

Laboratory Safety

Course

Pathophysiology

Unit II

*Laboratory
Safety and the
Tools of
Investigation*

**Essential
Question**

*Why is it so
important to
follow laboratory
safety policies
and
procedures?*

TEKS

*130.208 (c)1A,
1B*

**Prior Student
Learning**

n/a

Estimated time
2-6 hours

Rationale

The laboratory environment is a hazardous place to work. For the prevention of injury and illness, it is important to adhere to laboratory safety policies and procedures.

Objectives

- Demonstrate safe practices during field and laboratory investigations
- Identify the location of first aid supplies
- Describe proper Personal Protective Equipment (PPE) for laboratory work
- Interpret the information on a Material Safety Data Sheet (MSDS)
- Understand and demonstrate emergency procedures in the laboratory

Engage

A laboratory technician opens the refrigerator door, and an unlabeled bottle falls from the door and breaks on the floor. The volatile chemical immediately fills the room with noxious fumes; the building is evacuated; no one ID's the bottle.

Key Points

- I. Laboratory safety is an important aspect of any lab-based science class. Caution should always be maintained to protect the students and the instructor. The microbiology laboratory contains potential pathogenic microorganisms and toxic chemicals. Standard precautions are practiced throughout each laboratory investigation.
 - A. Safety rules and symbols are important so that students do not injure themselves or their classmates.
 - B. Most lab students do not think the rules are important until something does happen and they have to take action.
- II. Disposal of hazardous and biological waste
 - A. Some waste can be washed down the drain, but other waste is an environmental threat.
 - B. A Material Safety Data Sheets (MSDS) is a valuable resource to have in a science lab. The MSDS lists all the hazards and proper waste disposal techniques associated with a chemical.
- III. Most Frequent Lab Accidents
 - A. Splashes/spills
 - B. Needle sticks/cuts
 - C. Back injuries
 - D. Explosions

- E. Fires
- F. Toxic fumes
- G. Mouth pipetting

IV. Personal Protective Equipment (PPE)

- A. Chemical splash goggles
- B. Face shields
- C. Lab coat
- D. Lab apron
- E. Gloves (selected based on the material being handled and the particular hazard involved)

V. Basic Chemical Safety

- A. Plan ahead
 1. Have the proper materials and PPE to safely handle chemicals.
 2. Substitute less toxic chemicals whenever possible.
 3. Purchase the minimum quantities possible.
 4. Determine potential hazards beforehand.
 5. Have a safety plan for emergencies.
- B. Do not underestimate the risks – read the chemical labels and MSDS beforehand.
- C. Minimize exposure
 1. Use the smallest quantities of chemicals possible.
 2. Never smell chemicals or compounds of unknown toxicity.
 3. Use fume hoods or other ventilation devices.
 4. Use carrying containers.
 5. Do not eat or drink in the lab.
- D. Be prepared for accidents
 1. Know the location of eye washes, showers, fire extinguishers, and exits.
 2. Be prepared to provide basic first aid.
 3. Anticipate the actions of others.
 4. Remove all jewelry and “snug-up” all loose fitting clothing and ties.

VI. A Material Safety Data Sheet (MSDS) contains information regarding the proper procedures for handling, storing, and disposing of a chemical substance.

- A. An MSDS accompanies all chemicals or kits that contain chemicals.
- B. If an MSDS does not accompany a chemical, many web sites and science supply companies can supply one, or they can be obtained from www.msdsonline.com.
- C. Save every MSDS and store them all in a designated file or binder using a system that is organized and easy to understand.

- D. Place the MSDS collection in a central, easily accessible location known to all workers and emergency personnel.
- E. Typically the information is listed in a standardized format (ANSI Z400.1-1998, Hazardous Industrial Chemicals-Material Safety Data Sheet-Preparation).

VII. The National Fire Protection Association (NFPA) Hazard Labels

- A. The National Fire Protection Association (NFPA) has developed a visual guide (right) for a number of chemicals pertinent to the MSDS. The ANSI/NFPA 704 Hazard Identification system, the NFPA diamond, is a quick visual review of the health hazard, flammability, reactivity, or special hazards a chemical may present.
- B. The diamond is broken into four sections (blue, red, yellow, and white). The symbols and numbers in the four sections indicate the degree of hazard associated with a particular chemical or material.

Health Hazard (Blue)		
4	Danger	May be fatal on short exposure. Specialized protective equipment required
3	Warning	Corrosive or toxic. Avoid skin contact or inhalation
2	Warning	May be harmful if inhaled or absorbed
1	Caution	May be irritating
0		No unusual hazard

Flammability (Red)		
4	Danger	Flammable gas or extremely flammable liquid
3	Warning	Combustible liquid, flashpoint below 100 °F
2	Caution	Combustible liquid, flashpoint of 100° to 200 °F
1		Combustible if heated
0		Not combustible

Reactivity (Yellow)		
4	Danger	Explosive material at room temperature
3	Danger	May be explosive if shocked, heated under confinement, or mixed with water
2	Warning	Unstable or may react violently if mixed with water
1	Caution	May react if heated or mixed with water but not violently
0	Stable	Not reactive when mixed with water

Special Notice Key (White)	
W	Water Reactive
OX	Oxidizing Agent

VIII. Rules for a safe laboratory environment

- A. Applying cosmetics, eating, and drinking are all strictly prohibited in the laboratory.
- B. Wear shoes that adequately cover the whole foot; low-heeled shoes with non-slip soles are preferable. Do not wear sandals, open-toed shoes, open-backed shoes, or high-heeled shoes in the laboratory.
- C. All personal belongings (books, purses, and backpacks) must be kept away from the work surface.
- D. Tie back long hair.
- E. Keep your hands away from your face, eyes, mouth, and body while using chemicals.
- F. Gloves and goggles must be worn whenever students are working with microorganisms.
- G. If gloves become soiled, change them immediately.
- H. Always wash your hands after removing gloves.
- I. Do not put pencils or pens in your mouth while working with microorganisms.
- J. Cover and protect exposed wounds.
- K. The use of personal audio or video equipment is prohibited in the laboratory.
- L. Laboratory coats or aprons should be worn at all times during laboratory investigations.
- M. Never use lab glassware for eating or drinking.
- N. Locate all fire extinguishers in the laboratory.
- O. Locate the eyewash station. If a sink is used as an eyewash station, always use cold water to flush your eyes.
- P. Disinfect the work space before and after each investigation. Use the 10% bleach solution for disinfectant.
- Q. Handle all bacterial cultures with extreme caution.
- R. Use a bulb and pipette; never place your mouth on a pipette.
- S. Inspect all equipment for damage (cracks, defects, etc.) prior to use; do not use damaged equipment.
- T. Notify the instructor immediately if a culture has been spilled.
- U. Place all materials in the appropriate containers upon completion of the laboratory investigation.
- V. Cultures must never leave the laboratory workspace.
- W. The performance of unauthorized experiments is strictly forbidden.
- X. If there is a fire drill, turn off all flames and electrical equipment if possible, and exit in an orderly fashion. (follow school procedures)

Activity

- I. Review and practice correct hand washing procedures.
- II. Participate in the Lab Safety Exercise.
- III. Complete the Scenarios activity.
- IV. Complete the MSDS/Chemical Labels activity.
- V. Complete the Laboratory Scavenger Hunt.

Assessment

Successful completion of activities

Successful completion of the Laboratory Safety Quiz

Materials

<http://www.osha.gov/SLTC/laboratories/index.html>

<http://absa.org/>

<http://www.cdc.gov/>

http://www.accessexcellence.org/AE/AEC/AEF/1994/mccadden_safety.php

<http://www.cpsc.gov/cpsc/pub/pubs/niosh2007107.pdf>

Laboratory Safety Guidelines and Contract

Laboratory Safety Letter to Parents

Various safety rules and letters are provided to be tailored for specific classroom needs

Accommodations for Learning Differences

For reinforcement, the student will create a poster illustrating the lab rules.

For enrichment the student will write a short story or draw a cartoon depicting characters in unsafe lab situations.

For enrichment, the student will create and act out a scenario of an unsafe laboratory practice to demonstrate the dangers of not following safety rules and regulations. Additional extra credit will be awarded to students who research actual cases involving personal injury in the lab and include them in their presentation

National and State Education Standards

National Health Science Cluster Standards

HLC06.01

Health care workers will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.

HLC06.02

Health care workers will understand the fundamentals of wellness and the prevention of disease processes. They will practice preventive health behaviors among their clients.

TEKS

130.208 (c) (1)(A) demonstrate safe practices during laboratory and field investigations; and

130.208 (c) (1)(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

Texas College and Career Readiness Standards

English Language Arts

II. B. Understand new vocabulary and concepts and use them accurately in reading writing and speaking.

III. B. Develop effective speaking styles for both group and one on one situations.

IV. A. Apply listening skills as an individual and as a member of a group in a variety of settings.

Science

1.E.1. Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.

1.E.2. Use essential vocabulary of the discipline being studied.

3.A.1. Use correct applications of writing practices in scientific communication.

Lab Safety

Lab Hygiene

- **Food and drink:** not permitted in the lab. All food and drink should remain outside the lab or in your backpack. This is not negotiable.
- **Hand washing:** wash your hands before leaving the lab.
- **Tabletops:** clean your lab tabletop with soap and water (or disinfectant when working with bacteria) before and after your work.

Discard Rules

Nothing should be casually thrown in the trash or down the sink. Check with your teacher for the proper disposal of waste materials, including chemical solutions, biological wastes (biohazard bags may be required), broken glass, sharps, and other supplies.

Personal Protection

- Gloves – to protect you from potentially harmful chemicals or organisms, and/or to protect chemicals from you.
- Safety glasses – worn whenever there is the possibility of a splash injury.
- No open-toed shoes when working in the lab.
- If the use of a lab coat is required, wear the lab coat only in the lab area.

Care of Equipment

- Do not use aluminum foil or metal in the microwave.
- Balance tubes before using centrifuges.
- Follow directions, not only for use, but just as importantly, for cleanup.

Accidents in the lab

- Report all **accidents or incidents** immediately to your teacher.
- Use the proper safety equipment
- Always know where to locate the following **safety equipment** in your laboratory:
 1. Fire extinguisher
 2. Fire blanket
 3. Eye wash station
 4. Shower
 5. MSDS notebook

LABORATORY SAFETY GUIDELINES AND CONTRACT

Rules for a safe laboratory environment:

- A. Applying cosmetics, eating, and drinking are strictly prohibited in the laboratory.
- B. Wear shoes that adequately cover the whole foot; low-heeled shoes with non-slip soles are preferable. Do not wear sandals, open-toed shoes, open-backed shoes, or high-heeled shoes in the laboratory.
- C. All personal belongings (books, purses, and backpacks) must be kept away from the work surface.
- D. Tie back long hair.
- E. Keep your hands away from your face at all times.
- F. Gloves and goggles must be worn at all times.
- G. If your gloves become soiled, change them immediately
- H. Always wash your hands after removing gloves.
- I. Do not put pencils or pens in your mouth while working with microorganisms.
- J. Cover and protect exposed wounds.
- K. Laboratory coats or aprons should be worn at all times during laboratory investigations.
- L. Locate all fire extinguishers in the laboratory.
- M. Never use lab glassware for eating or drinking.
- N. Locate the eyewash station. If a sink is used as an eyewash station, always use cold water to flush your eyes.
- O. Disinfect the work space before and after each investigation. Use the 10% bleach solution for disinfectant.
- P. Handle all bacterial cultures with extreme caution.
- Q. Use a bulb and pipette; never use your mouth on a pipette!
- R. Notify the instructor immediately if a culture has been spilled.
- S. Place all materials in the appropriate containers upon completion of the laboratory investigation.
- T. Inspect all equipment for damage (cracks, defects, etc.) prior to use; do not use damaged equipment.
- U. Cultures must never leave the laboratory workspace.
- V. If there is a fire drill, turn off all flames and electrical equipment, if possible, and exit in an orderly fashion (follow school procedures).

I have read and agree to follow the above safety guidelines.

I agree to report any accident or injury to the instructor immediately.

I will never use any equipment or supplies without obtaining permission from the instructor.

Print Student name

Student Signature

Date

I have read and reviewed the above guidelines with my child.

Print Parent Name

Parent Signature

Date

Commitment to Safety in the Laboratory

To ensure that science experiments are safe and educational, students and teachers should read, discuss, and sign this commitment to laboratory safety agreement.

1. Perform the experiments as directed. Do not do anything which is not part of an approved experimental procedure.
2. Be properly prepared to do the experiment. Read the written procedures in advance and understand what you are going to do. Lack of familiarity wastes your time and is a major cause of injury. Know the hazards before you do the experiment.
3. Never work without instructor supervision. Do not enter the lab if no instructor is present.
4. Report all accidents, injuries, and close calls to your instructor immediately. Report any inappropriate activity to your instructor.
5. Wear appropriate protective equipment. ANSI approved splash-proof goggles should be worn at all times. Gloves should be used when appropriate.
6. Learn the locations and operation of emergency equipment. This includes eyewashes, safety showers, fire extinguishers, fire blankets, sinks, and first aid supplies.
7. Act responsibly at all times. No horseplay or fooling around in the lab.
8. Wear shoes that cover the whole foot. No sandals or canvas shoes. Clothing should not be loose-fitting, especially in the sleeves. Arms, legs, midribs and buttocks should be covered. Do not wear polyester clothing or hose/tights; they melt onto skin in a fire.
9. Tie back long hair to keep it away from flames and chemicals.
10. Never taste a chemical. Check odors, only if instructed to do so, by gently wafting some of the vapor towards your nose with your hand.
11. Turn off your Bunsen burner or other heat source whenever you are not using it. Never leave it on unattended. Always warn lab partners when the burner is on.
12. Treat burns immediately by putting the burned area under cold water for at least 15 minutes.
13. Read the chemical labels carefully. Many mistakes – some dangerous – result from mixing the wrong chemicals. If unsure of a procedure, ask for help before continuing.
14. No smoking, eating, or drinking in the lab.
15. Dispose of chemicals properly. Pour all wastes into the containers provided unless specifically instructed to pour it down the drain. Broken glass goes in special receptacles.
16. Never return unused reagents to the reagent bottle. Be careful to take only what you actually need to do the experiment.

17. Clean up spills immediately.
18. List your allergies at the bottom of the page. If the experiment deals with something to which you are allergic, consult your instructor. If you are pregnant or have special health concerns, you may request a list of the chemicals used during the semester so that you can discuss them with your healthcare provider.
19. If you wear contact lenses, indicate this at the bottom of the page. No evidence exists to suggest that wearing contacts in the lab is dangerous. However, your instructor needs to know if you wear contacts to properly treat potential chemical splashes.
20. Treat all chemicals with the respect they deserve. Know the hazards before you handle the material.
21. Never take chemicals, supplies, or equipment out of the laboratory without the knowledge and consent of the instructor. Likewise, do not bring such materials into the lab without the consent of your instructor.
22. Wash off chemicals splashed or spilled on your skin or body immediately. Wash affected areas for 15 minutes. Remove contaminated clothing immediately. Notify your instructor.
23. Clean your lab bench, put away all equipment and reagents, and wash your hands at the end of each lab period.

I have read and understand, and agree to follow these safety rules and procedures. I agree to abide by any additional instructions, written or verbal, provided by my instructor.

Student's Signature	Student's Printed Name	Date
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Do you wear contacts? Yes No

* List any allergies or medical problems that your instructor should be aware of.

I have read and understand, and agree to enforce these safety rules and procedures.

Instructor's Signature	Instructor's Printed Name	Date
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Course _____ Section _____ Semester _____

Adapted from *Science Safety Rules and Procedures Agreement* by The Laboratory Safety Institute

LAB SAFETY CONTRACT

- ◆ I will act responsibly at all times in the laboratory
- ◆ I will follow all instructions about laboratory procedures given by the teacher
- ◆ I will keep my area clean in the laboratory
- ◆ I will wear my safety goggles in the laboratory when instructed to by my teacher
- ◆ I will wear protective clothing in the laboratory when instructed to by my teacher
- ◆ I know where the fire extinguisher is located in the lab and have been trained in its use (at the laboratory teacher's discretion)
- ◆ I will immediately notify the teacher of any emergency
- ◆ I will tie back long hair, remove jewelry, and wear shoes with closed toes and heels while in the laboratory
- ◆ I will never work alone in the laboratory
- ◆ I will not take chemicals or equipment out of the laboratory without permission from the teacher
- ◆ I will never eat or drink in the lab unless instructed to do so by the teacher
- ◆ I will treat all living or preserved specimens carefully and as if they are dangerous
- ◆ I will only handle living or preserved specimens when authorized by the teacher
- ◆ I will not enter or work in the storeroom unless supervised by the teacher

A copy of this contract is to be kept in the student's class notebook.

The student and a parent/guardian should sign in the appropriate space below.

I, _____ have read each of the statements in the Science Laboratory Safety Contract and understand these safety rules. I agree to abide by the safety regulations and any additional written or verbal instructions by the _____ Independent School District or my teacher.

Student Signature

Date

Parent/Guardian Signature

Date

August XX, 20XX

Dear Parent/Guardian,

Your son/daughter is presently enrolled in a course called _____
_____. Students enrolled in this class will be using a variety of laboratory
equipment and supplies, including bacterial cultures. The student must attend a
safety demonstration and pass a written safety exam in order to participate in the
laboratory investigations.

Before your son/daughter may use any of the listed equipment, the attached
contract must be signed and returned. If you have any concerns regarding the
_____ laboratory investigations, please call me during
my conference period, _____, at (XXX)XXX-XXXX.

Sincerely yours,

The Instructor

Laboratory Safety Exercise

1. List as many laboratory safety statements as you can. You should be able to come up with at least seven of them. Work alone and without talking to anyone else.
2. When your instructor indicates, compare and discuss your statements with others in your group. Have a recorder list all of the statements. Pick a maximum of seven rules that your group finds to be most important. Rephrase them if necessary so that they are clear.
3. Record the seven rules and list a reason for following each of your group's rules.
4. Choose a member of your group to present your findings to the class; design a class list of procedures to be followed by all lab participants.

Adapted from:

http://www.accessexcellence.org/AE/AEC/AEF/1994/mccadden_safety.php

LABORATORY SAFETY AND EQUIPMENT EXAM

NAME: _____ DATE: _____

Please write either the word “safe” or “unsafe” beside each sentence below.

_____ Eating a candy bar while your laboratory partner assembles the material for the laboratory investigation.

_____ Holding a bacterial culture with gloved hands.

_____ Cleaning your work area with soap and water after a laboratory investigation.

_____ Lab coats may be worn throughout the school day.

_____ Never apply make-up while in the laboratory.

_____ Treat all microorganisms as possible pathogens.

_____ Eating out of glassware in the laboratory is acceptable, as long as the glassware has been autoclaved.

_____ Glasses can be laid on the work surface while looking through a microscope.

_____ Notify the instructor of any accidents in the laboratory.

_____ Don't worry about washing your hands, if you have worn gloves throughout the laboratory investigation.

_____ Exceptions can be made to standard precautions.

KEY- LABORATORY SAFETY AND EQUIPMENT EXAM

Please write the word safe or unsafe beside each sentence below.

unsafe Eating a candy bar while your laboratory partner assembles the material for the laboratory investigation.

safe Holding a bacterial culture with gloved hands.

safe Cleaning your work area with soap and water after a laboratory investigation.

unsafe Lab coats may be worn throughout the school day.

safe Never apply make-up while in the laboratory.

safe Treat all microorganisms as possible pathogens.

unsafe Eating out of glassware in the laboratory is acceptable, as long as the glassware has been autoclaved.

unsafe Glasses can be laid on the work surface while looking through a microscope.

safe Notify the instructor of any accidents in the laboratory.

unsafe Don't worry about washing your hands, if you have worn gloves throughout the laboratory investigation.

unsafe Exceptions can be made to standard precautions.

Safety scenarios

In each of the following situations, write 'yes' if the proper safety procedures are being followed and 'no' if they are not. Then give reasons for your answers.

1. Ellen started weighing chemicals before the teacher came into the room. Her nose started itching so she scratched it.
2. Since he was wearing glasses, Zach decided not to wear his safety goggles. He started heating a test tube and slanted it away from his work area and towards the students across the lab table.
3. Logan and Monica decided to just dump the leftover chemicals down the sink and run the water.
4. Ron notices that the electrical cord on his hotplate is frayed near the plug. He takes the hotplate to his teacher and asks for permission to use another one.
5. Alicia and John left their materials on the lab table when the bell rang for the next class.
6. Kathryn missed lunch and thought she would quickly eat a granola bar while she was working with her lab partner on their experiment.
7. Harris is really thirsty and decides to rinse a beaker with water, refill it with water, and take a drink.

KEY - Safety scenarios

In each of the following situations, write 'yes' if the proper safety procedures are being followed and 'no' if they are not. Then give reasons for your answers.

1. Ellen started weighing chemicals before the teacher came into the room. Her nose started itching so she scratched it.
No – Keep your hands away from your face at all times
2. Since he was wearing glasses, Zach decided not to wear his safety goggles. He started heating a test tube and slanted it away from his work area and towards the students across the lab table.
No – Goggles must be worn at all times, and a test tube should never be heated and pointed towards another person
3. Logan and Monica decided to just dump the leftover chemicals down the sink and run the water.
No - Dispose of chemicals properly. Pour all wastes into the containers provided unless specifically instructed to pour them down the drain.
4. Ron notices that the electrical cord on his hotplate is frayed near the plug. He takes the hotplate to his teacher and asks for permission to use another one.
Yes - Inspect all equipment for damage (cracks, defects, etc.) prior to use; do not use damaged equipment.
5. Alicia and John left their materials on the lab table when the bell rang for the next class.
No - Place all materials in the appropriate containers upon completion of the laboratory investigation.
6. Kathryn missed lunch and thought she would quickly eat a granola bar while she was working with her lab partner on their experiment.
No – Eating is strictly prohibited in the laboratory.
7. Harris is really thirsty and decides to rinse a beaker with water, refill it with water, and take a drink.
No - Never use lab glassware for eating or drinking.

Laboratory Scavenger Hunt

Provide the location and use of listed safety equipment.

No.	Safety Equipment	Location	Use
1	Chemical splash goggles		
2	Eye wash station		
3	Safety shower		
4	Fire blanket		
5	Fire extinguisher		
6	First aid kit		
7	Chemical spill kit		
8	Fume hood		
9	Fire alarm		
10	Emergency exit		

Demonstrate your knowledge of safe laboratory practices:

1. When should safety goggles be worn?
2. What should you do if glassware breaks?
3. If you accidentally spill water near electrical equipment, what should you do?
4. What precautions should you take when working near an open flame?
5. After you clean up your work area, what should you do before leaving the laboratory?
6. Is it always appropriate to dispose chemicals by flushing them down the sink? Explain.
7. What precautions should you take when using sharp objects like scissors?
8. What steps should you take when performing an experiment that involves poisonous or unpleasant vapors?



National Fire Protection Association Hazard Labels

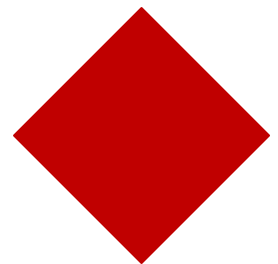
Health Hazard (Blue)

4	Danger	May be fatal on short exposure. Specialized protective equipment required
3	Warning	Corrosive or toxic. Avoid skin contact or inhalation
2	Warning	May be harmful if inhaled or absorbed
1	Caution	May be irritating
0		No unusual hazard



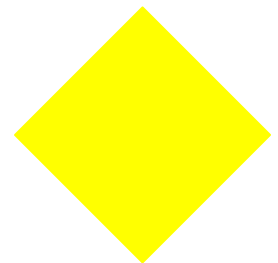
Flammability (Red)

4	Danger	Flammable gas or extremely flammable liquid
3	Warning	Combustible liquid flash point below 100 °F
2	Caution	Combustible liquid flash point of 100° to 200 °F
1		Combustible if heated
0		Not combustible



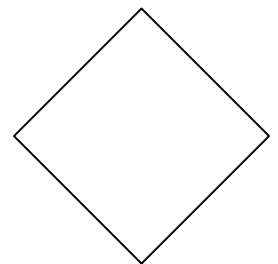
Reactivity (Yellow)

4	Danger	Explosive material at room temperature
3	Danger	May be explosive if shocked, heated under confinement, or mixed with water
2	Warning	Unstable or may react violently if mixed with water
1	Caution	May react if heated or mixed with water but not violently
0	Stable	Not reactive when mixed with water

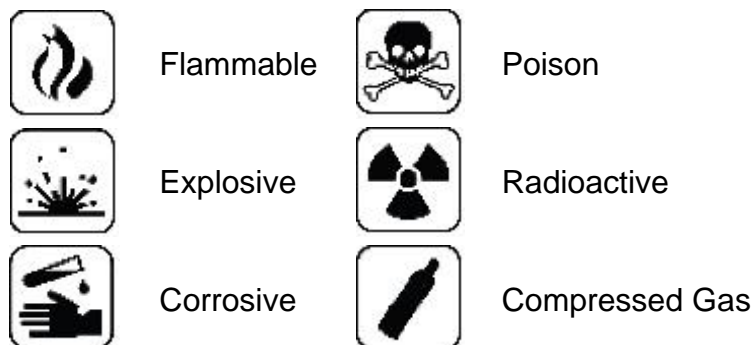


Special Notice Key (White)

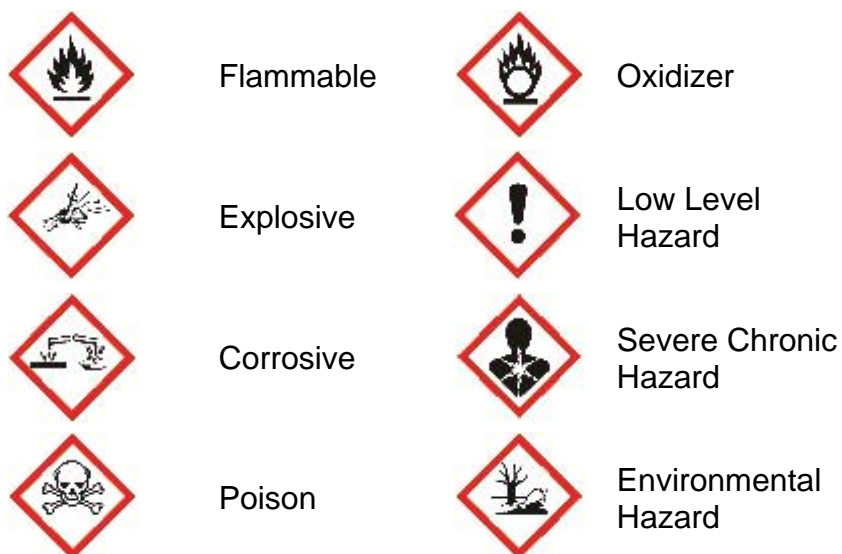
W	Water Reactive
OX	Oxidizing Agent



Common Safety Symbols



The above safety symbols may be replaced by the following symbols that are internationally accepted*:



*Globally Harmonized System of Classification and Labeling of Chemicals, United Nations New York and Geneva, 2005

Material Safety Data Sheets (MSDS)

The Texas Hazard Communications Act requires that technical bulletins detailing information about hazardous chemicals be available for each hazardous chemical stored in a school or work facility. These sheets must be readily available for reference by employees and laboratory students. When reading an MSDS, the following considerations should be taken.

The MSDS often outlines only the minimum precautions for safe handling of the chemical. Thus, if the employer's or reader's judgment suggests more stringent procedures, those procedures should be used.

In many cases, the emergency first aid procedures and handling precautions are written to deal with a worst-case scenario, such as an extensive exposure. Minor accidents may not require the same level of response. Seek the advice of an expert. React prudently.

Do not assume a substance is hazard free if there is no mention of a particular health effect in the MSDS. A particular hazard may not have been known at the time the MSDS was written.

The MSDS should be complete without blank spaces. Question the supplier if blank spaces are found. If data are not available, the MSDS sheet should indicate so in the space provided.

Study the MSDS provided carefully. Answer the questions below in complete sentences on a sheet of notebook paper. There are four more questions on chemical labels on the last page of this handout.

1. Which substance is described by this MSDS?
2. What is the chemical formula of this substance?
3. List two descriptions of this substance. Why is this information important?
4. What are the specific health hazards associated with the substance?
6. How would a spill of this substance be handled?
7. Which first aid procedures would be used in case of skin contact with this substance?

MATERIAL SAFETY DATA SHEET

CHEMICAL NAME & SYNONYMS SUDAN IV SOLUTION		FLINN CATALOG NUMBER S0160
FORMULA Mixture	FORMULA OR ATOMIC WEIGHT Mixture	CAS NUMBER 85-83-6 as Sudan IV
PHYSICAL DATA (DENSITY, SOLUBILITY, ETC.) Consists of: Sudan IV dry powder, acetone and ethyl alcohol.		
APPEARANCE AND COLOR Red liquid; distinct alcohol odor.		
COMPATIBLE CHEMICAL FAMILY Organic #2 See Flinn Chemical Catalog/Reference Manual	DOT CLASS Flammable Liquid	REACTIVITY Stable
CONDITIONS TO AVOID (IF ANY): Avoid heat. Avoid sources of ignition, i.e. (open flame, sparks).		
HEALTH HAZARDS (IF ANY): Toxic as ethyl alcohol. Not all health aspects of this substance have been fully investigated.		THRESHOLD LIMIT VALUE (TLV) IF ESTABLISHED 1000 ppm as ethyl alcohol or acetone.
FIRE HAZARDS (IF ANY): Use a triclass, dry chemical fire extinguisher. Flammable liquid.		
SPILLS AND LEAKS: Absorb on sand or vermiculite. Place in a suitable container. Use the disposal method listed on the right.		DISPOSAL METHOD 18b See Flinn Chemical Catalog Reference Manual
SPECIAL PRECAUTIONS (IF ANY): Wear chemical gloves and goggles. Use and dispense in a hood.		
FIRST AID (IF SUBSTANCE DANGEROUS): External: Wash affected parts with copious quantities of water. Internal: Wash mouth; see a physician. Eyes: Wash continuously for 15 minutes. See a physician. Respiratory: Transport to fresh air.		
Consult your copy of the Flinn Chemical Catalog/Reference Manual for even more information about laboratory chemicals		

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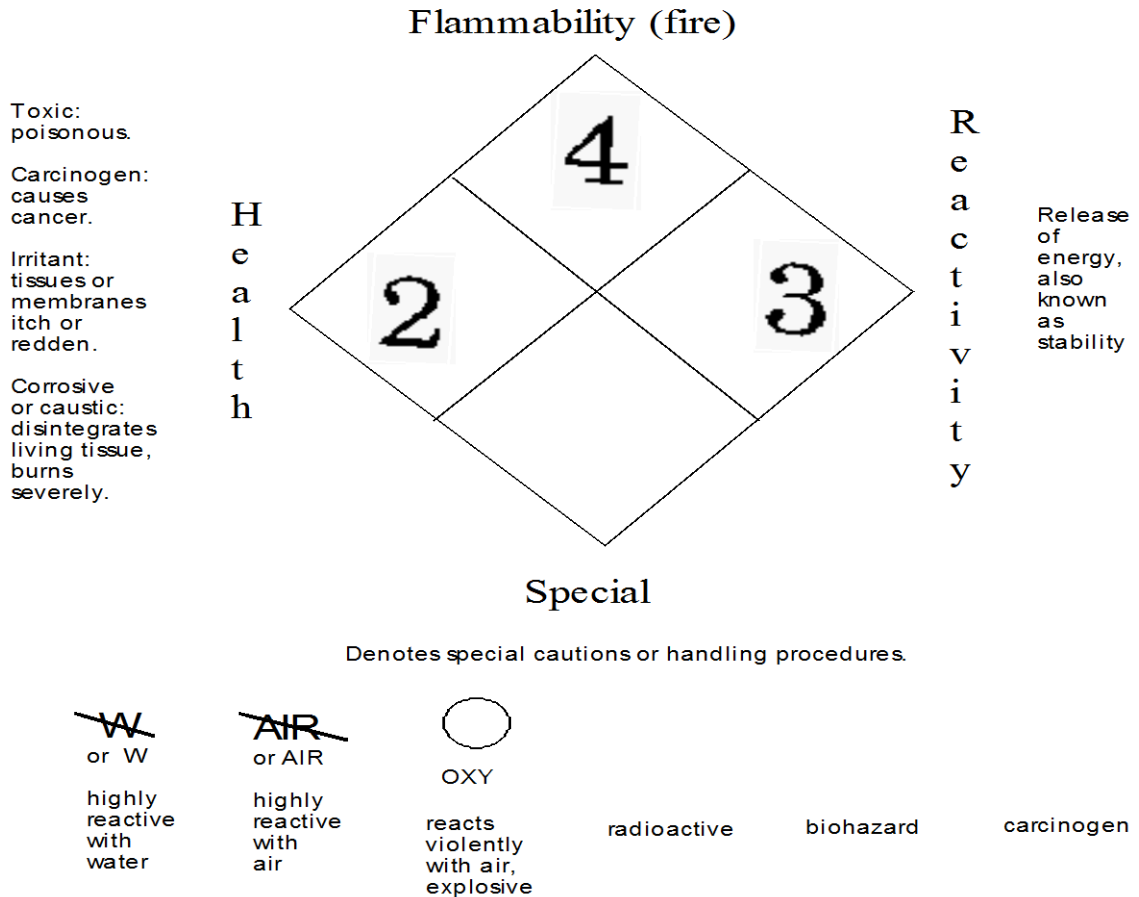
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Chemical Labels

Chemical labels contain a coding system that alerts the user to the specific kinds and degrees of hazards that the chemical poses. Each color code indicates the particular type of hazard. Blue indicates health hazards, red indicates fire hazards, yellow indicates reactivity hazards, and white indicates special hazards. The number within the color code indicates the degree of danger (in that hazard category) posed by the chemical. Higher numbers indicate increased hazards. See the reverse side of this sheet for details.

Study the diagram below. Color the diagram appropriately. Review the associated terms.

Note that flammability is highest when a substance is in a gaseous state. Liquids that are volatile (change to a gas readily) ignite easily.



Chemical Labels: Hazard Coding System*

Blue: Health Hazard		Red: Fire Hazard		Yellow: Reactivity Hazard	
Signal	Type of possible injury	Signal	Susceptibility of material to burning	Signal	Susceptibility to release of energy
4	Short exposure could cause death or permanent injury even if prompt medical attention is given.	4	Rapidly or completely vaporizes at atmospheric pressure and normal ambient temperature or readily dispersed in air, burns easily.	4	Readily capable of detonation or explosive decomposition or reaction at normal temperatures and pressures.
3	Short exposure could cause serious temporary or residual injury even though prompt medical attention is given.	3	Liquids and solids ignited under almost all ambient temperature conditions.	3	Capable of detonation or explosive reaction, but requires a strong initiation source, or reacts explosively with water.
2	Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.	2	Must be moderately heated or exposed to high ambient temperatures before igniting.	2	Normally unstable, undergoes violent chemical change but does not detonate, may react violently with water or form potentially explosive mixtures with water.
1	Exposure could cause irritation but only minor residual injury even if no medical attention is given.	1	Must be preheated before ignition can occur.	1	Normally stable but unstable at high temperatures and pressures, may be moderately water reactive.
0	Exposure under fire conditions offers no hazard beyond that of ordinary combustibles.	0	Will not burn.	0	Normally stable, even under fire conditions, not reactive with water.

**Modified from NFPA 704, National Fire Protection Association*

Study the table above and the chemical label. Answer the following questions.

8. Name the type of hazard indicated by each color and the meaning of the numbers shown on the chemical label.
9. Describe in general terms a substance for which the chemical label shows the following:
 Blue 1
 Red 2
 Yellow 1
10. List 3 of the special hazards that may be found in the white section of a chemical label.
11. What number and color would be found on the label of a chemical that would react violently with water or form an explosive mixture with water?

KEY - Material Safety Data Sheets (MSDS) / Chemical Labels

1. Which substance is described by this MSDS?

Sudan IV Solution

2. What is the chemical formula of this substance?

Mixture

3. List two descriptions of this substance. Why is this information important?

Red liquid, distinct alcohol odor.

4. What are the specific health hazards associated with the substance?

Toxic as ethyl alcohol. Not all health aspects have been fully investigated.

5. How would a spill of this substance be handled?

Absorb on sand or vermiculite. Place in a suitable container.

6. Which first aid procedures would be used in case of skin contact with this substance?

External: Wash affected parts with copious quantities of water.

Internal: Wash mouth; see a physician.

Respiratory: Transport to fresh air.

Eyes: Wash continuously for 15 minutes; see a physician.

7. Name the type of hazard indicated by each color and the meaning of the numbers shown on the chemical label.

Health Hazard (Blue)		
4	Danger	May be fatal on short exposure. Specialized protective equipment required
3	Warning	Corrosive or toxic. Avoid skin contact or inhalation
2	Warning	May be harmful if inhaled or absorbed
1	Caution	May be irritating
0		No unusual hazard

Flammability (Red)		
4	Danger	Flammable gas or extremely flammable liquid
3	Warning	Combustible liquid flash point below 100 °F
2	Caution	Combustible liquid flash point of 100° to 200 °F
1		Combustible if heated
0		Not combustible

Reactivity (Yellow)		
4	Danger	Explosive material at room temperature
3	Danger	May be explosive if shocked, heated under confinement or mixed with water
2	Warning	Unstable or may react violently if mixed with water
1	Caution	May react if heated or mixed with water but not violently
0	Stable	Not reactive when mixed with water

Special Notice Key (White)	
W	Water Reactive
OX	Oxidizing Agent

8. Describe in general terms a substance for which the chemical label shows the following:

Blue 1 – **Caution – may be irritating**

Red 2 – **Caution – Combustible liquid flash point of 100° to 200 °F**

Yellow 1 – **Caution – May react if heated or mixed with water, but not violently**

9. List 2 of the special hazards that may be found in the white section of a chemical label.

Water Reactive
Oxidizing Agent

10. What number and color would be found on the label of a chemical that would react violently with water or form an explosive mixture with water?

Yellow 3