

Quiz 4

Name: Key Group _____

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. Why does ice take more space than the same amount of water? Show on a molecular level why this is by including a diagram.

Water is a very unusual substance. It's the only material that expands as it gets colder. You can see with the States of Matter simulation how ice has a crystalline structure that creates large pockets of space. This is why ice takes up more space than liquid water.

3. 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.

4. What's in the bubbles of boiling water?

Water vapor which is steam or H₂O. Not separate hydrogen and separate oxygen molecules. It takes MUCH more energy to break the bonds that make H₂O what it is than it does to turn water into steam!

5. What are the conditions that allow molecules to stop moving completely?
The temperature reaches absolute zero which is 0 Kelvin. Otherwise molecules are wiggling.
6. How heavy would you say all the air in the **lab** room is? Could you lift it (assuming it could be put in a container that you can get a good grip on)?
- A. Yes, I could lift it because it's about 20 lbs. Similar to a one year old child.
 - B. Maybe not, because it's about 150 lbs. About the same as an adult human
 - C. No, because it is around 1000 lbs. About the same as a quarter horse.**
 - D. No, because it's around 5000 lbs. Similar to a Rhinoceros
7. If an object carries a net electrical charge, it will
- A. repel all other objects
 - B. repel all plastic objects
 - C. repel objects with the opposite charge
 - D. repel objects with a like charge**
8. If an object carries a net electrical charge, it will attract bits of paper
- A. only if it has a positive charge
 - B. only if it has a negative charge
 - C. if it has either a positive or a negative charge**
9. An item with a positive charge
- A. gained protons
 - B. lost electrons**
 - C. lost protons
 - D. gained electrons
10. Neodymium magnets are *strongly* attracted
- A. A nail, paperclip and aluminum rod
 - B. A nail and paperclip**
 - C. plastic pipe, clear plastic and glass test tube
 - D. A and C
 - E. B and C
11. All magnets
- A. have a net electrical charge
 - B. are attracted to all metals
 - C. both A and B
 - D. neither A or B**