

Quiz 8
Post-test

Name: _____

1. Consider a material in its solid phase, liquid phase and gas phase.
 - a. Please use diagrams to show how they each appear at the molecular level.
See States of Matter PhET simulation
 - b. Describe how the molecules move in each phase and how their movement differs from one phase to the other.

Solid	Liquid	Gas
Molecules in a solid wiggle constantly but not as fast as molecules in a liquid	Molecules in liquids move around throughout the liquid bumping into one another but still hang out at the bottom of the container	Molecules in a gas move with much greater speeds than molecules in liquids and bounce all over the place filling all the available space
Solids are bound tightly together in a structure. Sometimes they form a crystalline shape based on their bonds	Liquids also have bonds between the molecules but these bonds are not as tight as those in solid phase	Gas molecules do not have bonds between the individual molecules. (However, this is not to be confused with the bonds that make a molecule what it is. Water for example is still a bound Oxygen with two hydrogens)

2. What's in the bubbles of boiling water?
Water vapor which is steam or H₂O . Not separate hydrogens and separate oxygens. It takes MUCH more energy to break the bonds that make H₂O what it is than it does to turn water into steam!
3. What are the conditions that allow molecules to stop moving completely?
The temperature reaches absolute zero which is 0 Kelvin. Otherwise molecules are wiggling.
4. How heavy would you say the air in this room is? Could you lift it (assuming it could be put in a container that you can get a good grip on)?
I think we came up with 400 kg which is roughly 900 pounds - so no you cannot lift the air in this room.
5. Why does ice take more space than the same amount of water? Show on a molecular level why this is.
Water is a very unusual substance. It's the only material that expands as it gets colder. As water cools it shrinks but at 40C it actually starts expanding as it cools and forms ice. You can see with the States of Matter simulation how ice has a crystalline structure that creates large air pockets. This is why ice takes up more space than water.

6. **How can you experimentally determine the number of calories in a food? Experimentally means you can't look it up or ask someone else.**

Burn it! If you burn the food and measure the heat given off, you can determine the calories. Calories are a measure of energy. If you convert the food energy (chemical energy) into thermal energy, you can measure the amount of energy that the food had. We melted ice and calculated the amount of heat required to melt that amount of ice.

7. **What happens to molecules if you add more energy to them?**

They move faster – or they break their bonds that make them a solid or a liquid.