Heat, Energy and the States of Matter

Name: _____

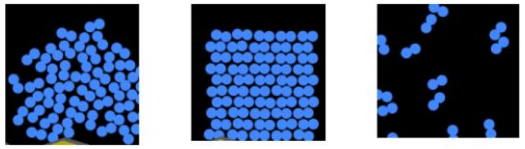
Predictions:

1. Describe how atoms of a solid differ from atoms of a liquid. Include an illustration.

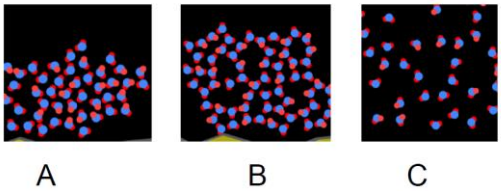
2. Describe how atoms of a liquid appear compared to a gas. Include an illustration.

3. What happens to atoms when you add heat to them?

4. Which is most likely oxygen gas?



Which is most likely liquid water?



Great questions from kids (still predictions for this assignment):

5. Do you think air can freeze?

6. Can all substances change into solid, liquid and gas form?

Investigation: Open the *States of Matter* PhET simulation: http://PhET.colorado.edu
Play around with the first tab for awhile, trying everything out.

1. How does solid Neon or Argon look compared to liquid Neon or Argon?

2. How about liquid Neon or Argon versus gas Neon or Argon?

3. How do the Oxygen and Water molecules compare to Neon and Argon? Draw each. Why do you think that could be?

4. What is the white part of each water molecule and what are the red parts of the water molecules? Include an illustration (black and white is fine)

5. Have you heard that ice takes up more space than water? If your pipes freeze, they split!! Can you see why that is the case? Include an illustration.

6. How about the other molecules, do they take up more space as a liquid or as a solid? Include an Illustration.

☆ ***Check your conlcusions for qusetions 4-6 with your instructor***

1. Can you get the molecules to stop wiggling? If so, how?

2. What happens to the molecules when heat is added?

3. What is in the bubbles of boiling water?

☆ ***Check your conclusions with your instructor***

Open the PhET simulation *Friction* and play around.

1. Describe what you observe.

2. What happens to the energy you put into rubbing the books together?

Weighing Air Name ___

All matter must possess two characteristics. If air is really a form of matter, it must have mass and it must take up space. It is relatively easy to observe that air takes up space. Just blow up a balloon. As more air is added, the balloon gets larger. However, determining the mass of air is more difficult. In today's activity, you will investigate the mass and volume of air.

It is easy to tell that air does not have very much mass but just how much mass does it have? Today, you will measure the mass of a bottle filled with air then mass it again after some air has been removed. To remove the air you will be asked "suck" it out yourself. You will need to use a sensitive balance to measure the mass because it is not very large. Since it is not possible to remove all the air, you will then have to determine how much air was actually removed.

PROCEDURE: **If you crush the bottle, you must buy a new one!!!**

1. Make sure the pinch clamp is not tightened so tight that it seals the rubber tube. Then put the bottle (large 24 oz. POM bottle), tube and pinch clamp on the balance and determine the mass of the apparatus to the nearest 0.01 gram.

Mass of bottle with air _____

2. Next, remove the bottle and "suck" as much air as possible out of the bottle. Don't just take one big suck; you will need to take several attempts. When you have removed as much air as possible from the bottle, screw down the pinch clamp to seal the tube. Make sure you wipe any spit you have left on the tube.

3. Place the bottle with the removed air on the balance and mass again to the nearest 0.01 gram.

Mass of bottle with air removed_____

(**Hint**: if you did not remove at least 0.10 grams you will have to try again)

4. Finally, you will need to determine the volume of air that was actually removed. To do this, put your evacuated bottle under water and gently open the pinch clamp. Water will rush into the bottle. The amount of water that enters the bottle is equal to the amount of air that was removed.

Volume of air that was removed_____

CALCULATIONS:

5. What was the mass of the air you removed? _____

6. According to your measurements what is the density of air in the room? You should give your answer in grams per milliliter or grams per cubic centimeter (remember ml and cm^3 are the same thing). SHOW WORK

Your calculated density of air (mass/Volume) =_____ Write your value on the board.
Class Average = _____

8. After eating your *Wheaties* for breakfast what do you think is the maximum weight that you could lift?

9. Do you think you can lift all the air in this room?

10. Determine an approximate value for the volume of air in the room. SHOW WORK

☆ ***Class discussion*:**

PRESSURE:

Here's what you do:

- Fill a cup part way with water.
- Carefully place a 3 x 5 card completely on top of the cup.
- Turn the cup over while supporting your 3 x 5 card.
- Remove the hand holding the 3 x 5 card.

What happens?

Why do you think this is?

What is holding up the card?

When you suck on a straw, why do you think your cool refreshing drink makes it into your mouth?

When you placed your partly empty (some air removed) Pom bottle in water, why did water flow into the bottle?

Have you ever filled your straw with water, juice, etc.., sealed the end with your finger and then pulled your full straw out of your glass? Why doesn't your drink come out of the straw?

☆***Check your conclusions with your instructor***