

Critical Thinking Skills

Properties of Matter

Skills For Critical Thinking		Reading Comprehension							Hands-on Activities
		Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	
LEVEL 1 Knowledge	<ul style="list-style-type: none"> List Details/Facts Recall Information Match Vocab. to Definitions Define Vocabulary Label Diagrams Recognize Validity (T/F) 	✓ ✓ ✓	✓ ✓ ✓	✓	✓	✓ ✓ ✓	✓ ✓	✓ ✓	✓
LEVEL 2 Comprehension	<ul style="list-style-type: none"> Demonstrate Understanding Explain Scientific Causation Rephrasing Vocab. Meaning Describe Classify into Scientific Groups 	✓	✓ ✓ ✓	✓ ✓ ✓ ✓	✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓	✓
LEVEL 3 Application	<ul style="list-style-type: none"> Application to Own Life Model Scientific Process Organize and Classify Facts Utilize Alternative Research Tools 	✓ ✓	✓	✓		✓ ✓	✓ ✓	✓	✓ ✓ ✓
LEVEL 4 Analysis	<ul style="list-style-type: none"> Distinguish Roles/Meanings Make Inferences Draw Conclusions Based on Facts Provided Classify Based on Facts Researched 	✓ ✓			✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓
LEVEL 5 Synthesis	<ul style="list-style-type: none"> Compile Research Information Design and Application Create and Construct Imagine Self in Scientific Role 		✓	✓ ✓	✓	✓ ✓	✓		✓ ✓ ✓ ✓
LEVEL 6 Evaluation	<ul style="list-style-type: none"> State and Defend an Opinion Justify Choices for Research Topics Defend Selections and Reasoning 				✓	✓ ✓	✓		✓ ✓

Based on Bloom's Taxonomy



Physical Changes vs. Chemical Changes

1. Some changes are described below. Write **P** beside the changes that are physical changes. Write **C** beside the changes that are chemical changes.

- _____ a) Water boils on a stove.
- _____ b) An old penny, lost in the grass, turns green.
- _____ c) Fireworks explode in the night sky.
- _____ d) Frost forms on a pumpkin.
- _____ e) An old Jack-O-lantern begins to rot.

2. Circle **T** if the statement is TRUE or **F** if it is FALSE.

- T** **F** a) Chemical changes happen only in things that are alive.
- T** **F** b) Physical changes happen only in things that are not alive.
- T** **F** c) The way atoms are fastened together changes during a chemical change.
- T** **F** d) Atoms and molecules are both particles.
- T** **F** e) If a material changes color, it is proof that a chemical change is happening.



Physical Changes vs. Chemical Changes



We learned that **chemical changes** cause new materials to be formed.

What do we mean by *new*?

Earlier, we read that particles, called **atoms**, sometimes fasten together to form larger particles, called **molecules**. Sometimes atoms get **rearranged** and fastened in a new way to form different molecules. This is a chemical change. In a physical change, the particles are the same before and after the change.



When clouds begin to form in a clear, blue sky, it looks like a new material is being formed. This is not true. The air is full of many water molecules that we cannot see. They are the gas called water vapor. When they come together to form tiny drops, a cloud appears. This is a physical change because the water molecules did not change. They just went from the gas state to the liquid state.

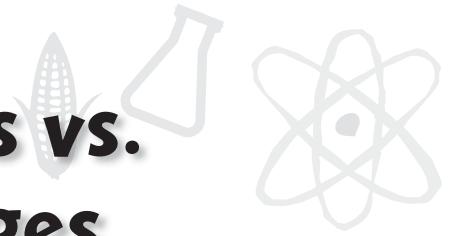
When hydrogen gas burns, it **combines** with oxygen gas to form water. This is a chemical change because a new material is formed. Atoms in hydrogen and oxygen molecules come apart. Then they fasten together in a new way and form water molecules.

Another example of a chemical change is rust forming on an iron nail. First, oxygen molecules come apart. Then the oxygen atoms fasten onto iron atoms and form a new material. The new material is rust. Rust has the chemical name, iron oxide.

These two examples are both chemical changes because atoms have been rearranged to form new molecules.



Physical Changes vs. Chemical Changes



Do you think it is possible to tell whether a change is chemical or physical by just watching it? It is often hard to tell, but there are some good clues. Flames show a chemical change is taking place. Other signs are not a sure bet. If the change only goes in one **direction**, it is *usually* a chemical change. For example, you can re-freeze a melted ice cube. (This is a physical change.) You cannot un-burn a match. (This is a chemical change).



When a candle burns a chemical change is happening. What could you do to a candle that would cause a PHYSICAL change?

When bubbles rise out of a liquid, it may show that a chemical change is forming a gas. But boiling also makes bubbles rise out of a liquid, and that is a physical change. **Explosions** are often chemical changes. Exploding fireworks are a chemical change, but an exploding balloon is a physical change. Changes in color, temperature, and smell can all happen with either a chemical or physical change.

So it may take more than a close look to tell whether a change is chemical or physical. You may need to know more about the materials before and after the change.

Finally, it is good to know that many changes are *both* chemical and physical. A physical change can be only a physical change. Chemical changes usually cause physical changes to happen close by. As you watch a fire in a fireplace, you are seeing a chemical change. But the fire is warming the air, and that is a physical change.