

Physical & Chemical Changes

Major Topic and SOL

Science SOL

Physical & Chemical Changes in Matter

PS.5a, b

Length of Unit

4- 60 minute class periods (plus two additional classes for final quiz & mini-project presentation)

Major Understanding

The student will....

- define and describe physical and chemical properties.
- define and describe physical and chemical changes.
- differentiate between physical and chemical properties and changes.
- determine the identity of an unknown substance by comparing its properties to those of known substances.
- Determine the types of interactions between substances that result in a chemical change.

Essential Questions

- What are some physical properties to help identify a substance?
- What are chemical properties to help identify a substance?
- What do you find unique about physical and chemical properties and changes?

Student Objectives

Students will be able to...

- understand physical and chemical properties and changes and how to use these concepts to identify a substance. These properties can then help model the substance and understand how the substance will behave under various conditions.
- design an investigation from a testable question related to physical and chemical properties of matter.
- use inquiry based skills to compose a clear summarization by using various organizers to “tie it all together.”
- apply concepts of properties and changes to create a project modeling a physical or chemical change.

Bloom's Taxonomy Skills	21 st Century Learning Skills
<ul style="list-style-type: none"> • Creating • Evaluating • Analyzing • Understanding • Remembering 	<ul style="list-style-type: none"> • Critical Thinking • Problem Solving • Communication • Creativity & Innovation • Collaboration • Information & Media

Assessment Evidence

Performance Tasks

Students will...

- Complete a What I know, What I want to find out T-chart
- Review daily lectures and activities, and then write several sentences illustrating the main ideas of physical and chemical properties and changes.

Other Evidence

- Class Participation
- Teacher Observations
- Notebooks
- Writing Assignments
- Group Work
- Quizzes
- Rubrics
- Projects

Technology

Computers, Printer, Internet Connection, Document Camera (optional), Interactive White Board (optional), Concept Organizers (optional), Word Processing (optional)

Internet Resources

- BrainPop Account (or comparable/supplemental videos)
- Student Response System (and questions/answers)

Supplies/Materials

Lesson 1

- T-chart (attached)
- BrainPop videos: Measuring Matter and Property Changes (or other comparable video)
- Venn diagram (attached)
- Exit Ticket (attached)

Lesson 2 (will depend on lab demonstrations chosen)

- Various density liquids and large graduated cylinder
- Sugar, salt, or Kool-Aid, a glass, spoon and water to model solubility
- [Chemical Reaction](#) (bottle): A quart size plastic bottle and cap with aluminum foil balls and *The Works* toilet bowl cleaner
- [Gummy Bear Explosion](#): A large test tube, potassium chlorate, and a gummy bear, along with a test tube clamp and ring stand, with fuel
- [Film Canister Rockets](#): paper or index cards, tape, film canister, scissors, water, paper towels, Alka-Seltzer, watch or timer
- Chemical vs. Physical Properties worksheet (attached)

Lesson 3

- Carry on from Lesson 2 (students will need the Chemical vs. Physical Properties worksheet)

Lesson 4

- Student Response System or a tool to *poll* and collect data from your students (you could even create an online survey)

Final Evaluation (two additional classes)

- Class set of Physical and Chemical Properties and Changes quiz
- A rubric for the Physical and Chemical Change project for teacher (attached)
- A poster rubric for each student (attached)

Lesson 1: Changes to a “T” (1-60 minute period)

Engage:

- Ask students to think about what they already know about physical and chemical properties and changes.
- Have students make a T-chart (attached) to introduce, “What I know, what I want to learn.”
- Have students list three things that they already know about physical and chemical properties and changes into the first column.
- Then have them list three things that they would like to learn in the second column.

- After, show students two short video clips: "Measuring Matter" and "Property Changes" from www.brainpop.com or similar video clips on measuring matter or property changes.

Explore:

- Have students break into groups and complete a compare and contrast Venn diagram (attached) on Physical and Chemical Properties. Lists of phrases to use for the Venn diagram is provided, but encourage them to come up with their own.

Explain:

- Review the phrases for the Venn diagram.
- Ask students were did they place the proper phrases and why? This may be done under the document camera or via SmartBoard, where students engage and come up to complete.

Elaborate:

- Ask students to get out their T-chart from the beginning of class.
- Give them a chance to modify their statements on what they know or would like to learn.
- Ask them to participate and share the statements they listed.

Evaluate:

- Ask students to write a short summarization (a couple sentences) on the difference between a physical and chemical change.
- At the end of class, give students an Exit Ticket (attached) that lists five different substances and have students list a physical or chemical property for each.

Lesson 2: Is That an Explosion? (1-60 minute period)

Engage:

- During the beginning of class engage students by questioning them on the difference between physical and chemical changes.
- Have students share their sentences from their short summarization on the *differences between a physical and chemical change* from Lesson 1.
- Discuss that a physical change involves a change in the state of a substance.
 - *The substance may have some different properties, but it's still the same substance. For example, water can exist in three different physical states: solid (ice), liquid (water), and the gas state (water vapor). Regardless of what state the water is in, it still remains water. As water changes states its molecules rearrange, but are the same molecules. A chemical change produces a new substance by changing the way in which atoms are arranged. The bonds between atoms are broken and new bonds form*

between different atoms. After a chemical change takes place, the new arrangement of atoms form different substances. Ask students what are some types of evidence that they might think would indicate a chemical change? (formation of a gas, temperature change, color change, formation of a precipitate, property changes).

- Then demonstrate to students a physical change and chemical change, or changes. Physical changes could include the change of shape and size of an item, modeling of density by using various substances in a large graduated cylinder, or solubility by mixing salt, sugar, or Kool-Aid in water. For a chemical change: Take students outside and [explode a bottle or interact with alka-seltzer canisters](#), or explode a [gummy bear in a test tube](#) in the class room if you have a hooded vent (look at lesson 2 – Supplies/Materials for additional ideas).

Explore:

- In groups of three, ask students to discuss indicators and examples that would signal a physical or chemical change and why? For example, was heat and light produced?
- Groups will assign a *reporter, time keeper, and note taker* for this task

Explain:

- Review and explain to students that properties lead to changes and how changes can be undone (reversible with physical) and not chemical.
- Explain the clues that help determine a chemical change has taken place (reporters from groups will share).
- Summarize and discuss both physical and chemical properties and changes.

Elaborate:

- Ask students to get out their T-Chart and Venn Diagram from the previous lessons to summarize by questioning and answering of physical and chemical properties and changes.
- Ask students to get in groups and brainstorm ideas to demonstrate a physical or chemical change for a group project. They will be modeled to the class during a mini-project/presentation (to be announced).

Evaluate:

- Collect the group notes for informal evaluation.
- Have students complete a Chemical vs. Physical Properties worksheet (attached).

Note: Students can begin this in class and complete the rest at home that evening.

Lesson 3: Physical or Chemical? (1-60 minute period)

Engage:

- Present students with a list of physical and chemical properties that can lead to various physical and chemical changes. This may be done via a PowerPoint with slides, pictures, under the document camera or simply a list on paper.

Explore:

- Have students get out their Chemical vs. Physical Properties worksheet from the day before.
- Assign students to groups with tasks: leader, recorder, time keeper. Have students collaboratively work together to share their answers and allow them the opportunity to discuss and make changes to their worksheets.

Explain:

- Review the Chemical vs. Physical Properties worksheet after the students have finished as an entire class.

Elaborate:

- Pass out rubrics (attached) detailing the project and your expectations.
- Groups will decide what their mini-project will be (modeling a chemical or physical change).

Evaluate:

- Students will use the collaboration rubric to evaluate their peers during this lesson (attached)

Lesson 4: It's Not Just Fun and Games (1-60 minute period)

Engage:

- Explain how the students will be using a digital poll or survey to answer some review questions regarding Physical and Chemical Properties and Changes.
- Establish the rules and procedures of whatever tool you decide to use.

Explore:

- Students will work in groups/teams to take the poll or survey.

Explain:

- After each question, review with the class the answer and the poll or survey class results.

Elaborate:

- The teacher will review the two rubrics (attached) and review expectations.
- Students will be given a short time to further discuss/plan their mini projects in their groups.

Evaluate:

- Student's poll or survey group scores will evaluate student progress from previous lessons.

Unit Notes: Student will have a final evaluation from this unit by adding two additional class periods. During one class, the students will complete the quiz (attached). The second class, the students will present their group mini-projects with their posters. The presentation will be graded by the teacher using the project rubric and the poster rubric will be used for a peer evaluation.

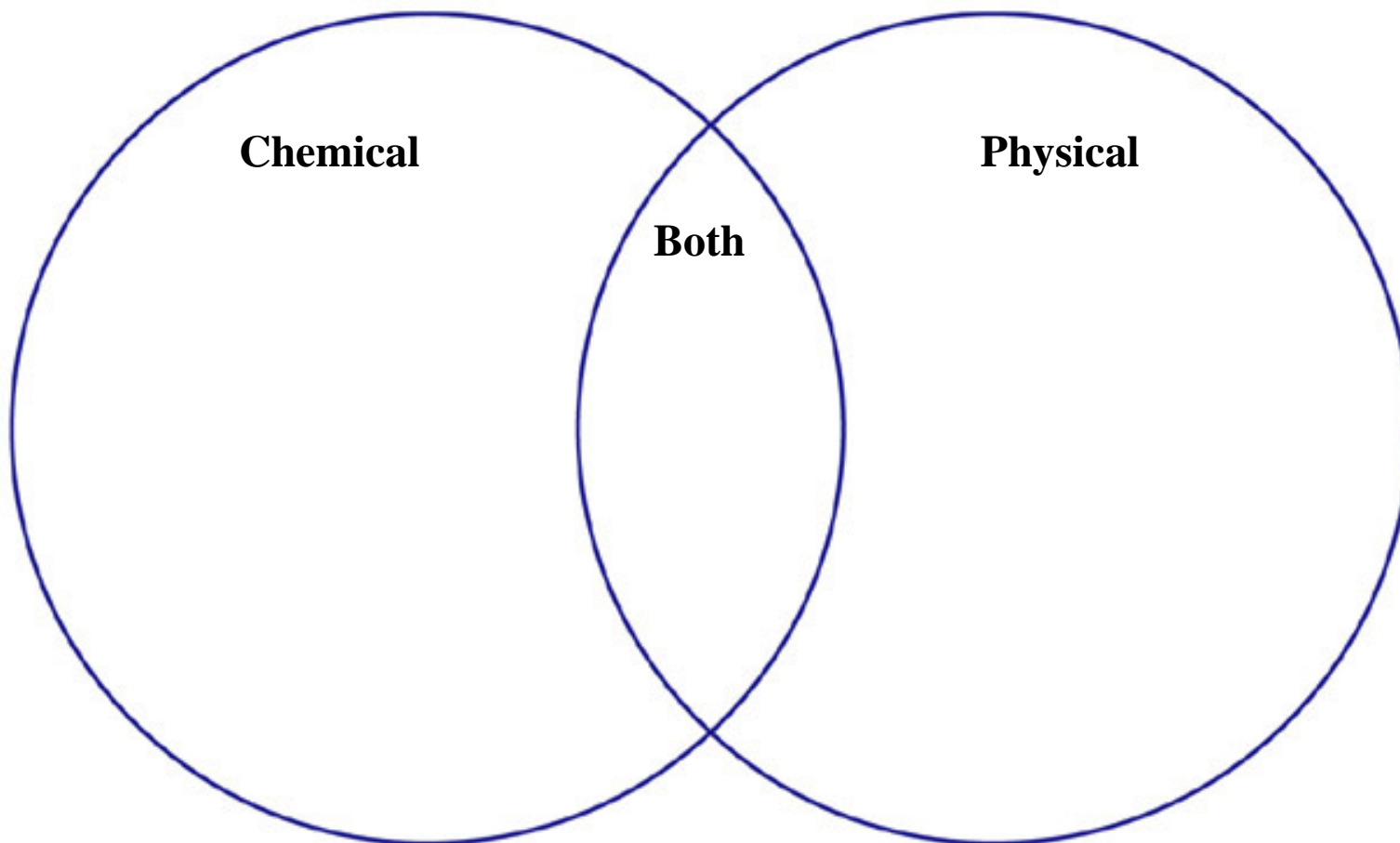
Physical and Chemical Properties and Changes

What I Know	What I Want to Learn

Collaboration Rubric (Peer Review)

	Exemplary (4)	Proficient (3)	Partially Proficient (2)	Unsatisfactory (1)
Focus on the Task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must sometimes remind this person to keep on task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Participation	A true team member who contributes a lot of effort, and encourages and supports the efforts of others in the group.	A strong group member who tries hard.	Sometimes a satisfactory group member who does what is required	Sometimes chooses not to participate and does not complete assigned tasks.
Dependability and Shared Responsibility	Follows through on assigned tasks and does not depend on others to do the work, responsibility for tasks is shared evenly.	Follows through on most assigned tasks.	Does not follow through on most assigned tasks and sometimes depends on others to do the work.	Seldom or never follows through on assigned tasks. Depends on others to do all of the work.
Listening, Questioning and Discussing	Respectfully listens, interacts, discusses and poses questions to all members of the team during discussions and helps direct the group in reaching consensus.	Respectfully listens, interacts, discusses and poses questions to others during discussions.	Has some difficulty respectfully listening and discussing, and tends to dominate discussions.	Has great difficulty listening, argues with teammates, and is unwilling to consider other opinions. Impedes group from reaching consensus.
Group/Partner Teamwork	All team members contributed equally to the finished project. Always did the assigned work.	Assisted group/partner in the finished project. Completed most of the assigned work.	Finished individual task but did not assist group/partner during the project. Completed some of the assigned work.	Contributed little to the group effort during the project. Relied on others to do the work.

Physical and Chemical Changes (Lesson 1)



Use the following terms/phrases to help you create a Venn Diagram on Chemical and Physical changes:

color	malleability	shape	heat conductivity	melting point	electrical conductivity
properties of a substance	change	can often be reversed	not easily reversed	forms new substances	
solubility	acidity	burning	changes of state	flammability	density
reactivity	basicity				

Physical or Chemical Exit Ticket (Lesson 1)

Mixing a substance into another substance to form a solution.	Physical or Chemical
Acid in tomato sauce can corrode aluminum foil.	Physical or Chemical
A sheet of copper can be pounded into a bowl.	Physical or Chemical
Silver tarnishes when it comes into contact with hydrogen sulfide in the air.	Physical or Chemical
Barium melts at 725° C	Physical or Chemical

Physical or Chemical Change? Indicate a 'P' or a 'C' for which type of change is taking place.

- | | |
|-----------------------------------|--|
| 1. ____ glass breaking | 11. ____ mixing salt and water |
| 2. ____ hammering wood together | 12. ____ mixing oil and water |
| 3. ____ a rusting bicycle | 13. ____ water evaporating |
| 4. ____ melting butter | 14. ____ cutting grass |
| 5. ____ separate sand from gravel | 15. ____ fireworks exploding |
| 6. ____ bleaching your hair | 16. ____ cutting your hair |
| 7. ____ frying an egg | 17. ____ crushing a can |
| 8. ____ squeeze oranges for juice | 18. ____ boiling water |
| 9. ____ melting ice | 19. ____ an electric eel shocks its prey |
| 10. ____ <u>sublimation</u> | 20. ____ buoyancy |

Identify the following as being true or false to the left of the sentence.

- _____ 21. A change in size or shape is a physical change.
- _____ 22. A chemical change means a new substance with new properties was formed.
- _____ 23. When platinum is heated, then cooled to its original state, we say this is a physical change.
- _____ 24. When milk turns sour, this is a physical change because a change in odor does not indicate a chemical change.
- _____ 25. When citric acid and baking soda mix, carbon dioxide is produced and the temperature decreases.

Rubric for Physical and Chemical Changes Project

Criteria	1	2	3	4
Organization	<ul style="list-style-type: none"> ➤ Messy, all over the place ➤ Not all main points completed 	<ul style="list-style-type: none"> ➤ No heading, but supporting ideas listed ➤ Hard to follow ➤ Missing information ➤ Needs changes 	<ul style="list-style-type: none"> ➤ All information present but unclear as change/idea chosen ➤ Must reread for project idea clarity ➤ Some evidence of changes needed 	<ul style="list-style-type: none"> ➤ Defined project idea chosen ➤ Clear headings ➤ Flows nicely and easy to follow ➤ Finished product
Creativity (Uniqueness)	<ul style="list-style-type: none"> ➤ Bland/plain ➤ No use of color, diagrams, or pictures ➤ Boring to look at it, doesn't catch your eye ➤ Little interest, motivation, effort and time invested 	<ul style="list-style-type: none"> ➤ Very little use of color, diagrams, or pictures. However, enough to grasp one's eye 	<ul style="list-style-type: none"> ➤ Some use of color, diagrams, or pictures ➤ Will engage one's interest 	<ul style="list-style-type: none"> ➤ Very interesting, engaging and stimulating to the observer ➤ Use of color, diagrams, or pictures ➤ Interest, motivation, and effort clearly made
Science Content (Physical –vs.-Chemical Change)	<ul style="list-style-type: none"> ➤ No explanation of change ➤ Topic not supported ➤ No specific connection made with change chosen ➤ No use of resources (text, notes, online) 	<ul style="list-style-type: none"> ➤ Poor explanation of change ➤ Inaccurate connection with change chosen ➤ Misinterpreted science resources 	<ul style="list-style-type: none"> ➤ Sufficient explanation ➤ Science connection present with change, but could be developed further ➤ More than one resource present 	<ul style="list-style-type: none"> ➤ Explained topic ➤ Clear understanding of change chosen ➤ Content is accurate and well supported ➤ Excellent use of resources
Level of Difficulty and Understanding	<ul style="list-style-type: none"> ➤ Topic/Change chosen too easy not suitable for grade level 	<ul style="list-style-type: none"> ➤ Explanation describes minimal level of understanding ➤ Needs changes 	<ul style="list-style-type: none"> ➤ Task difficulty could be increased ➤ Some level of topic understanding shown 	<ul style="list-style-type: none"> ➤ Difficulty appropriate for grade level ➤ Understanding apparent and present

Poster rubric

CATEGORY	4	3	2	1
Required Elements	The poster includes all required elements as well as additional information.	All required elements are included on the poster.	All but 1 of the required elements are included on the poster.	Several required elements were missing.
Labels	All items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Almost all items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Many items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Labels are too small to view OR no important items were labeled.
Graphics - Relevance	All graphics are related to the topic and make it easier to understand. All borrowed graphics have a source citation.	All graphics are related to the topic and most make it easier to understand. Some borrowed graphics have a source citation.	All graphics relate to the topic. One or two borrowed graphics have a source citation.	Graphics do not relate to the topic OR several borrowed graphics do not have a source citation.
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed. It is not attractive.
Grammar	There are no grammatical/mechanical mistakes on the poster.	There are 1-2 grammatical/mechanical mistakes on the poster.	There are 3-4 grammatical/mechanical mistakes on the poster.	There are more than 4 grammatical/mechanical mistakes on the poster.

Name: _____ Class Period _____ Date: _____

Physical and Chemical Properties/Changes Quiz

1. A measure of how much mass is contained in a given volume (space) is called –
 - a) volume
 - b) cubic measurement
 - c) density
 - d) area
2. What is a physical property of matter?
 - a) acidity
 - b) combustibility
 - c) density
 - d) reactivity
3. What is another physical property of matter?
 - a) solubility
 - b) basicity
 - c) flammability
 - d) acidity
4. The density of an object is dependent upon the object's mass and –
 - a) area
 - b) height
 - c) weight
 - d) volume
5. Matthew likes his tea very sweet and sweetens it with sugar cubes. All of the following will help Matthew dissolve the sugar into his tea faster EXCEPT-
 - a) stirring the tea
 - b) using powdered sugar instead of sugar cubes
 - c) heating the tea
 - d) adding more ice
6. Which physical property can Erin calculate if she knows that the volume of a lead weight is 6.0cm and the mass is 120g?
 - a) solubility
 - b) volume
 - c) area
 - d) density
7. When a solid reaches the temperature of its _____, it can become a liquid.
 - a) freezing point
 - b) melting point
 - c) boiling point
 - d) density

8. What is a chemical property of matter?
- a) density
 - b) color
 - c) reactivity
 - d) solubility
9. What is another chemical property of matter?
- a) smell
 - b) shape
 - c) texture
 - d) acidity
10. Which of the following is an example of physical change?
- a) Mixing baking soda and vinegar together, and this causes bubbles and foam.
 - b) A glass cup falls from the counter and shatters on the ground.
 - c) Lighting a piece of paper on fire and the paper burns up and leaves ashes.
 - d) Baking a birthday cake for your mother.
11. Which of the following is an example of chemical change?
- a) Filling up a balloon with hot air.
 - b) Taking a glass of water and freezing it by placing it in the freezer.
 - c) A plant collecting sunlight and turning it into food.
 - d) Your dog ripping up your homework.
12. Which change can be easily be reversed?
- a) Chemical Change
 - b) Physical Change
 - c) Both a physical and chemical change
 - d) Neither a physical or chemical change
13. When a new substance is formed with different properties than the original substance it is called a
- a) Chemical change
 - b) Physical change
 - c) Freezing
 - d) boiling
14. If the chemical properties of a substance remain unchanged and the appearance or shape of an substance changes it is called a
- a) Chemical change
 - b) Physical change
 - c) Both a physical and chemical change
 - d) Neither a physical or chemical change

15. Which is an example of a physical change?
- Metal rusting
 - Silver tarnishing
 - Water boiling
 - Paper burning
16. Which is an example of chemical change?
- water freezes
 - wood is cut
 - bread is baked
 - wire is bent
17. Which is **not a clue** that could indicate a chemical change?
- Change in color
 - Change in shape
 - Gas production
 - A precipitate forms
18. A chemical change
- changes matter from one form to another.
 - destroys matter.
 - creates matter.
 - does not change matter in any way.
19. Which of the following is a physical change?
- iron is oxidized to iron oxide
 - aluminum meal is pounded into thin sheets
 - copper reacts with a strong acid
 - sodium metal explodes on contact with water
20. Which of the following is an example of a chemical change?
- melting solid gold
 - burning hydrogen gas
 - dissolving sugar in water
 - breaking a sheet of glass
21. Which of the following is a common sign that a chemical change has occurred?
- A chemical has changed size.
 - A chemical has changed to a different state (solid, liquid or gas)
 - A chemical has become a different shape.
 - A chemical has turned a different color.

22. Jolene wants to experiment with sugar cubes. Which of the following causes a sugar cube to only change physically, not chemically?

- a) burning the sugar cube with a match
- b) crushing the sugar cube and dissolving it in water
- c) dehydrating the sugar cube with sulfuric acid
- d) chewing the sugar cube and digesting it

23. A physical change occurs when...

- a) both the appearance of a substance and its identity change.
- b) the appearance of a substance changes but its identity does not.
- c) the identity of a substance changes but its appearance does not.
- d) neither the appearance of a substance nor its identity changes.

24. Diane draws a picture on a piece of paper and then folds it into a paper airplane. She throws it at her little brother, and it hits him in the head. He responds by ripping up the paper. Which of the following is an example of a physical change?

- a) ripping up the paper
- b) folding the paper into an airplane
- c) drawing on the paper
- d) all of these

25. What type of change is corrosion?

- a) physical
- b) chemical

Bonus Questions: Label as (P) for Physical or (C) for Chemical

_____ Crush

_____ Tarnish

_____ Grind

_____ Photosynthesis

_____ Sublimation

_____ Perfume evaporating on your skin

_____ Autumn leaves changing color

_____ Burning sugar