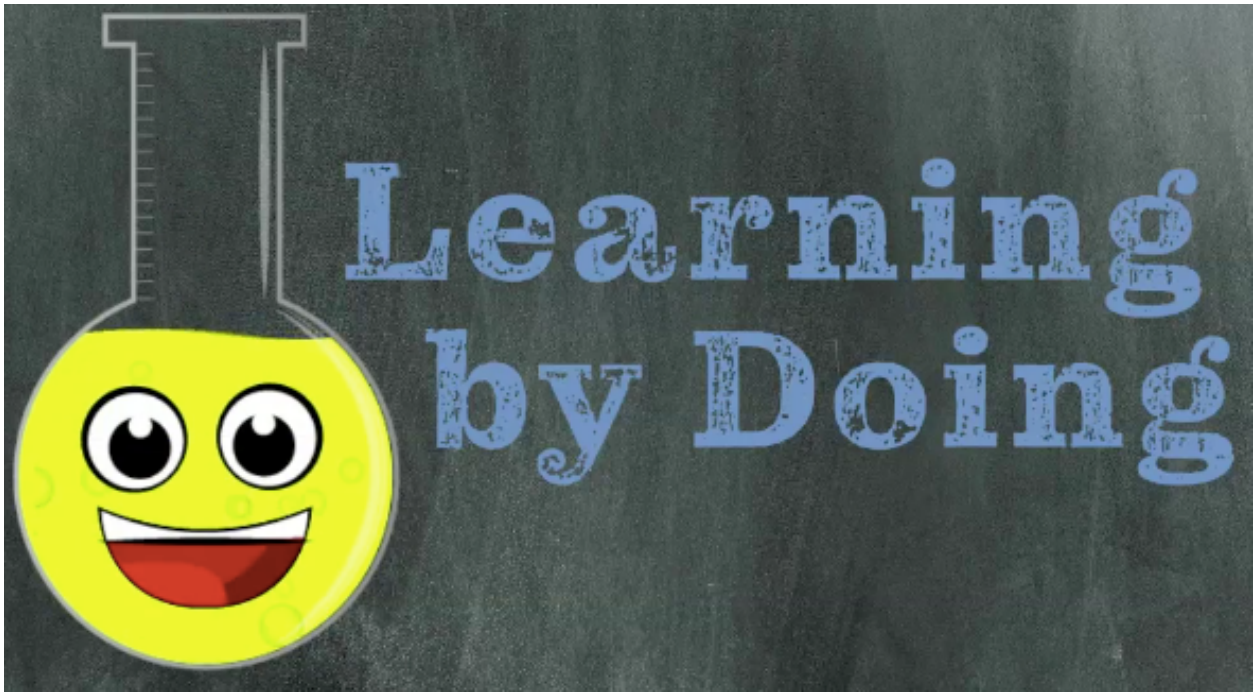

LEARNING MATERIALS

CONDENSATION

Condensation is the changing of the state of a gas into a liquid. This is a very familiar phenomenon that we see in action around us. In nature, the changing of the state of water vapor in the air into a liquid – water – is what happens when it rains. Water is fundamental to all life on Earth, so the process of condensation is a very important one. The air that we breathe is moist, and contains a lot of water in the form of vapor. You may have noticed that there are days when the humidity is very high, those are days, when water content of air is high.

In this experiment, we see the changing states of matter. Matter normally manifests as a solid, a liquid or a gas. And under the right conditions, we can transform one state of matter to the other. As we saw in the experiment, we first boil the water – so heating changes its state from liquid to gas in the form of steam that we see forming. Hot air is less dense than cold air, which is why you see it – the steam – rising up. On top of the glass jar we then placed a very cold container, much colder that the temperature of the steam. When the steam hit the cold surface of the container which we kept cold by ice, it *condensed* back into water droplets. This happened because water molecules in the steam are arranged more randomly than the molecules are in their liquid form. As condensation occurs, the molecules become more organized once again and, due to the high surface tension of water, they make the water form into droplets, which then fall back into the jar. In this experiment you see water change from liquid to steam (gas) back to a liquid. Of course, if you keep lowering the temperature and cooling water, which is what you do when you put water in the freezer, you make ice.

This water cycle operates in nature all year round. Often we see beads of water on the outside of a cold drinking glass; this occurs because the water vapor in the air surrounding the glass condenses when it hits the relative coldness of the glass. This is the same reason our eye-

glasses fog up when we go from a cool environment into a warmer one and, of course, when we are out driving, we see the moisture from the air settling on the windshield and the window.

Questions for testing comprehension:

(1) What are the three states of matter?
(2) How do you convert water into steam? And then back into water?

Questions for deeper understanding:

(1) Under what conditions (external) can you convert liquid water into its gaseous form – steam- and its solid form – ice?
(2) What are examples from nature of this water cycling process

Further reading & materials:

(1) Here are the states of matter of glass and how it can be changed from solid to liquid
    (a) https://www.youtube.com/watch?v=HAPc6JH85pM

(2) Additional Reading
    There are more than three states of matter and scientists are trying to make these exotic states of matter in the laboratory:
    (a) Bose-Einstein condensates:
        http://www.chem4kids.com/files/matter_becondensate.html
    (b) https://www.livescience.com/54667-bose-einstein-condensate.html