

**Live Safe!**  
**Work Smart!**

**BIOLOGICAL AND  
CHEMICAL  
HAZARDS**

**Health and Safety Resources for  
Ontario Secondary School Teachers**

**Produced by a partnership of:**



*Ford Motor Company of Canada, Limited*





**SECTION I**  
**Biological and**  
**Chemical Hazards**  
**Grade 11**

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**SCIENCE**

Biology, Grade 11, University; College  
Chemistry, Grade 11, University  
Physics, Grade 11, University  
Science, Grade 11, University/College; Workplace

**TECHNOLOGICAL EDUCATION**

Manufacturing Engineering Technology, Grade 11, College  
Manufacturing Technology, Grade 11, Workplace  
Technological Design, Grade 11, University/College; Workplace  
Transportation Technology, Grade 11, College; Workplace  
Construction Technology, Grade 11, College; Workplace  
Communications Technology, Grade 11, University/College; Workplace  
Health Care, Grade 11, College  
Hairstyling and Aesthetics, Grade 11, Workplace

**ARTS**

Visual Arts, Grade 11, University/College; Open

**WHMIS Review: Teacher's Note**

WHMIS is the acronym for the **Workplace Hazardous Materials Information System**. In Grade 9 and 10 Live Safe! Work Smart!, students were taught WHMIS principles in Science and had the lessons reinforced in both Arts and Technology.

Since Science is not mandatory in Grade 11, a lesson in WHMIS is included to meet the WHMIS-related expectations in Science, and also in Technology and Arts. The lesson is designed to reinforce the basic concepts and move students into more practical applications of WHMIS in preparation for workplace situations. At the Grade 11 level, many students may be working at part-time jobs and may be exposed to hazardous materials in their workplaces. This lesson accomplishes more than meeting the expectations in your course — it will help students be more safety-conscious in your classroom and prepare them for life in the workplace.

Since so many courses have expectations related to chemical handling, Live Safe! Work Smart! ensures that each course and subject teacher has appropriate materials available. To accomplish this, there is a generic lesson on WHMIS and an optional exercise that focuses on the chemicals used, handled and stored in your classroom. Depending on the course expectations and needs of your students, you may determine that there are portions of this lesson you can omit or shorten.

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**Teacher's note (cont'd.)****Excellent start to the semester**

Starting with the WHMIS lesson will assure you that students have the knowledge and skills to handle products safely in your classroom. By doing this you are following one of the principles of safety in the workplace. Safety training, including WHMIS training, must be done before workers can handle hazardous products.

**Gauging Recall of Previous Lessons**

To help you determine the basic knowledge each student has of WHMIS, administering the Grade 9 and/or Grade 10 test questions may be appropriate as the first step. The Grade 9 questions and their answers are on pages 19-25 of the Chemical Hazards module in grade 9/10 Live Safe! Work Smart! and the Grade 10 questions and answers are on pages 38-41. If it is determined that there are significant gaps in students' knowledge, it may be appropriate to select some basic lessons from the Chemical Hazards chapter of Grade 9 and 10 Live Safe! Work Smart! before continuing with the Grade 11 material.

**Classroom Safety Orientation**

The lab or classroom may be equipped with safety features and equipment to be used when your health and safety is at risk, including:

- **Fire exits** – Report to maintenance if exit lights are not lit. Always ensure that doors are not blocked.
- **Fire alarm** – Usually by the door; pull to activate. Keep access clear.
- **Fire extinguisher** – Usually mounted on the wall near a doorway. The type of extinguisher should be Multi-Purpose Dry Chemical labelled “ABC”. Directions are on the extinguisher. Always make sure access to the extinguisher is clear – no back packs in front of it or jackets hung on it!
- **Smoke detectors** – Located on ceilings. Smoke will activate this alarm.
- **Eyewash station** – This may be mounted on the wall or permanently attached to a sink. The eyewash station is used for rinsing chemicals or foreign material from the eye. Keep access to the eyewash clear at all times. Portable “bottles” need regular maintenance to ensure they are clean, fresh and ready for use.  
TIP: Have the students do a routine check to make sure there is a clear path to the eyewash station each time chemicals are used in the room. The first line of prevention when handling chemicals is wearing safety glasses, chemical splash goggles or face shields, whatever is appropriate for the type of work that is done. The eye wash station is the last line of defence after use of personal protective equipment.

**Classroom safety orientation cont'd.**

- **Optional: Safety shower (deluge shower)** – Use for heat burns and chemical splashes to the skin. Only for emergency use! Keep this area clear. These are usually used only when there are large quantities of chemicals dispensed or handled.
- **Personal Protective Equipment (PPE)** – Use appropriate safety glasses/goggles, aprons, lab coats, and gloves located in the classroom. Encourage students to report any defects to the teacher (e.g., a hole in the gloves) and insist that they NEVER conduct work with chemicals unless they use the appropriate PPE.

**Bright Idea!****A few simple rules...**

Establishing these rules each time students are about to use chemicals in the classroom reinforces the importance of safe work practices and instills an important skill — the ability to assess hazards before starting to work. You may consider putting these rules up in front of the classroom to remind students every time they come to class.

1. Check that safety equipment is in place and in good condition, and that access is not blocked;
2. Read labels and MSDSs of the chemicals before use;
3. Use or wear the personal protective equipment required;
4. Use fume hoods when necessary;
5. Dispose of products safely.

## Overhead

## Teacher's Notes

## What is WHMIS?

Answer: The Workplace Hazardous Materials Information System. It is a national system for ensuring that persons who handle hazardous products have the information, training and equipment necessary to work safely. It applies to all workplaces in Ontario and, in fact, in all of Canada, and to this school because there are people working here.

Products that fall under the WHMIS legislation are also called “controlled products”.

Grade 9 and 10 Science touched on the basics of WHMIS, so some parts of this lesson should be a review, but students also need to start thinking about WHMIS in terms of the place where they're currently working, or are thinking about working.

There are five main components of WHMIS designed to protect workers: preparing an inventory; WHMIS labels; Material Safety Data Sheets, Training and Personal Protective Equipment(PPE). We're going to take a look at each one of these so that we all know what's required in the place we work and how we can protect ourselves.

### 1. Inventory

An inventory is prepared to find out what types of products exist in the workplace. This job should be done by the employer or someone the employer designates to do it. After the initial inventory is completed, it is the employer's duty to keep the inventory up-to-date so that there is a current list of all the hazardous products used, handled or stored in the workplace.

Creating an inventory involves making a list of products that are present and seeing that each product is labelled to identify its contents. Some products may have WHMIS labels on them. These are easily identified by a hatched border around the edge of the label. Other products may be labelled with something called a workplace label. In some cases, there may be chemicals in unlabelled containers — those need to be identified and brought to the attention of the person in charge. It is essential that all substances have some type of label so that everyone who comes in contact with a substance knows what they're handling.



Biological and Chemical Hazards – Slide 1



Biological and Chemical Hazards – Slide 2

## Overhead

## Teacher's Notes



Biological and Chemical Hazards – Slide 3

### WHMIS Exemptions

When conducting an inventory of products in the workplace or classroom, it is important to know that not every chemical falls under WHMIS legislation.

Instead, some products are covered under other laws. Although these products do not require an MSDS or WHMIS label, requirements for worker education about any hazards associated with them remains.

Some of the types of products exempt from WHMIS include:

#### *Consumer Products*

A common example is liquid paper. These products are for non-commercial use and can usually be purchased at a store. Although they are intended for household use, products such as household cleaners, glue, and nail polish remover are sometimes purchased and brought into the workplace. The legislation covering consumer products has its own requirements for labelling for the safety of users. For instance, instead of the WHMIS symbols, they use three shapes for hazard identification:

Octagon (“danger”) – represents the most dangerous hazard.

Diamond (“warning”) – represents a moderate hazard.

Inverted Triangle (“caution”) – represents the least dangerous hazard.

#### *Food and Drugs*

Cosmetics, hair dyes, food and over-the-counter and prescription drugs are exempt from WHMIS requirements but fall under other consumer protection information legislation.

#### *Pest Control Products*

Pesticides, herbicides and fungicides are covered under strict legislation designed to protect not only those who handle them, but people who may be inadvertently exposed when the products are applied.

## Overhead

## Teacher's Notes

**Prevention message:** Even if a product is exempt from WHMIS, employers are still required to provide health and safety information if a worker is required to handle the product.

## 2. WHMIS Labels

Two different types of labels meet WHMIS requirements: **supplier labels** and **workplace labels**. There are some very limited circumstances where no label is required under WHMIS legislation, but in the vast majority of cases, a label of some type must be in place.

WHMIS **supplier labels** are placed on products by the manufacturer or distributor. The information on the label will depend on the volume of the container.

In any case, the name of the product, reference to an MSDS and first aid measures must appear on supplier labels.



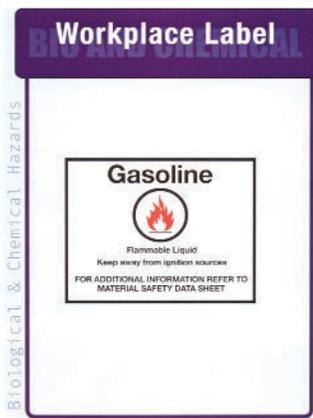
Biological and Chemical Hazards – Slide 4

### Supplier Label Requirements

Required On Label	> 100 kg (volume)	< 100 kg (volume)	< 10 kg – Lab Products
Product Name	✓	✓	✓
Supplier Name	✓	✓	
Reference to an MSDS	✓	✓	✓
Hazard Symbols	✓	✓	
WHMIS Border	✓	✓	
Info. about Hazards	✓		✓
Safety Precautions	✓		
First Aid Measures	✓		✓

## Overhead

## Teacher's Notes



Biological and Chemical  
Hazards – Slide 5

WHMIS **workplace labels** are for products that are produced and used in the workplace, or transferred from a supplier's container into other containers in the workplace. They display the product name, reference to an MSDS, and instructions for safe handling of the product. Some workplaces choose to add a WHMIS border, although this is not required.

### Laboratory Chemicals

Chemicals that are <10 kg in quantity, require only a label with:

- a product identifier
- a reference to an MSDS if one is available
- an applicable risk phrase (containing information about hazards)
- first aid measures.



### Reality Check

While at work, a 19 year-old worker grabbed a spray bottle of what she **thought** contained mineral spirits to clean fabric. The mineral spirits were always in the same clear plastic bottle. When she used the product, she immediately had a hard time breathing and had to be taken to hospital and put on a heart monitor. As a result of the investigation, it was found that the clear plastic bottle contained extremely hazardous hydrofluoric acid.

**Class Question:** What circumstances may have caused the incident?

**Potential Answers:** This situation could have occurred because:

- the bottle was mislabelled;
- the bottle was unlabelled;
- the bottle was labelled and the worker did not read the label, just assuming it was mineral spirits;
- the worker used the wrong container.

### Reality Check (continued)

#### Prevention:

- label containers properly,
- read labels,
- try to eliminate the use of extremely hazardous products and replace them with less toxic materials,
- store chemicals properly,
- provide proper training and supervision for workers.

### Overhead

### Teacher's Notes

## 3. Material Safety Data Sheet (MSDS)

The MSDS contains detailed information about products covered by WHMIS. It provides details about a product's chemical properties, but there is also some critical information that can protect users of the product, such as:

- How to use the product safely
- Properties that make the product hazardous
- What to do in case of an emergency, such as a spill.

The WHMIS legislation requires that:

- Suppliers of controlled products prepare an MSDS for each product
- MSDSs be updated if they are more than three years old
- MSDSs always be available for workers to review.



Biological and Chemical Hazards – Slide 6

## Overhead

## Teacher's Notes

**Teacher's Note: Material Safety Data Sheet Familiarization**

Material Safety Data Sheets can be intimidating documents to students and many workers. They contain a lot of technical information that, for most people, goes well above and beyond what they REALLY NEED TO KNOW to handle the product safely. This lesson is designed to make students comfortable with an MSDS regardless of their level of knowledge of chemical properties and scientific data.

Before you begin this section, it is advisable to distribute two handouts: the MSDS with explanations of each category, and the sample MSDS (propane). These are the first two handouts located in the Resources section of this chapter. Students can use the handouts to take notes on the categories of information they can find in an MSDS, and what these terms mean.

During the lesson, students can follow along with the explanatory MSDS and the sample propane MSDS. Science teachers may want to expand upon the information about chemical properties in some of the nine categories to compliment other science lessons.

Although all of the information on an MSDS is useful, students should learn to read the MSDS with particular attention to the three things that, as workers, they will REALLY need to know — the hazards a product poses, how to work with the product safely; and measures to be taken in the event of an emergency, such as a spill.

**The Material Safety Data Sheet (MSDS) – Nine Categories**

The law requires that a supplier include nine categories of information on each MSDS:

1. Product Information (identifies the product and use, supplier/manufacturer)
2. Hazardous Ingredients (name, concentration and toxicity of each ingredient)
3. Physical Data (physical properties)
4. Fire or Explosion Data (potential to ignite or explode)
5. Reactivity Data (stability and potential to react)



Biological and Chemical Hazards – Slide 7

## Overhead

## Teacher's Notes

6. Toxicological Properties (how it enters the body and its effects)
7. Preventative Measures (measures to protect a worker)
8. Emergency and First Aid Measures (safe evacuation and treatment)
9. Preparation Information (date of MSDS, by whom and number)

Having the same kind of information in every MSDS helps users of the product know all the important facts and ensures that every MSDS is consistent. Consistency makes MSDSs easier to read and understand.

Some MSDSs will contain more detailed information than others. Some may look a little different since some suppliers may place the required information in a different “spot”. For example, one MSDS may have emergency procedures under first aid, whereas another may put emergency procedures under Preventative Measures. Sometimes the categories are in a different order, or there may be additional categories. In any case, the basic information required under WHMIS legislation will be found on the MSDS.

As a worker handling a chemical, you must be able to recognize hazards, follow safety precautions, and know what to do in case of an accident in order to protect yourself from accidental injury.

**Prevention Message: Three Important Things to Identify from an MSDS are:**

1. Hazards associated with the product;
2. Safety precautions necessary for safe use;
3. What to do in case of an emergency.

When reading an MSDS, pay particular attention to the sections containing this information. From the list above, those sections would be 2 through 5 and 7-8.

### Optional Exercise: Students from all Course Areas

To reinforce the lesson that helps students identify KEY information on a Material Safety Data Sheet, students can use the handout with the sample MSDS (propane) and identify:

- hazards of propane,
- safety precautions necessary for use, and
- what they should do in case of an emergency.

The other handout, which defines the nine sections of an MSDS, can be used as a guide. Both handouts are found in the Resources section of this chapter.

#### Potential Answers:

##### 1. *How to handle the product safely:*

Eyes: Safety glasses, goggles or face shield required when transferring product.

Skin: Insulated gloves required if contact with liquid is expected. Wear gloves and long sleeves when transferring product.

Storage: Store at temperatures below 120 degrees F in a well ventilated, spark-free area.

Respiratory protection is not required with normal use. Also see Section 9 – Transportation, Handling and Storage.

##### 2. *Properties that make propane dangerous:*

Flammable: Carbon monoxide can be produced during combustion.

Fire and Explosive Hazards: Explosive air-vapour mixture may form if allowed to leak to atmosphere.

Storage: Keep separate from oxidizing agents. Gas explodes spontaneously when mixed with chloride dioxide. Also note Section 6 – Toxicological Properties to see health effects.

##### 3. *What to do in case of emergency:*

If propane is spilled, remove ignition sources and ventilate area. Eliminate leak if possible.

Ensure cylinder is upright. Monitor low areas as propane is heavier than air and can settle into low areas. Remain upwind of leak. Keep people away. Prevent vapour and/or liquid from entering into sewers, basements or confined areas.

Eyes: Should eye contact with liquid occur, flush eyes with lukewarm water for 15 minutes. Obtain immediate medical care.

Skin: In case of “cold burn” from contact with liquid, immediately place affected area in lukewarm water and keep at this temperature until circulation returns. If fingers or hands are frost-bitten, have the victim hold his hands next to his body, under the armpit for example. Obtain immediate medical care.

Inhalation: Remove person to fresh air. If breathing is difficult or has stopped, administer artificial respiration. Obtain immediate medical care.

### Optional Exercise: Science students

Homework: Provide students with a photocopy of three MSDSs pulled from the set of MSDSs for products used in the classroom or school. Students can be asked to determine:

- which of the three substances appears to be most dangerous and why;
- the safety equipment that should be available if all three products are used;
- which is the most flammable, most reactive or the most dangerous with regard to other physical properties discussed in classroom lessons.

**NOTE:** No answers for the teacher are provided, as answers will be based on the MSDSs provided.

### Classroom Discussion

#### Practical Application of WHMIS Protection

If you are required to handle a product at work and:

- it is not labelled, or
- no Material Safety Data Sheet is available, or
- you haven't been trained on how to handle the product,

what do you do?

Handling may include actual use of the product, or perhaps transporting it from one part of the workplace to another.

#### Potential answers:

1. Immediately report any deficiencies to your supervisor or employer — you must report hazards to your supervisor.
2. If you don't get the information you need, insist on knowing safe handling procedures before you handle the product.
3. You have the legal right to refuse unsafe work (more information on this topic is provided in the Societal Issues and Workplace Law chapters of Live Safe! Work Smart!).

## OPTIONAL EXERCISE

### **Bringing it All Together: Inventory, Labels, MSDSs and PPE**

This exercise ties in four aspects of WHMIS and is a practical way to reinforce the skills and knowledge students need to have to protect themselves. A blank INVENTORY SHEET to support this exercise is the third handout in the Resources section of this chapter.

Divide the class into three groups.

#### **GROUP #1: INVENTORY**

These students will conduct an inventory of hazardous products in the lab or classroom. The inventory should include any products that are in unlabelled containers. Each member of the group will help to complete the first three columns of the inventory sheet (product name, location, label present).

#### **GROUP #2: MATERIAL SAFETY DATA SHEETS**

These students must locate the Material Safety Data Sheets in the classroom and, on a piece of notebook paper, make a list of chemicals that have an MSDS. They must also check each MSDS to make sure that it is no more than three years old.

#### **GROUP #3: PROTECTIVE EQUIPMENT**

The last group must conduct an inventory of the classroom safety equipment and personal protective equipment, and list them on a piece of notebook paper.

When this step is complete (15 minutes), have the class work in new groups of three so that each group will have one representative from the previous Group #1, one from Group #2 and one from Group #3. Their task is to determine from the inventory sheet (which the Group #1 person completed), if all the MSDSs are present for the products inventoried (the Group #2 person will have a list of MSDSs), and if the personal protective equipment and safety equipment for using the product identified on the MSDS are available (the Group #3 person will have a list of what they found in the classroom).

**RESULT:** You may want to have a class discussion on what they found, deficiencies, if any, and what they must do to correct those deficiencies. A master inventory for the classroom should be compiled as a result of the exercise and made available to the students.

## Overhead

## Teacher's Notes

## 4. Training

Training is required by the WHMIS regulation. All workers who work with, or in close proximity to, a product covered by WHMIS must be informed about the hazards using information received from the supplier and any other hazard information that the employer is or ought to be aware of concerning safe use, handling and storage of the product. Students should know that they **MUST** get this type of training if they are working around chemicals in order to perform their work safely.



### Teacher's Note

The following section explains how chemicals enter the body and discusses the PPE to be used for each route of exposure.

Although the lesson discusses common protective measures against chemical hazards, it should be emphasized that the **BEST** control is to **REPLACE** hazardous chemicals with non-hazardous (or less hazardous) substitutes.

### Routes of Exposure

1. Inhalation
2. Absorption
3. Ingestion
4. Injection

## 5. Personal Protective Equipment (PPE)

### How do Chemicals Enter the Body?

Water can be a vapour, and you can breathe it in. When it's a liquid, you can drink it or it can be absorbed by your skin. Chemicals, depending on their use and state can enter our body in similar ways. An MSDS will often refer to the "route of exposure". This is the way that a chemical, under normal use, can enter the body. When determining appropriate protective measures, a clear understanding of the route of exposure is an important first step.

## Overhead

## Teacher's Notes

**Routes of Exposure:**

- Inhalation (breathing)
- Absorption (through the skin or mucous membranes)
- Ingestion (swallowing)
- Injection (through a puncture)

The most common routes of exposure are inhalation (breathing) and skin contact (dermal absorption).

**Summary Chart for Teachers: Routes of Exposure and PPE**

Route of Exposure	Safety Precautions
<b>A. Inhalation</b> - breathing in chemicals	Respirators, dust mask, ventilation
<b>B. Absorption</b> - through the skin, eyes, mucous membranes, and open wounds	Impervious clothing, eye protection, bandages over open wounds
<b>C. Ingestion</b> - swallowing chemicals	No eating or smoking during work, hand-washing, respirators, dust masks
<b>D. Injection</b> - puncture through the skin	Gloves, protective clothing

**A. INHALATION**

Inhalation is a common way that a chemical can get into the body. The effect on the body depends on the chemical, the form it is in when inhaled, e.g, gas or dust, the properties of the chemical, and the amount that is breathed in.

Although our immune system and the lungs have a mechanism to get rid of some unwanted objects, many chemicals are very strong and will overcome your defences.

Sometimes the first thing we notice is the smell of a chemical. Some products have an unpleasant smell, but are not hazardous by nature while others, like ammonia, are hazardous to our bodies when inhaled in large doses.

**BIO AND CHEMICAL**

**Inhalation**

**Symptoms:**

- Sore or burning throat
- Itchy or watery eyes

**Precautions:**

- Respirator
- Dust mask
- Ventilation

Biological and Chemical Hazards (11)

## Overhead

## Teacher's Notes

Symptoms, such as a sore throat and watery eyes, are the first things that we can feel when we breathe in a harmful chemical. Let's review each of the common safety measures to protect us from inhaling chemicals in more detail.

### *Respirators*

Respirators **do not** remove the hazard, but will reduce the amount you breathe in. The type to use depends on the nature of the chemical and exposure. There are two types:

1. those that provide clean air, and;
2. those that filter the air.

Those that filter the air rely on disposable cartridges in the respirator unit. The type of cartridge used in the respirator must match the type of chemical or product you're exposed to.

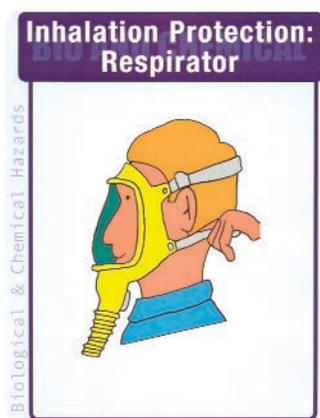
Respirators are generally acceptable for intermittent jobs or as an interim measure, but are not a replacement for removing contaminants from the air. For instance, where it has been determined that levels of airborne particulate from a welding operation exceed the allowable limits, the employer **MUST** reduce the amount of contaminants in the air and can only require workers to use respirators as an interim measure until testing proves that the air is safe to breathe.

Respirators must fit properly, and be in good condition — there must be no leaks, and cartridges must be replaced after their expiry date.

Getting a proper fit is essential to effective protection. Make sure that both straps are securely fastened around your head. Facial hair is a common reason why respirators do not fit properly — these respirators work when a “seal” is formed between the rubber of the respirator and your skin and hair interferes with the seal.

Anyone who is required to wear a respirator must be trained to use and care for it properly, and be fitted for it.

Lab classes will NOT likely require respirators. Respirators are used in jobs such as spraying pesticides, spray painting, and firefighting.



Biological and Chemical Hazards – Slide 10

## Overhead

## Teacher's Notes



Biological and Chemical Hazards – Slide 11

### *Disposable Masks*

Commonly used to minimize exposure to dust, these disposable paper masks keep larger particles from being inhaled. Dust masks do not protect against gases, vapours, or lack of oxygen.

Suppliers of dust masks provide information about the type of protection their products provide.

At home, a dust mask is suitable for activities where you may be exposed to large quantities of airborne particles, such as:

- woodworking,
- mowing the lawn, or
- spring cleaning the cottage.

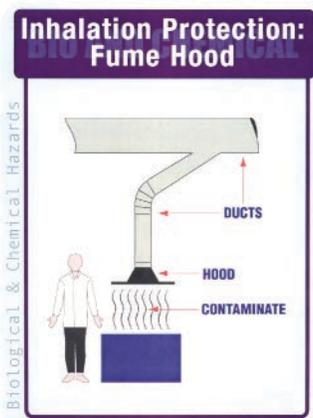
### *Ventilation*

In many operations, ventilation is the main method of reducing exposure to hazardous fumes or vapours.

Adequate ventilation can reduce the risk of hazards, such as fire and explosions and breathing in chemicals and other contaminants.

It is also important for providing clean air, drawing hazardous fumes and vapours away from our breathing zone and providing comfort by keeping the room temperature at a comfortable level.

Ventilation can be local, like a fume hood or a fan over your stove in the kitchen that draws fumes and steam away, or general, such as a system that regularly replaces the air in a factory with fresh air.



Biological and Chemical Hazards – Slide 12

A simple method to check that exhaust or supply sources are functioning properly is to hold a piece of tissue up to the source to see if the tissue is drawn into an exhaust, or blown if it is a supply source. Another method is to blow soap bubbles and observe how they travel. For workplace systems, more complex methods of determining velocity and function are used.

## Overhead

## Teacher's Notes

**Absorption**

**Symptoms:**

- Itching, burning skin
- Swollen, puffy, watery eyes

**Precautions:**

- Hand and arm protection
- Impervious gloves
- Eye protection
- Bandages over cuts

Biological and Chemical  
Hazards – Slide 13

**Hand, Arm and Eye Protection**

Biological and Chemical  
Hazards – Slide 14

## B. ABSORPTION

Perhaps the most common way that a chemical enters the body is through skin contact. This can occur if we touch liquid chemicals, or are exposed to their vapours. The effect can be on the surface of the skin, like a rash, or, when chemicals penetrate the skin, the exposure can affect other organs of the body.

A chemical can be absorbed more readily if the skin is broken. If you have a cut, cover it with a bandage that seals the wound and wear appropriate protection to keep the wound area safe from chemical penetration.

### *Hand and Arm Protection*

Gloves are the most common personal protective equipment for the hands. The type of glove depends on the type of hazard. For most chemical applications, gloves that prevent the chemical from coming into contact with the skin — called “impervious” gloves — are the best method of protection.

Different types of chemicals, however, require different types of impervious gloves. For example, butyl gloves are better for acetone exposure because they aren't permeated by this chemical as easily as neoprene gloves. Both are impervious, but the chemical properties of neoprene don't match well with the properties of acetone.

An MSDS will usually point to the appropriate type of gloves to use.

## Overhead

## Teacher's Notes

**Reality Check – The Case of the Disappearing Glove**

Bob had a new job in a factory. He was told to use gloves to do his job, which involved cleaning machinery parts with a chemical. He selected a pair of gloves from the different types available. After working with the gloves for several minutes, Bob noticed that there were holes in the gloves, like he had scraped them on something. He replaced the gloves with the same type of glove and went back to work. Again, after several minutes, the gloves appeared to be destroyed. Bob didn't stop to think about why new gloves continued to get destroyed. After ten pairs of new gloves, his co-worker, Dave, asked him why he kept taking new pairs of gloves. Bob explained how the gloves kept getting holes in them.

What do you think was happening here? Was Bob carelessly getting holes in his gloves? Were the gloves defective? What should have been done?

**Possibilities:**

- the gloves were not the type that were recommended by the manufacturer of the chemical — the MSDS should have been reviewed and proper protection identified;
- the chemical was “eating” through the gloves and likely coming into contact with Bob's skin;
- Bob should have realized that there was something wrong and notified his supervisor immediately.

***Eye Protection***

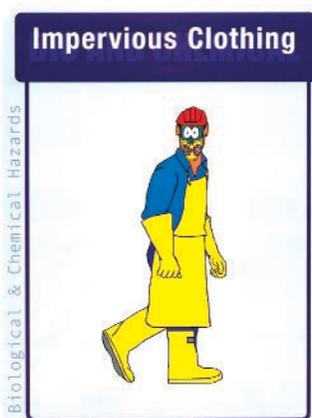
The type of eye protection required will depend on the chemical being used, and how you will be using it. Generally, safety glasses with side shields are recommended for most types of work, but, if there is a possibility that a chemical can splash into your eyes then chemical splash goggles would provide more appropriate protection.

In some situations, face shields, clear plastic shields that cover the face, are appropriate. This is where there is a likelihood that a chemical can splash in your face.

Eye protection should fit properly, or it will not protect you. If your glasses keep slipping off the bridge of your nose, then they don't fit properly.

## Overhead

## Teacher's Notes



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Biological and Chemical Hazards – Slide 16

### *Impervious Clothing*

Depending on the work, you may need special safety clothes for extra protection. For example, working with strong chemicals may require impervious aprons, bibs, or suits that will be a barrier between your skin and the chemical.

In some operations, chemical-resistant shoes and boots are required to prevent chemicals from soaking into footwear.

### C. INGESTION

Swallowing chemicals can sometimes occur without us knowing it, often simply from not washing our hands before putting something to our mouths when working with chemicals. Sometimes, if we eat or drink in an area where chemicals are being used, hazardous materials can inadvertently get into our food or drink.

For example, lead is easily ingested, and those who work with lead (such as people who do stained glass or certain types of welding), and eat or smoke without washing their hands can easily ingest small amounts of lead.

All workers should always wash their hands before eating so that any hazardous material on the hands is not ingested.

In labs or any areas where chemicals, drugs or other materials that are poisonous by ingestion are commonly used, there must be no drinking (coffee too!) or eating (not even a snack!). No food should ever be stored in refrigerators where chemicals or hazardous biological materials are stored.

## Overhead

## Teacher's Notes

**BIO AND CHEMICAL**

**Injection**

**Safety Precautions:**

- Safe handling of sharps
- Proper disposal
- Hand protection

Biological & Chemical Hazards

Biological and Chemical Hazards – Slide 17

Biological and Chemical Hazards – Slide 17

**BIO AND CHEMICAL**

**The Right PPE**

- ✓ Follow the manufacturer's instructions
- ✓ No new hazards
- ✓ No interferences

Biological & Chemical Hazards

Biological and Chemical Hazards – Slide 18

Biological and Chemical Hazards – Slide 18

## D. INJECTION

This happens when something sharp punctures the skin, and a chemical is brought through the skin and sometimes into the blood.

At home you might drop a glass on the floor. What do you do? Sweep it up with a broom? Pick it up with your bare hands? If you are working in a lab, and that glass just contained a toxic chemical, picking it up with your bare hands could lead to you getting cut, which could allow the chemical to enter the bloodstream through the cut or puncture.

Personal protective equipment must be worn when sharp objects are handled. Never handle or dispose of a needle, unless you are trained to do so. Disposal of sharp objects requires a container labelled for them.

### **Making Sure Your Personal Protective Equipment (PPE) Protects You:**

1. Make sure the type of protection is appropriate for the hazards you're exposed to.
2. Use PPE that does not create a hazard, e.g., make sure that it fits properly and doesn't interfere with the jobs you have to do (i.e., lab coat sleeves hanging over a bunsen burner; gloves so big that you drop things).
3. If using more than one PPE, make sure one doesn't interfere with the other (e.g., your respirator or dust mask does not prevent your eye protection from fitting properly).
4. PPE does not work if it's damaged. Always check before using it to make sure it is in good condition.



### Teacher's Note

Students should be aware that they should remove personal protective equipment (PPE), e.g., lab coats, gloves, eye protection, when outside of the area where it is required. These PPE can be carrying a hazard that can be carried into a “clean” work area.

### Optional Discussion

You may wish to wrap up the lesson with a brief discussion on chemicals that students have been in contact with at home, work or school. Ask them what PPE they should use for the following:

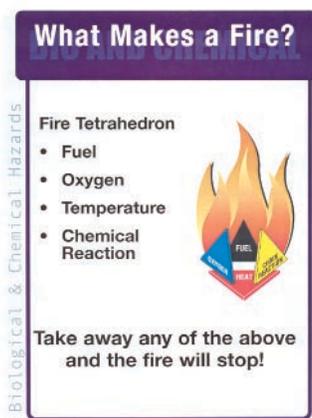
- liquids like cleaning products, paints, acids and solvents  
(Answer: Eye protection, respirators, impervious gloves)
- dusts and particulate like dust from cleaning out a pool, cabin or cottage  
(Answer: dust mask, eye protection)

**SCIENCE**

Science, Grade 11, Workplace  
Chemistry, Grade 11, University

**TECHNOLOGICAL EDUCATION**

Construction Technology, Grade 11, College; Workplace  
Manufacturing Engineering Technology, Grade 11, College  
Manufacturing Technology, Grade 11, Workplace

**Overhead****Teacher's Notes**

Biological and Chemical Hazards – Slide 19

**What makes a fire?**

The burning process requires four elements, often referred to as a fire tetrahedron:

- Fuel, such as coal, natural gas, wood, paper, etc., that burns
- Oxygen in the air that sustains burning
- A high temperature to produce enough vapours to burn, or a source of ignition like a spark. Remember only vapours and gases burn, not solids and liquids
- The chemical reaction involved in the burning process

If we remove any of the four items, the fire will stop. For example, if something is burning in a pot, put a lid on the pot and the burning will stop. This happens because we cut off the oxygen supply to the fire.

The WHMIS or consumer product label will show if a substance is flammable. The MSDS will point to important chemical properties and conditions that could start a fire.

**It Happens!**

Some situations that could lead to fire:

Flammables like hair spray should never be sprayed when smoking. The cigarette and lighter are sources of heat. Nail polish remover with acetone is also a source of fuel!

Oily rags with linseed or paints can combust spontaneously and are major causes of fires. Air is enough for them to burn in the right conditions. Dispose of them properly, e.g., in an air-tight non-combustible container, not thrown in a pile on the floor.

Bunsen burners in lab class are a source of fuel (gas is supplied to the burner). A spark is needed as the source of ignition.

## Overhead

## Teacher's Notes

## Fire Suppression and Extinguishers

A fire suppression system should comply with the Ontario Fire Code. The Code must be considered at every stage of new building design, in renovations, and when there are changes to the interior layout of existing buildings.

In your school or workplace, you may find one or more of the following control systems:

- Fire Sprinklers: automatic activation in case of fire in a room.
- Standpipe and hose system: generally located in the hallway. They should be used by trained personnel only.
- Portable Fire Extinguishers: these can be used to stop small fires if you are trained to use one. Use it if you know how. Otherwise, follow evacuation procedures since there is no time to figure out how to use an extinguisher when a fire is already burning.

If your clothes catch fire: STOP, DROP, AND ROLL.

There are other types of suppression systems available that will depend on what caused the fire. **The general all-purpose extinguisher is a Type ABC extinguisher.** An MSDS will include what can be used to stop a chemical fire.

## Compressed Gases and Liquids

Compressed gases and liquids are contained in cylinders at a pressure greater than atmospheric pressure. This property means that they can be very dangerous in any situation. They are flammable and they can explode if they fall.

Compressed gas and liquid containers are commonly found in industrial workplaces for welding and cutting operations, as well as in food preservation facilities and in labs.

We use compressed gases and liquids at home, for example propane for an outdoor barbecue.

Common Compressed Gases	
Gas	Use
Acetylene	Welding
Nitrous oxide	Dentistry, medical
Propane	Barbecue fuel

## Overhead

## Teacher's Notes

Some gases, such as carbon monoxide, phosgene and hydrogen fluoride are toxic. Some, such as carbon dioxide, liquid oxygen and liquid petroleum gases, can cause frostbite on contact. Others such as ammonia, chlorine and fluorine are also corrosive, and can destroy skin and other body tissues on contact.

### Tips for Working Safely With Compressed Gases and Liquids

#### 1. Proper Training

- Never work with gases unless you have been trained and understand the hazards.
- Read the WHMIS symbol and MSDS for more details.

#### 2. Proper Storage

- Store different gases separately, and in a cool, dry, well-ventilated and fire-resistant area (away from any sources of ignition).
- Label empty cylinders as “empty”, and store in the appropriate place designated for them (not the regular garbage).
- Secure cylinders with a chain or similar restraint and keep them upright.
- Propane cylinders must be stored outdoors.

#### 3. Inspection

- Inspect cylinders prior to using — are there any leaks, tears, or signs of wear? When was the last test done for the cylinder's pressure?

#### 4. Safe Transportation and Use

- Never move cylinders without following safety procedures, which should include the use of a special carrier.
- Never use them for anything except their intended use.

#### 5. Personal Protective Equipment (PPE)

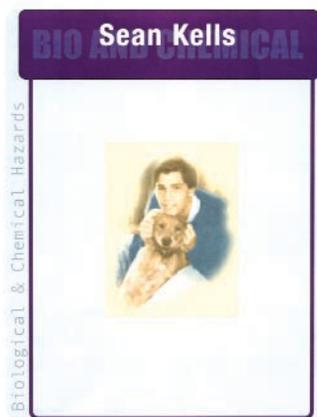
- Where the MSDS suggests appropriate PPE for safe handling of a product — use or wear it!



Biological and Chemical Hazards – Slide 21

## Overhead

## Teacher's Notes



Biological and Chemical  
Hazards – Slide 22

### Case Study: Sean Kells

It was his third day on the job, and a young worker was asked to pour a chemical product from a large container into a small container. Static electricity from the act of pouring the chemical created a spark that ignited the liquid, resulting in third degree burns to 90% of his body. He died the next day.

#### What Sean did not know:

- The container contained a hazardous material called toluene.
- Toluene is highly flammable.
- The act of pouring a chemical can produce a static charge that can ignite flammable vapours.

#### Why did he not know that it was a hazardous material?

- The container was NOT marked or labelled as hazardous.
- He had not received any WHMIS or other training from his employer.
- He did not know his rights under the *Occupational Health and Safety Act*.

## Overhead

## Teacher's Notes

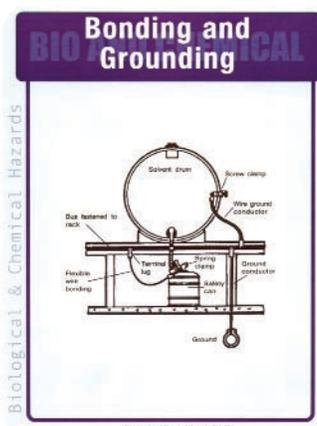
## Dispensing Flammable Liquids – Why Bond and Ground?

If you are going to transfer liquid from one container into another, static electricity from pouring the liquid can cause a spark. Bonding and grounding, a method to ensure the electricity does not cause a hazard, is required by Ontario regulations.

Bonding between containers removes differences in electrical charges between them. This is often done with a wire that runs between the container you're dispensing FROM to the container you're dispensing TO.

Grounding (e.g. with a ground wire, often copper) is also required to allow an electrical charge to be discharged to ground. This wire is attached to the container you are dispensing FROM and runs to an approved ground source.

Reduced flow rate is an additional control for high static charges, as, for example, during the filling of a large gasoline vessel. Also note that plastic is not very good for bonding and grounding. Only use plastic that is specially designed and approved for transferring flammables.



Biological and Chemical Hazards – Slide 23

**SCIENCE**

Science, Grade 11, Workplace  
Biology, Grade 11, University; College

**TECHNOLOGICAL EDUCATION**

Health Care, Grade 11, College  
Hairstyling and Aesthetics, Grade 11, Workplace  
Hospitality, Grade 11, College; Workplace

**Overhead****Teacher's Notes****Infectious Biological Agents**

These are living organisms that can cause illness or disease. They include:

- Bacteria;
- Viruses; and
- Fungi.

Most people call them “germs”, but, for the purpose of studying them, we will refer to them as biohazards. Unlike physical hazards that we can see, biohazards are not always something we can sense that we’re exposed to. This increases our vulnerability. We need to be aware that in certain types of work, we are likely to be exposed to these hazards.

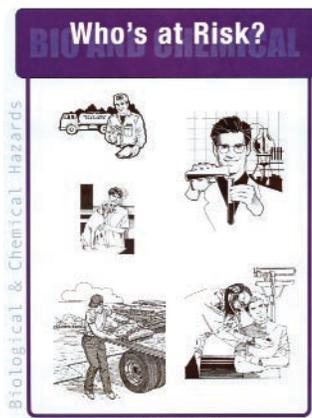
Suppliers of products that are biological hazards label them with a WHMIS label and symbol to make workers aware of the hazard. The WHMIS symbol for a biological hazard is depicted on the overhead.



Biological and Chemical  
Hazards – Slide 24

## Overhead

## Teacher's Notes



Biological and Chemical Hazards – Slide 25

Workers in various occupations may be exposed to biological hazards, for example:

- Animal handlers: in veterinary clinics, pet stores, zoos
- Agricultural workers: exposure to plants, animals
- Medical workers: exposure to people with disease; blood, urine and stool samples
- Child Care workers
- Laundry workers
- Laboratory workers
- Waste water and sewage workers.

The routes of exposure for biological hazards are the same as for chemical hazards. The most common routes for biological hazards are inhalation and ingestion, but people exposed to needles and sharps are highly susceptible to exposure through injection (skin puncture).

Biohazards are spread either through:

- direct contact with germs or someone who has them, or
- indirect contact through soiled articles, food, water, air, or insects that carry the biohazard.

**Bright Idea!**



### Diseases Related to Contact with Biological Hazards

You may want to discuss diseases related to biological exposure that can be contracted at work. Some occupations expose workers to biological hazards. Here are some examples of diseases which can be contracted and the types of workplaces where this might occur.

**Rabies:** Workers in veterinary clinics, zoos, parks, agriculture, and labs. Infection can occur from a bite or scratch from a diseased animal, whether it be wild or domestic. Signs of a rabid animal are nervousness, aggressiveness, excessive drooling and foaming at the mouth, abnormal behaviour. For workers working directly with animals, training and protective clothing and equipment is required.

**Hepatitis B:** Health care workers. This disease causes inflammation of the liver. Hepatitis B is 50 to 100 times more infectious than HIV (the virus that causes AIDS). Infection can occur from a needle-stick injury if the needle is contaminated with a biohazard, or from contact with the blood and bodily fluids of an infected person. Controls are vaccination and PPE for the eyes and skin.

**Psittacosis:** Workers in laboratories, pet stores, veterinary clinics. This disease results in fever, headache, and can affect the lungs. Infection can occur from inhaling dried bird droppings and secretions, or touching birds that are infected. Birds can be household birds, such as parrots, or wild birds like pigeons. Controls include use of a respirator or mask and wearing rubber gloves.

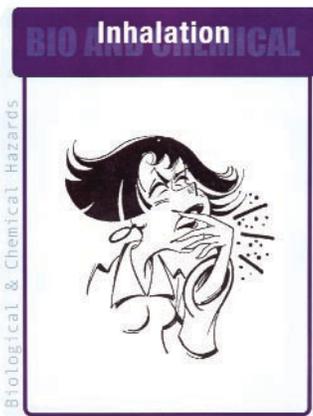
## Overhead

## Teacher's Notes

**Teacher's Note**

If the lesson on Chemical Hazards, where these routes of exposure have been discussed in-depth, has been taught, you can ask the students to provide definitions and an example of each route of exposure: inhalation, ingestion, injection, and absorption.

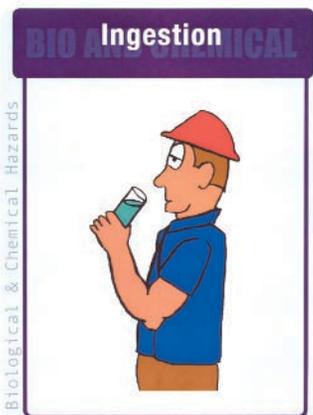
(e.g., absorption is when an agent soaks through the skin, and an example would be spilling a chemical or a lab sample on your bare hands).



Biological and Chemical Hazards – Slide 26

**A. INHALATION**

The most common route of exposure is through the lungs, by breathing in biohazards. Our lungs have protective mechanisms but sometimes we still get sick. Some workplaces have more germs in the air than others. For example, hospitals have many more airborne biohazards than other types of workplaces. Contaminants such as mould and fungus can negatively affect air quality in some workplaces.



Biological and Chemical Hazards – Slide 27

**B. INGESTION**

Working around people or with biohazards requires diligent hand-washing. Hands can become contaminated, and touching your mouth, or something that will go to your mouth, can increase the chance of contacting germs and getting sick.

**Foodborne Diseases**

A common means of exposure to biohazards is through food that is contaminated. Foodborne disease occurs when food or beverages that are contaminated with germs are eaten. There are many types of biological agents that can cause disease, and many types

## Overhead

## Teacher's Notes

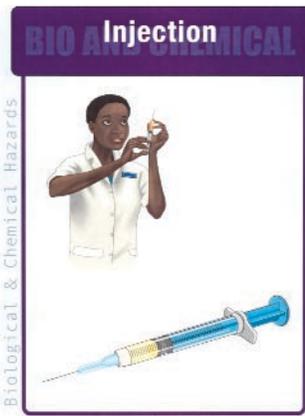
of foodborne disease. The most common types of agents that can cause infectious disease are the *Salmonella* species, *Staphylococcus aureus*, and *Clostridium Perfringens*.

Common symptoms of foodborne disease include nausea, vomiting, abdominal cramps, and diarrhea.

### C. INJECTION

When the skin is punctured by something that is infected with a biological hazard, such as a needle or sharp object, there is a high risk of becoming infected.

Personal protective equipment, such as gloves, must be worn when handling sharp objects. Never handle or dispose of a needle, unless you are trained to do so. Disposing of sharp objects requires a special type of container, properly labelled for the bio-hazard it contains.



Biological and Chemical Hazards – Slide 28



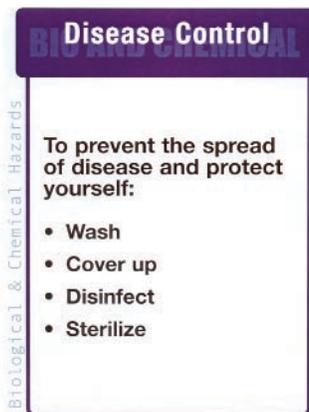
Biological and Chemical Hazards – Slide 29

### D. ABSORPTION

Skin, as the largest organ of the body, is the first line of defence against biohazards. However, if it has an open wound, or has cuts and scratches, then the defence is reduced, increasing the chances of exposure. Putting on a band-aid that adequately covers and seals the wound will keep it clean and separate from germs. In any case, when working with any substances that may be infected, impervious gloves, masks or other appropriate PPE should be used.

## Overhead

## Teacher's Notes



Biological and Chemical Hazards – Slide 30

There are four very simple methods of preventing the spread of disease.

Unlike guarding machinery and wearing complicated personal protective equipment, the basic methods of disease control are very simple.

Why then does disease spread? Perhaps it's because we know to do these things, but we don't always do them properly or at the critical time.

## 1. Handwashing

Preventing the spread of disease has probably the simplest solution – first and foremost, WASH YOUR HANDS. You've been told this since you were young, but it's not just Mother who was right: the world's leading experts in disease control tell their learned colleagues the same thing – WASH YOUR HANDS.

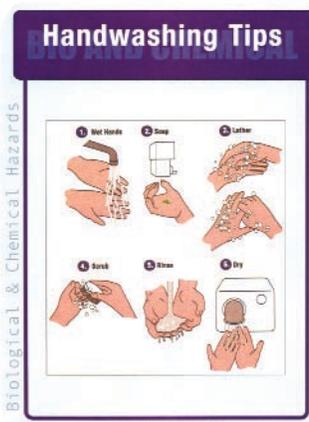
**Note to teacher:** Review and discuss the proper technique of handwashing, and its importance in reducing the risk of spreading germs or getting sick.

### Procedure:

- Use soap and lather up
- Hands should be washed for 30 seconds
- Try not to dirty hands again by touching the faucet taps or bathroom door handle — use a tissue or wipe, or even your elbow if possible.

### When? Before and after:

- Handling foods
- Eating
- Handling animals, plants or people.



Biological and Chemical Hazards – Slide 31

## Overhead

## Teacher's Notes

**Keep Clean:**

- Avoid touching your face
- Keep hands and unclean things away from your eyes, mouth, nose, ears and open wounds.

Good personal hygiene will protect you from exposure and avoid contaminating other people or food.

**2. Covering up to control exposure to biological hazards:**

- Cover cuts with bandages — the best is a bandage impervious to liquids that seals well around an open wound. Gauze alone does not provide adequate protection, nor does a bandage with open sides.
- “Cover your mouth when you cough”. Again, Mother was right! The spread of germs and cross-contamination can be greatly reduced if we only turned away from people, food and other objects and covered our mouths when we cough, sneeze or yawn.
- Using impervious gloves when handling biohazards is important in the food industry. Glove use is only meant for food preparation — if you have to handle money, or go to the wash-room, dispose of your gloves, wash hands between tasks and put new gloves on before you go back to handling food.
- Aprons or coats may be worn to keep yourself clean and sanitary. Depending on the type of work you do and the likelihood that materials can splash on your body, you may need to wear a rubber apron, but generally a lab coat is sufficient for biological hazards.
- Hair nets are essential to keep your hair on your head and not in food.



Biological and Chemical Hazards – Slide 32

**Cool or foolish?**

On TV medical professionals look “professional” in their lab coats and hospital greens.

Wearing a lab coat or hospital greens allows those workers to protect their own clothing from exposure to biological hazards

## Overhead

## Teacher's Notes

such as bodily fluids and lab samples. If their work involves exposure to any biological agents, those same lab coats or greens should not be worn out of the contaminated area and especially NOT into the cafeteria.

- Don't store work clothes with clothes you will wear home.
- Don't wear contaminated clothing outside of the contaminated area and don't bring the clothing home.

### 3. Disinfection

A major source of foodborne disease is cross-contamination. This can occur if cooked food is in contact with uncooked food, or if cooking tools, work surfaces, cloths, or cutting boards that are in contact with contaminated food, e.g. chicken, eggs, come into contact with other food, e.g., dessert, fruit, vegetables. In fact, anything that comes into contact with contaminated food, could also become contaminated.

To prevent this spread, wash whatever has come into contact with food, such as sponges, cloths, utensils, cutting boards and work surfaces. Wash surfaces with hot, soapy water. Germs can remain on certain surfaces, unless they are properly disinfected. Chemicals, like bleach and alcohol, can be used to disinfect surfaces. There are many new retail products that can be used to disinfect kitchen surfaces.

In the workplace, there are many disinfectants such as halogens (hypochlorites and iodine compounds), hydrogen peroxide, phenols, glutaraldehyde, and alcohols. These are commonly used on work surfaces in food preparation areas, hospitals, labs, etc. These chemicals can also be hazardous to different degrees. Read the MSDS prior to use for the safety precautions, PPE, and other details.

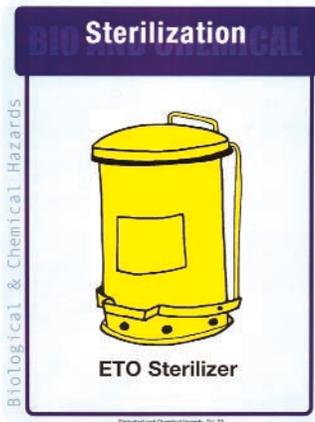
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## Overhead

## Teacher's Notes

#### 4. Sterilization

Disinfection does not completely destroy all harmful biohazards, whereas sterilization does. Sterilization is used in hospitals where bodily fluids and bacteria commonly come into contact with equipment. Ethylene oxide sterilizers and steam are two methods of sterilization. Ethylene oxide is a very toxic gas (and is called a “Designated Substance” by Ontario health and safety law), and is one of the methods used to sterilize equipment, especially plastics that could be destroyed by using high heat as a sterilizer . Only a trained person can use ethylene oxide sterilizers.



Biological and Chemical  
Hazards – Slide 33

Sharing is a fundamental lesson we learn in kindergarten that must promptly be forgotten for any activity that may carry organisms that can harm you.

- Don't use unclean eating utensils and personal items from others, such as combs, hairbrushes, or towels.
- Practice personal hygiene when coughing and sneezing.
- Wash hands thoroughly after handling a person's belongings that could have germs, like laundry, or after visiting someone in hospital.



### Reality Check

Recently, while enjoying a movie at an end-of-term party, students shared pop, chips and other snacks. As this normally goes on in the cafeteria during the school year, no one thought anything of it. However, this time, one of the students was infected with the meningitis virus. She became ill and later died in hospital. This disease can be spread through contact with used utensils or straws, and so many of the students in the class also came down with symptoms. They were promptly treated and the remaining students in the school were vaccinated.

#### **Suggested Learning Activity: Classroom Discussion or Group Work**

Have students provide examples of activities where germs can be spread in school or at home. Have students discuss prevention methods.

#### **POTENTIAL ANSWERS:**

**Germs can be spread by:** Sharing utensils or drinking cups, holding hands, borrowing cosmetics, hairbrushes/combs, or unwashed clothes, not washing hands after using the washroom, walking barefoot in change rooms, eating contaminated food, touching your mouth, face, or eyes with unwashed hands, not covering your mouth when sneezing or coughing.

**Preventing spread of germs:** Proper handwashing after using the washroom, before eating, before food preparation and between touching raw meat and eggs and other foods, using own utensils, not sharing makeup, brushes, or drinking cups, not exchanging unwashed clothing, wearing socks/shoes in change rooms, proper hygiene.

**TECHNOLOGICAL EDUCATION**

Health Care, Grade 11, College  
 Hospitality, Grade 11, College  
 Hospitality and Tourism, Grade 11, Workplace

**Overhead****Teacher's Notes**

### Golden Rules for Safe Food Handling and Preparation



Biological and Chemical Hazards – Slide 34

- Use proper handwashing techniques.
- Wooden cutting boards harbour bacteria more than plastic ones. Wash with hot water and soap after each use. Use wooden cutting boards only for bread and vegetables.
- Sponges, mops, and towels also harbour biohazards. Wash in hot, soapy water, or use disposables.
- Cook raw foods and reheat cooked food thoroughly.
- Choose food processed for safety, like processed milk.
- Right away:
  - Eat foods right away (don't keep them on the stove!).
  - Store foods right away — don't wait for leftovers to cool off before putting them in the fridge— refrigerate immediately (ideally in containers that aren't too deep, or else the centre of the food will still be warm and bacteria will grow).
- Don't let raw food touch cooked food:
  - Keep them physically separated — the smallest contact can cause cross-contamination.
  - Don't use the same knife or cutting board for raw meats and cooked meats or cross-contamination will occur.
- Protect food from insects, rodents, and other animals since they also can carry biohazards and infect the food.
- Keep everything clean:
  - Any surface to prepare food must be kept clean.
  - Clothes that are in contact with dishes or raw food must be cleaned before they are used again.

## Overhead

## Teacher's Notes



## Teacher's Note

You can distribute the handout illustrating proper handwashing technique to reinforce this lesson. It can be found in Section III, Resources in this chapter.

## Handling People

Care must be taken when handling people, especially if they are sick or may be sick. In health care Universal Precautions are taken when handling patients. The idea is that since we cannot tell whether or not someone is infected, we must always protect ourselves by treating all blood and other bodily fluids as if they are a biohazard. Universal Precautions include:

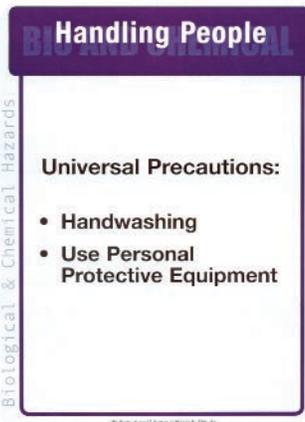
- Handwashing,
- Using personal protective equipment, like latex gloves and a mask, or a face shield if a splash of body fluid could touch our face.

Even touching dirty laundry that may have body fluid on it, could cause illness if workers are not wearing gloves and washing hands afterwards.

## Handling Infants

Handling infants requires safety precautions as well, since you may be dealing with many children at once. Some health and safety tips:

- Bottle-fed infants are at higher risk of infection by bacteria, such as Salmonella, that grow in a bottle of warm formula left at room temperature for many hours. Care must be taken to discard leftover milk, and disinfect the bottle.



Biological and Chemical Hazards – Slide 36

## Overhead

## Teacher's Notes

- Always wash your hands well before feeding a child. If you've changed the baby's diaper, your hands may have material on them that can be hazardous by ingestion, so it's important to wash your hands afterwards and before eating.
- Vaccination to ensure that you don't contract disease is essential.

**Bright Idea!**



### What is Salmonella?

Salmonella is a group of bacteria that can cause “salmonellosis”, resulting in diarrhea, fever, and abdominal cramps 12-72 hours after infection, and lasting an average of 4-7 days. It passes from the feces of people or animals to others. It also comes from eating food like beef, poultry, milk and eggs from an infected animal.

**To Prevent it:** Cook food thoroughly, avoid eating raw or under-cooked eggs, wash hands.

## SCIENCE

Biology, Grade 11, University; College

## Overhead

## Teacher's Notes

## Agriculture and Landscaping

Jobs in agriculture, such as farming and landscaping, including cutting trees and mowing lawns, expose workers to a wide variety of chemical and biological hazards.

Chemicals include: ammonia, carbon dioxide, carbon monoxide, hydrogen sulfide, methane, silo gas (nitrogen dioxide), fertilizers (ammonium nitrate) and pesticides.

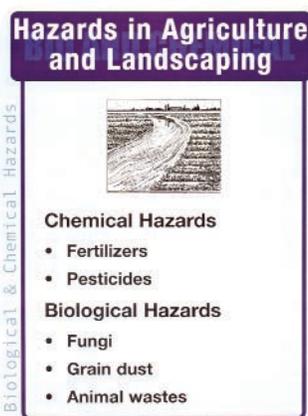
Biological Hazards include: fungi, grain, food, hair/skin, and wastes. Diseases passed from animals to humans are generally called “**zoonoses**”. This means that animals can be infected with a biological hazard, and pass it along to humans. Many types of diseases in animals are not spread to humans.

## Pesticides

Pesticides are used to destroy, repel or prevent an unwanted plant or animal pest. Pesticides are generally applied as dusts, sprays and liquids. These include herbicides, rodenticides, and insecticides. Students can be exposed to pesticides in landscaping and agricultural jobs, or even at home with a consumer product.

Exposure is through inhalation, ingestion or absorption through the skin. The health hazard will depend upon the chemical used — some cause lung damage, others cause poisoning.

Precautions must be taken when diluting strong concentrations. Use the appropriate personal protective equipment, such as a respirator to prevent inhaling the chemicals, and gloves, clothing and boots that prevent the chemical from touching your skin. Make sure you read the MSDS. At home, read the hazard label, manufacturer's instructions, and make sure that ventilation is adequate.



Biological and Chemical Hazards – Slide 37

### Discussion: Confined Spaces in Agriculture

Did you know that manure releases hydrogen sulfide gas? That plant material releases nitrogen dioxide? These are very toxic gases that, when released in a space that has limited entry and exits, are deadly because they compete with oxygen for the space. The oxygen rarely wins and has to move out of the space, making it dangerous for workers.

These spaces are called confined spaces, and include sewers, tanks, and silos. To enter these areas, specific training, procedures and protective equipment are required.



### Reality Check

Recently, in Southern Ontario, a worker on a farm collapsed inside a manure spreader he had been cleaning out. Two other workers, including a young worker, went in to rescue him and also collapsed. All three workers died.

Why did this happen? Nitrogen makes the oxygen move out, and in a confined space, the oxygen level becomes dangerously low, causing confusion. As a result, workers cannot escape safely in time.

When a worker collapses in a confined space, the first reaction of those who find him is to go in and help him. Because of this natural first reaction, far too often there are multiple deaths in confined spaces. When someone has collapsed in a confined space, immediately call for emergency help (911 where available) – DO NOT ENTER THE SPACE.

Confined spaces don't only exist in farms – many workplaces require entry into confined spaces to clean or do repairs – in any case, training and adherence to procedures is not only required – it's a life saver!

## Grade 11 Biological and Chemical Hazards Review Questions

### *Chemical Hazards*

**1. The H in WHMIS stands for:**

- a. household
- b. hazardous
- c. hostile
- d. history

**2. What label(s) is (are) required for WHMIS?**

- a. supplier label
- b. workplace label
- c. consumer label
- d. a and b

**3. A lab sample that is less than X kg does not have an MSDS. What is X?**

- a. 20kg
- b. 5kg
- c. 10kg
- d. 15kg

**4. What does a diamond stand for in a consumer product label?**

- a. danger (most dangerous)
  - b. warning (moderately hazardous)
  - c. caution (least hazardous)
  - d. not hazardous
-

**5. WHMIS legislation requires that:**

- a. MSDSs are expired if they are more than 3 years old
- b. MSDSs must be available for workers to review
- c. MSDSs are expired if they are more than 5 years old
- d. a and b
- e. b and c

**6. The most common route(s) of exposure for a chemical to enter the body is (are) through:**

- a. breathing (inhalation)
- b. swallowing
- c. skin contact
- d. puncture wound
- e. a and c

**7. PPE stands for:**

- a. proper protective equipment
- b. personal protective equipment
- c. personal protective entities
- d. proper prevention equipment

**8. Which of the following are examples of PPE?**

- a. respirators
  - b. gloves
  - c. eye shields
  - d. safety clothes
  - e. all of the above
-

9. In terms of engineering controls \_\_\_\_\_ means putting up a barrier, like a wall between people and the hazard.
10. The burning process requires 4 elements, often referred to as the \_\_\_\_\_.
11. Compressed gases are gases that are contained at greater/less than atmospheric pressure. Circle the correct answer.
12. List 5 of the items that must be contained in an MSDS sheet and explain (for 2) why this is important.

### *Biological Hazards*

1. The two main ways that infectious agents can be spread are \_\_\_\_\_ and \_\_\_\_\_.
  2. When washing hands to prevent the spread of germs, hands should be washed for:
    - a. 10 seconds
    - b. 15 seconds
    - c. 25 seconds
    - d. 30 seconds
-

## Grade 11 Biological and Chemical Hazards Review Questions (with answers)

### *Chemical Hazards*

**1. The H in WHMIS stands for:**

- a. household
- b. hazardous
- c. hostile
- d. history

Answer b

**2. What label(s) is (are) required for WHMIS?**

- a. supplier label
- b. workplace label
- c. consumer label
- d. a and b

Answer d

**3. A lab sample that is less than X kg does not have an MSDS. What is X?**

- a. 20kg
- b. 5kg
- c. 10kg
- d. 15kg

Answer c

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**4. What does a diamond stand for in a consumer product label?**

- a. danger (most dangerous)
- b. warning (moderately hazardous)
- c. caution (least hazardous)
- d. not hazardous

Answer b

**5. WHMIS legislation requires that:**

- a. MSDSs are expired if they are more than 3 years old
- b. MSDSs must be available for workers to review
- c. MSDSs are expired if they are more than 5 years old
- d. a and b
- e. b and c

Answer d

**6. The most common route(s) of exposure for a chemical to enter the body is (are) through:**

- a. Breathing (inhalation)
- b. Swallowing
- c. Skin contact
- d. Puncture wound
- e. a and c

Answer e

**7. PPE stands for:**

- a. proper protective equipment
- b. personal protective equipment
- c. personal protective entities
- d. proper prevention equipment

Answer b

---

**8. Which of the following are examples of PPE?**

- a. respirators
- b. gloves
- c. eye shields
- d. safety clothes
- e. all of the above

Answer e

**9. In terms of engineering controls \_\_\_\_\_ means putting up a barrier, like a wall between people and the hazard.**

Answer (isolation)

**10. The burning process requires 4 elements, often referred to as the \_\_\_\_\_.**

Answer (fire tetrahedron)

**11. Compressed gases are gases that are contained at greater/less than atmospheric pressure. Circle the correct answer.**

Answer (greater)

**12. List 5 of the items that must be contained in an MSDS sheet and explain (for 2) why this is important.**

- 1. Product Information (identifies the product and use, supplier/manufacturer)
  - 2. Hazardous Ingredients (name, concentration and toxicity of each ingredient)
  - 3. Physical Data (physical properties)
  - 4. Fire or Explosion Data (potential to ignite or explode)
  - 5. Reactivity Data (stability and potential to react)
  - 6. Toxicological Properties (how it enters the body and its effects)
  - 7. Preventative Measures (measures to protect a worker)
  - 8. Emergency and First Aid Measures (safe evacuation and treatment)
  - 9. Preparation Information (date of MSDS, by whom and number)
-

***Biological Hazards***

1. The two main ways that infectious agents can be spread are \_\_\_\_\_ and \_\_\_\_\_.

Answer (directly and indirectly)

2. When washing hands to prevent the spread of germs, hands should be washed for:

- a. 10 seconds
- b. 15 seconds
- c. 25 seconds
- d. 30 seconds

Answer d

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**SECTION II**  
**Biological and**  
**Chemical Hazards**  
**Grade 12**

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**SCIENCE**

Biology, Grade 12, University  
Chemistry, Grade 12, University; College  
Science, Grade 12, University/College; Workplace  
Earth and Space Science, Grade 12, University  
Physics, Grade 12, University; College

**Teacher's Note**

In Grade 12 science, while meeting the course expectations, there are two overall objectives in the Live Safe! Work Smart! lessons:

- to reinforce all the chemical and biological safety lessons covered in Grades 9 through 11; and
- to prepare students for application of these lessons.

**Chemical:**

By this time in their school career, students should be familiar with basic **Workplace Hazardous Materials Information System (WHMIS)** requirements:

- Preparing an **inventory of products** at the workplace to determine what materials are present;
- Identifying **labels** on products – knowing that a supplier label has a back-hatched border, that in some cases workplace-prepared labels are suitable, and that in any circumstances all products should be labelled to ensure that the user knows what they're working with;
- That **Material Safety Data Sheets (MSDS)** are required for every WHMIS controlled product in the workplace and that consumer products and food and drug products don't require MSDSs, but have strict labelling requirements to protect users;
- That **training** for workers who are using or working in the proximity of a WHMIS controlled product *must be provided* by the employer; and
- That use of control measures to limit exposure is required based on the physical and chemical properties of the product, including use of **personal protective equipment** when the Material Safety Data Sheet indicates this is required to protect users.

### Teacher's Note (cont'd.)

These lessons have been covered in increasing complexity in Live Safe! Work Smart! from “What is WHMIS?” in Grade 9 to the exercise identifying three key safety messages on a Material Safety Data Sheet in Grade 11.

#### **Biological:**

In Biological Hazard Studies, students were introduced in Grade 9 to the concept of biological hazards existing in the world around us and learned about methods to prevent exposure to them. By Grade 11, the lessons covered the four routes of exposure to bio-hazards and related each route of exposure to methods of protecting people from inadvertent exposure.

The Grade 12 Science Biological and Chemical safety lessons provide the teacher with more flexibility:

- There is always the opportunity to go back to Grade 9, 10 and 11 Biological and Chemical safety messages and repeat concepts that you feel need reinforcement.
- The Grade 12 lessons are designed to help students learn to apply health and safety principles. The teacher can use the lessons for in-class work or assign them as research work. Those possibilities will be highlighted within the lessons. Choices for teachers help them match the needs of students in both workplace and university courses and can help reduce duplication for students who take several science classes.

#### **A good start, for life!**

The science class should always begin with a review of the safety rules for the classroom (a sample list of rules for a science classroom is located in the Grade 9 and 10 Live Safe! Work Smart! Resources section). This exercise makes sure that students are aware of working procedures that will make the science classroom safe, and it also prepares students for working life. When a worker starts a new job, or a new task at work, the employer's first step, according to the *Occupational Health and Safety Act*, is to provide information about hazards and the instruction and supervision the worker needs to do the job safely.

### Classroom Safety Orientation

The lab or classroom may be equipped with safety features and equipment to be used when your health and safety is at risk, including:

- **Fire exits** – Report to maintenance if exit lights are not lit. Always ensure that doors are not blocked.
- **Fire alarm** – Usually by the door; pull to activate. Keep access clear.
- **Fire extinguisher** – Usually mounted on the wall near a doorway. The type of extinguisher should be Multi-Purpose Dry Chemical labelled “ABC”. Directions are on the extinguisher. Always make sure access to the extinguisher is clear — no backpacks in front of it or jackets hung on it!
- **Smoke detectors** – Located on ceilings. Smoke will activate this alarm.
- **Eyewash station** – This may be mounted on the wall or permanently attached to a sink. The eyewash station is used for rinsing chemicals or foreign material from the eye. Keep access to the eyewash clear at all times. Portable “bottles” need regular maintenance to ensure they are clean, fresh and ready for use.  
TIP: Have the students do a routine check to be sure that there is a clear path to the eyewash station each time chemicals are used in the room. The first line of prevention when handling chemicals is wearing safety glasses, chemical splash goggles or face shields, whatever is appropriate for the type of work being done. The eye wash station is the last line of defence after use of personal protective equipment.
- **Optional: Safety shower (deluge shower)** – Use for heat burns and chemical splashes to the skin. Only for emergency use! Keep this area clear. These are usually used only when there are large quantities of chemicals dispensed or handled.
- **Personal Protective Equipment (PPE)** – Use the appropriate safety glasses/goggles, aprons, lab coats, and gloves located in the classroom. Encourage students to report any defects to the teacher (e.g., a hole in the gloves) and insist that they NEVER conduct work with chemicals unless they use the appropriate PPE.

**Bright Idea!****A few simple rules...(a learning opportunity for Grade 12 students)**

By now, students who have been instructed using Live Safe! Work Smart! lessons will be familiar with these rules. At the Grade 12 level, it may be appropriate to turn the tables: rather than providing students with the five rules, have them create some general safety rules regarding chemical handling for the classroom. This simple exercise ensures that students have learned how to use and handle products in a science classroom safely. Familiarity with the general safety rules means that they are prepared to start following safety procedures in their own lives — at their own part-time or summer jobs.

The five rules they establish should be recorded, posted in the classroom and reinforced every time they do a lab assignment. Failure to follow the rules should come with consequences.

The rules should include the five principles listed below. It should be emphasized that these rules are a combination of good work practices and requirements under provincial legislation designed to protect workers and the environment.

1. Check that safety equipment is in place and in good condition, and that access is not blocked;
2. Read labels and MSDSs of the chemicals before use;
3. Use the personal protective equipment required;
4. Use fume hoods when necessary;
5. Dispose of products safely.

## Getting Started – Optional Opening Exercise #1

### Review of key MSDS data and the basics of protecting yourself

Getting started sometimes means going back to reinforce basic concepts. Depending on class needs, repeating an exercise done in Grade 11 that has students determining the hazards of propane based on Material Safety Data Sheet (MSDS) information may be a good start. This makes certain that students can cut through the myriad of facts and information on an MSDS and find the three things they REALLY need to know to protect themselves:

- Properties that make the product hazardous;
- How to use the product safely;
- What to do in case of an emergency, such as a spill.

This can be used as a homework assignment. Students should record the information they find about propane under the three categories. This introductory lesson helps you test whether students can identify information necessary to protect themselves. The propane MSDS is on a handout located in Section III, Resources.

### Potential Answers from the Propane MSDS:

#### 1) *Properties that make propane dangerous:*

Flammable: Carbon monoxide can be produced during combustion.

Fire and explosive hazards: Explosive air-vapour mixture may form if allowed to leak to atmosphere.

Storage: Keep separate from oxidizing agents. Gas explodes spontaneously when mixed with chloride dioxide. Also note Section 6 "Toxicological Properties" to see health effects.

#### 2) *How to Handle the Product Safely*

Eyes: Safety glasses, goggles or face shield required when transferring product.

Skin: Insulated gloves required if contact with liquid is expected. Wear gloves and long sleeves when transferring product.

Respiratory Protection: Not required with normal use.

Storage: Store at temperatures below 120° F in well-ventilated, spark-free, flame-free area. Also see "Section 9 - Transportation, Handling and Storage".

**Getting Started – Optional Opening Exercise #1 (cont'd.)**

3) *What to do in case of an emergency:*

If propane is spilled, remove ignition sources and ventilate area. Eliminate the leak if possible.

Ensure cylinder is upright. Monitor low areas as propane is heavier than air and can settle into low areas. Remain upwind of leak. Keep people away. Prevent vapour and/or liquid from entering into sewers, basements or confined areas.

**Eyes:** Should eye contact with liquid occur, flush eyes with lukewarm water for 15 minutes. Obtain medical care immediately.

**Skin:** In case of “Cold Burn” from contact with liquid, immediately place affected area in lukewarm water and keep at this temperature until circulation returns. If fingers or hands are frost-bitten, they should be held under the armpits. Obtain medical care immediately.

**Inhalation:** Remove person to fresh air. If breathing is difficult or has stopped, administer artificial respiration. Obtain medical care immediately.

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## Getting Started – Optional Exercise #2

### Analysis of hazardous properties of chemicals and protection factors

This exercise provides the teacher with two approaches. One involves having students doing some initial research using the Internet and then having a class discussion; the other involves doing the initial work in class from handouts, followed by the same class discussion.

#### *1) Student Research Option*

Sometimes workers may not have all the information they need about chemical products at their fingertips. This exercise shows the student that they have resources available on the web to help them find out more about working safely.

Students are assigned the task of going to any or all of the following websites:

1. <http://msds.pdc.cornell.edu/msdssrch.asp>
2. <http://www.hazard.com>
3. <http://www.hc-sc.gc.ca/hpb/lcdc/biosafety/msds/index.html>
4. <http://www.physchem.ox.ac.uk/MSDS/#MSDS>
5. <http://www.fishersci.com/chemical/info/msdsinfo.jsp>
6. <http://siri.org/msds/>

On these web sites, they are to locate MSDSs for the two products listed and prepare a brief report on the substances in their own words, i.e., properties associated with the chemicals and safe handling and emergency procedures.

1. Varsol
  2. Acetone
-

**Getting Started – Optional Exercise #2 (cont'd.)*****ANSWERS FOR THE EXERCISE:***

The reports on the products should contain information on:

**Chemical and Physical Properties**

- What kind of product is it?
- What are its characteristics? Boiling point? Vapour pressure? Flash point? What other characteristics make this chemical hazardous? For example, lipophilic, low molecular weight, non-polar chemicals are readily absorbed through the gastrointestinal tract, skin and lungs.
- What state is it in?

**Health Hazards**

- What are the health risks?

**Safe Handling Procedures**

- What personal protective equipment should be worn? How should the chemical be stored and handled? What should be done if it spills?

**Emergency Procedures**

- What first aid procedure should be used if the chemical gets into the eye or is inhaled or ingested?

**Further considerations when handling a hazardous product include: WHAT CONCENTRATION OF THE CHEMICAL will they be working with, HOW LONG might they be working with it, and HOW OFTEN, since these factors will also determine the degree of the hazard that they will be exposed to.**

***2) Classroom Method***

In case students do not have access to the Internet, MSDSs for varsol and acetone are provided as handouts in the Resources section of this chapter. You can copy and distribute these and ask students to perform the same analysis and report either in class or as a homework assignment.

## Overhead

## Teacher's Notes

### Recognition, Assessment and Control

Starting in the mandatory Grade 10 Career Studies course, students following Live Safe! Work Smart! lessons have been exposed to the basic principles of health and safety: recognizing a hazard, assessing the hazard and then putting controls in place to prevent exposure to the hazard.

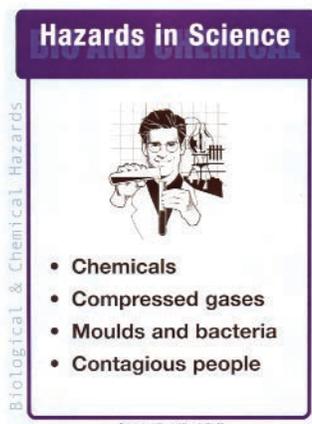
This Biochemical safety lesson for Science courses follows the same principles. The two optional opening exercises asked students to **RECOGNIZE** hazards of a product by going to an MSDS and determining properties that make the product hazardous to use, handle or store. Further, they had to **ASSESS** the properties of the product and think about how those properties make the substance they reviewed hazardous. Then they had to consider how to **CONTROL** exposure to the substance so that the risk to users is minimized.

Keeping to this theme, the following lessons focus further on examples of RECOGNITION, ASSESSMENT and CONTROL.

### Recognizing Hazards

Material Safety Data Sheets, labels on hazardous products, and our knowledge and experience teach us that chemicals, compressed gases, animals, moulds, bacteria, contagious people, plant material, poor air quality and many other chemical and biological agents can be hazardous to our health.

In science, we must recognize that the nature of work we do can expose us to hazards. Recognition that biological and chemical hazards exist is the first step in providing for safety in the science setting.



Biological and Chemical Hazards – Slide 38

## Overhead

## Teacher's Notes

## Assessing Hazards

Assessing hazards means spending time determining the nature of the hazards and how they can act and interact.

This phase is critical — it will determine the appropriate means of controlling the hazards in the third step of the process.

### Assessment: Biological Hazards

When we know or suspect that we are in the presence of a hazardous biological agent, the assessment phase of hazard analysis must include thought about how the biohazard can infect us and how it can spread.

“**Routes of exposure**” are the means by which substances can enter our body. The route can be through: inhalation (breathing), ingestion (swallowing), injection (penetrating skin and tissue), or absorption (through skin).

The way in which a biohazard spreads is known as the “**mode of transmission**”.

#### There are two modes of transmission:

**Direct:** This is defined as the “transfer of the infectious agent to a ‘route/portal of entry’, often with physical contact”.

Activities where direct transmission may be facilitated include biting, kissing, touching, sexual activities, and direct projection of saliva (less than 1 metre) into the mucous membranes of the eye, nose and throat during spitting, coughing, sneezing, singing, or talking, e.g., STDs, mononucleosis.

**Indirect:** Indirect transmission can be vehicle-borne, vector-borne or airborne.

*Vehicle-borne* is through exposure to contaminated materials such as toys, clothes, bedding, utensils, water (e.g., cholera, poliomyelitis), food (e.g., mad cow disease, trichinosis, food poisoning), milk, or biological products.

*Vector-borne:* The agent is spread by an insect (arthropod), e.g., lyme disease from ticks, malaria, encephalitis.

**Assessing Biological Hazards**

**Modes of transmission**

- Direct
- Indirect
  - Vehicle-borne
  - Vector-borne
  - Airborne

Biological & Chemical Hazards

Biological and Chemical Hazards – Slide 39

Biological and Chemical Hazards – Slide 39

## Overhead

## Teacher's Notes

*Airborne:* Microbial aerosols (a suspension in air of particles that contain the germs) enter a portal of entry, usually into the respiratory tract. These aerosols can stay suspended for long periods of time. They include contaminated dust from soil, bedding, or floors, e.g., influenza, tuberculosis.

**Considerations for Assessing Chemical Hazards:**

There are many things that need to be considered when assessing the hazards of a chemical product. In a simple and practical approach, this means two things: recognizing the properties that make a product hazardous, and determining how the product will be used.

**Properties:** The properties of chemicals are found on a Material Safety Data Sheet. Knowing if the product is a solid, liquid or gas is one simple example of understanding physical properties. Also essential to safe handling of a product is knowing what type of chemical it is, if it's flammable or reactive. Knowing that a material is flammable or combustible is one thing, but knowing more about that property will make you more conscious of how to work with it safely.

**Flammable and Combustible Liquids** both have the ability to burn and are fuels. They give off vapour that can be easily ignited. Combustibles are generally not as easy to ignite as flammable liquids.

Flammable liquids can cause skin irritation. Inhalation of vapours can cause immediate injury if they are inhaled in a large dose, or in small exposures over a long period of time. Flammable liquids are usually heavier than air, and can take the place of oxygen and thus create low oxygen atmospheres that are immediately dangerous to health and may result in death, especially in confined spaces.

Assessing Chemical Hazards

- **Properties**
  - Read the MSDS
  - Flammable vs combustible liquids
- **Intended use**
  - Confined space vs outdoors
  - With or without other chemicals

Biological & Chemical Hazards

Biological and Chemical Hazards – Slide 40

Biological and Chemical Hazards – Slide 40

## Overhead

## Teacher's Notes

**Intended Use**

Knowing how or where a product will be used will determine the necessary safe work precautions. If the product will be used in a confined space (one with limited egress where there is poor ventilation, like a tank) and it has the property of displacing oxygen, supplied-air respirators may be necessary, but if the product is used out-of-doors where there is sufficient ventilation, the precautions for handling it may be totally different.

Another important consideration is whether the product will be used or mixed with other chemicals. We all know that when you add salt (NaCl) to ice (frozen H<sub>2</sub>O) the ice melts — a reaction.

What happens if we are going to use bleach to sanitize wash-rooms and decide to use ammonia as well, because it's a better cleaner than bleach? One would assume that the two together would really get the job done! However, ammonia and bleach, when mixed, form hazardous phosgene gas. There have been far too many reported cases of housekeeping staff being overcome by this very hazardous gas, simply by mixing the two chemicals.

When you get a new prescription from the drug store, pharmacists will ask if you're taking any other prescription or over-the-counter medication. The reason they ask is to avoid the same risk as mixing bleach and ammonia — some medications and chemicals can have potentially dangerous reactions when used together and put our health and safety at risk.

**Reality Check**

Did you know that even water can be a hazard when mixed with the wrong chemical? When water is added to concentrated acid in a beaker, the water/acid mixture can react and spray out of the beaker into the face of the individual. The resulting acid burns to the eyes and face can be devastating. This situation has occurred in many lab and workplace settings in the past several years because individuals are not aware of the proper mixing procedures for certain chemicals. Make sure you can safely mix two chemicals before you start and if you are not sure, ASK!

## Overhead

## Teacher's Notes

### Controlling Hazards

Whether biological or chemical, there are some common methods of controlling exposure to hazards.

The **FIRST** and foremost control is to **ELIMINATE** the use of the hazardous product, or at least **SUBSTITUTE** it for a less hazardous product.

Consider if a chemical is really necessary to do the job — do we use it because “it’s always been used” or because “we saw it on TV”? Eliminating the use of a product is not always possible, but substitution is often a very reasonable possibility.

Substitution is used to reduce the exposure of people using a product to a hazard and to ensure that hazardous agents are **not** released into the environment — through the sewage system, into the soil or into the air. Often substitutions also save money.

Are you aware of some common substitutions used in households?

Some examples include:

1. Toothpaste to clean running shoes (rather than commercial whitening agents).
  2. Baking Soda as an air freshener in the refrigerator (rather than artificial solutions that produce scents).
  3. Vinegar and water solution for cleaning windows (rather than commercial cleaners containing flammable solvents).
-

**Bright Idea!**



### Substitution Saves Us All

As an additional activity, students could research some substitutions the experts have proposed. Internet resources include:

1. [www.city.toronto.on.ca/environment/index/htm](http://www.city.toronto.on.ca/environment/index/htm)
2. [www.ecomall.com/greenshopping/](http://www.ecomall.com/greenshopping/)
3. [www.epa.gov](http://www.epa.gov)
4. [www.environmentalchoice.com](http://www.environmentalchoice.com)
5. [www.prodaware.com/substitute.html](http://www.prodaware.com/substitute.html)

## Overhead

## Teacher's Notes

### CONTROL MEASURES

When elimination of the use of a hazardous product is impossible, or when substitution with a non-hazardous material isn't feasible, other control measures must be taken to protect those using it.

NOTE: Usually a Material Safety Data sheet will provide suggested control measures based on the properties of the product.

#### 1) Engineering Controls:

**Isolation:** Unnecessary exposure of workers to some biological or chemical hazards can be prevented by keeping the substances in isolation. People infected with contagious diseases are kept in isolation until the threat of spreading the disease has passed. The same principle is applied in research laboratories where biological hazards are present. Processes that involve hazardous chemicals are often kept in separate areas of the workplace to minimize chemical exposure.

### Engineering Controls

- Isolation
- Proper Storage
- Ventilation

## Overhead

## Teacher's Notes

**Proper Storage:** Certain types of containers are more suited to certain products. An acid that will “eat” through plastic should be kept in a glass container. Flammable liquids, defined in the Industrial Regulations as those with a flashpoint under 100 degrees Fahrenheit or 37.8 degrees Celsius, are to be stored and dispensed from special containers with spring-loaded caps and flame arrestors. When in storage, flammables are kept in a special explosion-proof cabinet. Dispensing of flammables in large quantities is carried out in a specially constructed storage room.

**Ventilation:**

*General:* This is the type of ventilation found in homes, classrooms, and workplaces. Also known as a HVAC system (Heating, Ventilation and Air Conditioning), this type of ventilation is used to provide “fresh air” (also called make-up air) to a room through an intake vent. Air is either heated or cooled, and replaces stale air, which is drawn out through exhaust vents. You might also have natural dilution ventilation when you have windows or doors open, allowing air to circulate throughout the room.

*Local Exhaust Ventilation:* Many workplaces use local exhaust ventilation in addition to their general ventilation system, since it is an efficient and safe way to capture and remove a chemical at or near the source, and to keep the possibility of fire and explosion for highly flammable material down. This type of ventilation usually has a hood, ducts, an air cleaner, and a fan. Local ventilation is required for very hazardous substances. When set up properly, local ventilation protects workers by removing the chemical from the breathing zone.

**2) Work Practices:**

How we work, the care we take, and the general practices we put in place, are important in the overall protection of people exposed to hazardous substances. It's essential to establish and enforce procedures, such as keeping the work area clean, making sure all spills are properly cleaned up, and reading an MSDS when handling a new chemical for the first time.

Workplaces should have health and safety policies and procedures in place. Workers should be trained in these procedures and follow them at all times.

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## Overhead

## Teacher's Notes

Other types of work practices could include:

- Prohibiting smoking or open flames where flammables are used;
- Prohibiting eating, drinking or smoking in areas where biological hazards are present;
- Being aware of electricity as a source of ignition where flammables are present — use spark-resistant tools and ensure that all electrical installations are inspected and approved;
- Bonding and grounding when flammable liquids are dispensed from one container to another to prevent sparks that can ignite vapours;
- Securing compressed gas cylinders in an upright position during storage and use;
- Disinfecting of surfaces where biological hazards may exist, for example using bleach to remove mould and mildew;
- Sterilizing materials that have been exposed to biological hazards, by boiling or using a commercial steam or gas autoclave; and
- Using antiseptic procedures, such as applying alcohol to someone's arm before injecting a needle to be certain that there are no micro-organisms on the surface of the skin that could enter the bloodstream at the point of injection.

**Universal Precautions:**

Universal precautions are established safety procedures used primarily in health and child care facilities, but which can be used in many occupations where there is any potential exposure to biological agents. Police officers, ambulance attendants, and laboratory and hospital staff almost always take universal precautions.

These precautions are taken on the assumption that all bodily fluids are infectious, and as a result, may cause disease.

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## Overhead

## Teacher's Notes



Biological and Chemical  
Hazards – Slide 42

Universal Precautions should be adopted at all times to protect against disease when working with sick people:

- Use the correct gloves to prevent contact
- Cover cuts with bandages and wear gloves for added protection
- Wash hands frequently
- Wash hands immediately after removing gloves or after touching blood or other bodily fluids
- Use care when handling or disposing of sharp materials such as needles or broken glass
- Avoid eating, drinking, or touching your mouth, nose or eyes when there is a risk of being exposed to blood and other bodily fluids.

Contact a supervisor if an injury (such as getting stuck by a needle) or illness occurs and seek medical assistance.

### 3) Administrative Controls:

In any situation where a worker is required to work with or in close proximity to a hazardous agent, **training** is required. Training is your first line of defence — knowing what the hazards are and how to protect yourself from them. Knowledge is power and not knowing can be deadly. Where training or instruction does not occur and you're required to work with a chemical or biological agent (even transporting blood samples from one room to another in a hospital), the supervisor **MUST** be alerted immediately. Where no training is provided, workers have the right to refuse to perform the task.

NOTE: work refusal procedures are covered in the Workplace Law chapter of this Live Safe! Work Smart! Grade 11 and 12 edition.

Other administrative controls may include frequent breaks, work procedures, rotation of jobs, etc.

## Overhead

## Teacher's Notes

**4) Personal Protective Equipment (PPE):**

Personal Protective Equipment can be described as equipment that protects our body from inhaling, ingesting or absorbing a hazardous substance. It can also protect us from puncture wounds, which can cause exposure to biochemical hazards through injection. Gloves, safety glasses, respirators, masks and impervious clothing are common types of PPE.

In many workplaces in the construction and manufacturing industries PPE such as hardhats and safety boots must be worn at all times to protect against injury from falling items or sharp objects. In workplaces where exposure to biological or chemical hazards is a concern, PPE is considered to be the “last line of defence”. It is not acceptable to simply provide workers with respirators when steps can be taken to reduce or eliminate the source of potential exposure. PPE is often used in conjunction with safe work practices, on an interim basis when other controls are being put in place, during repair work, when other controls cannot be used, or during emergencies.

It is the worker's responsibility to wear the required PPE and to notify management if the equipment has defects or doesn't fit properly. If, for example, you are using eye protection and the safety glasses fit loosely around your nose and can slip off, report the problem and get a pair that will not allow chemicals to get into your eyes.

Students should consult an MSDS to determine the type of PPE that should be used when handling a particular substance.



Biological and Chemical Hazards – Slide 43



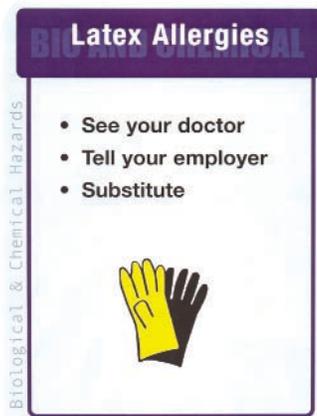
### Reality Check

Recently, a lab employee at a university in Ontario was not wearing her PPE. It was the weekend and she just had one more mixture to make. She knew that the chemical, mercuric acetate, was lethal with just one drop, that it was extremely hazardous and that personal protective equipment was absolutely necessary, but proceeded with her work without any protection. Unfortunately, as she was pipetting the liquid, a drop got on her hand. She knew her fate immediately. She died in hospital one month later after experiencing gradual loss of all functions.

It is important to be aware of the hazards of any chemical that you are working with and to ALWAYS use the control measures suggested in the MSDS and required by your employer.

## Overhead

## Teacher's Notes



Biological and Chemical Hazards – Slide 44

### A Note About Latex Allergies

Some protective equipment, especially disposable gloves used as a barrier to protect against contact with a biological agent, may contain latex.

Some people develop allergies to latex. Latex gloves are often used in health care, food handling, first aid, and in laboratories. In health care, latex is also found in catheters, IV tubes, and syringes. Allergic reactions can cause immediate or delayed reactions — from rashes, or skin irritation, to more severe reactions such as swelling and difficulty in breathing.

If a latex allergy is diagnosed or suspected, a substitute such as neoprene, nitrile or tactylon gloves can be used.

Other steps can be taken, such as using good quality gloves that are non-powdered since powder spreads latex proteins into the air, or, in extreme cases, asking to be assigned to a latex-free work area.

If you suspect you may have a latex allergy, get medical attention and inform your employer.

**Teacher's Note: Options for Wrapping up the Lesson**

Since this section provides materials for several different disciplines in the Science strand and covers workplace to university levels, several different types of assignments have been prepared to help you end the lesson. In all cases, they are designed to give the student the opportunity to apply the safety principles for handling chemical and biological hazards in a practical way.

**OPTION 1: Fill in the Blanks**

A handout for this fill in the blank exercise can be found in the Resources section of this chapter. The bleach MSDS has all the information about bleach on it, except for the safe handling procedures. The objective of the exercise is to have students analyze the properties of bleach and provide the appropriate safe handling procedures.

**Potential answers:**

*Ventilation:* local mechanical exhaust ventilation capable of minimizing emissions. The room should be properly ventilated, with windows and doors open.

*Personal Protective Equipment:* Hand protection: rubber gloves; Eye protection: safety glasses; a respirator appropriate for the vapor or mist concentrations; possibly a rubber apron and long sleeves.

*Emergency Equipment:* eyewash station

*Hygienic work practices:* wash hands after handling this product.

*Additional precautions:* do not mix with ammonia or other chemicals.

**OPTION 2: Industry Controls – *great for workplace-bound students!***

Lead a class discussion or give students a homework assignment based on the following chart. Students should be asked to brainstorm on appropriate control methods for the types of chemical and biological hazards found in common industries where many young people find employment.

At the same time, they should be encouraged to give practical examples based on any work experience they or someone they know has had.

For your reference, possible answers are provided below. A handout for this activity is in Part III, Resources.

Industries	Chemical Hazard	Suggested Control Methods
Retail	Cleaners, solvents, compressed gases	
Manufacturing	Solvents, degreasers, cleaners, propane (lift trucks)	
Restaurants	Cleaners, compressed gas, disinfectants	
Construction	Glues, solvents, paints – spray application, compressed gases, gasoline, dust	

**ANSWERS:**

Control measures may include:

- substitute for less hazardous chemical or eliminate use of the product;
- proper ventilation;
- safe work practices including not mixing chemicals, reviewing labels and MSDSs;
- training;
- wear proper PPE (e.g., gloves, respirator, eye protection);
- secure compressed gas cylinders.

**OPTION 3: Don't Minimize Minerals**

Naturally occurring minerals, such as silica, are processed and used in industry. Although many operations have found a less harmful substitute for silica, it is still used. With silica, the hazards to people come from inhalation of dust.

A Material Safety Data Sheet for Crystalline Silica can be found in the Resources section of this chapter.

Have students use the MSDS and research how the mineral is used in industry, and prepare a brief report on:

1. Common uses (should include sandblasting, abrasives)
2. Methods used to control general exposure (elimination, substitution, isolation of processes)
3. Common methods of personal protection when using silica (respirators with cartridges for silica).

**OPTION 4: Universal Precautions in a Student's Universe: *An in-class brainstorming session***

This exercise provides the opportunity for students to discuss their own experiences with biohazards in the workplace, and the importance of using universal precautions. Have students come up with several situations or jobs that they may have been in where there was the potential for the spread of bacteria. This should outline WHAT that potential was, HOW they could have been exposed, and what precautions they TOOK or SHOULD HAVE TAKEN to reduce the risk of contact with the biohazard.

For your reference, examples the students may have encountered include:

**Changing hotel or hospital bedsheets**, where bodily fluids can remain on articles and clothing. Mode of transmission: indirect (touching contaminated articles). Route of exposure: ingestion (touching contaminated hands to mouth, eyes, nose). Glove use would protect the hands from contact with the articles, and proper handwashing after removing the gloves and finishing the task would be necessary.

**Dental assistants or clean-up workers in a dental office** can be exposed to bodily fluids. Mode of transmission: indirect through airborne droplets, or through touching objects, or directly by being splashed. Route of exposure: inhalation, ingestion (contaminated hands). They need to follow the proper safety procedures for needle disposal, wear PPE such as gloves, a mask, and sometimes eye/face protection.

**Child care workers, including babysitters**, are exposed to illnesses prevalent among young children, that could be transmitted directly, such as through biting or scratching (direct, person-to-person), or indirectly (airborne), such as coughing, or vehicle-borne (contaminated articles, such as toys). Child care workers are also in contact with bodily fluids. To protect themselves, they need to wear proper PPE, such as when changing diapers, and use the proper handwashing technique.

**OPTION 5: On-the-job research**

Have the students talk to friends and family or use their own job and determine what hazardous substances (either chemical or biological agents, or both) that they or someone they know might be exposed to. The students can then search for appropriate MSDSs on the Internet, obtain a copies from the workplace or determine the effects of exposure through research.

The result should be a short paper on:

- The type of job where exposure occurs;
- What the hazardous biological or chemical agents are;
- Why they are hazardous;
- How the people in that occupation are exposed — what tasks cause exposure or how do they use the chemical; and
- Methods that should be used to control the exposure.

The students could then present their findings to the class.

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**TECHNOLOGICAL EDUCATION**

Hospitality and Tourism, Grade 12, Workplace  
Child Development and Gerontology, Grade 12, College

**Teacher's Note**

In Grades 9 and 10, students learned about the basics of the Workplace Hazardous Materials Information System (WHMIS). Some students may have taken a course in Grade 11 where students learned the importance of a Material Safety Data Sheet (MSDS). You may want to review the WHMIS lesson at the beginning of this Biological and Chemical Hazards chapter to determine the level of knowledge that students have.

**Overhead****Teacher's Notes****Infectious Biological Agents**

These are living organisms that can cause illness or disease. They include:

- Bacteria;
- Viruses; and
- Fungi.

There are many names for these organisms, but, for the purpose of studying them, we will refer to them as biohazards. Unlike physical hazards that we can see, biohazards are not always something we can sense that we're exposed to. This increases our vulnerability. We need to be aware that in certain types of work, we are likely to be exposed to these hazards.

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## Overhead

## Teacher's Notes

Suppliers of products that are biological hazards label them with a WHMIS label and symbol to make workers aware of the hazard. The WHMIS symbol for a biological hazard is depicted on the overhead.

The main problem with biological agents is that normally “safe” products and procedures can become sources of biological infection due to unsanitary work practices.

### **Recognize and Assess Your Exposure**

Routes of exposure are through inhalation, ingestion, injection and absorption. In the food and service industries, exposure most often occurs from inhalation and ingestion:

- Cleaning products such as bleaches, stainless steel cleaners, and ammonia can cause health effects such as lung and skin problems.
- Food can be contaminated with biological hazards, such as Salmonella or E.coli, which can spread if proper precautions for handling food are not followed.
- Bed linen and other articles can also be contaminated.
- Poor work practices such as changing diapers without washing hands after changing each child and/or before eating can lead to exposure.

### **Controlling Hazards**

#### **Working With People**

Working in an environment with the elderly or children requires health and safety precautions to protect yourself and others from the spread of germs. Germs, or “biohazards”, can be spread by handling articles infected people have used or by coming into contact with bodily fluids.

#### **Disinfection**

One important step in reducing the spread of biological agents, is the thorough cleaning of surfaces that could possibly pose a risk. For example, in child care, surfaces that can be contaminated are

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## Overhead

## Teacher's Notes



Biological and Chemical Hazards – Slide 45

those that children are in close contact with, such as toys, crib rails, food preparation areas and diaper-changing areas. Spills of body fluids, including blood, feces, nasal and eye discharges, saliva, urine, and vomit should be cleaned up immediately and properly disposed of. Proper personal protective equipment, such as impervious gloves may be necessary. Cleaning with an agent, such as bleach and water, or other types of germicides, can be effective. If working with industrial chemicals, read the WHMIS symbol and label, and the Material Safety Data Sheet (MSDS). Retail disinfectants will not have an MSDS, but will have a warning label and instructions that you should examine prior to use.

### Handwashing

It cannot be emphasized enough that handwashing is critical to reducing the spread of disease, and the possibility of infection. Handwashing prior to eating, and after tasks like changing diapers and handling people, is essential. Always wash your hands well before feeding a child or eating. If you've changed the baby's diaper, your hands may have material on them that can be hazardous by ingestion.

### Personal Protective Equipment and Training

Depending on the task, you may require personal protective equipment, such as hand protection, to protect your skin from absorbing germs, or being punctured by a sharp object that is contaminated. Employers must train workers about the hazards they're exposed to, and make them aware of controls that are required for the situation. If you are unsure, always ask your supervisor for the information.

### Control Your Exposure by Using Proper Procedures

By using proper safe work procedures we can greatly reduce our risk of exposure to biological and chemical hazards.

- Use proper handwashing techniques when working with people or preparing food.
- Wear PPE including gloves when in contact with bodily fluids.

## Overhead

## Teacher's Notes

- Always examine the WHMIS symbol and label and read the MSDS when using chemicals.
- Wear safety glasses when there is a risk of being splashed by cleaning chemicals or grease.

**Bright Idea!**

**Some health and safety tips for handling infants:**

- Bottle-fed infants are at higher risk of infection by bacteria, such as salmonella, that grow in a bottle of warm formula left at room temperature for many hours. Care must be taken to discard left-over milk, and to disinfect the bottle.
- Vaccination against specific diseases is essential.
- Make sure that you wash your hands after each diaper change to ensure that you don't spread disease to family members or other children.

**Reality Check**

There are many diseases that may be contracted when working with others. These include measles, whooping cough, strep throat, thrush, mumps, mononucleosis, scabies and hepatitis A. It's important to recognize the hazards that you may come in contact with, and take proper precautions to ensure that the diseases are not spread. This can be done by washing hands at regular intervals, and wearing gloves when in contact with bodily fluids.

## TECHNOLOGICAL EDUCATION

Hairstyling and Aesthetics, Grade 12, Workplace

## Overhead

## Teacher's Notes

## Biological and Chemical Hazards

There are many biochemical hazards that are present when working with others, and especially in hairstyling and aesthetics since these occupations involve working directly with many people.

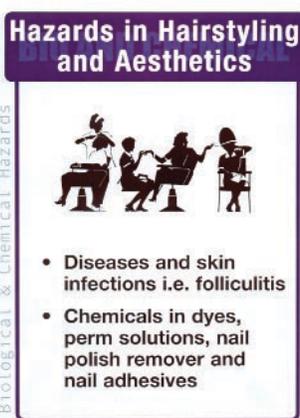
*Biological Hazards:* Although they may not be seen, biological hazards are present, and can be spread from contact with an article, such as a comb, a razor, nail cutters, or manicure and pedicure surfaces. Biological hazards include diseases and certain types of skin infections. One such example is **folliculitis** — this can be spread when razors, brushes and scissors are not disinfected before use on the next person. In addition, razors can cause cuts, and there is potential for spread of disease through an open wound.

*Chemical Hazards:* Working with chemicals, such as those for dyeing and bleaching hair, perm solutions, nail polish remover and nail adhesives, can cause skin, lung, and eye irritation. In addition, aerosol hairsprays can become an inhalation hazard if the work area is not ventilated properly.

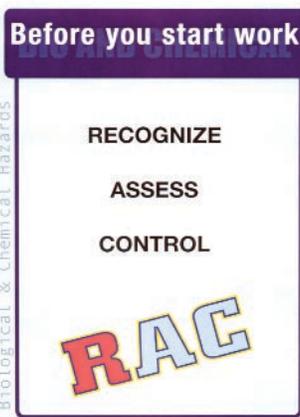
## Recognize, Assess and Control Your Hazards Before Starting

*Recognize:* Before beginning a task, examine what the chemical you will be using is by reading the label, the WHMIS symbols, and the MSDS. Consider how a task could spread disease. Do you or a client have an open cut? Will you be handling manicure and pedicure tools?

*Assess:* Examine the situation. Is there adequate ventilation in the room? Do you have the personal protective equipment, like



Biological and Chemical Hazards – Slide 46



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## Overhead

## Teacher's Notes

impervious gloves, that you will need for the task? Have equipment and manicure and pedicure work surfaces been disinfected before use with a new client?

*Control:* To reduce the spread of bacteria, fungus and other biological hazards, consider if disposable products can be used. One-time use of nail buffers and similar tools that can collect biological materials is the best way to prevent the spread of disease.

Where it is not practical to use disposables, you need to protect yourself and your customers by disinfecting combs, razors, scissors, nail cutters, buffers, cuticle tools, blades and other materials you use, before and after you see each customer.

A commercial grade disinfectant (don't water it down!) to sanitize all tools after every use is essential. Nail stations need to be completely sanitized and basins for soaking feet or hands must be thoroughly sanitized and any filters or drains must be removed and disinfected.

Hand protection may also be required. If you have a cut, cover it and wear gloves for added protection against both chemicals and infection. When using chemicals, follow the control measures, such as wearing suitable gloves, recommended in the MSDS.

The hazards associated with hair styling and aesthetics may be more difficult to address than hazards in other industries, although they can be just as dangerous. That's simply because the chemical products are so commonly used that workers and customers don't recognize the hazards. In addition, biological hazards are not easily seen, so they may go unrecognized. Diligence on the part of stylists, aestheticians and owners is essential to protect workers as well as clients.

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### Optional Activity: Disinfection

To help students be more prepared for work in a salon and to tie in lessons they've received throughout their secondary school career, a simple research product on disinfectants/sterilizers used in the profession is recommended. The exercise has students locating and reviewing Material Safety Data Sheets (MSDSs), something they've been exposed to since Grade 9. Since MSDSs are mandatory in all workplaces where commercial products are used, the exercise is not only practical, but can also give them skills to protect themselves at work.

- Students must first identify the name and type of disinfectant/sterilizer used in the salon, review the appropriate Material Safety Data sheet and determine the hazards associated with the product and the control measures that should be implemented to protect workers.
  - If there is an MSDS for the disinfectant available in the classroom, it can be copied and distributed to help the students. Otherwise, they may be able to get one from a local salon or the website of the supplier or manufacturer.
-

## TECHNOLOGICAL EDUCATION

Medical Technology, Grade 12, College



### Teacher's Note

In the mandatory Grade 10 Career Studies course students were introduced to the concepts of recognizing, assessing and controlling for hazards that may occur in the workplace. You may want to review these concepts in the Grade 10 Societal Issues chapter of *Live Safe! Work Smart!* before continuing with these lessons that provide more detail on controls that students can follow in the medical sector. You may also want students to review Universal Precautions covered on page 40 of this chapter.

### Overhead

### Teacher's Notes

We can be infected by biohazards that enter our bodies in several ways, such as through inhalation, ingestion, absorption through the skin and injection. Universal Precautions are those standard procedures that we use to protect ourselves, because we must assume that certain tasks present the possibility of infection. The following examines in more detail some hazards in health care.

### Injection

In health care, most injuries are caused by injection, as a result of needlestick injuries, or handling broken glass and other sharp objects.

Puncturing of the skin by a needle can occur during capping, or in the process of disposing of needles. Proper training in handling and disposing of needles is required. If you have not been trained, do not handle needles. Always assume a needle is contaminated with blood or toxic chemicals and that touching it could result in a serious, life-threatening disease. If stuck, get first aid immediately and report the injury. Handling sharp objects requires use of appropriate personal protective equipment and disposal techniques.



Biological and Chemical Hazards – Slide 48



### Reality Check

Did you know that needlestick injuries are common occupational injuries in the health care field? Employees are advised to visit the employee health centre immediately after a stick and get tested for HIV and hepatitis. However, even if they test negative, the concern is not over. The employees must return for an HIV test 6 months later to give the virus time to show up in the blood. Thus, it is not only the initial injury that is of concern, but it is the stress and waiting for the next 6 months. Thus, when changing bed linens, always check for needles before reaching for the sheets in a place you can't see — this is not the time to play guessing games.

### Overhead

### Teacher's Notes

**Biological Hazardous Waste:** include contaminated sharps, such as hypodermic needles, as well as syringes, Pasteur pipettes, broken glass, scalpel blades, blood and blood products, materials contaminated with body fluids and blood, and cultures from laboratories.

*What do you need to do as a worker?*

**Recognize** the biological hazards.

**Assess** the situation. Never place hands, even with gloves, into a container. Never attempt to put waste into a full container.

**Control** the situation. If it is part of the job to clean up, you should exercise Universal Precautions, including the use of proper footwear and gloves. Dispose of biohazardous waste in a puncture-resistant container marked with the biological hazards symbol. Proper training from the employer is essential.

“Isolation wastes” are those generated by patients who are isolated because of communicable diseases. A health care facility will have special handling procedures for these wastes.

## Overhead

## Teacher's Notes

## Chemical Exposure

In addition to biological hazards, workers in health care are exposed to a number of chemicals, such as waste sterilant and anesthetic gases, formaldehyde as a tissue preservative, industrial disinfectants and other cleaning agents such as glutaraldehyde.

Before beginning to work with a chemical, you must have the appropriate training. Read the WHMIS label and symbol, and the MSDS to understand:

- safety precautions to take,
- emergency procedures to use and
- what the health effects are.

For example, the effects of glutaraldehyde, which is used as a cold sterilant, include irritation of mucous membranes and contact dermatitis. Ethylene oxide is used in health care as a gas sterilant. It can cause cancer, and is a designated substance under provincial legislation that requires that specific health and safety precautions be taken when it is used in the workplace.

Workers can also be exposed to exhaled anesthetic gases in recovery rooms and in operating rooms with inadequate scavenging systems. Scavenger systems are special ventilation systems designed to exhaust exhaled anesthetic gases from a room, reducing exposure of the operating room staff to excess gas.

## Latex Allergies

Some protective equipment, especially disposable gloves, which are used as a barrier to protect against contact with a biological agent, may contain latex.

Some people develop allergies to latex. Latex gloves are often used in health care, food handling, first aid, certain manufacturing processes and laboratories. In addition to gloves, latex is also found in catheters, IV tubes, and syringes. Allergic reactions can be immediate or delayed. Symptoms can range from rashes, or skin irritation, to more severe reactions such as swelling and difficulty in breathing.

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## Overhead

## Teacher's Notes

If a latex allergy is diagnosed or suspected, a substitute such as neoprene, nitrile or tactylon gloves can be used. Other steps can be taken, such as using good quality gloves that are non-powdered since powder spreads latex proteins into the air. In extreme cases, ask to be assigned to a latex-free work area.

If you suspect you may have a latex allergy, get medical attention and inform your employer.

## Bright Idea!



The following are words commonly used in the medical profession, regarding the spread of biological agents. These definitions can be reviewed in class, or the words can be assigned as a homework assignment for the students to research and report back on.

***Antiseptic:*** A chemical which has the ability to destroy potentially infectious microorganisms and which can be used safely on living tissues, e.g., alcohol on your skin before a needle is administered.

***Disinfection:*** The use of germicidal chemical agents to destroy infectious agents, e.g., chlorine bleach to kill mould.

***Sterilization:*** The use of a physical process or chemical agents to eliminate all live microorganisms. Examples are steam and gas autoclaving, and dry heat ovens. Steam sterilization, also known as autoclaving, involves the use of saturated steam within a pressure vessel at temperatures high enough to kill infectious agents. Sterilization is accomplished primarily by steam penetration. Steam sterilization is effective with low-density material such as plastics. Incineration is an alternative method.

Gas/vapour sterilization uses a chemical such as ethylene oxide as the sterilizing agent.

***Thermal inactivation:*** The use of high temperatures to eliminate the presence of infectious agents, usually used for large volumes of infectious waste. Liquid waste is collected in a vessel and heated by heat exchangers or a steam jacket surrounding the vessel. Solid infectious waste is treated with dry heat in an oven, which is usually electric. This method requires higher temperatures and longer treatment cycles than steam treatment.

**TECHNOLOGICAL EDUCATION**

Manufacturing Technology, Grade 12, Workplace  
Manufacturing Engineering Technology, Grade 12, College  
Transportation Technology, Grade 12, College; Workplace  
Construction Technology, Grade 12, College; Workplace

**Teacher's Note**

A review of material introduced in Grade 9 Live Safe! Work Smart! in the Chemical and Biological Hazards chapters and reinforced through Grade 11 can be done before further lessons. In those lessons, students learned about WHMIS, the MSDS and concepts of fire safety and working with flammable materials. This Grade 12 lesson is a practical approach to reinforce principles of personal health and safety in the workplace.

**Recognize:** Students should be aware of hazards in their workplace and what they might need to do to be safe.

**Assess:** This includes thinking about health and safety and the situation they are confronted with.

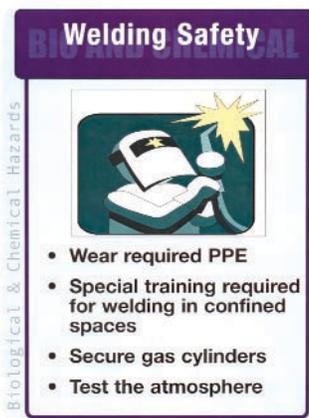
**Control:** This involves training, preparation, administrative procedures, workplace practices and equipment, personal protective equipment that is necessary, as well as asking further questions from employers, or from others who can provide them with necessary information.

**Prevention Message**

Some jobs may seem safe and easy but involve processes and practices that can cause injury, illness or disease. The key to safely handling these jobs is having the right tools, procedures, work practices and training to work safely. Part of “getting ready” to take on the job is asking questions and getting answers. You have the right to learn about these hazards from your employer, and the right to be trained to use safe work procedures. You also have the right to refuse unsafe work.

## Overhead

## Teacher's Notes



Biological and Chemical Hazards – Slide 49

The manufacturing, construction and transportation technology industries all involve many types of chemical and biological hazards. Although there are some common processes and chemicals used, they also can differ from workplace to workplace.

One practice common to most workplaces is welding. There are many different types of welding, and each has its own hazards. But, on a general basis, some of the hazards include: breathing in metal fumes or toxic gases, eye and skin damage from infrared and ultraviolet radiation, fire or explosion hazard from hot work in an explosive atmosphere and the use of compressed gases.

In order to make sure you are getting the protection you need, make sure you get training and ask your supervisor any questions you have about doing the job safely. Some general control measures that can be utilized include: training; local and general ventilation; respirators; eye and face shields, and protective clothing and hand protection (depending on the type of welding).

### Welding Tips

- Air that has more oxygen in it can cause things to be more easily ignitable (burn faster).
- Liquids, gases and dusts can be combustible.
- Always wear all protective equipment required for the job.
- There is specific training and education for work in confined spaces (limited access and egress, like manholes, tanks) — never weld in this environment unless you have the training and follow proper procedures.
- Wear eye protection and install shields or barriers to prevent bystanders from being exposed to weld flash.
- Make sure compressed gas cylinders are secured in position so they can't fall and that acetylene is always in an upright position.
- Have the atmosphere tested to find out if it's a potentially explosive atmosphere.

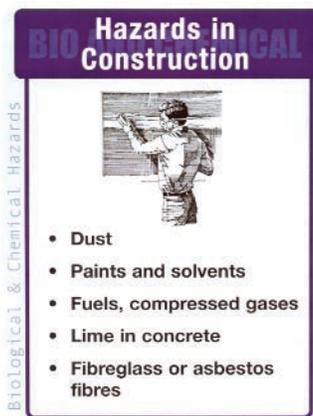
### Suggested Learning Activity

Ask students about jobs they may have had or are aware of. List some hazards and their controls. Some examples:

Job	Hazard	Control
Painting and spraying (paint, pesticides, coatings)	Inhaling solvent mists, vapours, toxic material; skin and possible eye contact; fire hazards from flammable material, compressed gases	<ul style="list-style-type: none"> <li>- training</li> <li>- respirator, eye protection, skin protection (gloves and clothing)</li> <li>- no smoking while working near compressed gases</li> <li>- proper storage</li> </ul>
Repair and maintenance of cars, equipment	Inhaling solvent vapours, dust, gases; skin contact with grease, oil and solvents; noise from equipment; fire hazard from flammable material (i.e., solvent recovery systems)	<ul style="list-style-type: none"> <li>- training</li> <li>- adequate ventilation</li> <li>- personal protective equipment, e.g., ear plugs or muffs, gloves</li> <li>- no smoking, other sources of ignition near flammables</li> <li>- proper storage of flammable and explosive material</li> </ul>
Shipper/Receiver	Inhaling chemical stored in warehouse, exposure to plastic fumes from bag sealers, diesel exhaust, propane, gasoline exhaust from forklifts and trucks, possible burns from acid of battery or explosion from battery hydrogen gas	<ul style="list-style-type: none"> <li>- training</li> <li>- adequate ventilation</li> <li>- proper storage and ventilation of chemicals</li> <li>- safe work practices, e.g., shut off engines during loading</li> <li>- don't charge batteries near source of ignition</li> <li>- preventive maintenance for trucks, batteries, etc.</li> </ul>

**TECHNOLOGICAL EDUCATION**

Construction Technology, Grade 12, College; Workplace

**Overhead****Teacher's Notes**

Biological and Chemical Hazards – Slide 50

There are a variety of health hazards in construction, depending on the trade and the job that is being done. On a construction site, workers can be exposed to hazards when performing certain tasks themselves, or as bystanders in the vicinity of work being done by workers in other trades. Hazards include:

- Dust, including fibrous material
- Solvents and their vapours
- Fire hazards from compressed gases or flammable liquids
- Paints/urethanes
- Fibreglass fibres from insulation
- Asbestos dust in removal operations
- Dust from sanding drywall or refinishing floors
- Fuels, oils and compressed gases (propane heaters)
- Lime in concrete.

The following are some examples of hazards and control measures to reduce exposure.

**Dust Inhalation**

Exposure to dust in construction can occur when mixing cement, sawing lumber, cutting tiles, or sanding drywall. Most of these dusts are lung irritants. Synthetic fibres and mineral wool in insulation can be inhaled and cause skin and lung problems. Dust masks are an appropriate means of reducing exposure.

## Overhead

## Teacher's Notes

## Inhalation and Absorption

Some chemicals will enter the body through inhalation, as well as by being absorbed through the skin. Paints, wet cement, and solvents, used in the installation of terrazzo tile, wood flooring, and wallboards, can cause skin disorders and adversely affect the lungs. Some solvents, paints and pesticides will affect other organs of the body as well. Glues or adhesives can also contain potentially toxic solvents that can be both absorbed by the skin and inhaled. One way to decrease inhalation when using paints is to roll the paint on rather than spray it. This will help to decrease the airborne concentration of the paint available for inhalation. Good ventilation is important. Respirators may be necessary in certain operations.

## Asbestos

Asbestos is a designated substance, which means it is regulated when used in the workplace, requiring specific health and safety precautions.

Asbestos exposure may occur during renovations, and in repair work where there is removal of tiles, insulation and pipes lined with asbestos. Asbestos is extremely hazardous to health when inhaled in fibre form, causing diseases such as lung cancer, asbestosis (fibrosis), and mesothelioma (cancer of the lung's lining). Removal of asbestos can only be done by specially trained professionals who have special equipment.

If you're asked to perform a task and you think that asbestos may be present, immediately bring it to the attention of your supervisor. There are strict controls required by law to protect workers. Material can be tested to determine if asbestos is present.



Biological and Chemical  
Hazards – Slide 51

**Bright Idea!**



To get more information about procedures for working with asbestos, you can purchase the guide to the asbestos on construction projects regulation and the regulation itself from your local Ministry of Labour office or from Publications Ontario. Publications about working with asbestos are also available for a minimal cost from the Construction Safety Association of Ontario. General information about the asbestos on construction projects regulation is on their website at [www.csa.org](http://www.csa.org)

**Overhead**

**Teacher's Notes**

### **Flammables and Combustible Material**

In certain conditions, wood dust can be an explosive. Appropriate ventilation is required. Fires have occurred from improper use of propane heaters and uncontrolled welding practices. Proper use and storage is required and isolation from sources of ignition, such as smoking, is essential.

### **Controls**

Training is essential to the recognition, assessment and control of workplace-specific hazards. Personal protective equipment, such as gloves, respirators, and eye protection are necessary when working in dangerous environments where dust, fibres, and vapours are present or may be created. To protect the skin, appropriate clothing should also be worn. Local exhaust ventilation may be necessary. Employ safe work practices, such as not standing upwind of cutting, and not using compressed gas for cleaning tools. Wet methods can be used to decrease dust generation. Smoking at work will increase possible ingestion of chemicals and dust and should be avoided.



### Teacher's Note

The Ministry of Labour has specific regulations under the *Occupational Health and Safety Act* governing construction, called the Regulations for Construction Projects .

A CD on construction legislation, produced by the Construction Safety Association of Ontario, is an excellent resource for your students. Some sample copies have been distributed to schools. A copy can be purchased from CSAO for a minimal cost. Information on how to contact CSAO is in the Resources section at the back of Live Safe! Work Smart!



### Reality Check

While pouring cement to finish a basement floor, two workers were kneeling in their jeans in the wet cement for several hours. Thinking it was only wet cement, they thought nothing of the job. However, after finishing the work and cleaning up, one of the workers noticed that he could not get the blackened cement off his knees. He later realized that this was not cement but burnt skin from the lime in the cement. He had to undergo skin grafts to restore the skin on his legs. Had the worker read the Material Safety Data Sheet (MSDS) before beginning the job, he would have noticed that the MSDS from the manufacturer recommended precautions to take, such as avoiding long-term contact with the cement. He would have also got information on the proper safety equipment to wear when working with this brand of cement. It is important when working with a new substance that you learn about the material and the proper precautions, and, if you are unsure, ASK!

**ARTS**

Visual Arts, Grade 12, University/College  
Exploring the Arts, Grade 12, Open

**Teacher's Note**

You may want to review Live Safe! Work Smart! material on chemical safety in the Grade 9 and Grade 10 edition. In Grade 11 arts students learned about Material Safety Data Sheets (MSDSs), and labels and explored concepts of recognizing, assessing and controlling hazards. A safety lesson focussing on chemical materials and specific issues for the arts classroom is ideal in the first few days of class at the beginning of a semester.

Consider chemicals that students will be working with and have the MSDSs available for discussion. By stressing working safely in your arts class, you send a message that is consistent in the curriculum — that safety is a priority in your classroom and students must understand safety concepts and be prepared to work safely in class.

If you'd like some help on establishing classroom safety rules, the student handout provided in Live Safe! Work Smart! Grade 9/10 in the Resources section of the Chemical module is a good start.

During your safety discussion, you may want to consider discussing any or all of the following that will be used in your classroom, along with the activities you'll undertake during the year/semester:

Oils

Glue

Solvents

Clays

Ink

Acrylics

Charcoal

You will want to emphasize proper use, handling and disposal of these products. Particularly dangerous products like varsol and linseed oil, which are highly flammable, should be reviewed in detail. Improper disposal (e.g., a heap of discarded rags) of linseed oil or paints is an invitation to spontaneous combustion.

A review of where the Material Safety Data Sheets and personal protective equipment (PPE) are stored and rules concerning their use and care should be taught at the beginning of the semester/year and emphasized every time a project will involve the use of WHMIS controlled products and/or PPE.

### Suggested Activity

Paint thinners are often used to clean paint brushes after use and students should be aware of some of the hazards when using varsol.

This exercise should be a review of what students have learned in earlier years and will assure you that students have basic skills in recognition, assessment and control of hazards.

An Material Safety Data Sheet for varsol is provided in the Resources section of this chapter. In a classroom discussion or as a homework assignment, have them pick out the three things that are most important for them to know when handling varsol.

- 1) Preventive Measures for how to use it safely, and what to do if there is a spill;
  - 2) First Aid Measures to know what to do in case of emergency;
  - 3) Properties that make it hazardous, such as fire and explosion data, reactivity data and health hazards.
-

## Grade 12 Biological and Chemical Hazards Review Questions

### *Science*

**1. MSDS stands for:**

- a. Material Standards for Dangerous Substances
- b. Material Safety Data Sheet
- c. Material Safety for Designated Substances
- d. Material Safety Description Sheet

**2. MSDSs contain information on:**

- a. Physical Hazards
- b. First Aid Procedures
- c. Substitution of alternative chemicals
- d. a and b

**3. What does the term RAC prompt you to do?**

- a. Recognize, assess and control
- b. Realize, act and continue
- c. React, assess and continue
- d. Recognize, act and control

**4. Routes of \_\_\_\_\_ are how chemicals enter our body and mode of \_\_\_\_\_ is the term for how biohazards are spread.**

**5. An example of vehicle-borne transmission would be:**

- a. getting a cold after touching contaminated toys
  - b. getting lime disease after a tick bite
  - c. a student getting meningitis after sharing a can of pop
  - d. a and c
-

- 6. An example of vector-borne transmission would be:**
- getting a cold after touching contaminated toys
  - getting Lyme disease after a tick bite
  - a student getting meningitis after sharing a can of pop
  - a and c
- 7. What is the term for using an alternative product that is less harmful to one's health and the environment? Give an example.**
- 8. You would use dilution ventilation**
- in the gym
  - in a fume hood
  - in an auditorium
  - a and c
- 9. You would use Local Exhaust Ventilation**
- in the gym
  - in a fume hood
  - in an auditorium
  - a and c
- 10. If you or someone you know has an allergy to latex, what would be the best advice for them?**
- continue to wear latex gloves, because you will get used to them
  - substitute neoprene or nitrile gloves for the latex gloves
  - don't wear any gloves at all — if you are allergic to latex, you will be allergic to all gloves
  - switch between neoprene and latex gloves to give your hands a break
-

***Technological Education (Hospitality and Tourism, Child Development and Gerontology)***

- 1. Common ways for hazards to enter our bodies (routes of exposure) are:**
  - a. inhalation
  - b. ingestion
  - c. absorption
  - d. all of the above
  
- 2. True or False? It is necessary to wash your hands after changing each infant, even if you are changing several at one time.**
  
- 3. True or False? If you are preparing chicken for dinner, there is no need to wipe off the utensils used to clean the chicken before using them on another item because everything will be cooked anyway, and that will get rid of the contaminants.**

***Technological Education (Hairstyling and Aesthetics)***

- 1. True or False? You can spread infections from one client to another by not disinfecting or sterilizing the razor after use.**
  
  - 2. True or False? You don't need to cover up any cuts that you have when working with a client because, when you are washing their hair or using chemicals, the soap or chemicals will kill any contaminants that may get on your cut.**
  
  - 3. Which of the following represents an inhalation hazard or causes irritation if the salon is not properly ventilated?**
    - a. aerosol hairsprays
    - b. perm solutions
    - c. nail polish remover
    - d. all of the above
  
  - 4. What does the term RAC prompt you to do?**
    - a. Recognize, assess and control
    - b. Realize, act and continue
    - c. React, assess and continue
    - d. Recognize, act and control
-

***Technological Education (Medical Technology)*****1. What does the term RAC prompt you to do?**

- a. Recognize, assess and control
- b. Realize, act and continue
- c. React, assess and continue
- d. Recognize, act and control

**2. True or False? The chemicals that you use to sterilize equipment are safe because they get rid of all the bacteria and biohazardous substances?****3. If you or someone you know has an allergy to latex, what would be the best advice for them?**

- a. continue to wear latex gloves, because you will get used to them
- b. substitute neoprene or nitrile gloves for the latex gloves
- c. don't wear any gloves at all — if you are allergic to latex, you will be allergic to all gloves
- d. switch between neoprene and latex gloves to give your hands a break

**4. An example of an antiseptic would be:**

- a. alcohol
- b. formaldehyde
- c. latex
- d. ethylene oxide

**5. The term “biological hazardous waste” refers to:**

- a. needles
  - b. syringes
  - c. blood
  - d. all of the above
-

## Grade 12 Biological and Chemical Hazards Questions (with answers)

### *Science*

**1. MSDS stands for:**

- a. Material Standards for Dangerous Substances
- b. Material Safety Data Sheet
- c. Material Safety for Designated Substances
- d. Material Safety Description Sheet

(answer b)

**2. MSDSs contain information on:**

- a. Physical Hazards
- b. First Aid Procedures
- c. Substitution of alternative chemicals
- d. a and b

(answer d)

**3. What does the term RAC prompt you to do?**

- a. Recognize, assess and control
- b. Realize, act and continue
- c. React, assess and continue
- d. Recognize, act and control

(answer a)

**4. Routes of \_\_\_\_\_ are how chemicals enter our body and mode of \_\_\_\_\_ is the term for how biohazards are spread.**

(answers — exposure, transmission)

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**5. An example of vehicle-borne transmission would be:**

- a. getting a cold after touching contaminated toys
- b. getting lime disease after a tick bite
- c. a student getting meningitis after sharing a can of pop
- d. a and c

(answer d)

**6. An example of vector-borne transmission would be:**

- a. getting a cold after touching contaminated toys
- b. getting lime disease after a tick bite
- c. a student getting meningitis after sharing a can of pop
- d. a and c

(answer b)

**7. What is the term for using an alternative product that is less harmful to one's health and the environment? Give an example.**

(answer — substitution, toothpaste to clean running shoes rather than commercial whitener)

**8. You would use dilution ventilation**

- a. in the gym
- b. in a fume hood
- c. in an auditorium
- d. a and c

(answer d)

**9. You would use Local Exhaust Ventilation**

- a. in the gym
- b. in a fume hood
- c. in an auditorium
- d. a and c

(answer b)

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**10. If you or someone you know has an allergy to latex, what would be the best advice for them?**

- a. continue to wear latex gloves, because you will get used to them
- b. substitute neoprene or nitrile gloves for latex gloves
- c. don't wear any gloves at all — if you are allergic to latex, you will be allergic to all gloves
- d. switch between neoprene and latex gloves to give your hands a break

(answer b)

***Technological Education (Hospitality and Tourism, Child Development and Gerontology)***

**1. Common ways for hazards to enter our bodies (routes of exposure) are:**

- a. inhalation
- b. ingestion
- c. absorption
- d. all of the above

(answer d)

**2. True or False? It is necessary to wash your hands after changing each infant, even if you are changing several at one time.**

(answer T)

**3. True or False? If you are preparing chicken for dinner, there is no need to wipe off the utensils used to clean the chicken before using them on another item because everything will be cooked anyway, and that will get rid of the contaminants.**

(answer F)

***Technological Education (Hairstyling and Aesthetics)***

**1. True or False? You can spread infections from one client to another by not disinfecting or sterilizing the razor after use.**

(answer T)

---

- 2. True or False? You don't need to cover up any cuts that you have when working with a client because, when you are washing their hair or using chemicals, the soap or chemicals will kill any contaminants that may get on your cut.**

(answer F)

- 3. Which of the following represents an inhalation hazard or causes irritation if the salon is not properly ventilated?**

- a. aerosol hairsprays
- b. perm solutions
- c. nail polish remover
- d. all of the above

(answer d)

- 4. What does the term RAC prompt you to do?**

- a. Recognize, assess and control
- b. Realize, act and continue
- c. React, assess and continue
- d. Recognize, act and control

(answer a)

***Technological Education (Medical Technology)***

- 1. What does the term RAC prompt you to do?**

- a. Recognize, assess and control
- b. Realize, act and continue
- c. React, assess and continue
- d. Recognize, act and control

(answer a)

---

**2. True or False? The chemicals that you use to sterilize equipment are safe because they get rid of all the bacteria and biohazardous substances.**

(answer F)

**3. If you or someone you know has an allergy to latex, what would be the best advice for them?**

- a. continue to wear latex gloves, because you will get used to them
- b. substitute neoprene or nitrile gloves for the latex gloves
- c. don't wear any gloves at all — if you are allergic to latex, you will be allergic to all gloves
- d. switch between neoprene and latex gloves to give your hands a break

(answer b)

**4. An example of an antiseptic would be:**

- a. alcohol
- b. formaldehyde
- c. latex
- d. ethylene oxide

(answer a)

**5. The term “biological hazardous waste” refers to**

- a. needles
- b. syringes
- c. blood
- d. all of the above

(answer d)

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# **SECTION III**

## **Resources**

**Where to Get More Information**

**Student Handouts**

**Overheads**



## Where to Get More Information

### Chemical Health and Safety

#### Health Canada

[http://www.hc-sc.gc.ca/english/magazine/2001\\_04/pesticides.htm](http://www.hc-sc.gc.ca/english/magazine/2001_04/pesticides.htm)

This website, “Don’t bug me!- use pesticides safely”, includes links to more information about pesticide use, including use in and around the home.

#### Environment Canada

<http://www.atl.ec.gc.ca>

A website that provides links to topics such as hazardous waste and toxic chemicals. A resource page provides links to information about different types of toxic chemicals in the environment and their proper disposal.

### National Institute for Occupational Safety and Health (NIOSH)

#### “NIOSH Pocket Guide to Chemical Hazards”

<http://www.cdc.gov/niosh/npg/pgdstart.html>

A free on-line version of the pocket guide developed by the U.S. National Institute for Occupational Safety and Health.

### Fire Safety

#### Office of the Fire Marshal

<http://www.gov.on.ca/OFM/index2.html>

Information on fire prevention and protection is available on this Ontario government site.

### Biological Health and Safety

#### Health Canada, Health Protection Branch–Laboratory Centre for Disease Control

#### “Laboratory Biosafety Guidelines”

<http://www.hc-sc.gc.ca/hpb/lcdc/biosafety/docs/index.html>

Extensive information about laboratory safety from the federal government.

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## Health Canada, Population and Public Health Branch–Office of Biosafety

“Material Safety Data Sheets”

<http://www.hcsc.gc.ca/hpb/lcdc/biosafety/msds/index.html>

A collection of MSDSs for various infectious substances. These have been designed to be a safety resource for laboratory personnel, but should be useful for everyone working with infectious substances.

## Ontario Ministry of Health and Long-Term Care

[http://www.gov.on.ca/health/english/pub/pub\\_links/pub\\_pubhealth.html](http://www.gov.on.ca/health/english/pub/pub_links/pub_pubhealth.html)

Fact sheets on public health topics, such as hand hygiene, and some communicable diseases.

## Ontario Ministry of Agriculture, Food and Rural Affairs

<http://www.gov.on.ca/OMAFRA>

The website provides links to other organizations that provide food safety information. It also contains a list of available publications. Free publications can be ordered using the on-line order form. To order paid publications print the on-line form and fax it to (519) 826-3633.

## Child Care Health and Safety

“The ABCs of Safe and Healthy Child Care”

<http://www.cdc.gov/ncidod/hip/abc/abc.htm>

This website offers an on-line handbook for child care providers, including information on biological hazards encountered in child care.

## Art Health and Safety

### Health Canada

“Art Teacher, Be Aware”

[http://www.hc-sc.gc.ca/ehp/ehd/catalogue/bch\\_pubs/art\\_teacher.pdf](http://www.hc-sc.gc.ca/ehp/ehd/catalogue/bch_pubs/art_teacher.pdf)

Download this free PDF version of a booklet about the safe use of arts and crafts materials. Although intended for elementary school teachers, the booklet provides background information about the hazards of a variety of crafts and materials, which may be useful for secondary school teachers.

“**Health Hazards in the Arts: Information for Artists, Craftspeople, and Photographers**”

<http://wally.rit.edu/pubs/guides/healthhaz.html>

This guide lists a selection of recent books, periodicals, and other library materials about the health and safety of visual and performing artists.

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## Teachers' Websites

### Science Teachers Association of Ontario

<http://www.stao.org>

An organization that provides safety resources for science teachers and links to other science-related sites. There are links to various course content and safety websites.

## General

The Ontario Ministry of Labour, the Health and Safety Associations and the Canadian Centre for Occupational Health and Safety all have resources on WHMIS and chemical and biological safety. Some resources are free, while others may require a nominal fee. Information about these organizations can be found in the Resources section at the very back of this volume of Live Safe! Work Smart!

### OSH For Everyone

<http://www.oshforeveryone.org/wsib/>

This website, maintained by Canadian health and safety organizations, offers a wide variety of health and safety information. Link to “specific hazards” to obtain information about particular biological and chemical hazards.

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Explanation of Material Safety Data Sheet (MSDS) Sections

### Section 1: Product Information

- Product Identifier: Name of Product and Product Use:
- Manufacturer's Name, Address, and Emergency Telephone Number
- Supplier's Name, Address, and Emergency Telephone Number

### Section 2: Hazardous Ingredients

This section identifies the names of chemicals and their percentage of the total concentration.

- CAS # (The Chemical Abstracts Service Registry Number is the identification number assigned to a chemical substance by the Chemical Abstracts Service Division of the American Chemical Society.)
- Chemical (A list of all hazardous ingredients in the product.)
- Concentration (% of each ingredient)
- PIN (Product Identification Number)
- LD50 (Species and Route)
- LC50 (Species and Route)

"LD50" means the single dose of a substance that, when administered by a defined route in an animal assay, is expected to cause the death of 50 per cent of a defined animal population.

"LC50" means the concentration of a substance in air that, when administered by means of inhalation over a specified length of time in an animal assay, is expected to cause the death of 50 per cent of a defined animal population.

### Section 3: Physical Data

This section includes properties such as the following:

Odour & Appearance; Odour Threshold (concentration where one can begin to smell the product)

Physical State	Boiling Point
Solubility in Water	Freezing or Melting Point
Specific Gravity	PH
Co-efficient of Water/Oil Distribution	Evaporation Rate
Vapour Pressure/Density	Viscosity

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Explanation of Material Safety Data Sheet (MSDS) Sections

### **Section 4: Fire or Explosion Data** [how easily it catches fire or explodes]

Conditions of Flammability [if yes, conditions where ignition can occur]

Fire Extinguishing Precautions [equipment and protection needed to fight the fire, e.g., type of fire extinguisher/protective equipment required]

Sensitivity to Mechanical Impact/Static Discharge [description of possible explosion due to impact or discharge, e.g. bond and ground dispensing container]

Flashpoint and Method [minimum temperature at which liquid gives off enough vapour to ignite in the presence of a source of ignition under specific test conditions]

Flammable or Explosive Limits [(upper and lower limits, % by volume) upper and lower concentrations of a gas/vapour in air where explosion or fire can occur with the presence of a source of ignition]

Auto-ignition temperature [temperature at which the vapour from a liquid will ignite without a source of ignition]

Hazardous Combustion Products [products that evolve from heat or combustion]

### **Section 5: Reactivity Data**

Stability [is it stable and, if yes, under what conditions?]

Incompatible Materials [if yes, lists materials to avoid (can be a name or class of substances) that the product is not compatible with]

Conditions of Reactivity [if yes, lists conditions to avoid]

Hazardous Decomposition Products [product that can be released if the substance is aged, heated, burned, oxidized, or reacts]

Hazardous Polymerization [if it will occur]

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Explanation of Material Safety Data Sheet (MSDS) Sections

### **Section 6: Toxicological Properties** [how it affects human health]

Route of Entry: [specifies routes, e.g. skin contact, absorption, inhalation, ingestion, eye contact and may include an explanation of health hazards and effects on the body]

Effects of Acute Exposure to Product [health effects from short-term exposure]

Effects of Chronic Exposure to Product [health effects from repeated exposure over a long period of time]

Exposure Limits [amount of the substance that workers may be exposed to daily without adverse health effects]

TWAEV: Time Weighted Average Exposure Value

STEV: Short Term Exposure Value

CEV: Ceiling Exposure Value

Irritancy of Products [capacity of substance to produce effects such as irritation, erythema, burns or swelling]

Synergistic Products [other substances that interact with the product resulting in a toxic effect greater than the sum of the effects of each substance acting separately]

Carcinogenicity [is there evidence that the substance can cause cancer?]

Sensitization to Product [if product can cause sensitization — repeated exposure can result in the body responding faster, with the effect staying longer]

### **Section 7: Preventative Measures** [Precautions for safe handling and use, Personal Protective Equipment (PPE) and other measures]

Eye Protection (specifies the type, e.g., goggles, face shield)

Respiratory/Inhalation Protection (specifies the type, e.g., type of respirator and cartridge, or dust mask)

Hand Protection (specifies the type, e.g., neoprene gloves. Will sometimes offer different types according to testing)

Foot Protection (specifies the type, e.g., safety boots)

**Live Safe!  
Work Smart!**



# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Explanation of Material Safety Data Sheet (MSDS) Sections

**Section 7: Preventative Measures** [Precautions for safe handling and use, Personal Protective Equipment (PPE) and other measures] (**continued**)

Other Equipment: [any other equipment required for safe handling of the product]

Engineering controls (specifies type, e.g., type of ventilation, enclosure)

Waste Disposal and Storage Requirements

Handling, Shipping/Transportation Procedure [can include Transportation of Dangerous Goods classification, shipping name and PIN]

Note: Sometimes Transportation, Handling and Storage will be in its own section on the MSDS.

**Section 8: Emergency and First Aid Measures**

Spill or leak [action to be taken if there is a spill or leak]

First Aid [what to do in case of any of the following]

Inhalation

Ingestion

Eye Contact

Skin Contact

**Section 9: Preparation Information** [date will inform you if MSDS is up-to-date]

Name, telephone number of group, person, department who prepared MSDS

Date of Preparation

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Propane MSDS

### SECTION 1 - PRODUCT INFORMATION

<b>Product Name:</b>	Propane
<b>Trade Name:</b>	LPG (Liquified Petroleum Gas), LP-Gas
<b>Chemical Formula:</b>	C <sub>3</sub> H <sub>8</sub>
<b>Date of MSDS:</b>	00/00/0000
<b>MANUFACTURER INFORMATION</b>	
<b>Supplier/Distributor:</b>	ABC Inc
<b>Address:</b>	75 Anywhere Court Anytown, Ontario Canada, L3R 9S3 Telephone: 999-999-9999
<b>Emergency Telephone No.:</b>	999-999-9999

**WHMIS Classification:** *Class A - Compressed Gas*  
*Class B, Division 1 - Flammable Gas*

**Application and Use:** Propane is commonly used as a fuel for heating, cooking, automobiles, forklift trucks, crop drying and welding and cutting operations. Propane is used in industry as a refrigerant, solvent and as a chemical feedstock.

### SECTION 2 - HAZARDOUS INGREDIENTS

COMPONENTS	CAS NO.	% Volume (v/v)	LD50
Propane	74-98-6	90% - 99%	Not Applicable
Propylene	115-07-1	0% - 5%	Not Applicable
Ethane	74-84-0	0% - 5%	Not Applicable
Butane	106-97-8	0% - 2.5%	Not Applicable

**Occupational Exposure Limit:** Based upon animal test data, the acute toxicity of this product is expected to be inhalation: 4 hour LC50 = 280,000 ppm (Rat).

**Note:** Composition is typical for HD-5 Propane, exact composition will vary from shipment to shipment.

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Propane MSDS cont'd.

### SECTION 3 - CHEMICAL AND PHYSICAL DATA

<i>Form:</i>	Liquid and vapour while stored under pressure.
<i>Boiling Point:</i>	-42°C @ 1 atm
<i>Freezing Point:</i>	-188°C
<i>Evaporation Rate:</i>	Rapid (Gas at Normal ambient conditions)
<i>Vapour Pressure:</i>	1435 kPa (maximum) @ 37.8°C
<i>Vapour Density:</i>	1.52 (Air = 1)
<i>Coefficient of Water/Oil Distribution:</i>	Not available
<i>pH:</i>	Not available
<i>Soluble in Water:</i>	Slight, 6.1% by Volume @ 17.8°C
<i>Specific Gravity:</i>	0.51 (water = 1)
<i>Appearance:</i>	Colourless liquid and vapour while stored under pressure. Colourless and odourless gas in natural state at any concentration. Commercial propane has an odourant added, ethyl mercaptan which has an odour similar to boiling cabbage.
<i>Odour Threshold:</i>	4800 ppm

### SECTION 4 - FIRE OR EXPLOSION HAZARD DATA

<i>Flash Point:</i>	-103.4°C
<i>Method:</i>	Closed cup
<i>Flammable Limits:</i>	Lower 2.4%, Upper 9.5%
<i>Auto Ignition Temperature:</i>	432°C
<i>Products Evolved Due to Heat or Combustion:</i>	Carbon monoxide can be produced when primary air and secondary air are deficient while combustion is taking place.
<i>Fire and Explosive Hazards:</i>	Explosive air-vapour mixtures may form if allowed to leak to atmosphere.
<i>Sensitivity To Impact:</i>	No
<i>Sensitivity To Static Discharge:</i>	Yes
<i>Fire Extinguishing Precautions:</i>	Use water spray to cool exposed cylinders or tanks. Do not extinguish fire unless the source of the escaping gas that is fueling the fire can be turned off. Fire can be extinguished with carbon dioxide and/or dry chemical (BC). Container metal shells require cooling with water to prevent flame impingement and the weakening of metal. If sufficient water is not available to protect the container shell from weakening, the area will be required to be evacuated. If gas has not ignited, liquid or vapour may be dispersed by water spray or flooding.
<i>Special Fire Fighting Equipment:</i>	Protective clothing, hose monitors, fog nozzles, self-contained breathing apparatus.

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Propane MSDS cont'd.

### SECTION 5 - REACTIVITY DATA

<i>Stability:</i>	Stable
<i>Conditions To Avoid:</i>	Keep separate from oxidizing agents. Gas explodes spontaneously when mixed with chloride dioxide.
<i>Incompatibility:</i>	Remove sources of ignition and observe distance requirements for storage tanks from combustible material, drains and openings to building.
<i>Hazardous Decomposition Products:</i>	Deficient primary and secondary air can produce carbon monoxide.
<i>Hazardous Polymerization:</i>	Will not occur.

### SECTION 6 - TOXICOLOGICAL PROPERTIES OF MATERIAL

#### ROUTES OF ENTRY:

<i>Inhalation:</i>	Simple asphyxiant. No effect at concentrations of 10,000 ppm (break exposures). Higher concentrations may cause central nervous system disorder and/or damage. Lack of oxygen may cause dizziness, loss of coordination, weakness, fatigue, euphoria, mental confusion, blurred vision, convulsions, breathing failure, coma and death. Breathing high vapour concentrations (saturated vapours) for a few minutes may be fatal. Saturated vapours may be encountered in confined spaces and/or under conditions of poor ventilation. Avoid breathing vapours or mists.
<i>Skin and Eye Contact:</i>	Exposure to vapourizing liquid may cause frostbite (cold burns) and permanent eye damage.
<i>Ingestion:</i>	Not considered to be a hazard.
<i>Acute Exposure:</i>	The acute toxicity of this product is expected to be inhalation: 4 hour LC50 = 280,000 ppm (Rat).
<i>Chronic Exposure:</i>	There are no reported effects from long term low level exposure.
<i>Sensitization to Product:</i>	Skin - unknown, Respiratory - unknown.
<i>Occupational Exposure Limits:</i>	ACGIH TLV: 2500 ppm.
<i>Carcinogenicity, Reproductive Toxicity, Teratogenicity, Mutagenicity:</i>	No effects reported.

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Propane MSDS cont'd.

### SECTION 7 - PREVENTIVE MEASURES

<i>Eyes:</i>	Safety glasses, goggles or face shield required when transferring product.
<i>Skin:</i>	Insulated gloves required if contact with liquid or liquid cooled equipment is expected. Wear gloves and long sleeves when transferring product.
<i>Inhalation:</i>	Where concentration in air would reduce the oxygen level below 18% air or exceed occupational exposure limits in section 6, self-contained breathing apparatus is required.
<i>Ventilation:</i>	Explosion proof ventilation equipment required in confined spaces.

### SECTION 8 - EMERGENCY AND FIRST AID PROCEDURES

#### FIRST AID:

<i>Eyes:</i>	Should eye contact with liquid occur, flush eyes with lukewarm water for 15 minutes. Obtain immediate medical care.
<i>Skin:</i>	In case of "Cold Burn" from contact with liquid, immediately place affected area in lukewarm water and keep at this temperature until circulation returns. If fingers or hands are frostbitten, have the victim hold his hand next to his body such as under the armpit. Obtain immediate medical care.
<i>Ingestion:</i>	None considered necessary.
<i>Inhalation:</i>	Remove person to fresh air. If breathing is difficult or has stopped, administer artificial respiration. Obtain immediate medical care.

#### SPILL OR LEAK:

- Eliminate leak if possible.
- Eliminate source of ignition.
- Ensure cylinder is upright.
- Disperse vapours with hose streams using fog nozzles. Monitor low areas as propane is heavier than air and can settle into low areas. Remain upwind of leak. Keep people away. Prevent vapour and /or liquid from entering into sewers, basements or confined areas.

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Propane MSDS cont'd.

### **SECTION 9 - TRANSPORTATION, HANDLING, AND STORAGE**

- Transport and store cylinders and tanks secured in an upright position in a ventilated space away from ignition sources (so that the pressure relief valve is in contact with the vapour space of the cylinder or tank).
- Cylinders that are not in use must have the valves in the closed position and be equipped with a protective cap or guard.
- Do not store with oxidizing agents, oxygen, or chlorine cylinders.
- Empty cylinders and tanks may contain product residue. Do not pressurize, cut, heat or weld empty containers.
- Transport, handle and store according to applicable federal and provincial regulations (CGA B149.2).

#### **Transportation of Dangerous GOODS (TDG)**

- TDG Classification: Flammable Gas 2.1
- TDG Shipping Name: Liquefied Petroleum Gas (Propane)
- TDG Special Provisions: 56, 90, 102
- PIN Number: UN1075

### **SECTION 10 - PREPARATION**

Prepared By: ABC Inc., Loss Prevention Department  
Emergency Phone: (999) 999-9999  
Date Prepared: 00/00/0000

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# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Sample Inventory Sheet

List all potentially hazardous products you can find in your lab or classroom, where they're stored and whether or not there is a label on the container to identify the contents. Another group will be reviewing MSDSs available for your class and determining if they are current (no more than 3 years old) and determining what type of personal protective equipment the MSDS recommends for safe handling of the product. A third group is checking to see what type of personal protective equipment is available in the classroom. The findings of the other two groups will be added to your chart at the end of the exercise. An example is provided to get you started.

Group # 1			Group # 2		Group # 3
Product Name	Location of Product	Label? (Y/N)	MSDS Available? Current?	Personal Protective Equipment	
				Recommended	Available
Acetone	Flammable storage cabinet	Yes	✓ ✓	Goggles Rubber Gloves	✓ ✓

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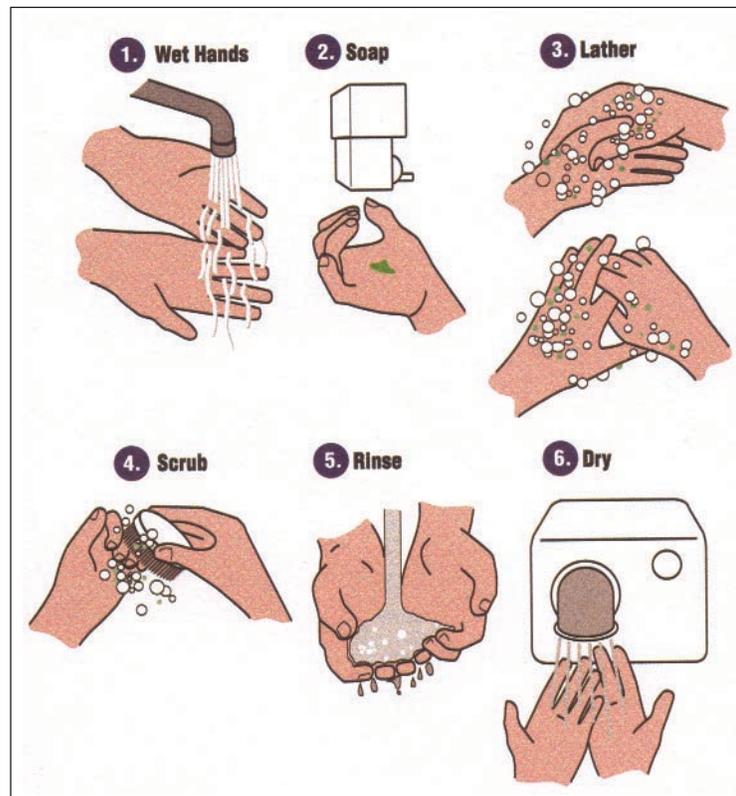
# STUDENT HANDOUT-Grade 11 BIOCHEMICAL HAZARDS

## Proper Handwashing Technique

### How Should You Wash Your Hands?

1. Use very hot water and wet your hands thoroughly.
2. Use soap and lather up your hands very well.
3. Scrub your hands, wrists and forearms with soap for 30 seconds.
4. Scrub your nails if possible.
5. Rinse thoroughly.
6. Dry with single use towel or hot air dryer.

Protect your hands from touching dirty surfaces as you leave the bathroom.



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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Varsol MSDS

### SECTION 1 – PRODUCT IDENTIFICATION

PRODUCT/TRADE NAME:	Varsol
SYNONYMS:	Aliphatic hydrocarbon
CHEMICAL NAME:	Not applicable
PRODUCT CODE:	1 L, 4 L, (205 L WHMIS Controlled)
MSDS NUMBER:	Not available
CAS NUMBER :	Not applicable
MOL. FORMULA:	Not applicable
GENERIC NAME:	Aliphatic hydrocarbon
COMPANY CODE:	Not available
DATE OF MSDS:	00/0000
MANUFACTURER:	ABC Inc.
ADDRESS:	850 Anywhere St. Anytown, Ontario 999-999-9999
EMERGENCY TELEPHONE NO.:	999-999-9999
GENERAL USES:	Consumer products: Paint thinner
<b>TRANSPORTATION OF DANGEROUS GOODS:</b>	
SHIPPING NAME:	Not applicable
PACKING GROUP:	Not applicable
CLASSIFICATION:	Not controlled under TDG (Canada)
PIN:	Not applicable

#### **CLASSIFICATION**

WHMIS Class B-3 : Combustible liquid with a flash point  
between 37.8°C (100° F) and 93.3°C (200°F).

WHMIS Class D-2B: Material causing other toxic effects (TOXIC).

### SECTION 2 – HAZARDOUS INGREDIENTS

INGREDIENT	CAS NO.	% WT	TLV
Stoddard solvent.	8052-41-3	100	Not available

#### **LD50/LC50:**

Stoddard solvent: [25,45,50,70]

ORAL (LD50): Acute: 5000 mg/kg [Rat].

VAPOR (LC50): Acute: 1400 ppm 4 hour(s) [Rat.].

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Varsol MSDS cont'd.

### SECTION 3 – PHYSICAL PROPERTIES

The following physical data are approximate only and do not represent specification values. They should only be used in the context of this Material Safety Data Sheet.

PHYSICAL STATE :	Liquid
SPECIFIC GRAVITY (20 deg C):	0.79 (Water = 1)
BOILING POINT (deg C):	Initial >158°C (316.4°F)
MELTING POINT (deg C):	Not available
PH:	Not applicable
OIL-WATER DISTRIBUTION COEFFICIENT:	The product is much more soluble in oil.
SOLUBILITY:	Easily soluble in diethyl ether, n-octanol. Insoluble in water.
APPEARANCE AND ODOUR:	Colorless; mild odour of petroleum distillates
ODOUR THRESHOLD:	Not available
EVAPORATION RATE:	<1 compared to Butyl acetate. (butyl acetate = 1)
VAPOUR DENSITY:	4.8 (Air = 1)
VAPOUR PRESSURE:	2.2 mm of Hg (@ 20°C)
VOLATILITY (% by vol):	100% (v/v). 100% (w/w).

### SECTION 4 – FIRE AND EXPLOSION HAZARDS

FLASH POINT (deg C):	CLOSED CUP: 43°C (109.4°F). (Tagliabue)
FLAMMABLE LIMITS (% in air):	LOWER: 1% UPPER: 13.3%
AUTO-IGNITION TEMP (deg C):	229°C (444.2°F)
FLAMMABILITY CLASSIFICATION:	Combustible
EXTINGUISHING MEDIA:	Combustible liquid, insoluble in water. SMALL FIRE: Use DRY chemicals, CO <sub>2</sub> , alcohol foam or water spray. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.
FIRE FIGHTING PROCEDURES:	Wear MSHA/NIOSH approved self-contained breathing apparatus or equivalent and full protective gear.
EXPLOSIVE HAZARD:	<i>Risks of explosion of the product in presence of mechanical impact: None.</i> <i>Risks of explosion of the product in presence of static discharge: Slightly.</i> No specific information is available in our database regarding the product's risks of explosion in the presence of various materials.
HAZARDOUS COMBUSTION PRODUCTS:	Carbon oxides (CO, CO <sub>2</sub> ). Fumes.

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# STUDENT HANDOUT-Grade 12

# BIOCHEMICAL HAZARDS

## Varsol MSDS cont'd.

### SECTION 5 – REACTIVITY

LEVEL OF STABILITY:	The product is stable
CONDITIONS TO AVOID:	No additional remark
INCOMPATIBILITY:	Reactive with oxidizing agents
HAZARDOUS DECOMPOSITION PRODUCTS:	Not available
HAZARDOUS POLYMERIZATION:	No

### SECTION 6 – TOXICOLOGICAL PROPERTIES

THRESHOLD LIMIT VALUE:	Not available
EFFECTS OF EXPOSURE:	This product may irritate eyes and skin upon contact. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening. Ingestion can cause burning sensation, vomiting, drowsiness and in severe cases pulmonary edema. Inhalation of excessive amounts may result in impairment, such as drowsiness, lack of coordination, headache and nausea.
CARCINOGENIC EFFECTS:	Not available
MUTAGENIC EFFECTS:	Not available
TERATOGENIC EFFECTS:	Not available
DEVELOPMENTAL TOXICITY:	Not available. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs. Effect of Chronic Exposure: Soporific or intoxicating effect if prolonged and in sufficient concentration.
TOXICOLOGICALLY SYNERGISTIC PRODUCTS:	Not available
OTHER HEALTH HAZARDS:	Slightly dangerous to dangerous in case of skin contact (irritant, sensitizer, permeator), of eye contact (irritant), of ingestion, of inhalation.

### SECTION 7 – EMERGENCY FIRST AID

EYES:	Rinse with water for a few minutes. If irritation persists, seek medical attention.
SKIN CONTACT:	Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing. No additional information.
INHALATION:	Allow the victim to rest in a well ventilated area. Seek medical attention. No additional information.
INGESTION:	DO NOT induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. SEEK IMMEDIATE MEDICAL ATTENTION. No additional information.

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STUDENT HANDOUT-Grade 12  
**BIOCHEMICAL HAZARDS**

Varsol MSDS cont'd.

**SECTION 8 – PREVENTIVE MEASURES**

PERSONAL PROTECTIVE EQUIPMENT:	Vapor and dust respirator. Gloves. Splash goggles.
STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED:	Absorb with an inert material and put the spilled material in an appropriate waste disposal. Combustible liquid, insoluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Prevent entry into sewers and surface waterways. Absorb with DRY earth, sand or other non-combustible material. Place in appropriate container and dispose of in accordance with regional regulations.
WASTE DISPOSAL METHODS:	Waste must be disposed of in accordance with federal, state and local environmental control regulations.
STORAGE AND HANDLING:	Combustible materials should be stored away from extreme heat and away from strong oxidizing agents. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed in a cool, well-ventilated place. Keep out of reach of children. Not available.
SPECIAL ENGINEERING CONTROLS:	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
SPECIAL SHIPPING INFORMATION:	Not applicable.
SPECIAL INFORMATION:	No additional remark.

**SECTION 9 – PREPARATION INFORMATION**

PREPARED BY: ABC Inc., Regulatory Affairs Department  
EMERGENCY PHONE: (999) 999-9999  
PREPARATION DATE: 00/00/0000

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Acetone MSDS

### SECTION 1 - PRODUCT IDENTIFICATION

PRODUCT NAME:	Acetone
PRODUCT IDENTIFICATION:	M651A
PRODUCT CODE:	M650-001
HMIS CODES:	H F R P 1 4 0 B
GENERAL ID:	SOLVENT
DOT HAZARD CL:	FLAMMABLE LIQ.
CLASS:	CLASS 3
SHIP. ID/PG.#:	UN 1090 PG 26
<b>MANUFACTURER INFORMATION</b>	
MANUFACTURER:	ABC Inc.
ADDRESS:	123 Anywhere St. Anytown, Ontario (999) 999-9999
EMERGENCY TELEPHONE NO.:	(999) 999-9999
DATE PRINTED:	00/00/0000
SIGNATURE OF PREPARER:	John Doe

### SECTION 2 - HAZARDOUS INGREDIENTS/SARA III INFORMATION

REPORTABLE COMPONENTS	CAS NUMBER	%	OSHA PEL	ACGIH/TLV
ACETONE	67-64-1	>1	750 PPM	500 PPM

No toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.

### SECTION 3 - PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING PT.:	133°F/56°C
VAPOR PRES.:	182 MM
VAPOR DENSITY:	>1.0 (AIR = 1)
SOLUBILITY IN WATER:	Moderate
SPECIFIC GRAVITY (Approx.):	0.79
EVAPORATION RATE:	>1.0 (B. Acetate = 1)
VOC:	0 g/l 0.00 lb/gl
HAP/LB SOLIDS:	*****
MELTING PT:	N/A
APPEARANCE AND ODOR:	Clear liquid, strong solvent odor.

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Acetone MSDS cont'd.

### SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

FLASH PT.:	-1°F/-18°C
METHOD USED:	TCC
FLAMMABLE LIMITS IN AIR BY VOLUME:	LOWER: 2.8%, UPPER: 13.2%
EXTINGUISHING MEDIA:	Water spray, "alcohol" foam, dry chemical, foam, CO <sub>2</sub> , or any class B extinguishing agent.
SPECIAL FIREFIGHTING PROCEDURES:	Wear self-contained breathing apparatus when fighting fires in confined space. If water is used, fog nozzles are preferred.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	Vapors are heavier than air, may travel considerable distance to a source of ignition and flashback. Water may be ineffective for fire fighting. Use water fog to cool containers to prevent rupturing.

### SECTION 5 - REACTIVITY DATA

STABILITY:	Yes
CONDITIONS TO AVOID:	Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively. Avoid exposure to heat, sparks, or flame.
INCOMPATIBILITY (MATERIALS TO AVOID):	Oxidizing materials can cause a vigorous reaction.
HAZARDOUS DECOMPOSITION OR BYPRODUCTS:	Combustion will produce fumes, smoke, carbon dioxide, and probably carbon monoxide.
HAZARDOUS POLYMERIZATION:	Will not occur.

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Acetone MSDS cont'd.

### SECTION 6 - HEALTH HAZARD DATA

HEALTH HAZARDS (ACUTE AND CHRONIC):	Harmful if inhaled, may affect the brain or nervous system, causing dizziness, headache or nausea. Causes nose, throat, eye and skin irritation. Reports have associated repeated and prolonged occupational over-exposure to solvents with permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal.
CARCINOGENICITY:	No
NTP CARCINOGEN:	N/L.
IARC MONOGRAPHS:	N/L.
OSHA REGULATED:	N/L.
SUBJECT TO CA. PROPOSITION 65 REPORTING?	CARCINOGEN: No REPRODUCTIVE: No
SIGNS AND SYMPTOMS OF EXPOSURE:	Breathing difficulty, light-headedness, dryness of respiratory tract.
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:	Any medical condition, allergy, sensitization which may become worse upon exposure to the product.
<b>EMERGENCY AND FIRST AID PROCEDURES</b>	
IN EYES:	Flush immediately with large amounts of water for 15 minutes. Take to physician for treatment.
IF INHALED:	Remove to fresh air, restore breathing. Consult a physician.
IF ON SKIN:	Wash areas with soap and water. Remove contaminated clothing. Consult physician.
IF SWALLOWED:	Do not induce vomiting. Consult physician immediately.

### SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:	Isolate, absorb and ventilate (open all windows, doors). Removal of all ignition sources, flames, hot surfaces. Avoid breathing of vapors, use respiratory protective device. Keep product out of water courses (drains, sewers) by diking or impounding.
WASTE DISPOSAL METHOD:	In accordance with federal, state and local regulations. Before attempting clean-up, refer to hazard caution information in other sections of form.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:	Avoid high temperatures. Do not store or use near heat, sparks or flame. Prevent prolonged or repeated breathing of vapor or spray mist.
OTHER PRECAUTIONS:	Do not take internally. Avoid prolonged contact with skin. DO NOT GET IN EYES. Avoid breathing of vapors or dust. KEEP OUT OF REACH OF CHILDREN! Follow label directions.

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STUDENT HANDOUT-Grade 12  
**BIOCHEMICAL HAZARDS**

Acetone MSDS cont'd.

**SECTION 8 - CONTROL MEASURES**

RESPIRATORY PROTECTION:	If workplace exposure limit(s) of product or any component is exceeded, a NIOSH approved, cartridge type respirator is advised in absence of proper environmental control.
VENTILATION:	LOCAL: Local exhaust not adequate. MECHANICAL: Mechanical exhaust sufficient to prevent exceeding listed TLV.
PROTECTIVE GLOVES:	Neoprene gloves (Hazard B or greater).
EYE PROTECTION:	Chemical splash goggles in compliance with OSHA regulations are advised; however, OSHA regulations also permit other types of safety glasses. Consult your safety representative.
OTHER PROTECTIVE CLOTHING OR EQUIPMENT:	Wear impervious clothing and boots.
WORK/HYGIENIC PRACTICES:	Personal contact should be avoided. Follow good housekeeping and personal hygiene.

**SECTION 9 - PREPARATION INFORMATION**

PREPARED BY: John Doe, ABC Inc.  
EMERGENCY TELEPHONE NUMBER: (999) 999-9999  
DATE PREPARED: 00/00/0000

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Fill in the Blank Exercise: Bleach MSDS

### SECTION 1 - PRODUCT IDENTIFICATION

PRODUCT NAME/IDENTIFIER	Bleach (5 - 12%)
TRADE NAME	Sodium Hypochlorite
CHEMICAL NAME	Sodium Hypochlorite
CHEMICAL FAMILY	Hypochlorite solutions
CHEMICAL FORMULA	NaOCl in water
PRODUCT USE	Used as a disinfectant and sanitizer.
CONTROLLED PRODUCT UNDER WHMIS	Yes
WHMIS CLASSIFICATION	E, D2B
SPECIAL SHIPPING INFORMATION	For 12% only TDG Classification: PIN 1791, Class 8(9.2), Packing Group III
<b>MANUFACTURER INFORMATION:</b>	
MANUFACTURER	ABC Inc.
ADDRESS	123 Anywhere St. Anytown, Ontario Canada, L2M 2A1 (999) 999-9999
EMERGENCY TELEPHONE NO.	(999) 999-9999

### SECTION 2 - HAZARDOUS INGREDIENTS OF MATERIAL

HAZARDOUS INGREDIENTS	CONCENTRATION %	CAS, NA, or UN NUMBERS
Sodium Hypochlorite	5 - 12	CAS# 7681-52-9

LC50 (SPECIES AND ROUTE): No information available

LD50 (SPECIES AND ROUTE): No information available

Balance: Sodium Chloride, Sodium Hydroxide, and Water

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

Fill in the Blank Exercise: Bleach MSDS cont'd.

## SECTION 3 - PHYSICAL DATA

PHYSICAL STATE (gas, liquid or solid)	Liquid
BOILING POINT (deg C)	Decomposes @ 40 deg C
FREEZING POINT (deg C)	25 deg C (12%)
VAPOR PRESSURE (mm) 1	7.5 mm @ 20 deg C
EVAPORATION RATE	As water
VAPOR DENSITY (Air*1)	0.9
DENSITY (g/ml)	Not applicable
SPECIFIC GRAVITY (water*1)	1.1-1.3
MOLECULAR WEIGHT	74.75
pH	9-10
ODOR THRESHOLD	For chlorine - 0.3 ppm
COEFFICIENT OF WATER/OIL DISTRIBUTION	100% water soluble
APPEARANCE AND ODOR	Clear, yellow liquid with a chlorine odor.

## SECTION 4 - FIRE AND EXPLOSION HAZARD OF MATERIAL

FLAMMABILITY	No
MEANS OF EXTINCTION	This material is not combustible. Use extinguishing media appropriate for surrounding fire.
FLASHPOINT (deg C) AND METHOD	Not applicable
UPPER EXPLOSION LIMIT (% by volume)	Not applicable
LOWER EXPLOSION LIMIT (% by volume)	Not applicable
AUTO IGNITION TEMPERATURE	Not applicable
TDG FLAMMABILITY CLASSIFICATION	Not applicable
HAZARDOUS COMBUSTION PRODUCTS	Not applicable
EXPLOSION DATA	Not applicable
SENSITIVITY TO MECHANICAL IMPACT	Not applicable
SENSITIVITY TO STATIC DISCHARGE	Not applicable

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

Fill in the Blank Exercise: Bleach MSDS cont'd.

## SECTION 5 - TOXICOLOGICAL PROPERTIES OF MATERIAL

OCCUPATIONAL EXPOSURE LIMITS	TLV not established for Sodium Hypochlorite. The ACGIH TWA-TLV for chlorine is 0.5 ppm.
<b>PRIMARY ROUTE(S) OF ENTRY:</b>	
SKIN CONTACT	Yes
SKIN ABSORPTION	No
EYE CONTACT	Yes
INHALATION	Yes
INGESTION	No

## POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC EXPOSURE)

Eye Contact	Liquid and mists may severely irritate or damage the eyes.
Skin Contact	Contact with the liquid will irritate the skin, causing redness and possible inflammation.
Inhalation	Inhalation of fumes or mists causes respiratory tract irritation and irritation of the mucous membranes. If sodium hypochlorite is mixed with ammonia or other chemicals, evolution of chlorine or hypochlorous acid results. These gases can produce pulmonary edema.
Ingestion	Mists and liquid are extremely corrosive to the mouth, throat, mucous membranes and stomach. Swallowing the liquid burns the tissue, causes severe abdominal pain, nausea, vomiting, circulatory collapse, confusion, delirium, coma, and collapse. Swallowing large quantities can cause death.
Chronic Effects of Exposures	Irritation effects increase with strength of solution and time of exposure. Prolonged or repeated exposure can lead to constant irritation of eyes and throat. Prolonged or repeated contact may cause dermatitis and sensitization.

## SECTION 6 - REACTIVITY DATA

CHEMICAL STABILITY	Yes (12% solution decomposes slowly at 40 deg C to yield NaCl and NaClO <sub>3</sub> . Exposure to sunlight accelerates decomposition).
CONDITIONS OF REACTIVITY	Oxygen may be liberated upon contact with certain metals. Toxic fumes are liberated by contact with acids or heat. Highly exothermic reactions with organic materials and oxidizable materials may cause fires.
INCOMPATIBILITY WITH OTHER SUBSTANCES	It is incompatible with acids (liberates chlorine), ammonia, urea, oxidizable materials, and metals such as nickel, copper, tin, manganese and iron (causes liberation of oxygen).
HAZARDOUS DECOMPOSITION PRODUCTS	Chlorine, hydrogen chloride, sodium chloride, sodium chlorate and oxygen which depend on pH, temperature and time.

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

Fill in the Blank Exercise: Bleach MSDS cont'd.

## SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE

Type of equipment that should be used or procedures that should be followed for preventative measures:

RESPIRATORY (Specify type of equipment)	
EYES (Specify)	
GLOVES (Specify)	
FOOTWEAR (Specify)	
CLOTHING (Specify)	
OTHER PROTECTIVE EQUIPMENT (Specify)	
ENGINEERING CONTROLS (Specify)	
LEAK AND SPILL PROCEDURES	
WASTE DISPOSAL	
HANDLING PROCEDURES AND EQUIPMENT	
STORAGE REQUIREMENTS	

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# STUDENT HANDOUT-Grade 12

# BIOCHEMICAL HAZARDS

## Fill in the Blanks Exercise: Bleach MSDS cont'd.

### SECTION 8 - FIRST AID MEASURES

Eye Contact	Immediately flush eyes with lots of running water for at least 15 minutes, lifting the upper and lower eyelids occasionally. Get immediate medical attention.
Skin Contact	Immediately flush skin with lots of running water for 15 minutes. Remove contaminated clothing and shoes. Wash before reuse. Seek medical attention.
Inhalation	Remove to fresh air. Give artificial respiration if not breathing. Get medical attention.
Ingestion	Do not induce vomiting. If conscious, give lots of water, or milk, or milk of magnesia. Get immediate medical attention. Do not give baking soda or acid antidotes. Do not give anything by mouth to an unconscious or convulsing person.

### SECTION 9 - MATERIAL SAFETY DATA SHEET PREPARATION INFORMATION

PREPARED BY: John Doe, ABC Inc., Industrial Hygiene Department  
EMERGENCY PHONE: (999) 999-9999  
DATE PREPARED: 00/00/0000

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STUDENT HANDOUT-Grade 12

# BIOCHEMICAL HAZARDS

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## Exercise: Industry Controls

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The chart below lists some of the chemical and biological hazards present in several industries where you might find employment. In the third column list the control measures that could be used to protect workers from the hazards listed in the second column.

Use the back of this handout to give practical examples of control measures used in workplaces where you have worked or where someone you know has been employed. For example, you might have worked in a situation where a certain type of ventilation was used or certain protective equipment was worn to eliminate a specific hazard. Describe the hazard and the control measure that was used and explain why that measure was necessary.

Industries	Chemical Hazard	Suggested Control Methods
Retail	Cleaners, solvents, compressed gases	
Manufacturing	Solvents, degreasers, cleaners, propane (lift trucks)	
Restaurants	Cleaners, compressed gas, disinfectants	
Construction	Glues, solvents, paints – spray application, compressed gases, gasoline, dust	

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# STUDENT HANDOUT-Grade 12

# BIOCHEMICAL HAZARDS

## Silica MSDS

### SECTION 1 - PRODUCT IDENTIFICATION

PRODUCT NAME:	Crystalline Silica - various grades
SYNONYMS:	Quartz, Crystalline Silica, Silicon Dioxide
MSDS NO.:	011-USM
WHMIS CLASSIFICATION:	Class D, Division 2, Subdivision A
DATE OF MSDS:	00/00/0000
<b>MANUFACTURER INFORMATION</b>	
MANUFACTURER:	ABC Inc.
ADDRESS:	123 Anywhere St. Anytown, Ontario (999) 999-9999
EMERGENCY TELEPHONE NO.:	(999) 999-9999

### SECTION 2 - COMPONENTS

CAS #	Component	Percentage	Exposure Limits
14808-60-7	Crystalline Silica (Quartz)	87-98.5%	PEL - See Below TLV- 0.1 mg/m <sup>3</sup> TWA (respirable fraction) MSHA - See Below

OSHA PEL AND MSHA Exposure Limit for Crystalline Silica (Respirable):  $\frac{10 \text{ mg/m}^3}{\% \text{ Silica} + 2}$

National Institute for Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be changed to 50 micrograms respirable free silica per cubic meter of air (0.05 mg/m<sup>3</sup>) as determined by a full shift sample up to 10 hour working day, 40 hours per week. The 1974 NIOSH Criteria for a recommended Standard for Occupational Exposure to Crystalline Silica should be consulted for more detailed information.

PEL means OSHA Permissible Exposure Limit.

TLV means American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.

MSHA means Mine Safety and Health Administration Exposure Limit.

TWA means 8 hour time weighted average.

Note: The Permissible Exposure Limits (PEL) reported above are the pre-1989 limits that were reinstated by OSHA June 30, 1993 following a decision by the 11th Circuit Court of Appeals. These PELs are now being enforced by Federal OSHA. Be aware that more restrictive exposure limits may be enforced by some states, agencies or other authorities.

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# STUDENT HANDOUT-Grade 12

# BIOCHEMICAL HAZARDS

## Silica MSDS cont'd.

### SECTION 3 - HAZARDS IDENTIFICATION

#### EMERGENCY OVERVIEW

This product is a chemically inert, non-combustible mineral. A single exposure will not result in serious adverse effects. Excessive inhalation of dust may cause lung disease, silicosis, with symptoms of shortness of breath and reduced pulmonary function. See "Cancer Status" in this Section 3.

#### HEALTH HAZARDS

##### **Inhalation:**

Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may have the following serious chronic health effects:

##### **Silicosis:**

Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

##### **Cancer Status:**

The International Agency for Research on Cancer has determined that there is "sufficient evidence" for carcinogenicity of crystalline silica to experimental animals and "limited evidence" with respect to humans (Group 2A - probably carcinogenic to humans). The National Toxicology Program classifies respirable crystalline silica as "reasonably anticipated to be a carcinogen".

##### **Other Data with Possible Relevance to Human Health:**

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by fibrosis of the lungs, skin and other internal organs) and kidney disease.

Inhalation of dust may cause irritation of the nose, throat and respiratory passages.

##### **Skin Contact:**

No adverse effects expected.

##### **Eye Contact:**

Contact may cause mechanical irritation and possible injury.

##### **Ingestion:**

No adverse effects expected for normal, incidental ingestion.

##### **Chronic Health Effects:**

See "Inhalation" subsection above with respect to silicosis, cancer status and other data with possible relevance to human health.

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Silica MSDS cont'd.

### SECTION 3 CONTINUED - HAZARDS IDENTIFICATION

**Medical Conditions Aggravated by Exposure:**

Individuals with respiratory disease, including but not limited to, asthma and bronchitis, or subject to eye irritation should not be exposed to respirable quartz dust.

**Signs and Symptoms of Exposure:**

There are generally no signs or symptoms of exposure to crystalline silica (quartz). See "Inhalation" subsection above for symptoms of silicosis.

### SECTION 4 - FIRST AID

**Gross Inhalation:**

Remove victim to fresh air. If breathing has stopped, perform artificial respiration. If breathing is difficult have qualified personnel administer oxygen. Get prompt medical attention.

**Skin Contact:**

No first aid should be needed since this product does not affect the skin. Wash exposed skin with soap and water before breaks and at the end of the shift.

**Eye Contact:**

Flush the eyes immediately with large amounts of running water, lifting the upper and lower lids occasionally. If irritation persists or for imbedded foreign body, get immediate medical attention.

**Ingestion:**

If large amounts are swallowed, get immediate medical attention.

### SECTION 5 - FIRE AND EXPLOSION DATA

Flash Point (Method Used):	Fully oxidized, will not burn
Autoignition Temp:	Will not burn
Flammable Limits:	LEL: Not applicable UEL: Not applicable
Extinguishing Media:	This product will not burn but is compatible with all extinguishing media. Use any media that is appropriate for the surrounding fire.
Special Fire Fighting Procedures:	None required with respect to this product. Firefighters should always wear self-contained breathing apparatus for fires indoors or in confined areas.
Unusual Fire and Explosion Hazards:	None
Hazardous Combustion Products:	None

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Silica MSDS cont'd.

### SECTION 6 - ACCIDENTAL RELEASE MEASURES

Wear appropriate protective equipment. If uncontaminated, collect using dustless method (HEPA vacuum or wet method) and place in appropriate container for use. If contaminated: a) use appropriate method for the nature of contamination, b) consider possible toxic or fire hazards associated with the contaminating substances. Collect for disposal.

### SECTION 7 - HANDLING AND STORAGE

Do not breathe dust. Do not rely on your sight to determine if dust is in the air. Silica may be in the air without a visible dust cloud. Use normal precautions against bag breakage or spills of bulk material. Avoid creation of respirable dust. Use good housekeeping in storage and use areas to prevent accumulation of dust in work area.

Use adequate ventilation and dust collection. Maintain and use proper, clean respiratory equipment (see Section 8). Launder clothing that has become dusty. WARN and TRAIN employees in accordance with state and federal regulations.

WARN YOUR EMPLOYEES (AND YOUR CUSTOMERS - USERS IN CASE OF RESALE) BY POSTING AND OTHER MEANS OF THE HAZARDS AND OSHA PRECAUTIONS TO BE USED. PROVIDE TRAINING FOR YOUR EMPLOYEES ABOUT OSHA PRECAUTIONS.

### SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation:	Use local exhaust as required to maintain exposures below applicable occupational exposure limits. See also ACGIH "Industrial Ventilation - A Manual for Recommended Practice", (current edition).
Respiratory Protection:	Use appropriate respiratory protection for respirable particulates based on consideration of airborne workplace concentrations and duration of exposure. Refer to the most recent standards of ANSI (Z88.2) OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57) and NIOSH Respirator Decision Logic.
Gloves:	Protective gloves recommended.
Eye Protection:	Safety glasses or goggles recommended.
Other Protective Equipment/Clothing:	As appropriate for the work environment. Dusty clothing should be laundered before reuse.

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Silica MSDS cont'd.

### SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor:	White powder, odorless.
pH:	Not applicable
Boiling Point:	4046 deg F / 2230 deg C
Melting Point:	2930 deg F / 1610 deg C
Solubility in Water:	Negligible
Percent Volatile:	0%
Specific Gravity (water = 1):	2.65
Vapor Pressure:	Not applicable
Vapor Density:	Not applicable
Evaporation Rate:	Not applicable

### SECTION 10 - STABILITY AND REACTIVITY

Stability:	Stable
Conditions to Avoid:	None
Incompatibility:	Powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, etc.
Hazardous Decomposition Products:	Silica will dissolve in hydrofluoric acid producing a corrosive gas, silicon tetrafluoride.
Hazardous Polymerization:	Will not occur

### SECTION 11 - TOXICOLOGICAL INFORMATION

No acute toxicity data is available for product or components. Refer to Section 3 for health hazard information.

### SECTION 12 - ECOLOGICAL INFORMATION

No ecotoxicity data is available. This product is not expected to present an environmental hazard.

### SECTION 13 - DISPOSAL

#### Waste Disposal Method:

If uncontaminated, dispose as an inert, non-metallic mineral. If contaminated, dispose in accordance with all applicable local, state/provincial and federal regulations.

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# STUDENT HANDOUT-Grade 12 BIOCHEMICAL HAZARDS

## Silica MSDS cont'd.

### SECTION 14 - TRANSPORTATION DATA

#### U.S. DOT HAZARD CLASSIFICATION

Proper Shipping Name:	Not Regulated
Technical Name:	N/A
UN Number:	N/A
Hazard Class/Packing Group:	N/A
Labels Required:	None
DOT Packaging Requirements:	N/A
Exceptions:	N/A

### SECTION 15 - OTHER INFORMATION

European Community Labeling Classification:	Harmful (Xn)
European Community Risk and Safety Phrases:	R40, R48, S22
NFPA Hazard Rating:	Health: 1 Fire: 0 Reactivity: 0
HMIS Hazard Rating:	Health: * Fire: 0 Reactivity: 0 * Warning - Chronic health effect possible - inhalation of silica dust may cause lung injury/disease (silicosis). Take appropriate measures to avoid breathing dust. See Section 3.

#### References:

Registry for Toxic Effects of Chemical Substances (RTECS), 1995  
Patty's Industrial Hygiene and Toxicology  
NTP Seventh Annual Report on Carcinogens, 1994  
IARC Monograph Volume 42, Silica and some Silicates, 1987

### SECTION 16 - PREPARATION INFORMATION

PREPARED BY: John Doe, XYZ Inc.  
EMERGENCY PHONE: (999) 999-9999  
PREPARATION DATE: 00/00/0000

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