American University of Beirut
Chemistry Department

Safety Training Session

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Laboratory Safety Training Objectives

- Proper appearance in labs

-Evaluation of chemical Hazards

- Handling chemicals properly

- Laboratory Emergency Preparedness and Spill Response

- Chemical Storage

- Laboratory Waste Disposal

- You follow safety at your home

- You follow safety on the roads

- You make sure everything is safe when it comes to babies and kids

- Then why not follow safety in laboratories,
  one of the major hazardous places.

Why Lab Safety? Why does it matter?

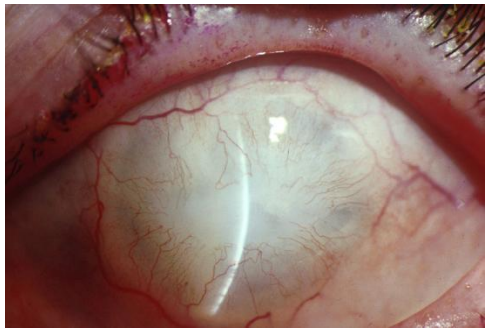
- Protect yourself from laboratory hazards

- Protect others from laboratory hazards

- Protect the environment

-Comply with the University's lab Safety Policy "Chemical Hygiene Plan"

To avoid such accidents



- A Yale University senior was killed in an accident in a chemistry laboratory's machine shop on April 12, 2011. The student's hair got caught in a machine while working on project. **The cause of death was asphyxia due to neck compression.**

- On 29 December 2008 a 23 year old researcher died following **a lab fire** at the University of California, Los Angeles (UCLA). Her supervisor, an organic chemist, and the University of California now both **face criminal charges**. Now, an arrest warrant has been issued for her supervisor who faces up to 4.5 years in prison if convicted, while UCLA could be fined up to $1.5 million.
The researcher, **not wearing a lab coat**, suffered third-degree burns, and died in hospital.

- Working in a laboratory can be an exciting experience.
- It can also pose many threats and hazards that a traditional classroom does not.
- Such hazards can be physical or chemical and can cause serious injuries.

Know Your Surroundings

Physical Hazards

- Bunsen Burners
- Autoclaves
- Compressed Gas Cylinders
- Broken Glassware
- Razorblades and needles
- Electrical Equipment
- Ultraviolet light

Chemical Hazards

- Flammable Chemicals
- Reactive Chemicals
- Corrosive Chemicals
- Toxic Chemicals
- Radioactve chemicals
- Explosive chemicals

Consequences of these hazards

Physical:

- Fires
- Explosions

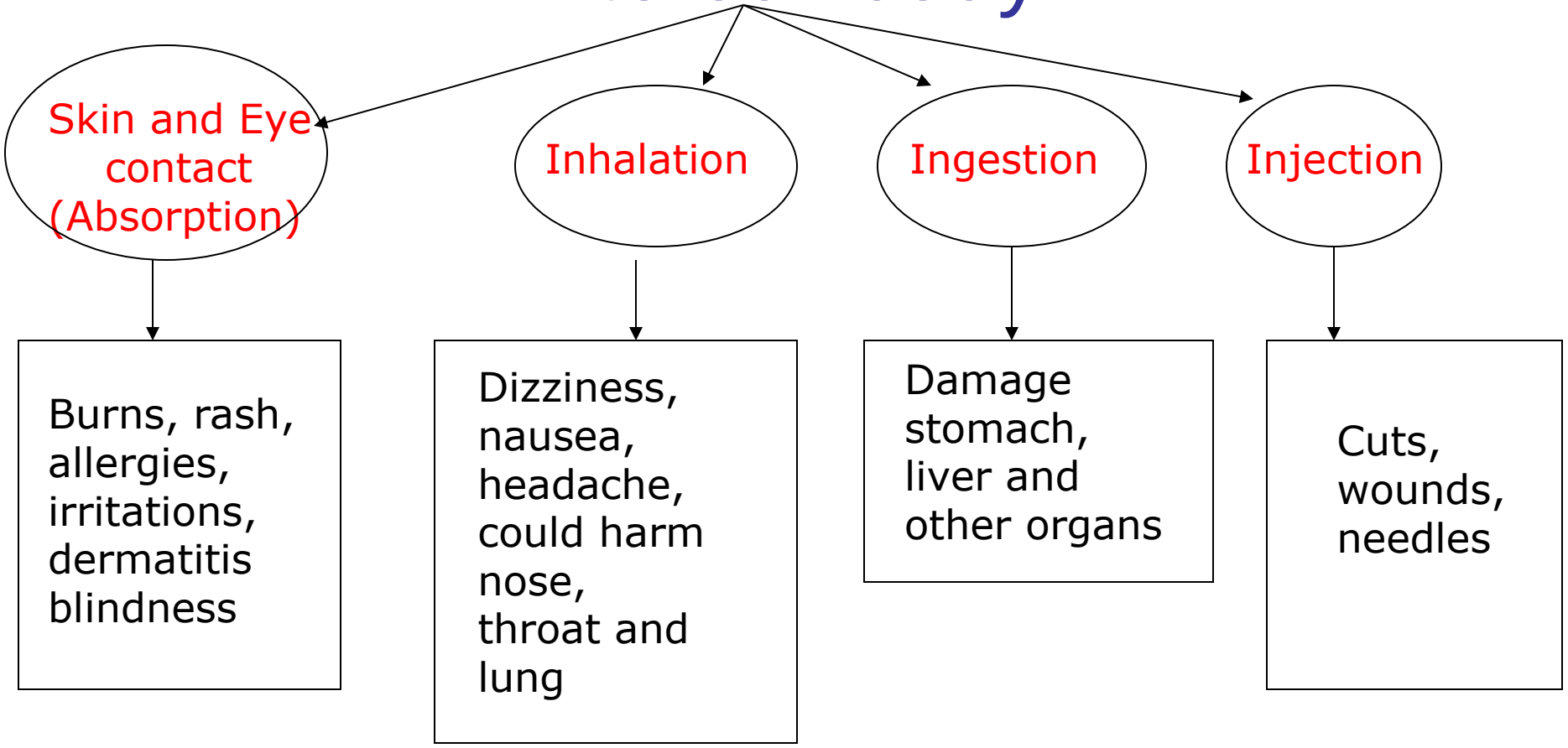
Chemical:

Burns

Poisoning

Irritation

Ways of penetration of chemicals into our body



Avoiding Hazards

- Wearing appropriate Personal Protective Equipment (PPE)
- Reading labels
- Knowing safety symbols
- Reading the MSDS of chemicals
- Knowing the locations of safety equipment
- Knowing Emergency Response Procedures
- Knowing storage procedures
- Knowing proper disposal procedures
- Knowing Emergency Numbers

Wearing appropriate PPE

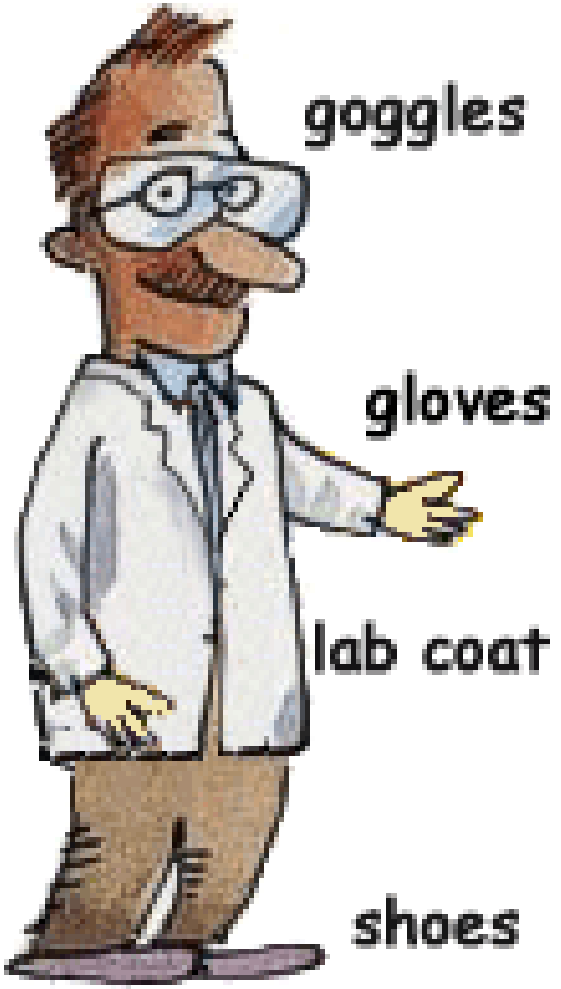
- Personal Protective Equipment

  – Eye Protection – chemical/splash/impact goggles, faceshields (no contact lenses)

  – Clothing -Labcoats, long pants, closed shoes, hair tied up in a bun.

  – Gloves - rubber, butyl, latex, nitrile?

  – Respirators



-No food or drink in the lab

-No chewing gum

-No application of cosmetics while in the lab

-No storing of food or drink in bags inside the lab.

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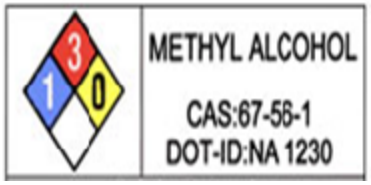
Reading labels

The national fire protection association

NFPA Diamond - used by fire/ rescue personnel

Ex: Cyanide compounds, merury and mercury compounds, benzene, CCL4

Ex: Methanol, toluene, acetic acid, phosphorous, magnesium,



Example

NFPA Diamond for
Sulfuric acid

NFPA Diamond for
Acetone

NFPA Diamond for door of room containing
Sulfuric Acid and Acetone

Other Common Symbols on Product Labels

Toxic

Flammable

Corrosive

Oxidizer

Explosive

Harmful (Xn) or Irritant (Xi)

Cryogenic hazard

Carcinogen (cancer hazard)

Harmful to the Environment

Gas Cylinder

Labels on prepared chemicals in labs

- All chemical containers must be labeled completely.

- Bottles should be labeled by date received and date opened.

- Chemicals transferred to other containers or prepared solutions should be labeled clearly with the following information:

  – Complete name of the chemical and concentration
  – Complete name of the solvent
  – Date of preparation
  – Course number/Research lab
  – Name (not initials) of the person preparing the solution/sample

Labels on prepared chemicals in labs

- When a chemical container is emptied the original label should be either removed or defaced completely using indelible ink marker or paint.

  This will minimize the possibility of accidentally using the wrong material due to a labeling confusion.

Deteriorated labels

Damage to container labels reduces their usefulness and can lead to mishaps and unknowns.

Have periodic checks on labels

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Reading the MSDS of chemicals

– **Types of information typically provided:**
  - » Chemical name
  - » Composition and ingredients information
  - » Potential health effects
  - » Exposure levels, with specific concentrations and times
  - » First Aid Procedures
  - » Fire fighting procedures
  - » Accidental release procedures
  - » Handling and storage procedures
  - » Recommended personnel protection
  - » Physical and chemical properties
  - » Stability and reactivity
  - » Toxicological information
  - » Environmental impact
  - » Disposal Recommendations
  - » Transportation information
  - » Regulatory information
  - » NFPA rating

MSDS Information
Exposure Limits

- There's no guarantee that if your exposure to a hazardous substance exceeds the limits, you'll automatically experience an adverse health effect.

- However, you can't assume that if you're exposed to permissible levels of a substance, you won't suffer adverse effects.

OSHA's Permissible Exposure Limit (PEL)

- Maximum daily human exposure to a specific substance allowed in a workroom's air over an 8-hour shift. It is based either on a time weighted average or the maximum exposure limit.

- Time-weighted averages, TWAs. This is an average exposure weighted for an 8 hour work day.

- Ceiling (C) limits, not to be exceeded during any part of the work day. Highest allowable concentration of a chemical to which a worker may be exposed over a period.

Example PELs

- Sulfur dioxide has the following OSHA PELs. Notice the units: ppm or mg/m^3.
  - 8-hr TWA: 2 ppm (5 mg/m^3)

Toxicity Data

- **Lethal Dose (LD50)** – the single dose of a substance that can result in the death of 50% of the exposed population.

- **LD50** is measured in micrograms (or milligrams) of the material per kilogram of the test-animal's body weight

- The lower the amount, the more toxic the material.

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Knowing the locations of safety equipment:

– body shower

(remove clothing in the shower and rinse for 15 minutes)

– eyewash station

(flush for 15 minutes)

– first aid kit

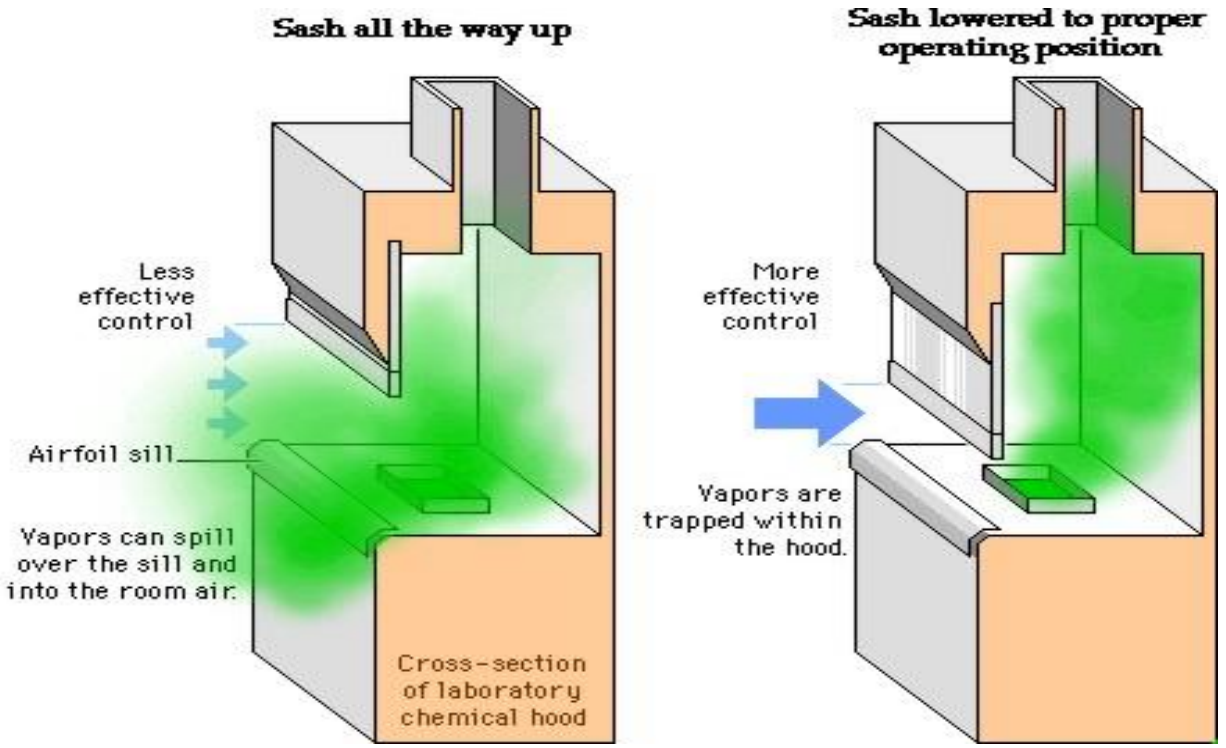
– Spill kit

– fire extinguisher

Fume Hood

- Ventilated enclosure that protects you from being exposed to chemical fumes, gases and aerosols generated within the hood.

- Lower sash to marked (sash level) position.



Fume Hood

- Use with materials that can produce harmful gasses or vapors (an example is lachrymators).
- Air intake velocity must be at least 100 Cubic feet per minute .
- Remember, do not put your face inside the hood!
- The hood is not for storing chemicals.

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Spills

When a spill occurs, an aerosol can be created which can make the material several times more potent.

- Minor Spills

– A minor spill is a small spill that involves less than 500 g solid or 500 ml liquid of non-acutely hazardous materials.

- Major Spills

– A major spill is a large spill that involves more than 500 g solid or 500 ml liquid or any amount of an acutely hazardous material.

An acutely hazardous material is any material that is imminently dangerous to life and health.

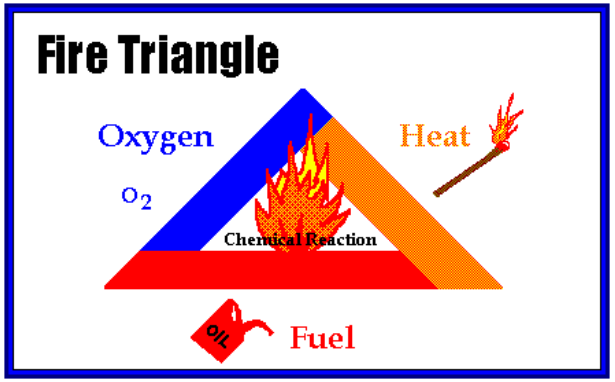
Spills

- Minor Spills
  – Notify other laboratory workers, control access to the area, consult MSDS, wear proper PPE, use the spill kit to clean up the mess yourself outside-in (Absorb, collect, dispose), notify Safety & Health Department to remove cleaned-up spill materials.

- Major Spills
  – Protect people, Remove ignition sources/reactive materials, Evacuate the lab, call University Safety & Health to clean up the mess.

What to do in case of Fire

Fire



-You need oxygen, fuel, and an ignition source to start a fire.

-The key to safety is removing, or otherwise making inaccessible, at least one side of the fire triangle.

-Inorganic acids give off oxygen and flammables act as a source of fuel.

Fire Safety

- **If a fire occurs:**

  - **Remember two words:**

PASS ***REACT***

PASS

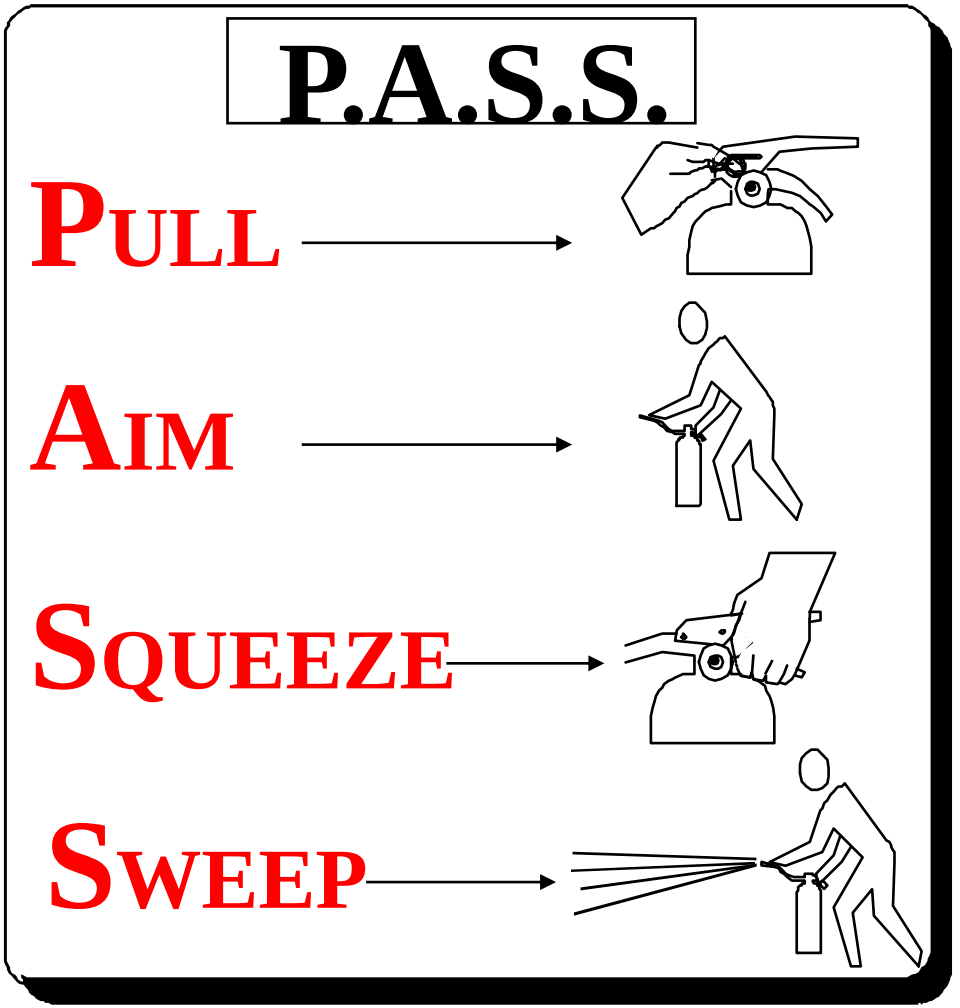
(for small fires and if you are trained)

- **P (pull) – A (aim) – S (Squeeze) – S (Sweep)**

1) Keep your back to a clear escape route,

2) Stand back 6 to 8 feet from the fire,

3) ***Then >>:***



REACT

Remove persons in immediate danger!
Ensure doors are closed! (*confine fire/smoke*)
Activate the building alarm !
Call the Fire Department !
Treat ALL fires as **DANGEROUS!**

- **Continue a complete building evacuation**
- **Do not attempt to fight a fire UNLESS you are OSHA certified in use of a fire extinguisher !**

or **R (rescue) - A (alarm) - C (confine) - E (Extinguish/Evacuate)**

If someone catches fire

- shower
- fire blanket
- *Stop, Drop, and Roll.*

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Knowing storage procedures

- Storing chemicals
- Storing gas cylinders
- Storing chemical waste

Storing chemicals

- Do not store chemicals in alphabetical order.
- Separate incompatible chemicals (flammable, corrosive, reactive, cryogenics, pyrophoric) (ex: Nitric acid (ox. agent) and alcohol (red. agent))
- Keep the amount of chemicals in the lab to a minimum
- Never store chemicals on the floor
- Store chemicals below shoulder height when possible
- Use secondary containment
- Do not store food in a chemical storage refrigerator
- Do not store chemicals in hood, on top of cabinet, on high shelves and on the floor.
- Do not store above eye level
- Old and outdated chemicals should be disposed of through Safety and Health.
- Store on shelves with raised edges.
- Keep an Up-to-date chemical inventory

Reactive Storage ….

Segregate:

- Acids from Bases
- Acids and bases from flammables
- Pyrophoric compounds from flammables
- Perchloric acid from reducing agents
- Water from water reactive chemicals
  - Sodium/phosphorus & aqueous material - fire
  - Acid with cyanide compounds - toxic gas
  - Chlorine & ammonia - toxic chloramines
- Store thermally unstable materials in approved refrigerator

Storing Gas cylinders

- Gas cylinders must be restrained vertically with a chain or strap between the “waist” and “shoulder” of the cylinder to a wall/bench.
- Remove regulators and cap cylinders before moving.
- Always use a cart & safety chain when transporting cylinder.
- Cap unused cylinders
- Never use grease or Teflon tape on cylinder fittings
- The cylinder (not the cap) must be labeled as to contents.
- Fittings vary between gas types: toxic, corrosive, inert, flammable, oxidizing.
- Never force a fitting. If it has to be forced, it is probably the wrong type.

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Storing waste and disposing it

- *Hazardous Waste*- This is a waste which contains the characteristics of being any of the following:

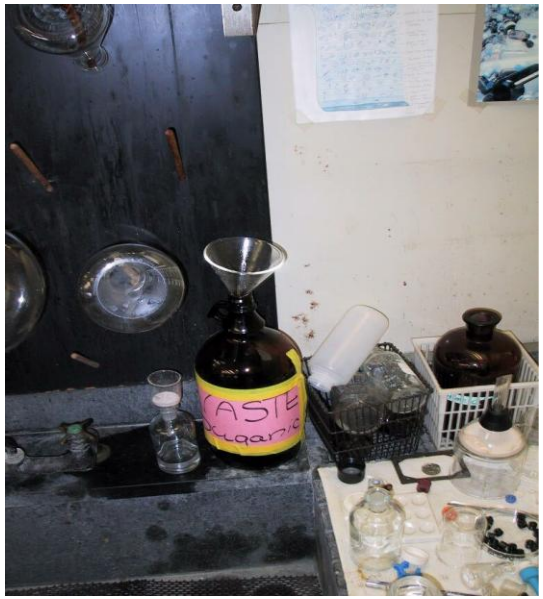
- Toxic
- Corrosive
- Ignitable
- Flammable
- Oxidizer

Storing waste and disposing it

-All containers must be labeled with contents and date started. (full chemical name and approximate percentages).

-Waste should not be filled to the top.

- No leaking containers or bottles without caps.



Storing waste and disposing it

- Segregation of the chemical waste stream:

- Aqueous heavy metals
- Non-halogenated organic solvents
- Halogenated organic solvents

Unknown waste is never acceptable.

Good Housekeeping

Prudent Laboratory Practices:

- Clean-up and properly store materials
- Don’t block access to emergency equipment
- No eating, drinking, chewing, smoking or applying makeup
- Remove gloves and wash hands
- Never smell or taste chemicals or pipette by mouth
- Never add water to acid. Always do the opposite.
- Wear appropriate PPE
- Remove your gloves before using instruments, telephone, and leaving the laboratory
- Know emergency procedures
- Ensure that all containers are clearly labelled with their contents and a hazard label
- Never work alone – Let someone know where you are

Knowing Emergency Numbers

- EH&SC : 2360
- For Fire: 5555
- Protection Office: 2400

Remember these costly phrases

- "Frequently used chemicals should be ordered in bulk."
- "Ordering in bulk is the best deal for the money."
- "Accept any donated chemicals…"
- "Labs will always do the same experiments and demonstrations…"
- "I'll remember what I put in that jar."
- "Nothing will happen."

- Safety as:

  (1) Common sense

  (2) always applied. This is the hard part!

- Just because you have gotten away with something 100 times doesn't mean the 101st time is safe.

Ultimately it is up to you the individual laboratory worker who is responsible for his/her safety and the safety of their coworkers- after all it is you who has the most to lose, your health, eyesight, or life.

Penalties (teaching labs)

- If not wearing proper attire, you will not be admitted to the lab session.

- Penalties for mistakes performed during lab hours:

- Dismissal from the lab with a zero grade on the report.

- 2nd offense might result in drop from the course.

Quiz

During the next lab lecture.

Thank you.