

Lesson 2.6: Physical and Chemical Changes

Task	Page(s)	Learning Target
1	2	I can gather evidence to categorize and describe physical and chemical changes.
2	3	I can explore lab investigations featuring different types of substances interacting with each other in order to describe physical and chemical changes.
3	4	I can describe environmental pollution issues related to chemical and physical reactions that impact air, land, or water quality.
4	5-6	I can research environmental pollution issues related to chemical and physical reactions that impact air, land, or water quality.
5	7	I can design a product that will clean up the pollution issues or help prevent pollution.
6	8	I can present a product design that will clean up the pollution issues or help prevent pollution.

Task 1 Learning Target: I can gather evidence to categorize and describe physical and chemical changes.

1. Read and/or watch the Mosa Mack Mystery on Physical vs. Chemical Changes:
 - a. Video Link: <https://sites.google.com/a/ps207tigers.org/207sci/mosa>
 - b. Comic Book Link: <https://sites.google.com/a/ps207tigers.org/207sci/physical-and-chemical-reactions-comic>

2. Answer the following questions and cite the specific page numbers/time codes in the Comic Mystery:
 - a. Amir and Gracie left some evidence of breakfast behind. Luckily, some of it can be changed back. What does Mosa write down as clues that a substance will easily change back?

 - b. Where is the water in the pot going? Is it disappearing?

 - c. How does E. Mulsion, celebrity food scientist, define a physical change, and what examples does he give?

 - d. Why is unfrying the eggs impossible?

 - e. As Mosa studies eggs and toast, what does she write down in her notebook as indicators of chemical reactions?

 - f. How is lighting a match an example of a chemical reaction?

 - g. How is the dissolving antacid tablet an example of a chemical reaction?

 - h. What did Mosa figure out? Why can't they get back the eggs and the bread? Why can't they turn the pancakes back into the original ingredients?

 - i. Complete a T-Chart that compares physical and chemical change using the following phrases:

-Change in shape
-Change in color
-Change in size
-Produces gas in form of bubbling or fizzing
-Molecules change

-Change in smell
-Change in texture
-Absorbs or gives off heat
-Tearing, bending, breaking
-Usually easily reversible

-Molecules stay the same
-Change in state (solid, liquid, gas)
-Dissolving
-Dilution
-Produces light
-Not easily reversible

Physical Change	Chemical Change

Task 2 Learning Target: I can explore lab investigations featuring different types of substances interacting with each other in order to describe physical and chemical changes.

Visit the following link to explore 6 different lab investigations:

<https://sites.google.com/a/ps207tigers.org/207sci/physical-and-chemical-changes>

Complete the chart by recording your observations and conclusions.

Lab Investigation	Draw/sketch and describe your observations.	Was the interaction a physical or chemical change ? Explain.
Station 1: Alka-Seltzer and Water		
Station 2: Ice in a Beaker		
Station 3: Iodine on a Potato		
Station 4: Paper Ripping		
Station 5: Liver and Hydrogen Peroxide		
Station 6: Baking Soda and Vinegar		

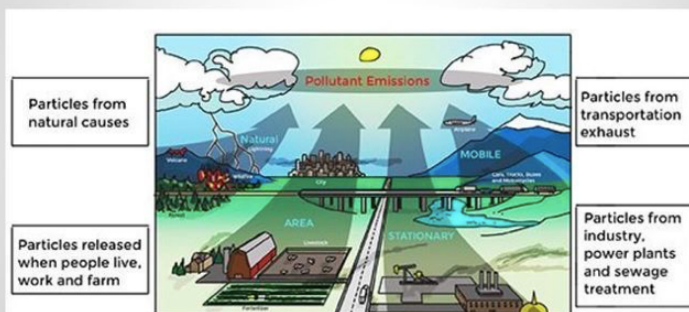
Complete the following prompts:

- Describe a way to control or prevent a chemical reaction.
- In what ways can we control or prevent physical interactions?
- Why is it difficult to reverse a chemical change?
- Of the physical changes you observed, are any easily reversible? How would you do it?

Task 3 Learning Target: I can describe environmental pollution issues related to chemical and physical reactions that impact air, land, or water quality.

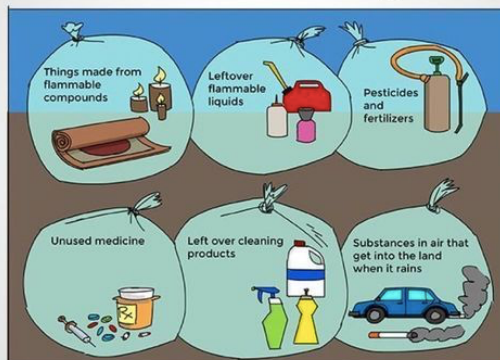
Air pollution forms when particles released into the air interact with each other and molecules in the air. Particles are released from natural causes like volcanoes and wildfires, from areas where people live and work, from stationary sources like factories, power plants and sewage treatment facilities, and from mobile sources like transportation exhaust, including planes, trains and automobiles.

Physical and Chemical Changes in the Air



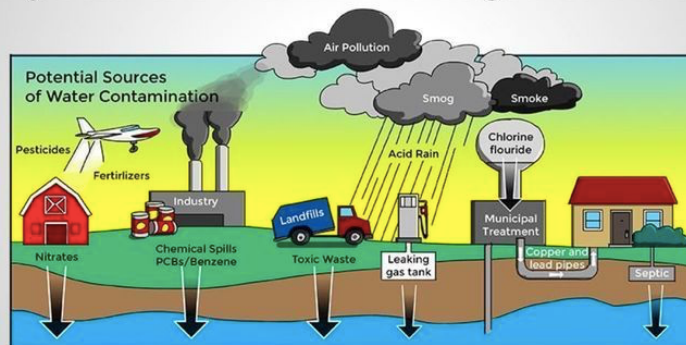
Land pollution forms when particles released into land interact. Particles are released from products that humans use and discard in landfill or other ways. Sources in our landfill include things made from flammable compounds, leftover cleaning products, unused medicines, pesticides and fertilizers, leftover flammable liquids and substances in air that get into the land when it rains.

Physical and Chemical Changes on Land



Water pollution forms when particles released into the water interact. Particles that end up in water originally come from many places, including nitrates in pesticides and fertilizers, chemicals from spills and industry, toxic waste in landfills, acid rain from air pollutions, copper and lead pipes corroding in soil and human waste from septic treatment systems in homes.

Physical and Chemical changes in Water



Answer: Which form of pollution do you find most threatening? Explain.

Task 4 Learning Target: I can research environmental pollution issues related to chemical and physical reactions that impact air, land, or water quality.

Oh no! There has been a discovery of major pollutants in the air, land and water near Toxic Town, and we need your help. Select one environmental issue for which you will design and build a solution. Toxic Town needs you to help it become a 'greener' city.

*See **Appendix A** on the following page if you need more assistance.

Prepare

<p>Choose One. Will your solution clean up a pollution issue or prevent pollution?</p>	
<p>Is this pollution caused by a physical or chemical change?</p>	
<p>Background Information: Find two reliable sources online. Research the pollution and ways in which people have cleaned up or prevented this pollution in the past. Record your findings below.</p>	
<p>Brainstorm your own ideas to solve the problem. This could be an improvement upon an existing solution or a brand-new solution of your own. Include sketches in your brainstorm.</p>	

Appendix A:

Potential Environmental Problems and Solutions: Suggestions to Spark Student Ideas

Environmental Issue Examples	Sources			Implications	Potential Solutions
	Air	Land	Water		
Volatile Organic Compounds (VOCs)	10X higher indoors from household products	Leach into soils from landfill from discarded household products containing VOCs	Rain drives leachate from soil in landfills into groundwater	Health issues including cancer	Physical -filters -garbage sorters -sifters Chemical
Garbage (moderate to large-sized solid waste)	Incinerators burn garbage that contains toxins, releasing toxic smoke into the air	Toxic solid waste contaminates the soil	Contaminated soil contaminates the water flowing through it	Reduction of quality of life Severe effects on flora, fauna with the potential of long term and biomagnifying effects (increased toxicity over time) and compounding effects (more than one toxin acting together)	-reaction that neutralizes toxins before or after it enters the environment -process that captures and encapsulates toxin for easy removal
Microplastics (small fragments of plastic materials)	N/A	Floating microplastic become a surface to which invasive species can attach and be transported to land	Abundant in aquatic ecosystems	plastics degrade in heat and UV, releasing toxins into the environment marine animals feed on them	Policy -product regulations -industry regulations City Planning and Communication -citywide initiatives to reduce landfill (recycling programs) -community gardens to encourage composting - Billboards support “green living”

Task 5 Learning Target: I can design a product that will clean up the pollution issues or help prevent pollution.

Design your device

What will your design do?	
Will you make a design that is UNIQUE and created by you, or will you IMPROVE UPON AN EXISTING DESIGN ?	
What are your solution requirements? What are some possible constraints (limitations) to consider? <i>For example, a requirement may be size or usability; a limitation may be cost or space.</i>	
What MATERIALS would you need to build your design solution? Where would you SOURCE these materials?	
How will your design clean up a pollution issue or prevent pollution issue?	
How does your design work?	

Task 6 Learning Target: I can present a product design that will clean up the pollution issues or help prevent pollution.

With the above plan in mind, now it is time to create your solution.

Choose the format in which you'll be presenting your solution.

This will be either

- Option A: Build a 3D model or
- Option B: Create a technical drawing.

If you choose option A, you will build a model and write the information text on a separate piece of paper.

If you choose option B, you will draw a technical sketch and write supporting information on the same paper.

For each presentation format, complete the following requirements.

- Title: Name of design as heading
- An explanation of how your solution works
- An explanation of the pollution and indication of whether it is caused by a physical or chemical change.
- An explanation of whether the solution **prevents** pollution or **cleans up** pollution.
- Explanations of all parts and how they contribute to the product
- Create a caption that explains how your solution will ultimately solve the pollution problem
- Final presentation of design solutions in written and verbal format as if you are presenting/pitching your device to the town

Evaluating Science & Engineering Practices

	Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Designing Solutions	Applies no scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies minimal scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies adequate scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies complete scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.
Communicating Findings/Design (Oral Presentation)	Findings/design are incompletely and inaccurately communicated. Or no evidence of using appropriate eye contact, adequate volume, or clear pronunciation.	Findings/design are completely communicated with some misconceptions. Or uses minimal eye contact, inappropriate volume, or inconsistent pronunciation.	Findings/design are completely communicated but lacking depth and complexity. Or often uses eye contact and engaging and appropriate volume and pronunciation but is inconsistent.	Findings/design are completely communicated with depth and complexity. Or mostly uses eye contact and engaging and appropriate volume and pronunciation.