Material Safety and Data Sheets (MSDS) are defined as a form containing data regarding the properties of a particular substance. They provide information about the hazards of a specific chemical or product. MSDS's vary in content, but all contain certain required information.

You need to become familiar with the material contained in these sheets and what the content means. If any emergency situation arises in the lab, the location of the MSDS is most important. Please become comfortable reading the information.

Material Safety Data Sheets must provide the following information:

- **The material's identity,** including its chemical and common names
  Example:
  - Brand name: Clorox (TM)
  - Chemical name: Sodium hypochlorite
  - Common name: Bleach

- **Hazardous ingredients,** or any chemical which poses a health or physical hazard (even in parts as small as 1%)
  Example:
  - Ingredients exposure: Sodium hypochlorite
  - Formula: NaOCl
  - Percentage by weight: 5.25%

- **Physical and chemical hazards and characteristics,** such as stability, reactivity, flammability, explosiveness, corrosiveness, compatibility with other materials, and hazardous combustion or decomposition
  Example:
  - Stability: Stable
  - Incompatibilities: strong acids, organic materials, finely powdered metals
  - Hazardous combustion or decomposition products: Chlorine
  - Hazardous polymerization: Will not occur

- **Health hazards**, or any potential physical injuries that handling the material without proper protective equipment may cause, including:
  - Acute effects: Injuries which occur immediately, such as burns or unconsciousness
  - Chronic effects: Injuries which occur from exposure over a period of time, such as allergic sensitization, skin problems or respiratory disease

- **Recognition of a material as a carcinogen or an agent capable of producing cancer,** as listed by Occupational Safety and Health Administration (OSHA), International Agency for Research in Cancer (IARC), or National Toxicology Program (NTP). A cancer review may include both animal and human summaries.

- **Exposure limits,** primary routes of entry into the body, specific target organs likely to sustain damage, and medical problems that can be aggravated by exposure
  Example:
    - Airborne exposure limit: 8-hour time-weighted average
    - Route: Ocular
    - Symptoms of overexposure: Headaches and pressure sensation, nausea, vomiting, anxiety, and difficulty thinking

- **Precautions for handling and storing and safety equipment** such as protective gloves, eye protection, and monitoring equipment or detectors

- **Emergency and first aid procedures** dealing with topics such as inhalation, ingestion, and eye or skin contact.
  Example:
    - Skin contact: Wear respiratory protective mask and remove contaminated clothing. Immediately wash contaminated skin with copious amounts of soap and water.
    - Ingestion: Do not induce vomiting. First symptoms are likely to be gastrointestinal. Immediately administer Nerve Agent Antidote Kit.
    - Inhalation: Hold breath until respiratory protective mask is donned. If severe signs of agent exposure appear, immediately administer all three Nerve Agent Antidote Kits.

- **Specific fire-fighting information** such as flammability limits, lower and upper explosive limits, and fire fighting procedures

- **Procedures for cleanup of spills and leaks** in both field and laboratory procedures

- **Precautions for safe handling and use**, including emergency showers and eyewash stations

- **Identity of the organization responsible for creating the MSDS,** date of issue, and emergency phone number

Common Abbreviations:

TWA – time weighted average

PEL – permissible exposure limit

STEL – short term exposure limit

IDLH – immediately dangerous to life and health

NIOSH – National Institute for Occupational Safety & Health

ACGIH – American Conference of Industrial Hygienists

OSHA – Occupational Safety and Health Administration

CAS – Chemical Abstract Service

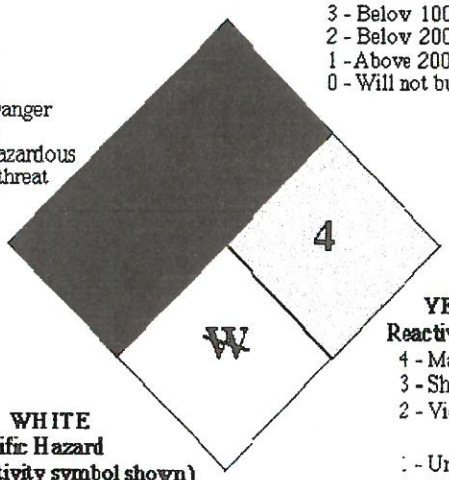
NFPA – National Fire Protection Association

ppm – parts per million (a concentration unit)

ppb – parts per billion (a concentration unit)

When you are ready, obtain a MSDS sheet from the file folder and a question sheet from the instructor. In this activity you will be required to find the information that is asked of you by looking through the MSDS sheets.

Health Hazard	Fire Hazard	Reactivity Hazard
4 Materials which on very short exposure could cause death or major injury, even with prompt medical attention.	4 Materials which will rapidly vaporize at atmospheric pressure and normal temperature, or which are readily dispersed in air and which will burn readily.	4 Materials which are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3 Materials which on short exposure could cause death or major injury even though prompt medical treatment is given.	3 Liquids and solids that can be ignited under almost all temperature conditions.	3 Materials which in themselves are capable of detonation or explosive reaction but require a strong initiating source or which must be heated under confinement before initiation or which react explosively with water.
2 Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.	2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	2 Materials which are normally unstable and readily undergo violent chemical change but do not detonate. Also materials which may react violently with water or which may form explosive mixtures with water.
1 Materials which on exposure would cause irritation but only minor residual injury, even if no treatment is given.	1 Materials that must be preheated before ignition can occur.	1 Materials which are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
0 Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.	0 Materials that will not burn.	0 Materials which are normally stable, even under fire exposure conditions, and which are not reactive with water.



BLUE
Health Hazard
4 - Deadly
3 - Extreme Danger
2 - Hazardous
1 - Slightly Hazardous
0 - No health threat

RED
Fire Hazard
Flashpoints
4 - Below 73 F
3 - Below 100 F
2 - Below 200 F
1 - Above 200 F
0 - Will not burn

YELLOW
Reactivity Hazard
4 - May detonate
3 - Shock or heat may detonate
2 - Violent chemical reaction;
water reactive
1 - Unstable if heated
0 - Stable

WHITE
Specific Hazard
(Water Reactivity symbol shown)
OX - Oxidizer
ACID - Acid
CORR - Corrosive

Hydrochloric Acid 12N

MSDS # 329.10

ScholAR Chemistry

Section 1: Product and Company Identification

Hydrochloric Acid 12N

Synonyms/General Names: Muriatic Acid
Product Use: For educational use only
Manufacturer: Columbus Chemical Industries, Inc., Columbus, WI 53925.

24 Hour Emergency Information Telephone Numbers

CHEMTREC (USA): 800-424-9300 **CANUTEC (Canada): 613-424-6666**

ScholAR Chemistry; 5100 W. Henrietta Rd, Rochester, NY 14586; (866) 260-0501; www.Scholarchemistry.com

Section 2: Hazards Identification

Clear colorless liquid, pungent odor.

HMIS (0 to 4)

Health	3
Fire Hazard	0
Reactivity	2

DANGER! Strongly corrosive to all body tissue and moderately toxic by ingestion and inhalation.
Target organs: Respiratory system, eyes, skin, lungs

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Section 3: Composition / Information on Ingredients

Hydrochloric Acid (7647-01-0), 36-38%. Water (7732-18-5), 62-64%.

(CAS)

Section 4: First Aid Measures

Always seek professional medical attention after first aid measures are provided.

Eyes: Immediately flush eyes with excess water for 15 minutes, lifting lower and upper eyelids occasionally.
Skin: Immediately flush skin with excess water for 15 minutes while removing contaminated clothing.
Ingestion: Call Poison Control immediately. ***Do not induce vomiting***. Rinse mouth with cold water. Give victim 1-2 cups of water or milk to drink.
Inhalation: Remove to fresh air. If not breathing, give artificial respiration.

Section 5: Fire Fighting Measures

When heated to decomposition, emits acrid fumes.

Protective equipment and precautions for firefighters: Use foam or dry chemical to extinguish fire. Firefighters should wear full fire fighting turn-out gear and respiratory protection (SCBA). Cool container with water spray. Material is not sensitive to mechanical impact or static discharge.

Section 6: Accidental Release Measures

Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all ignition sources and ventilate area. Contain spill with sand or absorbent material and place material in a sealed bag or container for disposal. Wash spill area after pickup is complete. See Section 13 for disposal information.

Section 7: Handling and Storage

White

Handling: Use with adequate ventilation and do not breathe dust or vapor. Avoid contact with skin, eyes, or clothing. Wash hands thoroughly after handling.

Storage: Store in Corrosive Area [White Storage] with other corrosive items. Store in a dedicated corrosive cabinet. Store in a cool, dry, well-ventilated, locked store room away from incompatible materials. Shipped with a blue safety color code cap.

Section 8: Exposure Controls / Personal Protection

Use ventilation to keep airborne concentrations below exposure limits. Have approved eyewash facility, safety shower, and fire extinguishers readily available. Wear chemical splash goggles and chemical resistant clothing such as gloves and aprons. Wash hands thoroughly after handling material and before eating or drinking. Use NIOSH-approved respirator with an acid/organic cartridge. Exposure guidelines Hydrochloric Acid: OSHA PEL: 5 ppm ceiling and ACGIH TLV: 2 ppm ceiling, STEL: N/A.

Section 9: Physical and Chemical Properties

Molecular formula	HCL.	**Appearance**	Clear liquid.
Molecular weight	36.46.	**Odor**	Pungent odor.
Specific Gravity	1.18 g/mL @ 20°C.	**Odor Threshold**	N/A.
Vapor Density (air=1)	1.27.	**Solubility**	Completely soluble in water.
Melting Point	-114°C.	**Evaporation rate**	N/A. *(Butyl acetate = 1).*
Boiling Point/Range	85°C.	**Partition Coefficient**	N/A. *(log P_{OW}).*
Vapor Pressure (20°C)	15 mm Hg.	**pH**	0 to 1(very acid & corrosive).
Flash Point:	N/A.	**LEL**	N/A.
Autoignition Temp.:	N/A.	**UEL**	N/A.

Section 10: Stability and Reactivity

Avoid heat and ignition sources.
Stability: Stable under normal conditions of use and storage.
Incompatibility: Alkalis, strong bases, metals, amines, carbonates, metal oxides, cyanides, sulfides, sulfites and formaldehyde.
Shelf life: Indefinite if stored properly.

Section 11: Toxicology Information

Acute Symptoms/Signs of exposure: ***Eyes***: Redness, tearing, itching, burning, damage to cornea, conjunctivitis, loss of vision. ***Skin***: Redness, blistering, burning, itching, tissue destruction with slow healing. ***Ingestion***: Nausea, vomiting, burning, diarrhea, ulceration, convulsions, shock. ***Inhalation***: Coughing, wheezing, shortness of breath, headache, spasm, inflammation and edema of bronchi, pneumonitis.
Chronic Effects: Repeated/prolonged skin contact may cause thickening, blackening or cracking. Repeated eye exposure may cause corneal erosion or loss of vision.
Sensitization: none expected
Hydrochloric Acid: LD50 [oral, rabbit]; 900 mg/kg; LC50 [rat]; 3124 ppm (1 hour); LD50 Dermal [rabbit]; N/A
Material has not been found to be a carcinogen nor produce genetic, reproductive, or developmental effects.

Section 12: Ecological Information

Ecotoxicity (aquatic and terrestrial): LC50 - 282 mg/l - 96 h - Gambusia affinis (Mosquito fish).

Section 13: Disposal Considerations

Check with all applicable local, regional, and national laws and regulations. Local regulations may be more stringent than regional or national regulations. Small amounts of this material may be suitable for sanitary sewer disposal after being neutralized to pH 7.

Section 14: Transport Information

DOT Shipping Name:	Hydrochloric Acid.	**Canada TDG:**	Hydrochloric Acid.
DOT Hazard Class:	8, pg II.	**Hazard Class:**	8, pg II.
Identification Number:	UN1789.	**UN Number:**	UN1789 .

Section 15: Regulatory Information

EINECS: Listed (231-595-7).
WHMIS Canada: D1A, E: Very toxic material, Corrosive liquid.
TSCA: All components are listed or are exempt.
California Proposition 65: Not listed.
The product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Section 16: Other Information

Current Issue Date: December 20, 2011

MSDS Laboratory

Directions: Find the following information on a chemical using its MSDS sheet.

Name of Chemical:

Synonyms of Name:

CAS #:

Physical State	
Appearance	
Odor	
pH	
Evaporation Rate	
Boiling Point	
Melting Point	
Solubility	
Molecular Formula	
Molecular Weight	

In case of a fire, what precautions should be taken?

What are the recommended handling and storage procedures?

What personal protective equipment should we use when handling this chemical?

What are the target organs for this chemical?

What are the potential health effects?

What are the different first aid measures?

What procedures should take place if we were to accidentally spill this chemical?

Chemistry 092
Review – Chapter 2
(Do in class and turn in. May use notes and/or book)

I. Put the following into scientific notation
0.00823
a. 93002.
b. 37.013
c. 0.000402

II. Put the following into standard form
a. 7.09×10^{5}
b. 4.2760×10^{-2}
c. 3.9308×10^{3}
d. 8.005×10^{-4}

III. Name the SI unit that is used to measure each of the following (Please give name and abbreviation)
a. mass –
b. time –
c. amount of chemical substance –
d. light intensity –
e. length -
f. electric current -
g. temperature -

IV, Tell the number of sig. figs. in each of the following numbers

a. 100900
b. 0.80050
c. 307.002
d. 6.023×10^{23}
e. 3800900.
f. 0.0004000

V. Record each of the following measurements so that each will have only three sig. figs.

a. 0.00043450 kg
b. 4060.2 cm
c. 9.8745 m
d. 50000. m
e. 1964.32 g
f. 3.8769×10^{5}

VI. Record the following number so that it has the number of sig figs in the parenthesis
870005.280
a. (7) b. (5) c. (4)

VII. Perform the following operations and record answers to correct sig figs.

a. 97.52 mm – 8.739 mm = _____
b. 3.48 kg + 5.5 kg + 22 kg = _____
c. 900.04 g / 3.0 mL = _____
d. 30.0 m x 8740.3 m = _____

VIII. Match the following

_____ 1. milli	a. 10^{-6}
_____ 2. nano	b. 10^{9}
_____ 3. giga	c. 10^{2}
_____ 4. centi	d. 10^{12}
_____ 5. micro	e. 10^{-3}
_____ 6. mega	f. 10^{-12}
_____ 7. hecto	g. 10^{1}
_____ 8. pico	h. 10^{-2}
_____ 9. deci	i. 10^{-9}
_____10. tera	j. 10^{3}
_____11. deka	k. 10^{6}
_____12. kilo`	l. 10^{-1}

IX. Make the following conversions

1. 7.5 Mg = _____ dag
2. 0.0092 cm = _____ μm
3. 5.232×10^{2} km = _____ Gm
4. 0.83 m = _____ cm
5. 1.87 nm = _____ pm
6. 7834. hg = _____ dg
7. 0.390 Tg = _____ Mg
8. 5.1×10^{-4} mm= _____ hm
9. 25.78 pm = _____ μs
10. 0.58 Mm = _____ cm

X. Density Problems (Show work in space provided)

1. What is the density of 25 g of ethanol which has a volume of 31.7 mL?

2. Calculate the mass of 33.3 cm^3 of bone which has a density of 1.8 g/cm^3 ?

3. The density of sodium metal is 0.93 g/cm^3. What is the volume of a 75g piece of sodium metal?

4. A cube of an unknown metal was measured to have a length of 2.5 cm. and a mass of 75.0 g. What is its density?