SNC1D CHEMISTRY

ATOMS, ELEMENTS, & COMPOUNDS

- ☞ Physical & Chemical Changes (P.~)

Physical & Chemical Changes

You may have tried some popular treats made with marshmallows. When you melt marshmallows to mix with Rice Krispies, you change only the physical properties of the marshmallows. However, when you roast marshmallows a new substance forms.

Physical Changes

When you melt marshmallows, you are only changing the state of the marshmallows (i.e. solid and liquid marshmallows are the same substance). A physical property has changed, but the composition of the substance is the same. This is called a ***physical change****. If you fold paper into an origami crane, the paper has changed shape, but it is still paper. If you saw wooden planks to build a tree house, the wood is in a new shape. But, it is still the same substance – wood.*

Physical Changes

In a physical change, the composition of the substance remains exactly the same. No new substances are made. For example, boiling changes water from a liquid to a gas, but it does not change water into a new substance. When wax is heated it melts but when it cools it turns back into a solid. Its physical properties changed, but its composition stayed the same – the wax is still wax whether it is solid or melted.

Physical Changes

Dissolving is also a physical change. When salt is dissolved in water, you cannot see the salt, but if you took a sip you would taste the salt. And, if you allowed the water to evaporate, the salt would remain in the container. Dissolving salt in water does not produce a new substance. So, it is a physical change.

Physical Changes

NOTE!

Some physical changes can be reversed while others cannot. For example, when sugar dissolves in water, the change can be reversed by evaporating the water away. But, if you were to cut a log into lumber, you could not put the log back together.

Physical Changes

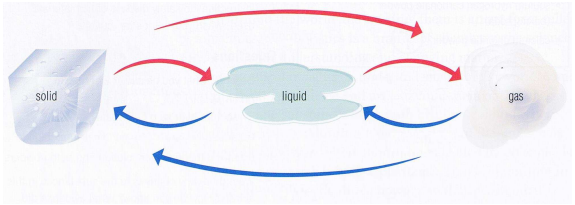
PHYSICAL CHANGE

- substance remains the same (i.e. no new substances are produced)
- generally easy to reverse (but not always)
- melting, boiling, dissolving, …

Physical Changes

PRACTICE

1. Solids, liquids and gases are called states of matter. Specific terms are used to describe changes of state of a substance. Copy and complete the diagram showing the physical changes that water undergoes as it changes states.



Physical Changes

PRACTICE

2. In each of the situations below, it seems that a new substance may have been produced. Explain why each situation represents a physical change.
   (a) A tailor makes a new suit out of a piece of fabric.
   (b) A chef makes a salad out of lettuce, tomatoes, and cucumbers.
   (c) A mechanic builds a boat engine out of a lawnmower.
   (d) A chemist boils water until only salt crystals are left.
   (e) A child makes juice by adding water to juice concentrate.

in each case the appearance has changed but the original material has not changed

Chemical Changes

*A change that results in the formation of a new substance is called a **chemical change**. For example, roasting a marshmallow on a campfire produces a brown, flaky substance on the surface of the marshmallow. This substance is clearly different from the gooey centre of the marshmallow.*

Chemical Changes

You can tell a chemical change has taken place because a new substance formed. For example, some jewellery might leave a green stain on your skin. The green stuff is a new substance produced when the metal reacts with sweat. Many chemical changes are easy to observe and occur all around you.

NOTE!
The original substances do not disappear though. Instead, their components (i.e. their atoms) are rearranged when the new substance is formed.

Chemical Changes

Permanent hair colouring also involves chemical changes. For example, a bleaching chemical such as hydrogen peroxide is first used to change the natural pigment in your hair into new substances that have no colour (i.e. the hair dye changes the chemical inside each strand of hair).

Chemical Changes

CHEMICAL CHANGE

- change in which one or more new substances is formed
- atoms of the original substance(s) are rearranged

Chemical Changes

PRACTICE

3. Classify each as a physical or chemical change:
   (a) folding a paper airplane P
   (b) water freezing on a pond P
   (c) a car rusting C
   (d) making a campfire C
   (e) melting a marshmallow P
   (f) dissolving sugar in coffee P

Chemical Change Clues

PRACTICE

4. There are 6 distinctive clues (either alone or together) that indicate a chemical change has occurred. What are they?

CHEMICAL CHANGE CLUES

① a new colour appears
② a new odour appears
③ heat/light is given off
④ bubbles of gas are formed
⑤ a solid material (precipitate) forms
⑥ the change is difficult to reverse

Chemical Change Clues

NOTE!

These "chemical change" clues can help you decide whether a chemical or physical change has occurred. But it is important that you do not come to a conclusion too quickly. While all of these clues suggest that a new substance has been produced, any one of them could also accompany a physical change. You must consider several clues in order to determine what type of change has taken place.

Chemical Change Clues

PRACTICE

5. What evidence suggests that these changes are chemical changes?
   (a) Bubbles form when baking soda is mixed with lemon juice.

   (a) bubbles of gas are formed (& change is difficult to reverse)

Chemical Change Clues

PRACTICE

5. What evidence suggests that these changes are chemical changes?
   (b) Cookies baking in the oven give off a delicious aroma.

   (b) new odour appears (& change is difficult to reverse)

Chemical Change Clues

PRACTICE

5. What evidence suggests that these changes are chemical changes?
   (c) A match is struck and ignites.

   (c) heat/light is given off (& change is difficult to reverse)

Chemical Change Clues

PRACTICE

5. What evidence suggests that these changes are chemical changes?
   (d) When two liquids are mixed a solid red substance appears.

   (d) a solid precipitate forms (& change is difficult to reverse)

Chemical Change Clues

PRACTICE

5. What evidence suggests that these changes are chemical changes?
   (e) A banana tastes sweeter as it ripens.

   (e) the change is difficult to reverse

✔ Check Your Learning

1. When a frozen pizza is placed in the oven, the cheese begins to melt and then darken. The crust becomes brown on the edges. Are these physical or chemical changes? How do you know?

   cheese melts – physical (easy to reverse)
   crust/cheese browns/darkens – chemical (change is difficult to reverse)

✔ Check Your Learning

2. A candle burns for 15 minutes before it is extinguished. Some wax melts, drips down the side, collects at the base of the candle, and then hardens again. The candle becomes shorter.
   (a) What changes were physical changes? Explain.

   (a) wax melting/hardening and candle getting shorter – chemical properties did not change

✔ Check Your Learning

2. A candle burns for 15 minutes before it is extinguished. Some wax melts, drips down the side, collects at the base of the candle, and then hardens again. The candle becomes shorter.
   (b) Was there any evidence of a chemical change? Explain.

   (b) burns – heat/light is given off and the change is difficult to reverse

✔ Check Your Learning

3. Classify each of the following as a physical change or a chemical change. For each chemical change, explain how you can tell that a new substance has been formed.
   (a) Water boils and turns into steam. P
   (b) Wood is sawed and made into a toy box. P
   (c) Firewood burns and ashes remain. C
   (d) Orange drink crystals are stirred into a pitcher of water. P
   (e) Sugar, eggs, and flour are mixed and baked into cookies. C

✔ Check Your Learning

TEXTBOOK
P.161 Q.4,6,8

WIKI (CHEMISTRY)
✎.... 1DCHEM - QUIZ1 (Matter)

REMEMBER!
① Use the on-line quiz answers to check your answers (& for help when you run into difficulty).
② Mark your answers right or wrong as you check (& include the correct answers when necessary).
③ Include a total at the top of the quiz before handing it in.