STEM Sims™

Chemical Reations

Chemical Reactions

Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start learning right now about how substances change in a chemical reaction. Take the following brief quiz to see how much you already know about chemical changes. See the bottom of page 4 to check your answers.

1. Regular soap effectively kills germs that live on the skin of people.
   a. true
   b. false

2. From where was the name of soap said to be derived?
   a. from the abbreviation “suds on a person.”
   b. from the name of the person who invented soap
   c. because it rhymed with rope, as in soap on a rope
   d. from the fictitious Mount Sapo

3. What are the two primary ingredients in regular soap?
   a. hydrochloric acid and salt
   b. alkali and animal fat
   c. sodium chloride and ammonia
   d. oxygen and nitrogen

4. Television shows called “soap operas” gained their name because people often cried while watching the shows, which resembled the look of a person with soap in their eyes.
   a. true
   b. false

5. Soap very similar to the regular soap we use today was first recorded being used in what year?
   a. 2,800 BC
   b. 500 BC
   c. 500 AD
   d. 1,500 AD

Tying Up Soap

Hard water is water that contains many charged particles called ions, such as calcium and magnesium. Sometimes these ions can react with other substances in water and other times these ions remain in water without causing a reaction. A chemical reaction occurs when two or more substances combine to make a new substance with different chemical and physical properties. One indicator of a chemical reaction is the formation of a solid when two liquids are mixed. This new solid formed is called a precipitate. Can the presence of one of these ions found in hard water cause a reaction with soap and change the chemical properties of the soap?

Materials

2- empty 500-mL water bottles
small amount of tap water
marker
2-capfuls of dishwashing soap
½ capful of Epsom salt

Directions

1. Make sure to get proper permission before you do this experiment. It can get messy.
2. Label one empty 500-mL water bottle as “soap” and one bottle as “soap + salt.”
3. Fill each empty 500-mL water bottle halfway with tap water.
4. Place one capful of dishwashing soap in the bottle labeled “soap.”
5. Place ½ capful of Epsom salt in the bottle labeled “soap + salt.”
6. Place one capful of dishwashing soap in the bottle
7. labeled “soap + salt.”
8. Place the lid tightly on each water bottle.
9. Shake both bottles vigorously for about 15 seconds.
10. Observe both bottles carefully.
11. Answer the questions below.

Questions

1. In which bottle did a chemical reaction occur? Explain how you know that a reaction occurred in that bottle.

2. What is the precipitate in this investigation?

3. Describe what implications this investigation has on cleaning clothes in a washing machine.

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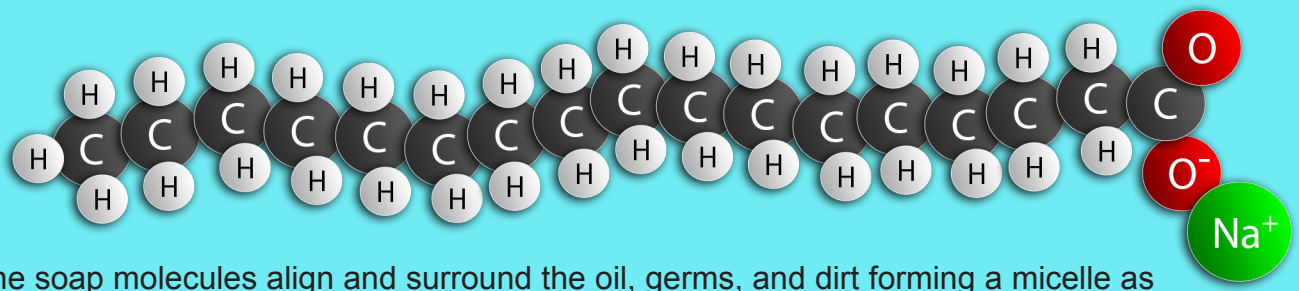
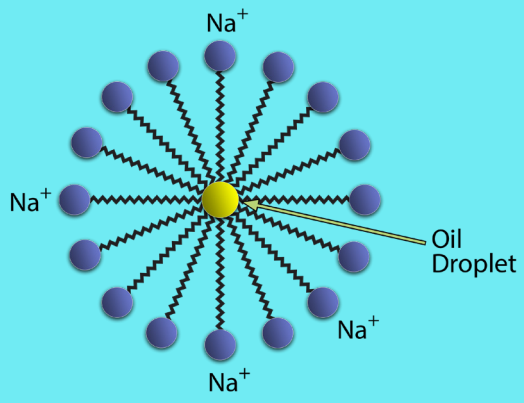
The Dirt on Soap!

Soap is a miracle substance that appears in most products people use to maintain good health. These cleaning products include body wash, lip balm, shaving cream, toothpaste, and shampoos. While soap alone does not kill bacteria or viruses, soap is used to remove these pathogens from the body. Germs stick to the oils and dirt that occur on peoples' hands and bodies. Rinsing the hands with water only does not remove these things from the hands since water does not attract oil on its own.

Soap works because it is both a hydrophobic and hydrophilic substance. This means that one end of soap is repelled by water and attracted to non-polar substances like dirt and oil (the left end of the molecule below). The foaming action of soap helps lift the pathogens off the skin with the oil and dirt. The other end of soap loves water and is attracted to water molecules (the right end of the molecule below).



The soap molecules align and surround the oil, germs, and dirt forming a micelle as shown below. Once the oil, germs and dirt are secured and lifted from the skin, the germs are carried along with the water and the hydrophilic end of soap and the dirty items go down the drain.



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Answers: Page 2 Answers: 1) b, 2) d, 3) b, 4) b, 5) a. **Page 3 Trying Up Soap Answers:** 1) The bottle with soap + salt had a reaction since a precipitate was formed. 2) The precipitate is soap + soap scum. 3) Answers will vary. Might include that hard water requires more soap to be used to achieve the same cleaning effects.