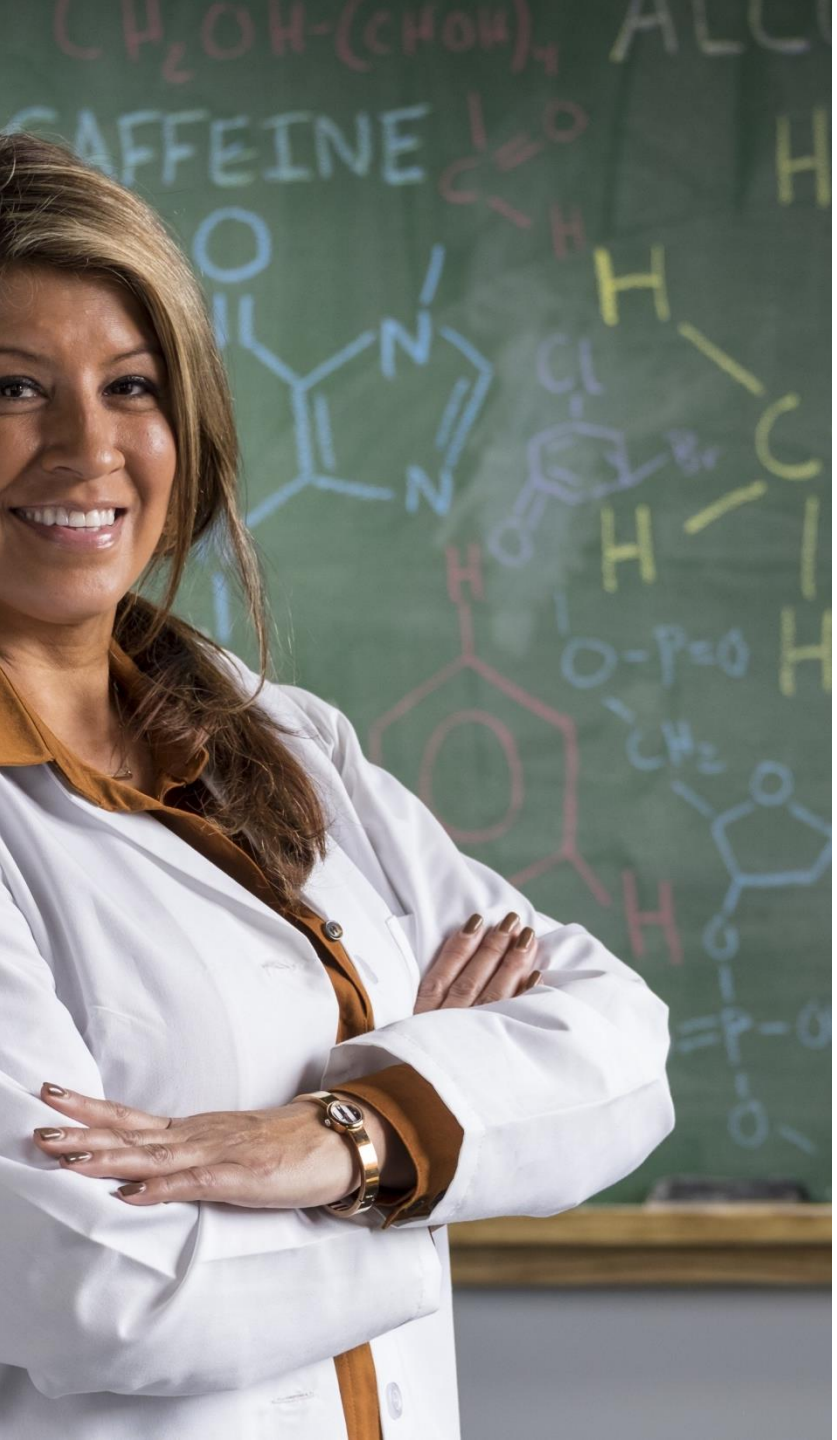
A bucket of dry, organics-free sand should be available for alkali metals fires.

American National Standards Institute (ANSI) coded Z87 or Z87.1 'D3' approved safety goggles should be provided for each student when there is danger of chemical or projectile hazard. Specially marked, non-vented goggles should be available for contact lens wearers.

Sanitizing and/or sterilizing equipment or materials, e.g., ultraviolet cabinets or alcohol swabs, should be available and used between classes to clean safety cover goggles.

Non-absorbent, chemical-resistant aprons should be provided for each student during laboratory activities wher there is a danger of spillage or spattering of chemicals or hot liquids.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/



Necessary Safety Infrastructure Items

- Heavy-gauge metal storage cans with an internal flame arrester (heat sump) should be used for storage and dispensing of flammable chemicals by the teacher only.
- Separate corrosives (primarily for acids) and Occupational Safety and Health Administration/National Fire Protection Association (OSHA/NFPA) approved flammables cabinets (primarily for alcohols and sol- vents) should be secured in the storeroom.
- A container should be provided and clearly marked for the disposal of broken glass only.
- Containers of diatomaceous earth should be kept available for general chemical spills. Vinegar and sodium hydrogen carbonate (sodium bicarbonate/baking soda) are need- ed for neutralization of bases and acids respectively. An aspirator and a mercury spill kit should be available for mercury spills. Disinfectants and 10% Clorox bleach solutions should be used to sterilize equipment and wash down counter tops.
- An adequately stocked first-aid kit for teacher use should be easily accessible in an emergency.
- Safety posters should be prominently displayed in the room.
- Emergency procedures and telephone numbers should be prominently posted in the room.

1. https://www.ors.od.nih.gov/sr/dohs/documents/chemicalsafetyguide.pdf
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.com/safe-storage-and-handling-of-lab-chemicals/sn033/

Federal and State Regulatory Connections

The following is a list of federal agencies and their most applicable regulations concerning safety in schools. This list is not to be considered com- prehensive. Many of the regulations cited and any recent updates/changes can be found on the Internet at the agency's web address, e.g., www.osha.gov or www.epa.gov.

- Asbestos Hazard Emergency Response Act (AHERA) – Environmental Protection Agency (EPA)
- Code of Federal Regulations (CFR), Appendix C, Part 20, Title 10, United States Nuclear Regulatory Commission (NRC) exempt quantities
- Resource Conservation and Recovery Act (RCRA) – EPA
- Title III Emergency Planning and Right-to- Know Sections 301-304, 311-313 – EPA
- Title IV – Superfund Amendments and Reauthorization Act (SERA) (indoor air quality) – EPA
- Toxic Substances Control Act (indoor air quality) – EPA

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

OSHA Laboratory Standard CFR 1910.1450; Part 29

- CFR, Part 29 (pertinent sections), Occupational Safety and Health Administration (OSHA) Standards:

1910. General Workplace Standards 1910.Subpart Z

Exposure Standards 1910.133 Eyewear Standards
1910.134 Respirator Standard

1910.1028 Benzene Standard

1910.1030 Bloodborne Pathogens Standards

1910.1048 Formaldehyde Standard

1910.1200 Hazardous Communication Standard

1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories

1910.20 Access to Employee Exposure and Medical Records

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Conducting Physical Inspections in the Laboratory and Prep Area Guidance

Several publications cited in the References contain checklists or information that could easily be used by those wanting to renovate or build new science labs. Much of what is cited below is excerpted from Total Science Safety System software (JaKel, Inc., 1998) with approval of the authors. This is NOT an exhaustive checklist and is only intended to address the secondary (9–12) science laboratory.

Flinn Scientific has provided an updated listing of criteria to observe and inspect during your science department safety and compliance walkthrough inspections. You are required to have the monthly on-site joint health and safety inspections with school administration and the JHS team, but also the formalized annual inspection as a part of the Chemical Hygiene Plan (CHP) or equivalent.

These inspections are critically important as they will allow for a documented record of what was identified, remediation, and a timeline to demonstrate progression and as a necessary annual filing by the Chemical Hygiene Officer for the school district.

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Science Department Inspection Criteria

- The room should not be overcrowded, with 45–60 square feet (4.2–5.6 square meters) of working space/student, depending upon the type of activities to be performed. It should be designed for no more than 24 students/teacher.
- There should be no less than 6 linear feet (1.8 meters) of workspace per student in the classroom/laboratory.
- In order to meet Americans with Disabilities Act (ADA) requirements for handicapped and disabled students, there should be at least an additional 20 square feet (1.9 square meters) of working space per student.
- Approximately 15 square feet (1.4 square meters) per computer station, 10 square feet (.9 square meters) for a TV with VCR or laser disc player, and 12 square feet (1.1 square meters) for a projector should be added to total lab area to accommodate minimum technological equipment.
- The room should have no blind spots where students cannot be observed and supervised.

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Science Department Inspection Criteria

- General light level should be between 538.2–1076.4 lumens per square meter with diffuse lighting preferred.
- Aisle width should be adequate (4–5 feet or 1.2–1.5 meters) to accommodate handicapped students and equipment needs.
- The room should have two exits, both opening outward and at least 5 feet wide (1.5 meters) to accommodate handicapped students and facilitate equipment carts and emergency exit. Doors should have rein- forced glass viewing windows or peepholes.
- **Per NFPA 45 2015 & 2019 "7.2.1 - "Laboratory units and laboratory hoods in which chemicals are present shall be continuously ventilated under normal operating conditions." 7.3.1 - "Laboratory ventilation systems shall be designed to ensure that chemical fumes, vapors, or gases originating from the laboratory shall not be recirculated" 7.4 - "Air exhausted from chemical fume hoods and other special local exhaust systems shall not be recirculated.“ Schools need to check with local or state fire marshal to determine which NFPA 45 edition has been adopted as law in their state.**

- The exhaust ventilation system should be separate from that of the chemical fume hood and should meet the American National Standards Institute (ANSI) Z9.5 Standard.

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Science Department Inspection Criteria

- For high school labs where chemicals of low to moderate toxicity are used, at least one functioning exhaust hood (portable or permanent) that meets American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 110 testing standard, with a face velocity of approximately 80–120 linear feet/minute (24.4–36.6 meters/minute), should be provided.
- Exhaust should be vented to the outside through the roof or outside wall. A common through-the-wall hood may serve the laboratory and preparation room. Exhaust hood(s) should be located away (10 feet or 3.1 meters) from entrances/exits, windows, intake ducts, and high traffic areas.
- There should be a telephone or an intercom available for notifying the office and others of emergencies.
- Tile floors should be covered with a non-skid wax.
- There should be lockable storage for certain items. Emergency/master shut-off controls for water, gas, and electricity should be in a securable location near the teacher's station.
- There should be sufficient electrical outlets located at intervals of 6–8 feet (1.8–2.4 meters) that make extension cords unnecessary. They should be capped when not in use. Those outlets within 6 feet (1.8 meters) of water should be equipped with Ground- Fault Interrupters (GFIs).
- Goose-necked faucets should be used on sinks to allow attachment of portable eye-washes and shower hoses.
- Lab surfaces should be made of material unaffected by acids, alkalis, solvents, and temperate heat.

1. https://www.acs.org/content/acs/en/chemical-safety/basics/chemical-hygiene-plan.html
2. https://www.cpsc.gov/s3fs-public/NIOSH2007107.pdf
3. https://www.flinnsci.ca/api/library/Download/bece13a7fc1f4884a2b09ab28e63f6dc

Key Points for Prep Room Safety & Compliance during extended closures (traditional summer holidays and pandemic environments)

Keep room and chemical cabinets locked	Make sure chemicals are stored properly	Empty the lab fridge ASAP	Unplug all electrical items for storage
Ensure there is adequate ventilation	Make sure biological specimens are stored properly	Shut off gas lines for duration and lock valve into ‘OFF’ position	Fill ‘P’traps for plumbing in sinks and floors to prevent odors
Remove any clutter & mess from the Prep Room	Generate a current chemical inventory of what is on-hand	Have a plan for live animals and plants in the science area	Communicate with your school administration

Storage and Prep Room Organization

Keeping prep and storage rooms clean and organized is a never-ending task. Flinn has many helpful resources for you.

We recognize that in the unexpected school closures there are likely some levels of ‘messiness’ in the prep area as a result of not planning to be away for an extended period of time.It can be overwhelming to address organizing your prep room when a school closes abruptly, or if you only have limited time in your school.

First, make sure all safety equipment is easily accessible including: Fire extinguisher; fire blanket; spill kit; PPE; UV goggle sanitizer; drench shower; eye wash station; first aid kit; master shut-off switches; smoke detectors. There needs to be clear access to these items.

Storage and Prep Room Organization

Keeping prep and storage rooms clean and organized is a never-ending task. Flinn has many helpful resources for you.

Many school science departments keep certain lab reagents and consumer commodities in there (including eggs used for lab activities which will expire and smell really bad…) or milk products used for dairy labs etc. These will need to be purged ASAP to minimize potential odors & bacterial growth. If you cannot get into the school, you should alert your principal and the janitor/maintenance people to remove any products/items from the fridge when they can.

Make it a priority to organize the prep area once you are back in the building and that may require the removal of clutter. Student projects, textbooks, lab activities, glassware, boxes, random science items and bottles of chemicals are the usual contributors to the disorganization.

Employee Training Program

Have the teachers been trained in the following areas?

- Chemical labelling (GHS) and SDS management
- Chemical storage (compatibility issues / space / location..)
- Chemical handling & dispensing techniques (solution dilution)
- Chemical disposal process and storage of hazardous wastes
- Chemical spills (acid / base / solvent)
- Fire / Flood / Broken Glass / Accidental Injury
- CHP Review and Updating annually – including administration
- First Aid
- Fire Extinguisher & Fire Blanket Safe and Proper Use
- Identifying hazards and prevention

Best Practices in the Science Department

Being consistent is critical to the on-going safety and success in the school science department.

- Current inventory of chemicals on-site and a manageable effective storage system
- All chemicals labelled according to GHS
- Organized lab areas – no clutter or leftover lab activities for weeks
- Safety training and compliance for ALL employees
- Always use (model) PPE when in the lab
- Use of a Lab Safety Contract or safety acknowledgement form with students to reinforce behavior.
- Follow procedures from the CHP / school district safety manual / DOE policy documents
- Ordering chemicals in smaller amounts in the lowest concentration possible to minimize storage and disposal

Common Concerns about Safety Regulatory Compliance

- Do we have the ‘right’ chemical storage cabinets?
- Do we have hazardous chemicals? (risk exceeds value)
- Do we have an accurate inventory?
- Do we have GHS labels on the chemicals?
- Do we have a Chemical Hygiene Plan in place? How current?
- Do we have a Chemical Hygiene Officer? Who is it?
- Do we have the necessary PPE? (Goggles / respirator / gloves etc.)
- Do we have a functional fume hood / eyewash / shower?
- Do we have an ongoing safety training program for employees?
- Do we have a Banned list of chemicals / activities that is communicated?

Compliance Concerns Continued…

- How do we make a Chemical Hygiene Plan?
- Who will be the Chemical Hygiene Officer?
- How do we label ALL of our chemicals for GHS compliance?
- How do we create an accurate inventory of our chemicals & SDS?
- How do we inspect PPE? (Goggles / respirator / gloves, etc.)
- How do we inspect our fume hood / eyewash / shower?
- How do we engage in an ongoing safety training program for employees?
- How do we create Banned list of chemicals / activities?
- How much is this going to cost?
- How long does this laboratory safety compliance take to implement?
- How do we start the process?

Flinn Scientific Checklist for Lab Safety 101

CRITERIA	YES	NO
1. Do you have only 'new' chemicals in the lab? (less than 3 years old)		
2. Is there a current chemical inventory? Are the new SDS's accessible to all?		
3. Are chemicals labelled and stored properly? (GHS labels & organized safely)		
4. Is there adequate PPE in the lab? (goggles/gloves/aprons etc.)		
5. Are there proper chemical storage cabinets? (acid, corrosive, flammables cabinets)		
6. Are teachers properly trained in safety protocols and procedures? (recertification?)		
7. Is a Safety Contract used with students in the lab?		
8. Is there adequate fire safety equipment in each room? (extinguisher / blanket etc.)		
9. Is there a current Chemical Hygiene Plan in place? Is there a CHO designated?		
10. Is there a hazardous waste procedure in place / scheduled pick-up for disposal?		
11. Is there a Banned/Restricted list of chemicals?		
12. Do you feel comfortable with the accountability for safety in the science department?		

References Used in the Publication

The following is a list of general references. It should be obvious that it is not exhaustive. The references provided are for those interested in obtaining additional information from primary sources. A much more exhaustive listing of references and resources can be found in two excellent state documents: Guidebook for Science Safety in Illinois, available from the Illinois State Center for Educational Innovation and Reform (contact Illinois State Board of Education) and Maryland Science Safety Manual, K-12, available from the Maryland Science Supervisors Association (con- tact the Maryland State Department of Education). No implication of endorsement or lack of endorsement should be read into inclusion or omission of any referenced material within this document.

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References and Original Contributors Attribution

Alaimo, R. J. et al. (1993). Safety in the Elementary (K-6) Science Classroom. American Chemical Society.

American Red Cross. (1995). First-Aid Fast. Mosby Lifeline.

Berry, K. O. et al. (1995). A Model Chemical Hygiene Plan for High Schools. American Chemical Society.

Biehle, J. T. et al. (1999). NSTA Guide to School Science Facilities. National Science Teachers Association.

Converse, R. E. & Wright, W. C. (n.d.). Suggestions for constructing or renovating science laboratory facilities. Reproduction by Flinn Scientific from Third Sourcebook of Science Supervisors, National Science Teachers Association

Cote, R. (1997). Life Safety Code Handbook. 7th ed. National Fire Prevention Association

Earley, M. W. (1999). National Electrical Code Handbook, 7th ed. National Fire Prevention Association.

Fischer, L., Schimmel D., & Kelly, C. (1999). Teachers and the Law, 5th ed. Longman Publishing.

Gerlovich, J. & Gerard, T. (1989). Reducing district liability in science teaching: a safety solution. American School Board Journal, 176, 5.

Johnson, W. B. & Walden, M. B. (1997). Animals in Alabama schools: guidelines for visiting and residential pets. [brochure].

State of Alabama, Department of Public Health.

Katz, D.A. (1994). Safer alternatives to fire and explosions in classroom demonstrations. Journal of Hazardous Materials, 36, 149-58.

Kucera, T.J. (ed). (1993). Teaching Chemistry to Students with Disabilities. American Chemical Society.

National Science Teachers Association. (1993). Safety in the Secondary Classroom. National Science Teachers Association.

Pan-Educational Institute. (1994). Chemical Health and Environmental Management in Schools (CHEMIS) – Systems Management Manual. Pan-Educational Institute

Original Contributors References Continued

- Summerlin, L. R. & Summerlin, C. B. (1999). Standard safety precautions. The Science Teacher, 66, 6. (This entire issue is dedicated to safety issues.)
- Task Force on Laboratory Waste Management. (1993). Less Is Better: Laboratory Chemical Management for Waste Reduction, 2nd ed. American Chemical Society.
- Taylor, P. H. (n.d.). Planning of facilities for teaching science in elementary and secondary schools. Reproduction by Flinn Scientific from Third Sourcebook of Science Supervisors, National Science Teachers Association.
- U.S. Department of Health and Human Services. (1997). (NIOSH) Pocket Guide to Chemical Hazards. Washington, DC: Government Printing Office.
- Wood, C. G. (1991). Safety in School Science Labs. James A. Kaufman and Associates.
- Young, J., Breazeale, J. et al. (1995). Safety in Academic Chemistry Laboratories, 6th ed. American Chemical Society

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Trusted Online Sources for Safety, Regulatory and Compliance Content

American Association of Law Librarians: http://www.aallnet.org/aallnetweb.html American Chemical Society: http://www.acs.org

Centers for Disease Control: http://www.cdc.gov Council of State Science Supervisors: http://csss.enc.org Eisenhower National Clearinghouse: http://www.enc.org Environmental Protection Agency: http://www.epa.gov Flinn Scientific: http://www.flinnsci.com/

Flinn Scientific Inc. https://www.flinnsci.com

Howard Hughes Medical Institute. Online Information Site: http://www.practicingsafescience.org and http://www.hhmi.org/science/labsafe/lcss/

Humane Society of the United States: http://www.hsus.org/programs/research/animals_education.htmlJaKel, Inc. Online Information Site: http://www.netins.net/showcase/jakel

Kansas City Hazardous Waste Program: http://www.metrokc.gov/hazwaste/rehab/ Laboratory Safety Institute. Online Information Site: http://www.labsafety.org MSDS Online: http://www.msdsonline.com

National Association of Biology Teachers: http://www.nabt.org National Fire Protection Association: http://www.nfpa.org National Institutes of Health: http://www.nih.gov/od/ors/

OSHA Laboratory Standard - 29 CFR 1910.1450: http://www.osha.gov Sargent-Welch: http://www.sargentwelch.com/html/safetyck.html University of Virginia: http://keats.admin.virginia.edu/

Wellesley College: http://www.wellesley.edu/ScienceCenter/lab-safe-home.html

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