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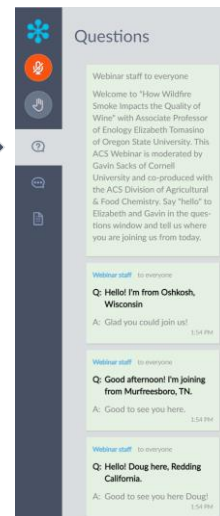


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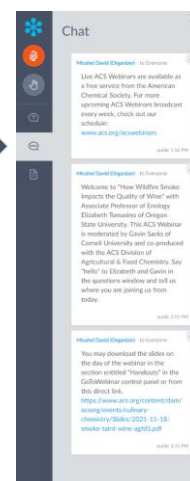
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Chat
Announcements and hyperlinks from our team



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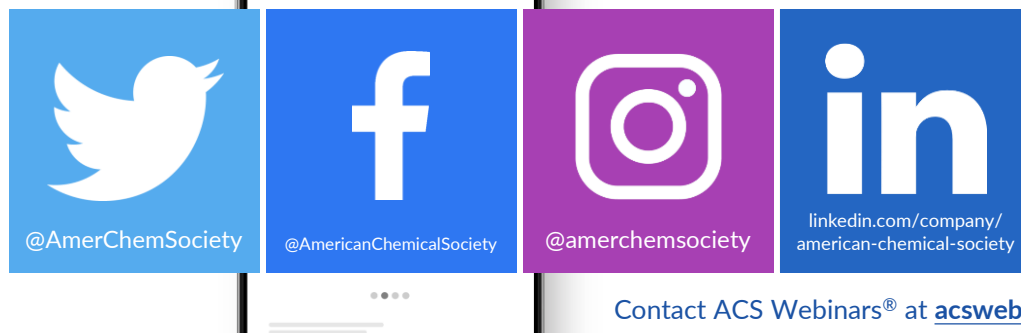


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A Career Planning Tool For Chemical Scientists



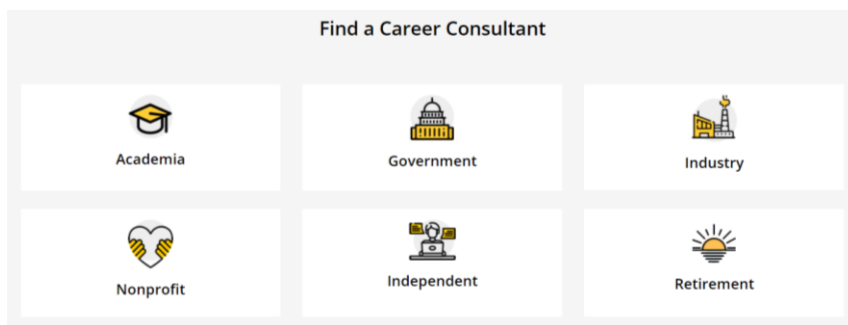
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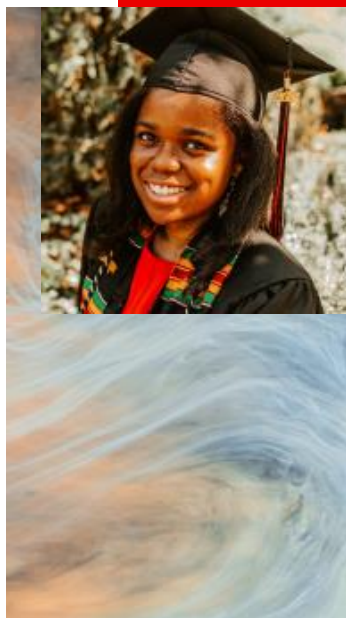


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ACS Scholar Adunoluwa Obisesan

BS, Massachusetts Institute of Technology, June 2021
(Chemical-biological Engineering, Computer Science & Molecular Biology)

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Diversity, Equity, Inclusion, and Respect

**Adapted from definitions from the Ford Foundation Center for Social Justice:

Equity**

Seeks to ensure fair treatment, equality of opportunity, and fairness in access to information and resources for all. We believe this is only possible in an environment built on respect and dignity. Equity requires the identification and elimination of barriers that have prevented the full participation of some groups.

Diversity**

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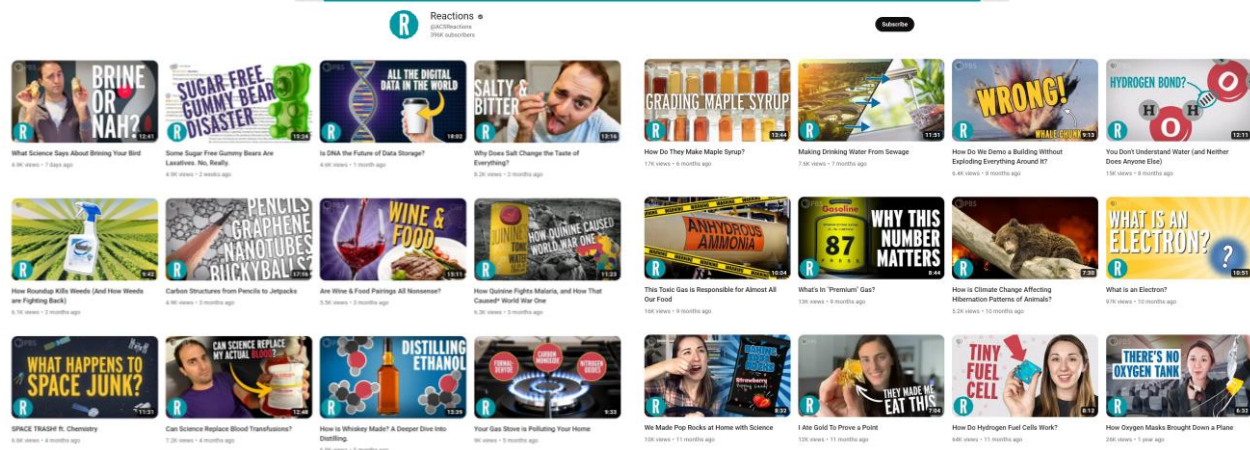
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REACTIONS

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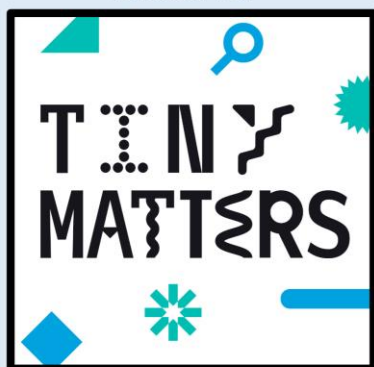
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Carolyn Bertozzi and K. Barry Sharpless chat about sharing the 2022 Nobel Prize in Chemistry
December 6, 2022



Bonus Episode
Bioorthogonal, click chemistry clinch the Nobel Prize
October 5, 2022



Episode #40
Lithium mining's water use sparks bitter conflicts and novel chemistry
September 13, 2022



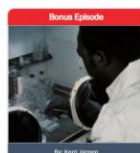
Bonus Episode
Happy 100th birthday, John Goodenough! For John Goodenough's 100th birthday, Stereo Chemistry revisits a fan-favorite interview with the renowned scientist
July 25, 2022



Bonus Episode
Jess Wade on Wikipedia and work-life balance
June 21, 2022



Bonus Episode
The sticky science of why we eat so much sugar
May 31, 2022



Bonus Episode
There's more to James Harris's story
April 27, 2022



Bonus Episode
The helium shortage that wasn't supposed to be
March 24, 2022

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ACS Career Resources



Virtual Office Hours



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Personal Career Consultations



Jim Tung works at Lacunas Laboratories in Portland, OR, currently as a business development manager. He has been with Lacunas for 10 years, working on developing new chemical manufacturing projects. Before that, he was a senior research chemist at Oblet Research in Champaign, IL, performing kilo-scale organic chemistry.

An Oregon native, Jim got his B.S. in biochemistry from the University of Oregon, his Ph.D. in organic chemistry from the University of Notre Dame, with postdoctoral experience at Pfizer's laboratories in La Jolla, CA. He is past chair of the Portland Section of the American Chemical Society and was 2019 general co-chair of NORM 2019. He has interests in process chemistry, labor economics, social media outreach and encouraging career exploration and development for younger chemists.

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 Applying for academic jobs
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How to Safely Manage Chemicals in Educational Settings



SUSAN WIEDIGER, PhD

Professor, Chemical Education,
Department of Chemistry, Southern
Illinois University Edwardsville



SAMUELLE B. SIGMANN, MS, NRCC-CHO

Safety Education Consultant & Past
Stockroom, Director, and Chemical Hygiene
Officer, Appalachian State University (Retired)



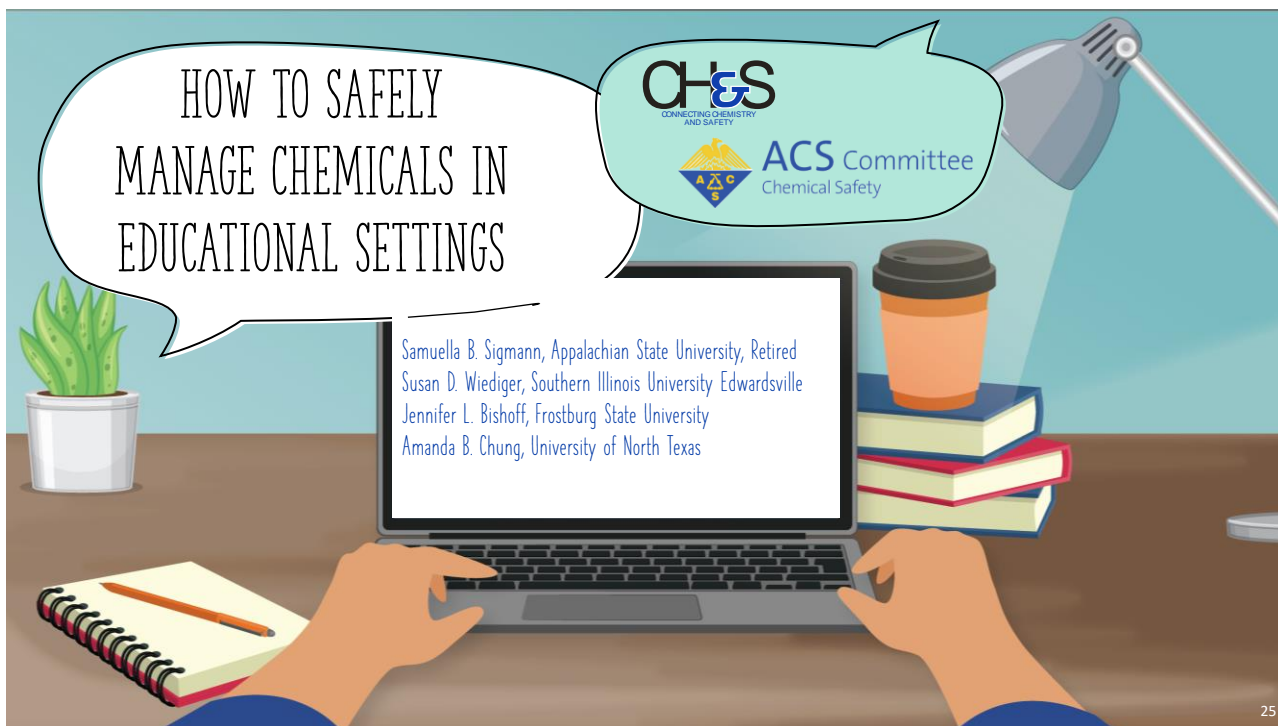
AMANDA CHUNG, PhD, CHO

Chemical Hygiene Officer,
University of North Texas

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- HOW AND WHY TO ORGANIZE CHEMICALS BASED ON HAZARD CATEGORIES
- BEST PRACTICES FOR UPKEEP AND MAINTENANCE OF CHEMICAL STORAGE AREAS
- ESSENTIAL INFORMATION NEEDED FOR INVENTORY MANAGEMENT INCLUDING BEST LABELING PRACTICES FOR SECONDARY CONTAINERS

WHAT YOU WILL LEARN

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CHEMICAL HYGIENE PLAN

Required by the Occupational Safety and Health Administration (OSHA) Laboratory Standard, which most educational laboratories fall under.

Even if your state is not regulated by OSHA, a prudent approach to chemical management should include a CHP outlining how your chemicals will be safely procured, used, inventoried, stored, and disposed of.



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Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



I currently store my chemicals:

- Alphabetically
- By experiment
- Randomly
- Hazard class
- By container size

** If your answer differs greatly from the choices above tell us in the chat!*

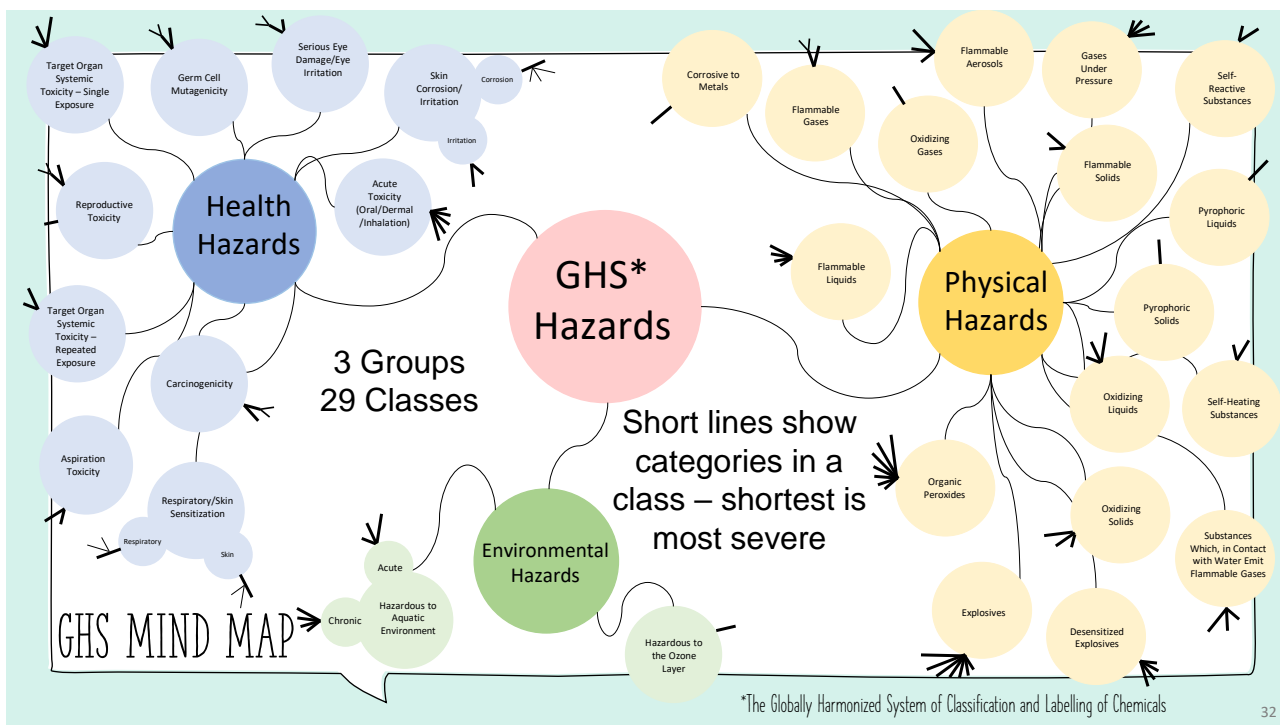
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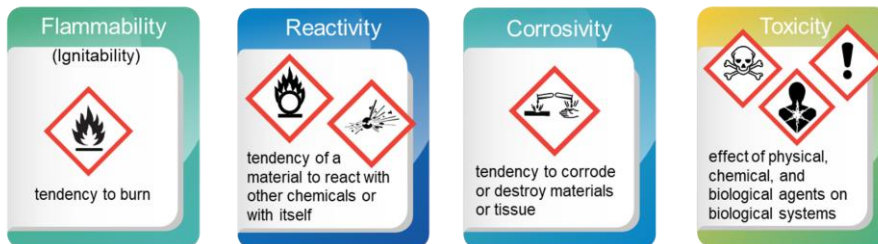
AT SOME POINT, SYSTEMS NOT BASED ON SEPARATION OF HAZARD TYPES WILL FAIL

Alphabetical Storage

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THE FOUR PRIMARY CHEMICAL HAZARD TYPES & THEIR GHS PICTOGRAMS

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FOUR PRIMARY STORAGE AREAS

Flammability



Flammable
Combustible

Reactivity



Oxidizers (also corrosive)
Air, Water, Shock Sensitive
Self heating/ Polymerizing
Potentially Explosive Compounds
Time Sensitive

Corrosivity



Acids (organic/inorganic)
Bases (organic/inorganic)

Toxicity



Toxic
Acutely Toxic

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CUSTOM SYSTEMS - A WORD OF CAUTION

- There are several well-known systems that organize chemicals (e.g., Stanford, Fisher, Flinn)
- Color systems?
 - Great if you only order from one place
 - Aftermarket tape conflicts
- Avoid conflicts with National Fire Protection Association colors



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POSSIBLE SCENARIOS

- Low or non-hazardous chemicals (by GHS)
- A chemical classified with one hazard type (flammable, reactive, corrosive, or toxic)
- A chemical that is incompatible with other chemicals that have the same hazard type
- A chemical with multiple types of hazard
- Generally problematic chemicals (bad actors)

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INCOMPATIBILITIES BETWEEN HAZARD TYPES



Reactions between acids and metals produce flammable gases.



Oxidizers and flammable solvents can explode or create a fire if mixed.



Reactions between acids and some toxic salts can produce toxic fumes.

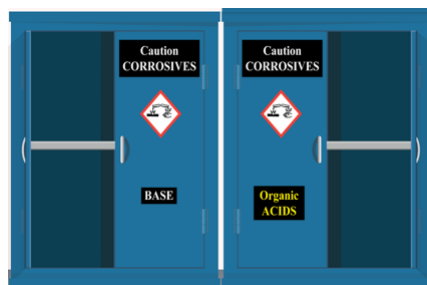
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INCOMPATIBILITIES WITHIN THE SAME HAZARD TYPE



Salt formation on bottles can be seen when acids and bases react in storage.



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CHEMICAL STORAGE LOGIC FOR CHEMICALS W/ MULTIPLE HAZARDS

Flammability



First: Protect the flammables from ignition sources.

Reactivity



Next: Prevent energetic interactions between reactive chemicals stored in the laboratory.

Corrosivity



Then: Protect the laboratory and equipment from corrosive damage.

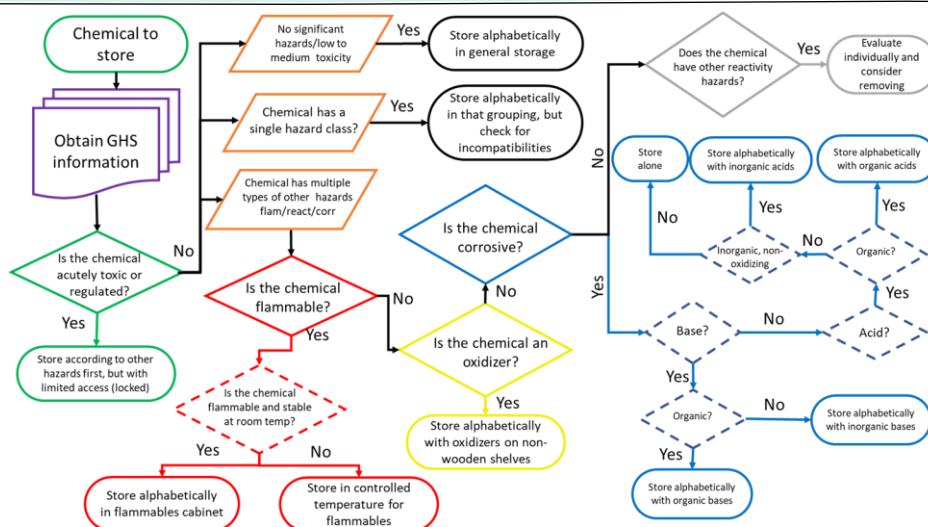
Toxicity



Finally: Secure high-toxicity chemicals from theft or accidental release.

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This flowchart is only for general guidance and should be supplemented with information from other authoritative information sources such as PubChem or the SDS.

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Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT

Nitric acid is corrosive and oxidizing – **where do you store it?**

- In a corrosives cabinet
- On a metal shelf
- In a separated area within a corrosives cabinet
- On a wooden shelf
- By itself

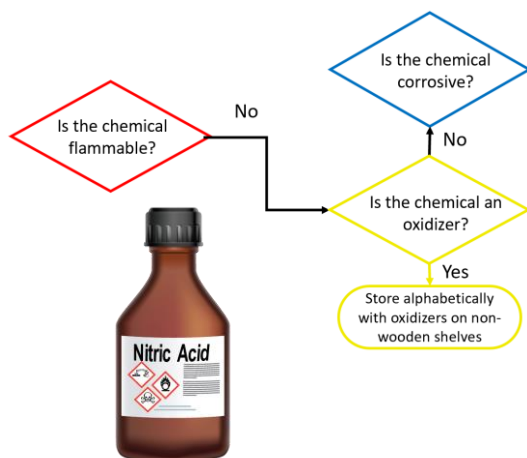


** If your answer differs greatly from the choices above tell us in the chat!*

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ESPECIALLY PROBLEMATIC CHEMICALS - NITRIC ACID



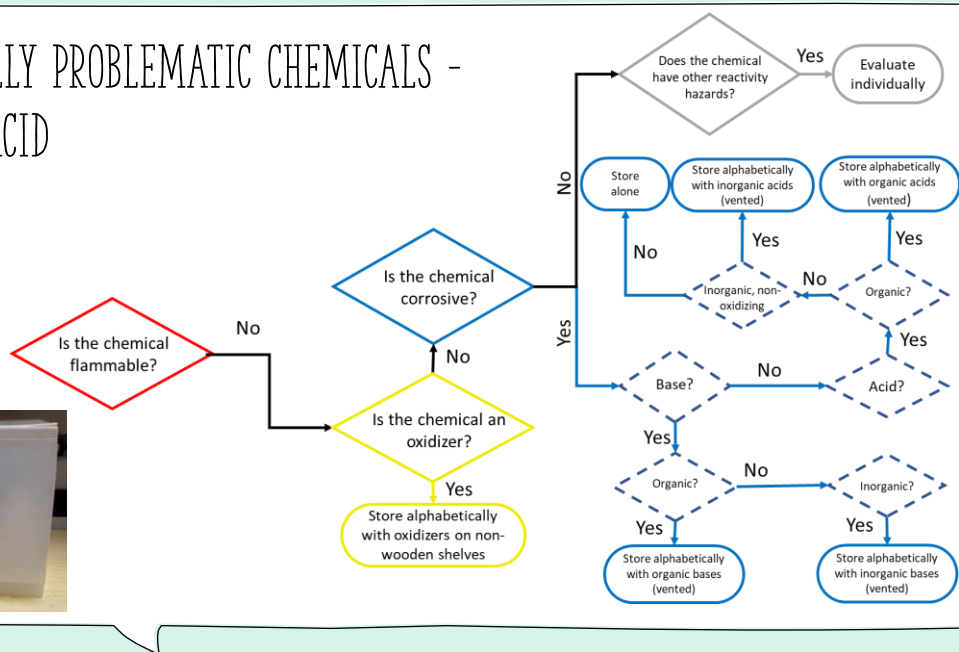
Using the storage flowchart, you may put nitric acid with oxidizers, which are stored on non-wooden shelving for reactivity concerns.

The corrosivity of nitric acid also makes it incompatible with metal shelving.

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ESPECIALLY PROBLEMATIC CHEMICALS - NITRIC ACID

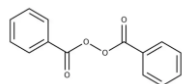


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RAMP: THE ITERATIVE NATURE OF SAFETY

For each chemical -



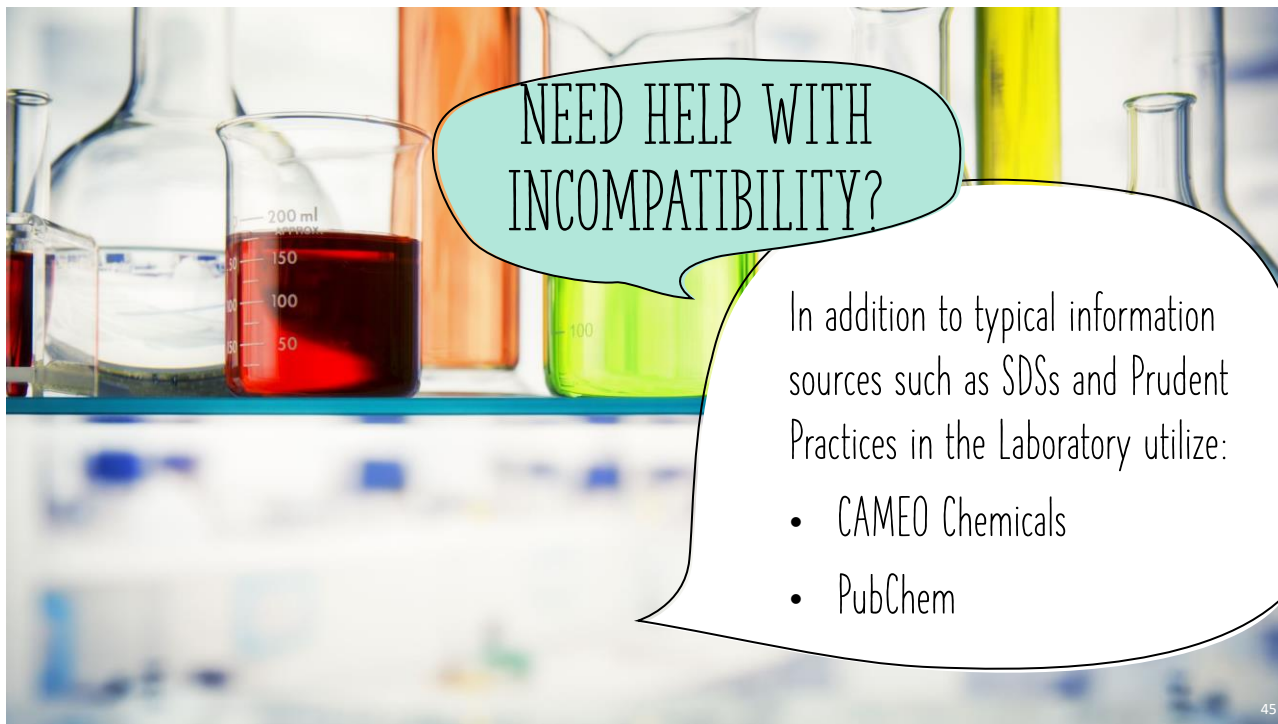
benzoyl peroxide CAS RN 94-36-0 100%



- **R**ecognize the hazards: benzoyl peroxide CAS RN 94-36-0 100%
- **A**ssess the compatibility and storage issues: Reacts violently with many organic acids, inorganic acids, alcohols and amines. This generates fire and explosion hazard. May decompose explosively on shock, friction or concussion. Temperature sensitive
- **M**inimize the chance of a reaction in storage: It must be kept in a cool place, in isolation and out of the sunlight or sources of heat. Also, avoid shock or friction.
- **P**repare for the storage issues: Fireproof. Separated from combustible substances and reducing agents. Store only in original packaging. Wet spills to avoid dusts, but don't allow in drains. Make sure to capture storage conditions in your inventory.

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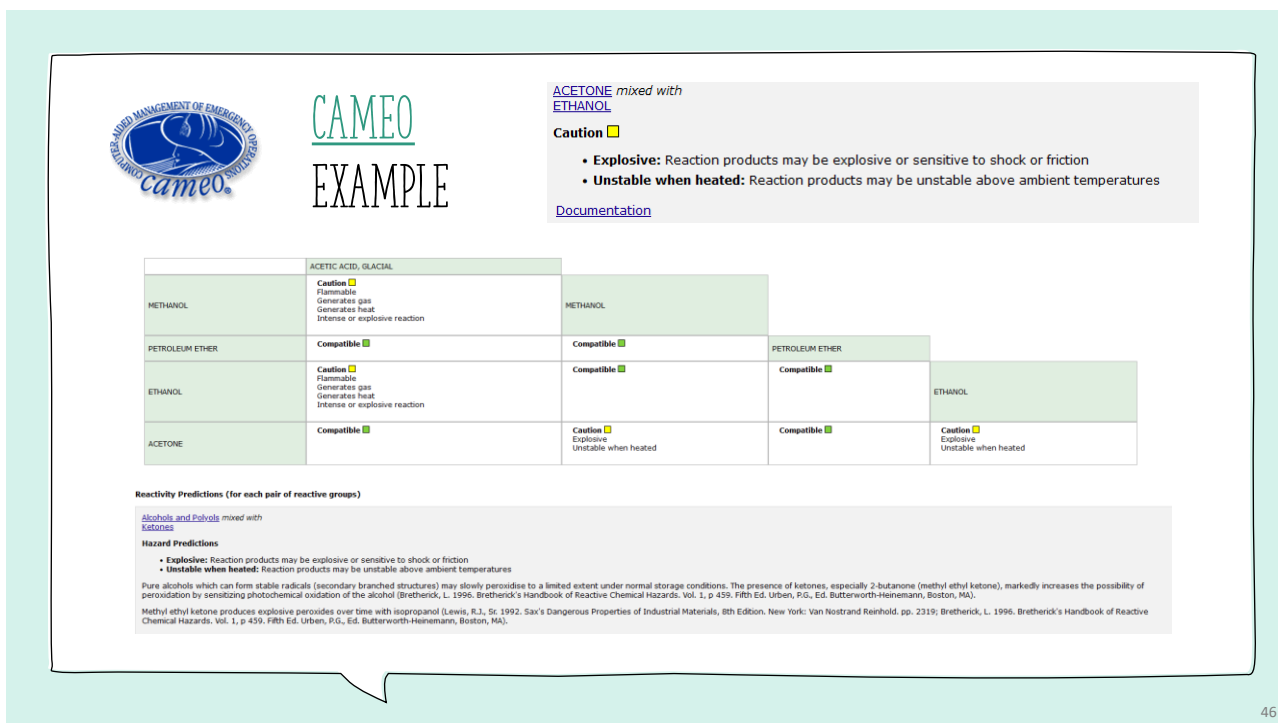



NEED HELP WITH INCOMPATIBILITY?

In addition to typical information sources such as SDSs and Prudent Practices in the Laboratory utilize:


- CAMEO Chemicals
- PubChem

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








 **CAMEO**
EXAMPLE

ACETONE mixed with ETHANOL

Caution 

- **Explosive:** Reaction products may be explosive or sensitive to shock or friction
- **Unstable when heated:** Reaction products may be unstable above ambient temperatures

[Documentation](#)

	ACETIC ACID, GLACIAL			
METHANOL	Caution  Flammable Generates gas Generates heat Intense or explosive reaction	METHANOL		
PETROLEUM ETHER	Compatible 	Compatible 	PETROLEUM ETHER	
ETHANOL	Caution  Flammable Generates gas Generates heat Intense or explosive reaction	Compatible 	Compatible 	ETHANOL
ACETONE	Compatible 	Caution  Explosive Unstable when heated	Compatible 	Caution  Explosive Unstable when heated

Reactivity Predictions (for each pair of reactive groups)

Alcohols and Polyols mixed with Ketones

Hazard Predictions

- **Explosive:** Reaction products may be explosive or sensitive to shock or friction
- **Unstable when heated:** Reaction products may be unstable above ambient temperatures

Pure alcohols which can form stable radicals (secondary branched structures) may slowly peroxidise to a limited extent under normal storage conditions. The presence of ketones, especially 2-butanone (methyl ethyl ketone), markedly increases the possibility of peroxidation by sensitizing photochemical oxidation of the alcohol (Bretherick, L. 1996. Bretherick's Handbook of Reactive Chemical Hazards. Vol. 1, p. 459. Fifth Ed. Urban, P.G., Ed. Butterworth-Heinemann, Boston, MA).

Methyl ethyl ketone produces explosive peroxides over time with isopropanol (Lewis, R.J., Sr. 1992. Sax's Dangerous Properties of Industrial Materials, 8th Edition. New York: Van Nostrand Reinhold. pp. 2319; Bretherick, L. 1996. Bretherick's Handbook of Reactive Chemical Hazards. Vol. 1, p. 459. Fifth Ed. Urban, P.G., Ed. Butterworth-Heinemann, Boston, MA).

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BEST PRACTICES FOR
UPKEEP AND
MAINTENANCE OF
CHEMICAL STORAGE
AREAS

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“HOW DO I STORE MY CHEMICALS”?

- Depends on local conditions (humidity & temperature)
- Space available for storage (number of shelves, cabinets, drawers, specialized units)
 - Type of available storage (wood, metal, cold, dry)
- Number of containers to store
- Variety of chemicals
- Security



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Some Common Storage Questions to Ask?

Do I have non-wooden shelving? *If not, my oxidizers will need non-reactive secondary containment.*

Do I store non-denatured ethanol? *If yes, I need it behind two locks.*

Do I have to stack bottles to fit everything in? *If yes, I have too many for the available space.*

Do I have flammable chemicals that require temp. control? *If yes, I need a flammable materials cold unit.*

Do I have doors or lips on shelving? *If not, my chemicals need to be six inches back from shelf edge.*

Do I have problematic chemicals such as nitric acid? *If yes, I need a dedicated acid cabinet?*

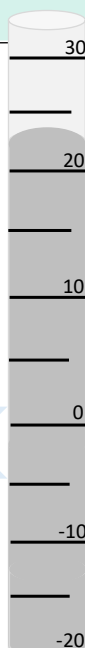
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FOLLOW THE MANUFACTURERS
RECOMMENDED STORAGE TEMPERATURE

KEEP HUMIDITY AS LOW AS POSSIBLE

Refrigerator storage (2 °C to -4°C): For
example: t-butyl lithium; isoamyl nitrite



Room temperature (25 °C to 20 °C): Most
common laboratory chemicals

ALSO CONSIDER WHAT ROOM CONDITIONS
WILL BE IN DOWNTIMES OR IF THERE IS A
POWER OUTAGE (HEAT OR COOLING LOSS).

Freezer storage (-10 °C to -20 °C):
Many biological reagents

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MORE ON TEMPERATURE, HUMIDITY, & AGE

- Is the chemical in the expected state?
 - Salts deliquescing due to high humidity
 - Pure phenol is solid at room temperature
- Ether - often stored incorrectly in a flammable materials refrigerator
 - Peroxides can solidify at a higher temperature than the solvent. "At ordinary refrigerator temperatures, diethyl ether peroxide is insoluble in diethyl ether and forms the solid shock-sensitive diethyl ether peroxide."^{*}

^{*}From [Safety in Academic Chemistry Laboratories Volume 2: Accident Prevention for Faculty & Administrators](#) 7th ed

Always store chemicals according to the manufacturer's guidelines and monitor them regularly in storage.

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Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Which of these things most annoys you?

- Unlabeled containers
- Almost empty reagent bottles
- Secondary containers with multiple labels
- Unlocked storage spaces
- Materials "borrowed" without permission

** If your answer differs greatly from the choices above tell us in the chat!*

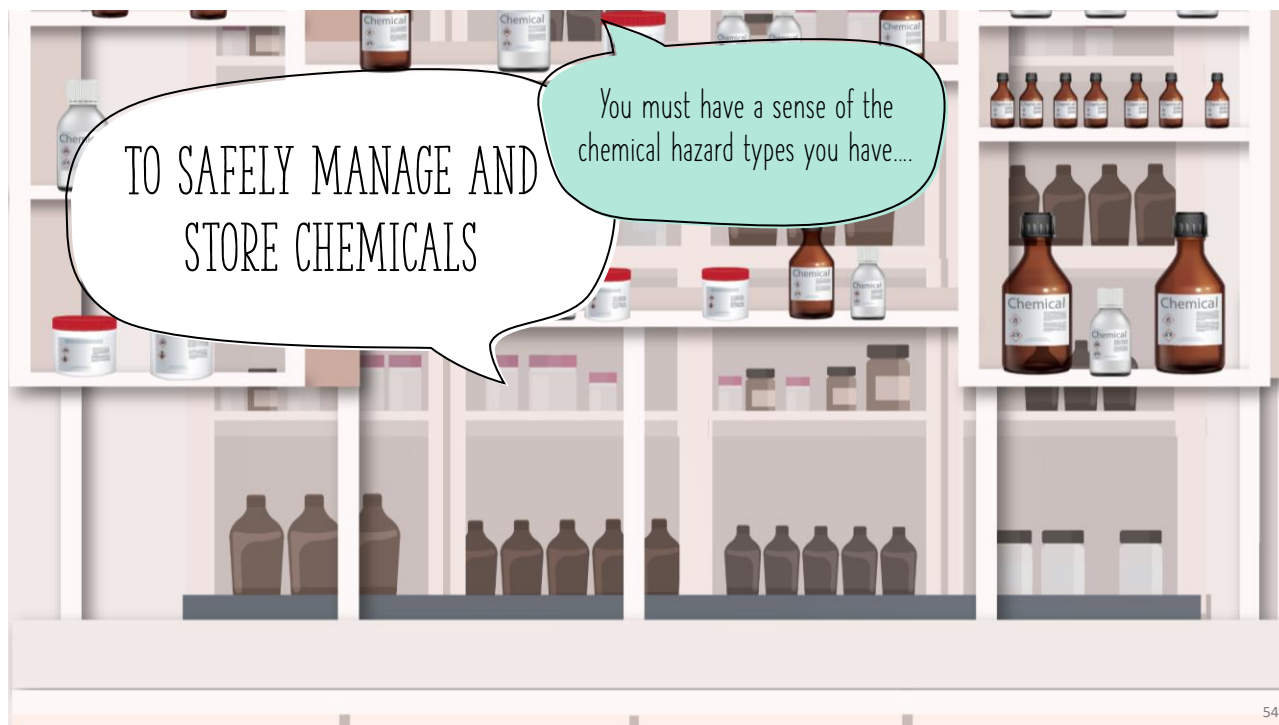
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ESSENTIAL INFORMATION NEEDED FOR INVENTORY MANAGEMENT

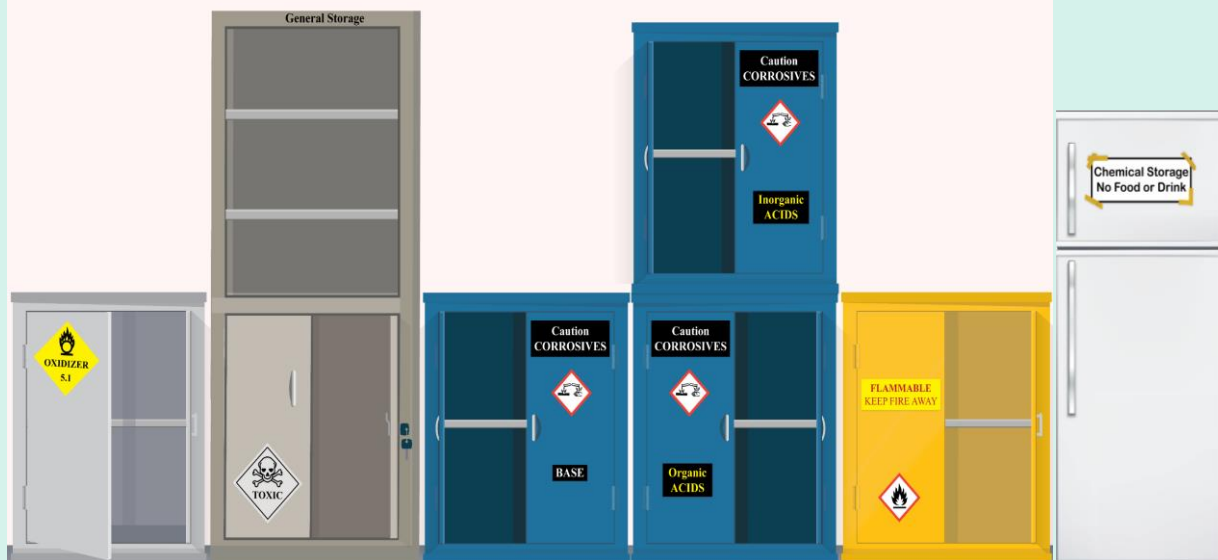
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...and the storage options you have available.

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INVENTORY BASICS

Creating an inventory from scratch is outside the scope of this webinar. The scheme shown here outlines the basic iterative procedure required.

If you do not have an inventory at all, we encourage you to refer to the Foundations for Storing, Organizing, and Disposing of Chemical in Educational Settings at the ACS Learning Institute.

Many campuses will have a software solution that you will be working within.



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CHEMICAL MANAGEMENT SYSTEM: TYPICAL INFORMATION

Basic Information	Special Conditions	Useful Information	Local Information
Chemical Name	Hazards (GHS)	Chemical Form	Barcode number
CAS RN®*	Special Storage	Container Material	Storage Unit
Manufacturer	Training Required	Container Size	Room Number
Amount/Units	Regulatory	Purchase Date	GHS Updated Labels
Concentration	NFPA	Estimated Age	SDS
	Date of Check/Decision		

*Chemical Abstracts Service Registry Number

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INVENTORY EXAMPLES

Name	CAS RN®	Amount	Conc/ Purity	Purchase Date yyyy/mm/dd	Pictograms	Manufacturer	SDS	Storage Unit
Nitric acid	7697-37-2	500 mL	16 M	2019/08/25		Alfa Aesar	yes	Isolation Cabinet 5
Silver nitrate	7761-88-8	25 g	98%	Pre 2015		Flinn Scientific	yes	Ox G4
Acetic acid	64-19-7	1 L	17 M	Pre 2015		Fisher	yes	Vented Cabinet
Acetic acid	64-19-7	1 L	1 M	Fall 2022		In House	yes	Acid Cabinet
Diethyl ether	60-29-7	1 L	99%	2023/01/20		Millipore Sigma	yes	Flammable Cabinet
Ethyl alcohol	64-17-5	20 L	95%	2019/08/25		PharmCo	yes	Locked Flammable Cabinet
Sodium chloride	7440-23-5	500 g	98%	2022/11/01	Non- hazardous by GHS	Morton	yes	GS 5B
Argon	7440-37-1	2.3 m ³	99.999%	2022/11/01		ARC 3	yes	Back wall

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TIPS AND TRICKS: MAXIMIZING STORAGE

- Utilize "hidden" space for isolation cabinets
- Place isolation cabinets in larger cabinets
- Utilize desiccators
- Where fugitive vapor is not the issue, one can use physical barriers that can contain a spill



<https://www.scientificplastics.com/wp-content/uploads/2018/11/Trays-comply-with-OSHA-EPA-Chemical-Hygiene.pdf>

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UTILIZE MULTIFUNCTION CABINETS

Many combinations can be purchased
Singly, they can be placed on benchtops



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ANCILLARY INVENTORY STUFF

- Food items brought into the lab for experimental reasons should be marked "NOT FOR HUMAN CONSUMPTION"
- Household chemicals need to be inventoried when they are used in a way not intended by the manufacturer.
- Donations - Just say NO... or have a procedure or process in place
- Utilize just-in-time ordering as much as possible - don't stockpile

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PRIMARY LABELS

- The GHS defines label elements (1910.1200)

PEROXIDE FORMING CHEMICAL

Date Received _____ Date Opened _____

Date/Test Results _____

Date/Test Results _____

Date/Test Results _____

- Never remove or deface a manufacturer's label
 - Supplemental label information (adding GHS or storage area for example) must be added to empty space on the container
 - Label "flags" can be used on small containers or put the small container in the larger one that can be supplementally labeled

- HOWEVER, once the chemical is consumed and you want to reuse or recycle the container, remove the label completely and wash and air dry the bottle



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BEST LABELING PRACTICES FOR SECONDARY CONTAINERS

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SECONDARY LABELS - BEST PRACTICES

A good secondary label contains the:

- Chemical name (spelled out)
- Concentration (for solutions)
- CAS RN[®]
- Date the bottle was prepared, if known.
- GHS hazard information such as pictograms (sticker or printed), signal words, hazard and precautionary statements.
- Optional information: manufacturer name*, storage location

* May be a required element for pure chemicals



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LABEL YOUR CONTAINERS SO THAT IF YOU DIE, I KNOW WHAT IT IS.

- In 1910.1200(f)(8), OSHA does not require that portable containers for immediate use be labeled.
- Somewhere you need to identify abbreviations or acronyms used for solutions or chemicals locally.
- Anything not used immediately (within one shift) should be labeled.



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APPROPRIATE CONTAINERS FOR LONG TERM STORAGE

- Anything to be stored, should be transferred to a proper storage container with an appropriate lid (no reaction glassware, no parafilm, corks, etc.) and labeled.
- Get rid of penny-top stoppered bottles
- Use [compatibility charts](#) to determine the best storage container material



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BEST PRACTICES: CHEMICAL MANAGEMENT

- Document laboratory practices for inventory reconciliation, labeling, unused portions, dispensing, cleaning procedures, etc.
- Containers
 - Inspect each chemical container (bottle, lid, label, and contents) at least once a year
 - Check every layer of containment
 - Stress test empty HDPE* and LDPE* before refilling
- Inspect storage cabinets regularly and address noted issues immediately.
 - Use vapor absorbent cartridges
 - Use sealants on exposed surfaces
 - Switch to fire approved laminate cabinets



*High- and Low-Density Polyethylene

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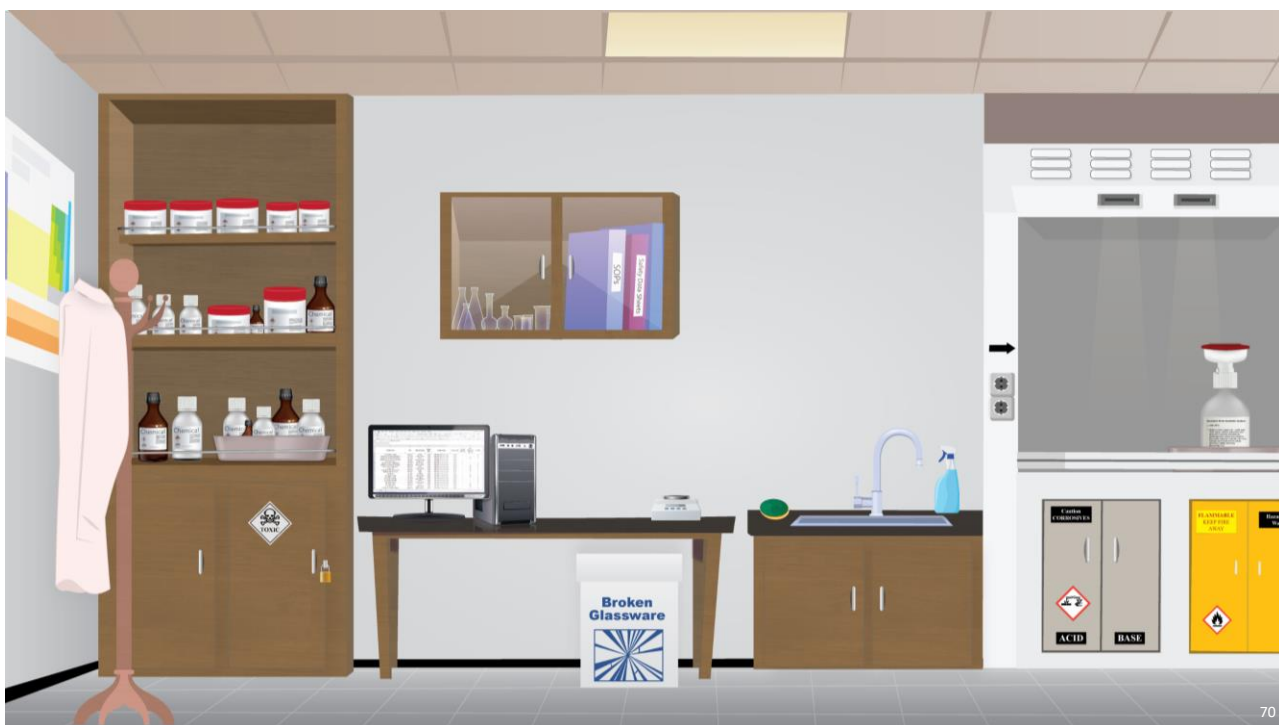
SUMMARIZING

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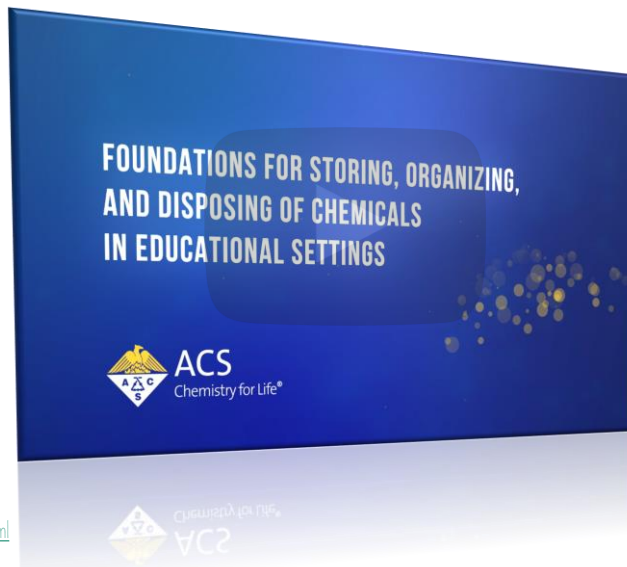
CHECK OUT THIS SHORT
VIDEO ABOUT THE FREE
ONLINE COURSE!

👁 Pricing: Free

🕒 Duration: > 1 day

Registration Info

<https://institute.acs.org/foundations-for-storing-organizing-and-disposing.html>

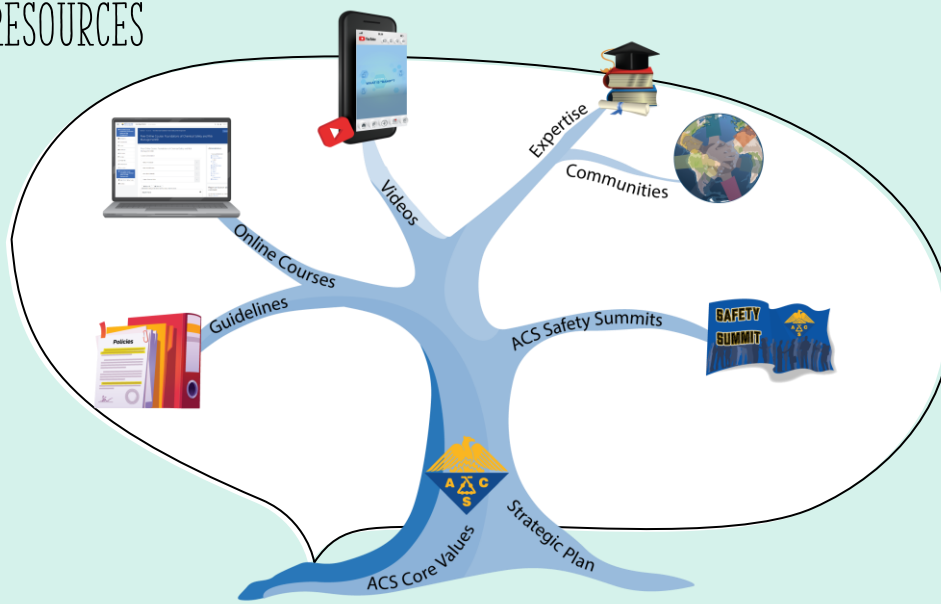


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ACS SAFETY RESOURCES

<https://institute.acs.org>



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THANK YOU!
QUESTIONS?



[ACS Center for Lab Safety](#)

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WORKSHOP: RAMP IN THE RESEARCH LAB

Wednesday, August 2, 2023 | 2:00 PM – 5:00 PM EDT



Register by Friday, July 21, 2023!



tinyurl.com/RAMP-workshop-Aug23



Learn the principles of the **RAMP** paradigm through a series of case studies and discussion sessions focused on practicing each of the **RAMP** steps. Near the end, participants will apply a risk assessment guide to an experimental procedure to help build confidence in doing risk assessments in research labs.

WORKSHOP GOALS ARE TO:

- Educate participants about the value and principles of RAMP risk assessment.
- Guide participants through breakout sessions to practice RAMP steps with case studies and to practice a full risk assessment.
- Supply participants with the knowledge and resources to incorporate risk assessment into their research lab.

This 3-hour virtual workshop, led by grad student researchers with significant lab safety experience, is primarily directed at frontline researchers at academic institutions: Graduate students, Postdoctoral scholars, Undergraduate students, Faculty and safety staff are also welcome to participate.

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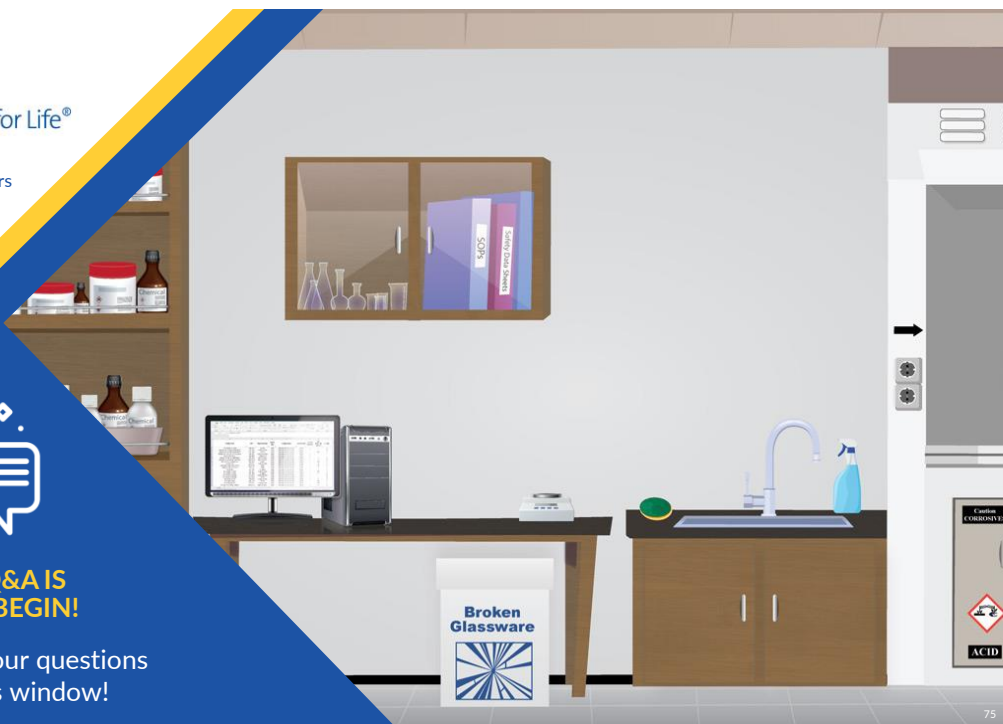


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**THE LIVE Q&A IS
ABOUT TO BEGIN!**

Keep submitting your questions
in the questions window!



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Wednesday, May 24, 2023 | 2-3pm ET

How to Develop a Strategic Mindset

Co-produced with ACS Division of Professional Relations



Thursday, May 25, 2023 | 2-3pm ET

Catalysis in Sustainable Chemistry

Co-produced with ACS Green Chemistry Institute



Thursday, June 1, 2023 | 2-3pm ET

The Road to Carbon Sequestration

Co-produced with the open access journal, ACS Engineering Au

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