

Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third year)

Subject: Chemistry

Course Code: CHD 102

Course Title: Green methods and safety aspects in chemistry

Unit: 06

Module Name: Working with electricity, water, and high pressure equipment.

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Notes

Working with electricity

- Electrically powered equipment is used routinely for laboratory operations requiring heating, cooling, agitation or mixing and pumping.
- Fluid and vacuum pumps, lasers power supplies, electrophoresis, electrochemical apparatus, x-ray equipment, stirrers, hot plates, heating mantles, microwave ovens and ultrasonicators.
- Electric shock is the major electrical hazard.
- If improperly used, electrical equipment can ignite flammable or explosive vapours.
- Caution must be exercised during installation, modification and repair, as well as during use of the equipment.

All electrical equipment must be installed and maintained in accordance with the National Electrical Code (NEC) of the National Fire Protection Association ([NFPA, 2008](#)).

- All repair and calibration work on electrical equipment must be carried out by properly trained and qualified personnel.

- Before modification, installation, or even minor repairs of electrical equipment are carried out, the devices must be de energized and all capacitors discharged safely.
- All new electrical equipment should be inspected on receipt for a certification mark.

General precautions for working with Electrical equipment

- Insulate all electrical equipment properly.
- Visually inspect all electrical cords monthly, especially in any laboratory where flooding can occur.
- Keep in mind that rubber-covered cords can be eroded by organic solvents, ozone (produced by ultraviolet lamps), and long-term air oxidation.
- Before reconnecting electrical equipment to its power source after servicing, check the equipment with a suitable tester such as a **multimeter** to ensure that it is properly grounded.
- **AC frequency rather than direct voltage.**
 - A variable autotransformer that controls voltage and not frequency could cause the motor to overheat and presents a fire hazard.
 - Equipment plugged into an electrical receptacle should include a fuse or other overload protection device to disconnect the circuit if the apparatus fails or is overloaded.
 - Do not use appliances (e.g. kitchen refrigerators, mixers, and blenders) with such motors in laboratories where flammable materials may be present.
 - Locate electrical equipment to minimize the possibility of spills onto the equipment or flammable vapours carried into it.
 - If water or any chemical is spilled on electrical equipment, shut off the power immediately at a main switch or circuit breaker and unplug the apparatus using insulated rubber gloves.
 - If a person is in contact with a live electrical conductor, **disconnect the power source** before removing the person from the contact and administering first aid.

- **Working with water**

- The use of cooling water in laboratory condensers and other equipment is common laboratory practice, but can create a flooding hazard.
- Hoses can pop off under irregular flows when building water pressure fluctuates or can break when the hose material has deteriorated from long-term use.
- Floods also result when exit hoses jump out of the sink from a strong flow pulse or sink drains are blocked by an accumulation of extraneous material.
- Precautions while working with liquids
- Never pipette chemicals by mouth. Use pipette filler.
Do not point the mouth of a vessel being heated toward any person, including you.
- Wear protective gloves and clothing whenever handling corrosive or other hazardous chemicals.
- In the event of a chemical splashing into your eye(s) or on your skin, immediately flush the affected area(s) with running water for at least 20 minutes.
- Never wear sandals or other open-toed shoes in the lab.
- Footwear should always cover the foot completely

- **Working with high pressure equipments**

- Perform high-pressure operations only in special chambers equipped for this purpose.
- Trained laboratory personnel should ensure that equipment and pressure vessels are appropriately selected, properly labelled and installed, and protected by pressure-relief and necessary control devices.
- Vessels must be strong enough to withstand the stresses encountered at the intended operating pressures and temperatures.

- The vessel material must not corrode when it is in contact with its contents.
- The material should not react with the process being studied, and the vessel must be of the proper size and configuration.
- Never carry out reactions in, or apply heat to, an apparatus that is a closed system unless it has been designed and tested to withstand the generated pressure.
- Pressure regulators are required to reduce a high-pressure supplied gas to a desirable lower pressure and to maintain a satisfactory delivery pressure and flow level for the required operating conditions.
- They are available to fit many operating conditions over a range of supply and delivery pressures, flow capacities, and construction materials.
- All regulators are typically of a diaphragm type and are spring-loaded or gas-loaded, depending on pressure requirements. They can be single-stage or two-stage
- Under no circumstances should oil or grease be used on regulator valves or cylinder valves because these substances may react with some gases (e.g., oxygen).
- Each regulator is supplied with a specific CGA standard inlet connection to fit the outlet connection on the cylinder valve for the particular gas.
- Never tamper with or adapt regulators for use with gases for which they are not designed
- Unqualified persons must never attempt to repair or modify regulators.
- Check regulators before use to verify they are free of foreign objects
- Regulators for use with noncorrosive gases are usually made of brass.
- Regulators used with carbon dioxide gas must have special internal design features and be made of special materials.

- Regulators used with oxidizing agents must be cleaned specially to avoid the possibility of an explosion on contact of the gas with any reducing agent or oil left from the cleaning process