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TEACHER INFO

CHEMICAL VS. PHYSICAL CHANGES
GRADES 3-5

COMMON MISCONCEPTIONS

- Chemical changes are caused by heat.
  Chemical changes can be caused by heat, such as toast being burned in a toaster, but heat can also cause physical changes (like when water boils away to steam). Chemical changes are also caused by other means where heat is not a factor.

- Melting and boiling are chemical changes.
  Melting and boiling are physical changes. Melting happens when heat is added to a solid and boiling occurs when heat is added to a liquid. Melting is the phase change between solid and liquid, and boiling causes liquid to evaporate to gas. Phase changes are physical changes because the material changes forms but does not result in a new substance.

PHYSICAL CHANGES

Physical changes to matter occur when two or more substances are mixed together and the resulting product(s) are not different types of substances than those you started with. For example, if apples, bananas and strawberries are cut up and mixed together, the fruit has only undergone a physical change because the fruit salad is still made up of apples, bananas and strawberries. Phase changes, when a solid melts into a liquid, liquid freezes as a gas; a liquid evaporates into a gas, or gas condenses to a liquid; a gas is deposited directly as a solid, or a solid sublimates directly to a gas, are all examples of physical changes because although a substance's form has changed, it is still the same substance. Whether ice, liquid in a gas or steam, water is still H_2O.

CHEMICAL CHANGES

When matter changes and a new substance is formed, a chemical change has taken place. Two or more different substances may react (fizzing, bubbling, etc.) when mixed together. There are many ways for chemical change to occur. Materials may dissolve into one another, or precipitate out (come out of liquid solution as a solid). Substances may mix at the atomic level and combine to form new chemical structures (this level of detail is not addressed in this lesson). Burning materials often creates new substances. Rusting metal or rotting food or milk are other examples of chemical changes.

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CAUSE AND EFFECT

The crosscutting concept of cause and effect is inherent in what happens during both chemical and physical changes. Something that is done to one or more substances—mixing in another substance, adding heat, cooling, etc. causes a change (effect) that we classify as physical or chemical depending on the properties of the resulting substance(s). Cause and effect can be specifically explored through flame tests, as different gases cause different results (effects) that are key in identifying otherwise difficult to differentiate gases.

OBSERVATIONS AND DATA AS EVIDENCE

It is key for student to understand not only what physical and chemical changes are, but how we know which one has occurred. To be able to classify a reaction as one or the other, it is key to be able to identify the end product to determine if it is a new substance or not. During the video, Dr. Jeff, Zoe and Izzy conduct tests on the products of some of the reactions to learn what the substance is. Flame tests are introduced as a way to identify different types of gases. Students observe how flame reacts to CO_2 (flame is extinguished) which is visibly no different from the surrounding air. They also observe how hydrogen reacts to flame (flash and pop) on both a small and large scale. It is key for students to understand that the flame tests and other methods Dr. Jeff, Izzy and Zoe demonstrate, are an important part of understanding physical changes. The evidence that verifies whether a change is physical or chemical comes from knowing what product was made.

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