Natural Snowmaking

Snowmaking and Changes of State

Snowmaking is a very simple process that calls for three basic ingredients -- water, air and cold temperatures. Here is a background lesson to help students be able to compare how Wachusett Mountain Ski Area uses science and engineering to mimic mother nature's way of making snow.

Background Info:

The Basics of the Particle Model of Matter: *https://owlcation.com/stem/what-is-the-particle-model*

Everything around you is made of particles so tiny that we cannot see them even with the most powerful microscope. These particles are arranged and move differently in each state of matter. Take water as an example; the size, shape and chemical composition of the water particles remains the same whether it is solid water (ice) or gaseous water (steam) - but how those particles move and are arranged is different for each state.

The particle model has four main principles:

- *All substances are made of particles.*
- *The particles are attracted to each other (some strongly, others weakly).*
- *The particles move around (have kinetic energy).*
- *As temperature increases, the particles move more (their kinetic energy increases).*

Change of State - Freezing

As you cool a substance, the kinetic energy of the particles goes down. This means that the particles move less and less. If a liquid gets cold enough the particles move slowly enough for them to be attracted together again, pulling them into rigid rows and restricting movement. At this point, the liquid has frozen - turned from liquid to a solid.

Student check for understanding:

During the change of state described above which properties of the particles will change?

A. *The size and shape of individual particles change*
B. *The spacing between the particles will get closer*
C. *The chemical structure of the particles is rearranged*

During changes of state the chemical structure of the material (type of molecules it is made of) always stays the same, and the size and shape of individual particles do not change. The material may look different because as thermal energy is added or removed its particles are either pulled closer together or spaced farther apart.

Best answer is B

Change of State - Condensation

How does this relate to snowmaking in nature?

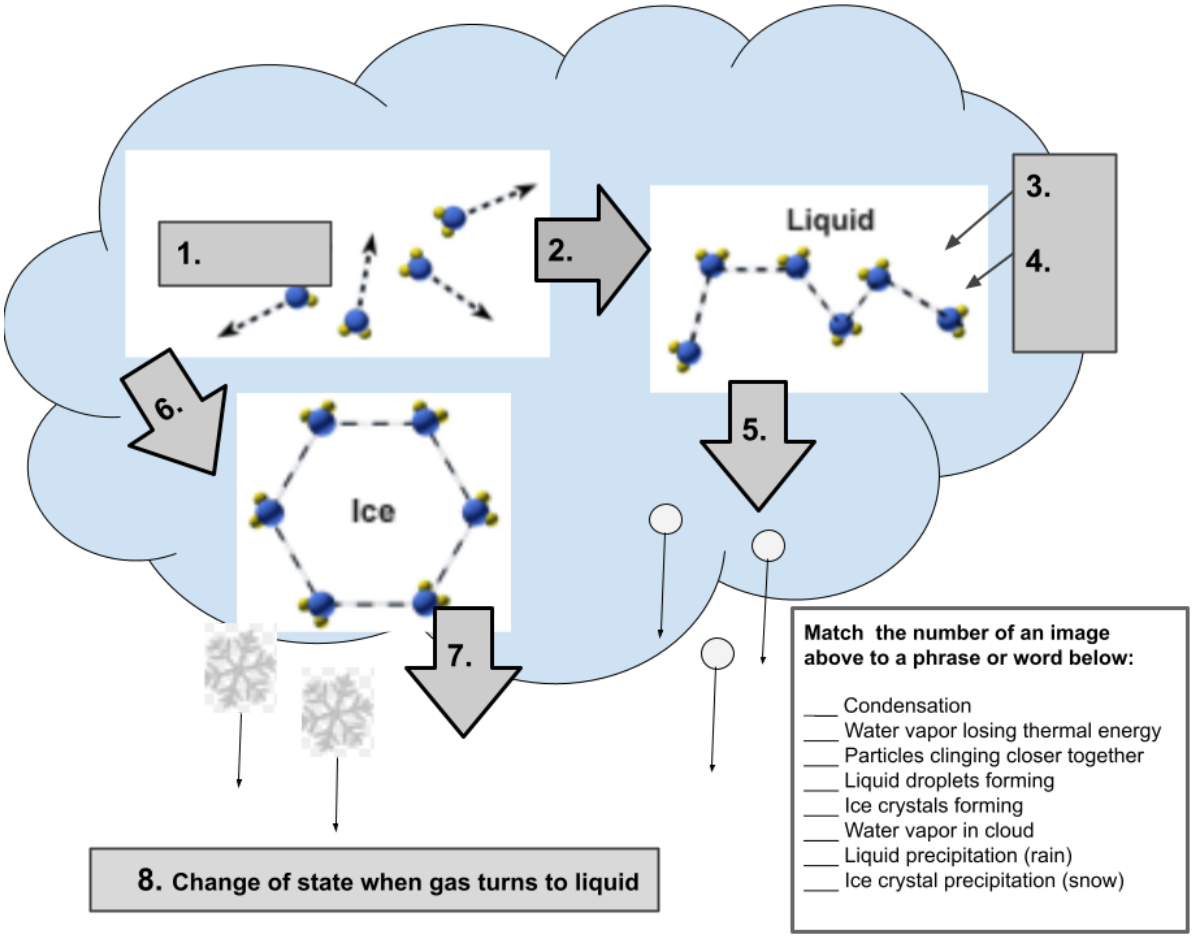
Make a prediction of what happens to the spacing between the particles of a gas as the temperature around it cools down. Then read below to see if you were correct.

I think _____

In nature, it is very cold at cloud level and as the water vapor in the clouds loses its thermal energy its H_2O (water) particles slow down and move closer together. When the H_2O particles are closer, they attract and cling together. As this happens the water vapor changes its state to either water droplets (rain/precipitation) or ice crystals (snow) depending on the air temperature. Condensation is the name for the change of state when water vapor loses enough thermal energy causing the H_2O particles to go from their gas state to liquid state.
For more info: National Geographic

Check your understanding: A Change of State from Gas to Liquid.

Choose a number from the diagram to match the words in the box.



Answer Key- 8- 2- 3 & 4(either order) 6-1-5 -7