Matter and Energy: Evaporation and condensation

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Condensation on a cold bottle of water. Condensation is when a gas becomes a liquid. It happens when a gas, like water vapor, cools down. Photo from: Wikimedia Commons.

Evaporation and condensation are two processes through which matter changes from one state to another. Matter can exist in three different states: solid, liquid or gas. In evaporation, matter changes from a liquid to a gas. In condensation, matter changes from a gas to a liquid.

All matter is made of tiny moving particles called molecules. Evaporation and condensation happen when these molecules gain or lose energy. This energy exists in the form of heat.

Evaporation

Evaporation happens when a liquid is heated. For example, as the sun heats water in a puddle, the puddle slowly shrinks. The water seems to disappear, but it actually moves into the air as a gas called water vapor. This is an example of evaporation.

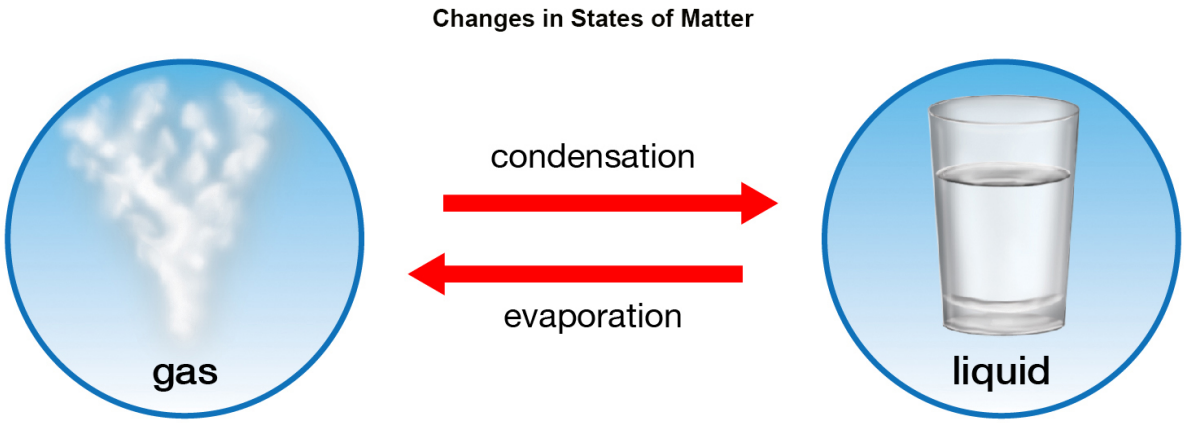
All molecules in a liquid move. Some move faster than others, though. As the molecules at the surface of a liquid absorb heat, they begin to move around more quickly. This gives them the energy to break the bonds that connect them to other water molecules. When the molecules are moving fast enough, they are able to "escape." They leave the surface of the liquid as gas molecules.

Evaporation Versus Boiling

Evaporation is not the only process that can change a substance from a liquid to a gas. The same change can occur through boiling. As a liquid is heated, its molecules absorb heat and move faster. When the liquid starts to boil, bubbles of vapor form within the liquid and rise to the surface. The temperature that causes this to happen is known as the boiling point of a liquid.

There are two key differences between evaporation and boiling. The first difference is where the change of state occurs. Evaporation takes place only at the surface of a liquid, whereas boiling may occur throughout the liquid. In boiling, the change of state takes place at any point in the liquid where bubbles form. The bubbles then rise and break at the surface of the liquid.

The second difference between evaporation and boiling concerns temperature. Evaporation can take place at any temperature. For example, a puddle of water will evaporate on a cold day, though the rate of evaporation will be slower than it would be on a warm day. In contrast, boiling only occurs at the boiling point of the liquid.



Condensation

An example of condensation can be seen when drops of water form on the outside of a glass of ice water. The drops seem to appear from nowhere. However, they actually form from water vapor in the air. The dew that forms on grass overnight is another example of condensation.

Condensation happens when molecules in a gas cool down. As the molecules lose heat, they lose energy and slow down. They move closer to other gas molecules. Finally these molecules collect together to form a liquid.

Quiz

1 Based on the information in this article, which of the following is TRUE?

(A) Water looks like it disappears when heated because the molecules slow down.

(B) Water will evaporate faster on a warm day than on a cold day.

(C) Cooling water down would cause the molecules to speed up and condensate.

(D) Dew forms in the morning because of water vapor located within the grass.

2 Select the sentence from the article that BEST explains why molecules can "escape" during evaporation.

(A) For example, as the sun heats water in a puddle, the puddle slowly shrinks.

(B) The water seems to disappear, but it actually moves into the air as a gas called water vapor.

(C) This gives them the energy to break the bonds that connect them to other water molecules.

(D) Evaporation is not the only process that can change a substance from a liquid to a gas.

3 Read this paragraph from the section, "Evaporation Versus Boiling."

> *Evaporation is not the only process that can change a substance from a liquid to a gas. The same change can occur through boiling. As a liquid is heated, its molecules absorb heat and move faster. When the liquid starts to boil, bubbles of vapor form within the liquid and rise to the surface. The temperature that causes this to happen is known as the boiling point of a liquid.*

Which answer choice BEST summarizes the paragraph?

(A) Boiling is another way matter changes from a liquid to a gas. When a liquid is heated, molecules move faster. Bubbles form and rise to the surface of the liquid.

(B) Evaporation and boiling both happen when water is heated. When bubbles form in liquid, it has reached its boiling point and evaporates.

(C) Molecules move faster when a liquid is heated. This forms bubbles in the water. Evaporation and boiling both change liquid into gas.

(D) When molecules absorb heat, they move faster and turn into water vapor. Water vapor rises off liquids that are boiling.

4 Which idea would be MOST important to include in a summary of the article?

(A) examples of evaporation and condensation

(B) how temperature affects evaporation and boiling

(C) the differences in evaporation and boiling

(D) what happens when molecules are heated or cooled.

Answer Key

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