



# CHEMICAL HAZARD AWARENESS MODULE

Student instructions + worksheets

## INTRODUCTION

This lab will teach you how to compare the hazards of different chemicals and decide which chemicals are the safest to use in a lab experiment.

Many organizations have been working to find a consistent way of determining chemical hazards. If each organization uses its own criteria, consumers and other users won't have a standardized way to compare the hazards of different chemicals and decide which are safer to use.

## CHEMISTRY CONCEPTS

Nomenclature, double displacement reactions, environmental health and safety

## BACKGROUND READING

### ***How Toxic is Toxic?***

[www.acs.org/content/acs/en/education/resources/highschool/chemmatters/past-issues.html](http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters/past-issues.html)

Chem Matters, American Chemical Society, December 2014

### ***Natural vs. Synthetic Chemicals is a gray matter***

[blogs.scientificamerican.com/guest-blog/natural-vs-synthetic-chemicals-is-a-gray-matter](http://blogs.scientificamerican.com/guest-blog/natural-vs-synthetic-chemicals-is-a-gray-matter)

### ***When It Comes To Chemicals, How Safe Is "Safe"?***

[ewg.org/enviroblog/2013/06/when-it-comes-chemicals-how-safe-safe](http://ewg.org/enviroblog/2013/06/when-it-comes-chemicals-how-safe-safe)

### ***Chemicals of Concern***

[safecosmetics.org/get-the-facts/chemicals-of-concern](http://safecosmetics.org/get-the-facts/chemicals-of-concern)

### ***Banned in Europe, Safe in the US***

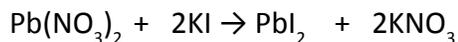
[ensia.com/features/banned-in-europe-safe-in-the-u-s](http://ensia.com/features/banned-in-europe-safe-in-the-u-s)



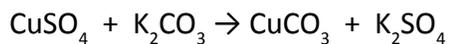
## PROCEDURE:

Let's compare three examples of chemical reactions commonly used to demonstrate double displacement reactions in high school lab experiments. Read the SDSs for each of the six reactants in the chemical reactions below.

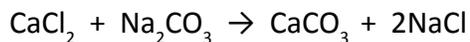
### REACTION 1:



### REACTION 2:



### REACTION 3:



**Which of the three reactions would you suggest using in your classroom? Why?**

1. Write the name of each reactant used in the reactions above:

a.  $\text{Pb}(\text{NO}_3)_2$  \_\_\_\_\_

b. KI \_\_\_\_\_

c.  $\text{CuSO}_4$  \_\_\_\_\_

d.  $\text{K}_2\text{CO}_3$  \_\_\_\_\_

e.  $\text{CaCl}_2$  \_\_\_\_\_

f.  $\text{Na}_2\text{CO}_3$  \_\_\_\_\_



- Gather the SDSs for the above chemicals. We will start by analyzing only the six reactants—not the products.
- For each chemical, list the data from these two sources on your Student Worksheet (page 6):
  - Hazardous Chemicals in Schools (HCS) List: [www.hazwastehelp.org/educators/chemlist.aspx](http://www.hazwastehelp.org/educators/chemlist.aspx)
  - Data found on the Safety Data Sheet (SDS)
- Using the guides on page 4, assign a hazard level of LOW, MEDIUM, or HIGH for the Health Hazard data and the Environmental Hazard data. Record the answer on your Student Worksheet.
- Assign each reactant an overall Hazard Level score of LOW, MEDIUM, or HIGH using this guide:

OVERALL HAZARD LEVEL	
HIGH	Health Hazard OR Environmental Hazard = HIGH
MEDIUM	Health Hazard OR Environmental Hazard = MEDIUM
LOW	Health Hazard OR Environmental Hazard = LOW

If the Health Hazard and Environmental Hazard are different, the **higher** score determines the overall Hazard Level. Example: if Health Hazard = MEDIUM and Environmental Hazard = LOW, the overall Hazard Level = MEDIUM.

- Based on overall Hazard Levels you assigned each of the six reactants, which of the three reactions do you recommend performing in the lab?



# HAZARD LEVEL GUIDES

## H-STATEMENTS (OR H-PHRASES):

Risk	Health Hazard	Environmental Hazard
<b>HIGH</b>	H350, H340, H360, H301, H311, H331, H310, H330, H300	H400, H401, H410
<b>MEDIUM</b>	H351, H341, H361, H302, H312, H332	H402
<b>LOW</b>	H303, H313, H333 or No H-Phrases	No H-Phrases

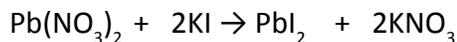
## SDS TOXICITY DATA:

Risk	Health Hazard	Environmental Hazard
<b>HIGH</b>	IARC Group 1 or 2a Carcinogen Oral LD50 ≤ 300 mg/kg Dermal LD50 ≤ 1,000 mg/kg Inhalation (g) LC50 ≤ 2,500 ppm Inhalation (v) LC50 ≤ 10.0 mg/l Inhalation (dust, mist) LC50 ≤ 1.0 mg/l	96 hr LC50 (fish) ≤ 10 mg/l 48 hr EC50 (crustacea) ≤ 10 mg/l 72 or 96 ErC50 (algae) ≤ 10 mg/l
<b>MEDIUM</b>	IARC Group 2b or 3 Carcinogen Oral LD50 > 300 but ≤ 2,000 mg/kg Dermal LD50 > 1,000 but ≤ 2,000 mg/kg Inhalation (g) LC50 > 2,500 but ≤ 20,000 ppm Inhalation (v) LC50 > 10.0 but ≤ 20.0 mg/l Inhalation (dust, mist) LC50 > 1.0 but ≤ 5.0 mg/l	96 hr LC50 (fish) > 10 but ≤ 100 mg/l 48 hr EC50 (crustacea) > 10 but ≤ 100 mg/l 72 or 96ErC50 (algae) > 1 but ≤ 100 mg/l
<b>LOW</b>	Oral LD50 > 2,000 mg/kg Dermal LD50 > 2,000 mg/kg Inhalation (g) LC50 > 20,000 ppm Inhalation (v) LC50 > 20.0 mg/l Inhalation (dust, mist) LC50 > 5.0 mg/l	Technical Criteria: 96 hr LC50 (fish) > 100 mg/l 48 hr EC50 (crustacea) > 100 mg/l 72 or 96 ErC50 (algae) > 100 mg/l

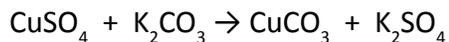


## SUPPLEMENTAL ACTIVITY:

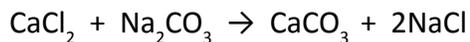
### REACTION 1:



### REACTION 2:



### REACTION 3:



1. Write the name of each product created in the reactions above:

a.  $\text{PbI}_2$  \_\_\_\_\_

b.  $\text{KNO}_3$  \_\_\_\_\_

c.  $\text{CuCO}_3$  \_\_\_\_\_

d.  $\text{K}_2\text{SO}_4$  \_\_\_\_\_

e.  $\text{Ca}_2\text{CO}_3$  \_\_\_\_\_

f.  $\text{NaCl}$  \_\_\_\_\_

2. Gather the SDSs for the chemicals above.

3. For each chemical, list the data from these two sources on your Student Worksheet: Products (page 7):

- Hazardous Chemicals in Schools (HCS) List: [www.hazwastehelp.org/educators/chemlist.aspx](http://www.hazwastehelp.org/educators/chemlist.aspx)
- Data found on the Safety Data Sheet (SDS)

4. Assign a hazard level of LOW, MEDIUM, or HIGH for the Health Hazard data and the Environmental Hazard data.

5. Based on your evaluation of the products in the three reactions, would you still recommend performing the same reaction? Why or why not?



## STUDENT WORKSHEET: Reactants

Rxn #:	Chemical name:	Data Source:	Physical Hazard:	Health Hazard:	Environmental Hazard:	Hazard Level:
1		HCS List Data				
		SDS Data & H-Statements				
		HCS List Data				
		SDS Data & H-Statements				
2		HCS List Data				
		SDS Data & H-Statements				
		HCS List Data				
		SDS Data & H-Statements				
3		HCS List Data				
		SDS Data & H-Statements				
		HCS List Data				
		SDS Data & H-Statements				

## STUDENT WORKSHEET: Products

Rxn #:	Chemical name:	Data Source:	Physical Hazard:	Health Hazard:	Environmental Hazard:	Hazard Level:
<b>1</b>		HCS List Data				
		SDS Data & H-Statements				
		HCS List Data				
		SDS Data & H-Statements				
<b>2</b>		HCS List Data				
		SDS Data & H-Statements				
		HCS List Data				
		SDS Data & H-Statements				
<b>3</b>		HCS List Data				
		SDS Data & H-Statements				
		HCS List Data				
		SDS Data & H-Statements				