

Grade 7 Science  
Week of December 7– December 11

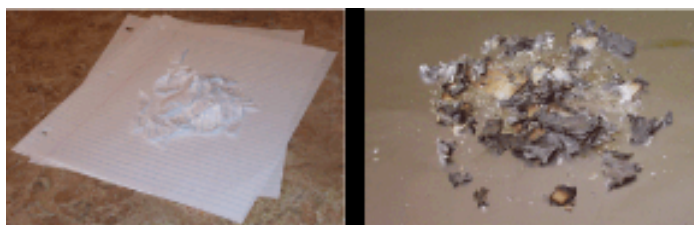
Physical and Chemical Change

## Changes in Matter

Take out a piece of paper. How can you change it, apart from writing on it, or folding it?

- You can tear it up into small pieces. Is it still paper? Yes, you have only changed the way the paper looks. This is called a physical change.
- You can burn the paper. Is it still paper? No, the new material is no longer paper. This is called a chemical change.

There are two types of changes: physical change and chemical change. It's important for you to be aware of the difference between these two types of changes.



## Physical Change

If you change something **physically** you still have what you started with. For example, if you tear a piece of paper you still have paper.

A change of state is a physical change - frozen water and liquid water are the same substance.

If you mix water with juice crystals you have changed it physically but no new particles are created. This is the kind of change that is reversible - you could evaporate the water and be left with the juice crystals. Most physical changes are **reversible** - you can usually change the substances back into their original form. Some are **non-reversible** - you can't put the two pieces of paper back into one piece.

## Examples of Physical Change

In a **physical change**, a substance changes its state, appearance, or shape but remains the same substance.

The following are some examples of physical changes:

- ice melting (phase change from solid to liquid—it's still H<sub>2</sub>O)
- water evaporating (phase change from liquid to gas—it's still H<sub>2</sub>O)
- cutting a piece of paper into bits (shape change but it's still paper)
- molding a lump of clay (shape changes but it's still clay)
- melting iron, pouring it into a mold, then cooling it (phase changes and shape change but it's still iron)

## Chemical Changes

If you change something **chemically**, you end up with something very different than what you started with. For example, if you burn a piece of paper you end up with carbon and no more paper. The original substance or reactant changes into a new substance, called a product, with different properties. Most chemical changes are non-reversible - you can't get back the original substance once you've changed it.

In the paper example, it is easy to determine whether something else was created. It's not always that easy. Here are some hints to determine whether a change is physical or chemical:

- **After the change, does it look the same (eg. colour)?**  
**If a different substance is formed, it may look different.**
- **Was heat or sound given off during the change?**  
**Chemical reactions can cause heat or sound.**
- **Were there bubbles formed (ie. a gas)?**  
**Bubbles often indicate that some chemical reaction is going on.**
- **Did solid particles form (ie. precipitate)?**  
**These are another good indicator that a chemical reaction happened.**
- **Can you change it back?**  
**Chemical reactions are often difficult or impossible to reverse, while physical changes are usually reversible.**

One of these changes alone is not always enough to determine what type of change has occurred. You may have to consider several clues.

|                        | Changes you can see   | Changes in particles   |
|------------------------|---|--|
| <b>Physical Change</b> | the matter is the same<br>the original matter can be recovered  | the particles may be rearranged                                  |
| <b>Chemical Change</b> | the matter is different<br>the original matter can not be recovered<br>the old substance is no longer there | the particles are broken apart and rearranged into new particles |

## Examples of Chemical Change

We find many chemical changes happening around us all the time. Matter regularly undergoes **chemical changes** but matter never disappears - it just has new forms. A burning paper can turn into ash and carbon, which in turn is used to provide nutrients in the soil. Chemical changes can occur in both the living and non-living environments.

### 1. Burning



Wood + Heat + Oxygen → Ash + Gases + Water Vapour

2. Metals that contain iron, when exposed to moisture and oxygen, can start a chemical change in the metal which we often refer to as rust – a new substance.

3. Compost - There are new substances formed in composting when moisture and oxygen are added.



4. Rusting – Metals that contain iron, when exposed to moisture and oxygen, can start a chemical change in the metal which we often refer to as rust – a new substance.



Iron + Oxygen  $\rightarrow$  Rust

5. Metals such as silver or copper, when combined with oxygen, can also form new substances. Tarnished silver is a new substance called silver oxide.



Silver + Oxygen  $\rightarrow$  Silver Oxide (tarnish)

## Physical and Chemical Changes

**Chemical changes** take place on the molecular level. A chemical change produces a new substance called a new product. Examples of chemical changes include combustion (burning), cooking an egg, rusting of an iron pan, and mixing hydrochloric acid and sodium hydroxide to make salt and water.

These examples of chemical change involve the formation of new products and a change in energy. For example, in the cooking of an egg energy is added to the reaction while burning of paper releases energy to the environment.

Sometimes a substance can undergo both a physical and chemical change. One example of this is wax.

A burning candle causes wax to melt and drip down the sides of the candle (physical change—solid becomes liquid). Some of the wax burns, keeping the flame alive. Black soot rises from the flame, and the flame gives off heat and light. These are all chemical changes (colour, heat, light). This is a combustion reaction, so carbon dioxide gas and water vapour are also produced, but you can't see them.



Physical and Chemical Change: <https://youtu.be/oQnPNBVmwuU>

## Physical vs. Chemical Changes

### Physical and Chemical Changes

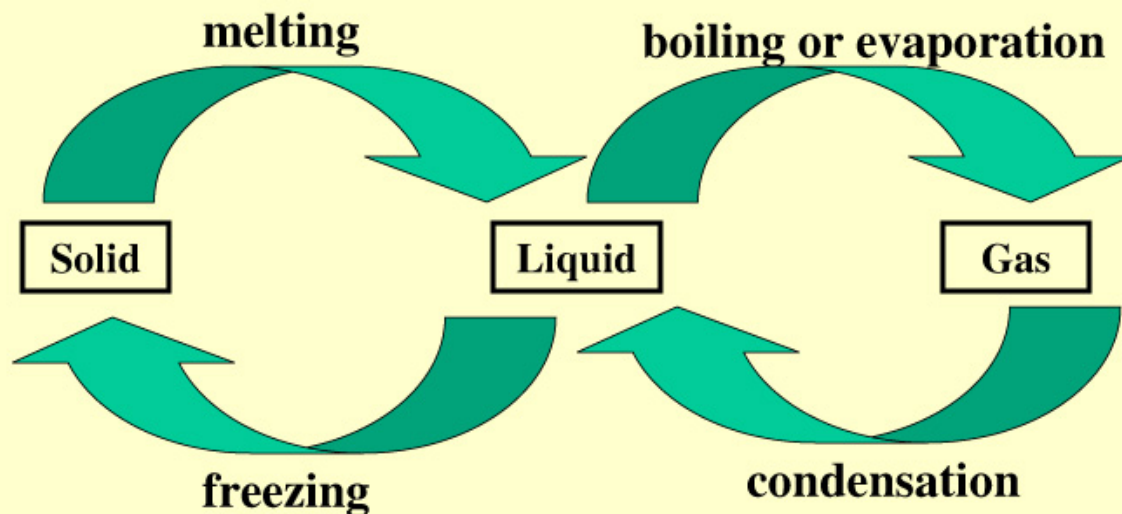


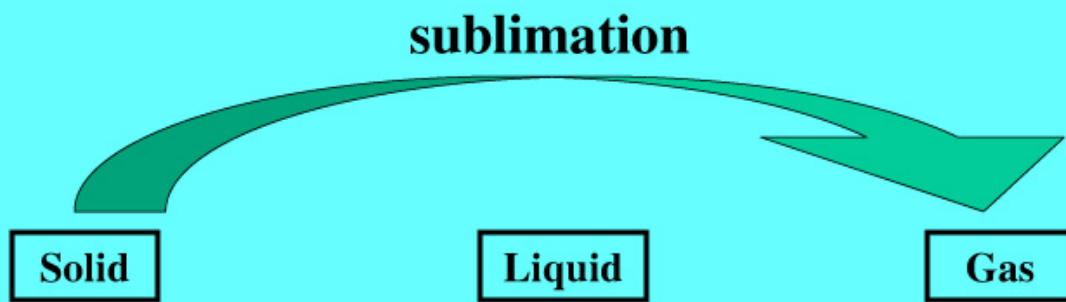
# Physical Change

A change in which no new substance is produced



Physical Changes can be Phase Changes





Going directly to a gas, skipping the liquid state

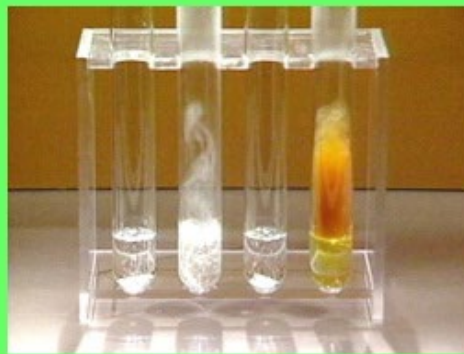
Other **Physical changes** could include things like:

- Mixing
- Dissolving
- Electric light bulb glowing



# Chemical Change

A change in which at least one new substance is produced. Starting materials are used up.



thermite



Some examples of **Chemical Changes** are:

- **Burning (combustion)**
- **Explosions**
- **Cooking food (not just warming it up)**
- **Digestion**
- **Photosynthesis**



In deciding whether a change is physical or chemical the following guides are helpful.

**Physical change:**

1. observed without changing the chemical make up of the substance.
2. A change of state (solid, liquid, gas) is a physical change.

**Chemical changes:**

1. are changes that produce a new kind of matter with different properties

Abbreviations used in chemical reactions:

- (s) - solid state
- (l) - liquid state
- (g) - gas state
- (aq) - aqueous, meaning "in water"

$\text{H}_2\text{O}_{(l)} \rightarrow \text{H}_2\text{O}_{(g)}$  describes a physical change.

$2\text{H}_2\text{O}_{(l)} \rightarrow 2\text{H}_2_{(g)} + \text{O}_{2(g)}$  is a chemical change.

## Did You Know?

### Green Pennies

Find some old pennies. Observe them closely.

- What colour are they?
- Are any green?

If so, you are observing a penny that has undergone a chemical change. Why did this happen? Over time, copper corrodes as it comes in contact with airborne sulfur compounds. Eventually, the surface colour reaches equilibrium, and the change is stabilized. The final surface is a patina, a thin layer on the metal. Usually it's a green colour, but this can vary.

Where else have you seen evidence of chemical change turning something green?

- Click [here](#) to learn about the Statue of Liberty and the restoration work carried out on it.

## Physical and Chemical Change

1. List five observations that are evidence of a physical change.
2. List five observations that are evidence of a chemical change.
3. Identify the properties listed below as physical or chemical properties.

- a. Colour -
- b. Density -
- c. Reacts in acid -
- d. Boiling point -
- e. Conductivity -
- f. Flammability -
- g. Freezing point -

4. Which of the following are physical changes and which are chemical changes? Include an observation that supports each choice.

| Example of Change             | Physical or Chemical | Supporting Observation |
|-------------------------------|----------------------|------------------------|
| Frying an egg.                |                      |                        |
| Crushing chalk.               |                      |                        |
| Growing a plant.              |                      |                        |
| Dissolving sugar in water.    |                      |                        |
| Slicing bread.                |                      |                        |
| Toasting bread.               |                      |                        |
| Cooking bacon.                |                      |                        |
| Making homemade popsicles.    |                      |                        |
| Whipping cream.               |                      |                        |
| Salting icy roads.            |                      |                        |
| Composting leaves.            |                      |                        |
| Cutting grass.                |                      |                        |
| Using a hot glue gun.         |                      |                        |
| Wave action on a beach.       |                      |                        |
| Formation of limestone caves. |                      |                        |
| Digestion of food.            |                      |                        |

|   |  |  |
|---|--|--|
| Ripening of bananas.                        |  |  |
| Evaporation of water.                       |  |  |
| Dew forming on grass.                       |  |  |
| Rusting of iron.                            |  |  |
| Mixing red and yellow paint to make orange. |  |  |
| Lighting a match.                           |  |  |
| Splitting wood.                             |  |  |

5. List three physical changes and three chemical changes not in the list above.