

Research methodology

Safety & Precautions

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Safety and precautions

Why does it matter ?

Our body is our most important asset. Its our duty to protect it.

Safe working protects :

- You
- Other lab workers
- House keeping staffs
- Visitors
- Your work

General hazards

- Fire
- Electrical hazard
- Compressed Gas cylinders
- Chemical hazard
- Radiation hazard
- Laser hazard
- Cryogenic hazard

- And many more



Classification of Fire

Class A	Solids (paper, wood plastic etc.)
Class B	Flammable liquids (paraffin, petrol oil etc.)
Class C	Flammable gases (propane, methane etc.)
Class D	Metals such as Al, Mg, Ti etc.
Class E	Fire involving electrical apparatus
Class F	Cooking oil and fats etc.

Fire Extinguishers

Water fire Extinguisher

Cheapest, Class A fire

Not suitable for liquid or electrical fire

Foam fire Extinguisher

Class A, and B fires

Not recommended for electrical fire

Dry powder fire Extinguisher

Class A, B and C fires

Special powder for Class D fire

CO₂ fire Extinguisher

Ideal for electric fire

Good for class A and B fires

Wet chemical fire Extinguisher

Especially for Class F fire

For cooking oil and fats

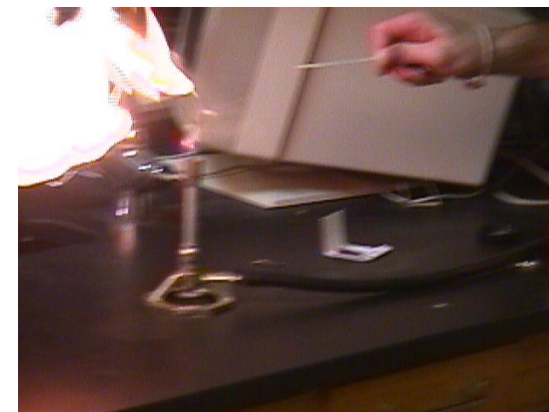
For metal fire Extinguisher

Especially for class D fires

Na, Li, Mn, Al metals in swarf or tuning form

Fire: Precautions

- Tie back hair and loose clothes when working with open flames
- Never look into a container as you are heating it
- Never point the end of a test tube being heated at yourself or others
- Never heat in a closed container
- Heated metal and glass looks cool, use tongs or gloves before handling
- Never leave a heat source unattended



Fire hazard

Avoiding fires

- Use minimum quantity of flammable substances
- Store flammable substance in special storage cabinet
- Use temperature control heating sources

Fire Safety

Make sure that you know what to do:

- If you have a fire
- If you hear a fire alarm

Electrical Hazards

- Electricity can kill
- Shock from faulty equipment can cause severe or permanent injury
- Faulty electrical appliance can lead to fire

Basic electrical safety

- Maintain all electrical equipments in good working condition
- Avoid overloading socket-outlets; using adapters/extension can cause fire
- Keep emergency Off button near the fixed machinery to cut off power in an emergency
- Ensure equipment is fitted with the correctly rated fuse.
- Ensure that all the electrical cables have proper insulating
- **Always assume supplies are live unless it is confirmed by a competent person**

Compressed gas cylinder

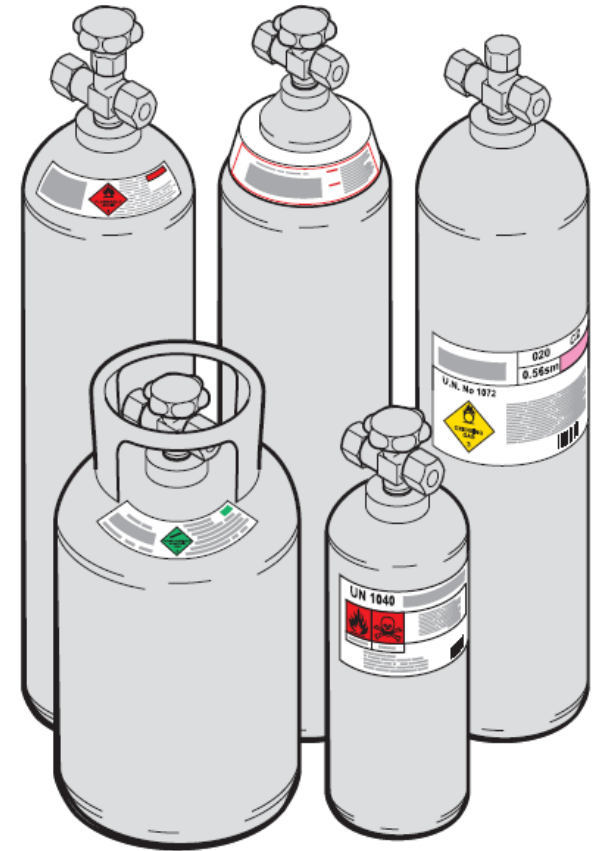
Storage Requirements

Store gas cylinders:

- In an upright position
- Separate from empty cylinders
- With a chain • With the cap on when not in use
- At least 20 feet away from all flammable, combustible or incompatible substances

Do not store gas cylinders:

- In exits routes
- In damp areas; near salt, corrosive chemicals, heat



Compressed gas cylinder

Handling Requirements

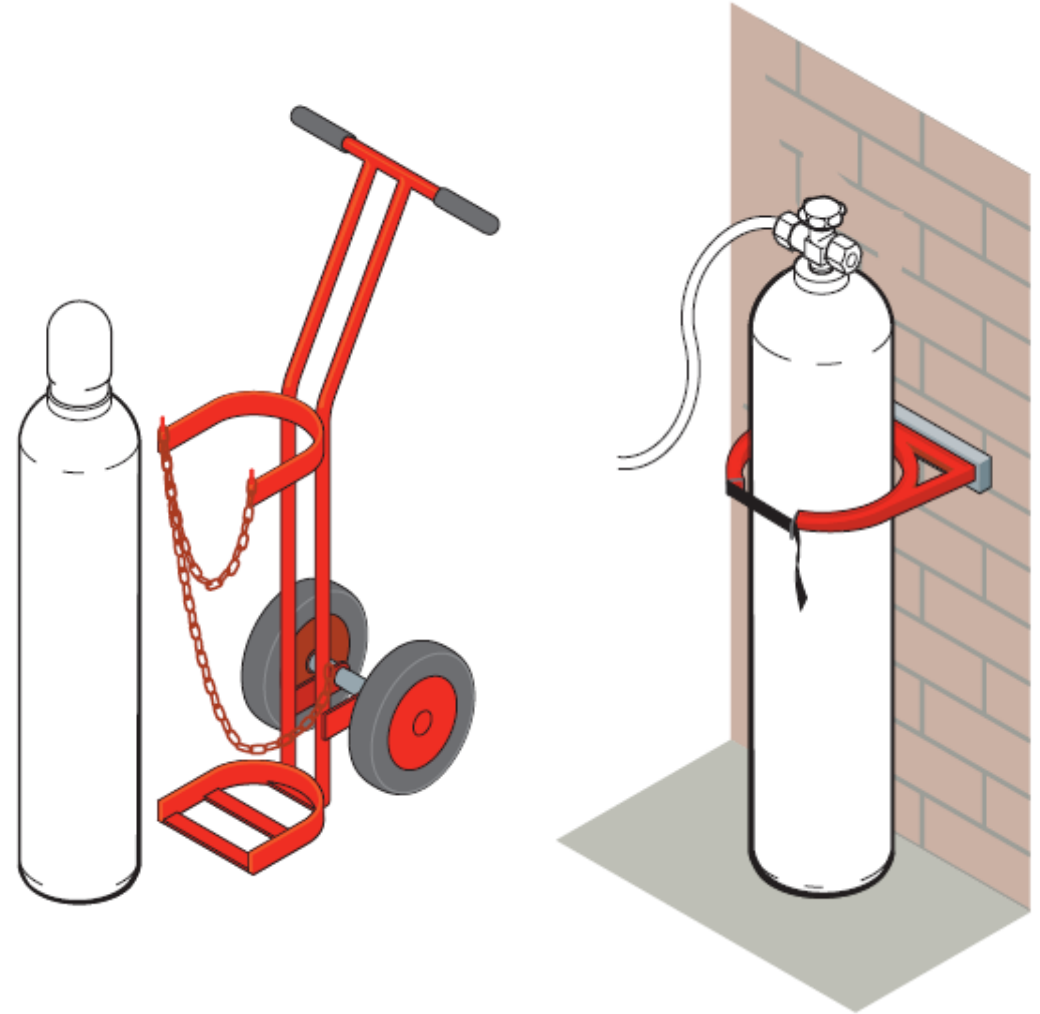
- Never drag or physically carry cylinders.
- Never pick up by the cap.
- Never paint a cylinder.

Lifting and moving requirements:

- **Use** only suitable cradles or platforms to hold a cylinder when lifting.
- **Use** a hand-truck designed for the transport of cylinders.

Elevator Transport

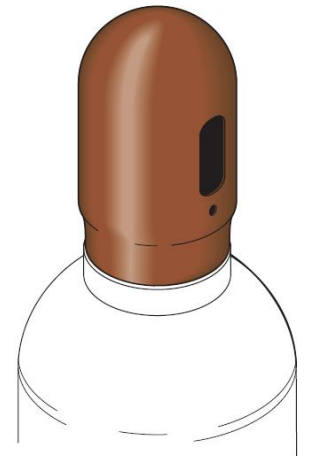
Do not accompany a compressed cylinder on an elevator.



Compressed gas cylinder

To safely use valves and regulators:

- Be sure the regulator pressure control valve is closed before attaching it to cylinders.
- Do not stand in-line with the regulator and valve outlet when attaching the regulator to the cylinder.
- Pressurize regulators slowly and ensure that valve outlets and regulators are pointed away from all personnel when cylinder valves are opened.
- Leave the wrench in place on the cylinder valve, when needed, to open the main valve.
- Use a cylinder cap hook to loosen tight cylinder caps.



Valve Protection Cap

Chemical Hazards

Staying safe means that

- Read labels on containers of chemicals
- Read the Material safety data sheet
- Handle chemical with care
- Use correct protective clothing and equipment
- Remember emergency procedures

Chemical Labels

- Name of chemical
- Physical and health hazards
- Precautionary measures
- First aid instructions
- Proper handling/storage instructions



Chemical Hazards

Health Hazards on label

- Carcinogen
- Toxic agent
- Reproductive hazards
- Irritant
- Corrosive
- Sensitizer
- Neurotoxin
- Nephrotoxin
- Hepatotoxin

Precautionary Measures

- Don not breathe vapors
- Use in well ventilated areas
- Avoid contact with skin
- Wash thoroughly with soap and water after handling
- Keep away from sparks, Heat and flame
- Don't store near combustible materials
- Store in tightly closed container

Chemical Hazards

Use protective clothing and equipment

Eye Protection

- Safety glasses -- flying particles, chemical splashes, dust
- Splash goggles - Corrosive liquids, solvents, powders
- Face shields -- high pressure systems

Skin and body protection

- Gloves - right type of gloves depending on the chemical
- Aprons and lab coats - strong acids and bases
- Shoes -- always worn in lab, closed toe and closed heel

Radiation Hazards

Main source : X ray, Gamma Rays etc.

Possible Hazards:

- Cancer
- Developmental problem,
- cause burn
- Eye sight problems

Maximum Annual Occupation Dose Limit

- | | |
|-------------------|----------------|
| • Whole body | 5000 millirem |
| • Extremities | 50000 millirem |
| • Lens of the Eye | 15000 millirem |
| • Fetus | 500 millirem |

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REM: Roentgen equivalent in man; One rem carries with it a 0.055% chance of eventually developing cancer

Radiation Hazards

Protection from X ray



- Minimize the exposure time
- Maintain a safe distance from the source
- Proper radiation shield around the source (Lead shielding, Lead apron etc.)
- Never temper with the interlocks of the source
- Use of Dosimeter and proper monitoring of it

Laser Hazards



It is not always possible to know immediately if your eye has been injured by a laser.

Sign of damage

- Sandy or gritty feeling in the eye.
- Dark spot or an after image that persist

Laser Hazards

- Class 1 lasers** Incapable of producing radiation levels e.g. Laser printers
- Class 2 lasers** Emits radiation in visible portion of spectrum, and protection is by normal human blink reflex. E.g. Laser pointers
- Class 3 lasers** NO serious injury if view momentarily with unaided eye. e.g. He-Ne laser (between 1 - 5 milliwatts radiant power)
- Class 4 lasers** Hazard to eye from direct/reflected/diffused-reflected beam
Can start fires and damage skin, Retinal injury e.g. Nd-YAG, He-Cd, Argon Krypton, CO₂

Laser Hazards

Laser safety



- Proper warning cards should be placed outside the lab for the visitors.
- Use laser safety goggles.
- Use suitable dark curtains so as to mask the any scattered laser radiation.

Cryogenic Hazards

- Liquid gases are extremely cold and can cause burns
- Liquid gas evaporate and many can cause asphyxiation
- Never accompany the liquid gas container in elevator



Laboratory Equipment

- Never use any laboratory equipment unless you are trained & have been authorized to do so
- If untrained, you may injure not only yourself and colleagues but cause very costly damages too

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When in Doubt -- ASK

DO NOT Guess

General Tidiness

- Keep your workplace tidy
- Clean up waste and put things away as you finish your work
- Make sure everything is safe before you leave things unattended



Waste Materials

How to dispose of waste lab materials safely

- Solvents and oils must be segregated into correct waste bottle or drum
- Follow institute/lab policy for disposing of chemical or biological materials
- Don't put materials down the drain or in with normal waste unless authorized to do so.



Safety

Our body is our most important asset. Its our duty to protect it.

Safe working protects :

- You
- Other lab workers
- Cleaners
- Visitors
- You work

Thanks...

Thats all for now