Activity: Dangerous Goods Specialist

FOR THE TEACHER

Summary
In this activity, students will take on the role of a Dangerous Goods Specialist for a large chemical company. In this role, students will research a specific commercially available industrial chemical looking at both the properties of the compound as well as how can they safely ship the chemical to a buyer in a cost effective and timely manner.

Grade Level
High or Middle school

Objectives
By the end of this activity, students should be able to
- discuss hazards of materials including: toxicity, flammability, volatility.
- understand real world applications for industrial chemicals.
- recognize how to read and write a Safety Data Sheet for a chemical.
- have a better understanding of the logistics and regulations for shipping commercial chemicals around the globe.

Chemistry Topics
- Chemical safety
- Physical Properties
- Chemical Properties

Time
Teacher Preparation: 30-45 min
Lesson: 2-3 days

Materials
- Safety Data Sheet (SDS) and Global Harmonized Systems (GHS) templates (documents are included)
- Shipping Checklist template (document is included)
- Laptops
- MERCK Manuals (if available)
- Poster board (optional)
- Assorted paper
- Markers/colored pencils
- Stencils

Safety
- No specific safety precautions need to be observed for this activity.
Teacher Notes

- This project-based activity would work well with groups of 3-4 students or can also be completed individually. If using groups, have the students determine how the work will be split up amongst the group. One student should be the “Manager” who oversees the work so that the product is shipped by the deadline.
- Create a list of chemical formulas for commercially available substances that you feel will engage your students. Do not use the names of the substances, only list their chemical formulas, so students will need to research the formulas to determine what the substance actually is.
- Based on the substances you choose, set a predetermined shipping amount for the assignment. This way, everyone is using a standard amount when researching shipping costs.
- Give the students a choice of how they want to present their project information to the class. All should complete a SDS (Safety Data Sheet) and GHS (Global Harmonized System label) sheet for their substance as well as a Shipping Label for their container. I suggest having students turn these in as part of their grade. After that, allow them options for the rest (poster, Prezi, video, etc.).
- Make sure students are using reputable sites when researching their substances.
- See student handout for specific research requirements.

Cross-Disciplinary Extensions

Connect to Math
Students could graph the results of their shipping methods. They could graph cost per mile for each shipping method.

Connect to Reading
Students will do a large amount of reading as they are researching their projects.

Connect to Writing
Students could write a brief (2-3 paragraph) summary of their thoughts on the career of a Dangerous Goods Specialist.

Connect to Social Studies
Students could research the economic impact of the chemical industry on society.

FOR THE STUDENT

Lesson

Dangerous Goods Specialist

Objective
In this lesson, you will take on the role of a Dangerous Goods Specialist for a large chemical company. In this role, you will research a specific commercially available industrial chemical looking at both the properties of the compound as well as how to safely ship the chemical to a buyer in a cost effective and timely manner.
Materials
- Safety Data Sheet template
- Global Harmonized System label template
- Shipping Checklist template
- Laptops/iPad (internet access)
- MERCK Manuals (if available)
- Poster board
- Assorted paper
- Markers/colored pencils

Safety
- No specific safety precautions need to be observed for this activity.

Procedure
1. You will play the role of a Dangerous Goods Specialist.
   a. In this role, you are the person within the chemical company that is in charge of making sure that all products produced by the company are shipped to the buyers in a safe, timely and cost effective method.
2. You will be given a list of chemical formulas of commercially available chemical compounds. Pick a chemical formula from the list.
3. You will be in charge of shipping to a buyer. Research the compound to determine the following things:
   i. Is the compound ionic/molecular/metalllic?
   ii. What is the structure of the substance (crystal, ring, etc.)?
   iii. What is the state of the formula (solid, liquid, gas)?
   iv. What is the melting/freezing point, flashpoint, boiling points, reactivity of the substance?
   v. Are there any hazards associated with the formula (volatility, flammability, toxicity, etc.)? What are they and how do they need to be managed when shipping?
   vi. Why is the buyer purchasing this substance? (Find out what the applications for this substance in the real world.)
   vii. What requirements are there for containment/clean-up of the substance if there is a spill or leak?
4. Complete the Safety Data Sheet template and Global Harmonized System label template for your chosen chemical.
5. Determine how your substance needs to be contained and packaged for shipping.

6. After completing steps 3-5, begin the process of transporting the order to the buyer. You will need to research the following:
   a. Logistics of shipping chemicals around the US and the world.
   b. What are the costs of shipping methods (look at air, rail, over the road, and vessel), excluding UPS, Fed X or USPS.
   c. What is the time frame for each shipping method?
   d. What regulatory constraints are there with each type of shipping method? Is there any additional training required for the handlers of the material? (Drivers, package fillers, etc.)
e. How does the container/package need to be labeled for each method of shipping?

f. Do any of the shipping methods require special paperwork/documentation for the substance?

**Conclusion**

1. Complete and submit the required Shipping Checklist template for the chemical you have chosen. Also submit the completed Safety Data Sheet and Global Harmonized System label.

2. Finally, compile the information that you collected into a *creative* visual display for a short class presentation. You may create a poster board, a PowerPoint, a Prezi, a video, etc. Be creative with your presentation, and be sure to make it both information and engaging for the audience.