

Student Page: Name: _____ Date _____

Title: Hot, Medium, and Cold Water Comparison in a Cup

Introduction:

Everything around us is made up of matter, from our skin that makes up our body, to the soda pop you drink, and to the air we breathe. All this matter is made up of particles we call atoms and molecules. If we had microscopes that could look close enough we would be able to see how these small particles are arranged in the stuff around us. These arrangements can be very different depending on whether the “stuff” is a solid, liquid, or gas. Warming it up and cooling it down can also change how these particles are arranged. Since we can’t zoom in and look at the real thing, we are going to see what the results are when cold water meets hot water and come up with conclusions of why the different temperatures are doing what they are doing.

Prediction/Hypothesis:

1. Which takes up the most space: hot water, room temperature, or cold temperature?

Hot Water

2. Which takes up the least space: hot water, room temperature, or cold temperature?

Cold Water

3. If the hot, room temperature, and cold water represent liquid matter, how can we use this information to show a model of what is happening at each temperature?

The hot water will float on the room temperature and cold water since it is lighter in weight being less dense and will take up more space.

The cold water will sink to the bottom of the cup since it is heavier and being more dense and will take up less space.

The room temperature water will be lighter in weight than the cold water being less dense than cold water and heavier than the hot water being more dense than the hot water.

Experiment:

Your group is to come up with an experiment to explain what is happening with water particles at the atomic level of hot, room temperature, and cold water.

1. In groups of three or four, you are to get hot water, room temperature water, and cold water in the three plastic cups and fill all the cups up about half way full. Then go over to the food coloring table and put in 5 drops of blue coloring in the cold cup and 5 drops of red coloring in the hot cup. The room temperature water is to stay clear.

2. With the three different temperature water cups in front of you, write in their journals what you know about the particle movement in each of the three cups. Draw the three cups and show the particle movement in your cups.

3. Write in your journals specific questions that you might have as to what will happen as you put the three temperatures of water together.

4. Room temperature water (clear water) will be the water that the hot and cold water will go into for observation. For the experiment to show what happens when different temperatures of water are brought together, use a syringe to put the water carefully in the clear cup as to not to disturb the other temperatures of water too much. You are also to use the thermometer as much as you can while doing the investigation.

5. You are to plan an investigation with the three temperatures of water to see how they react with each other and what the water particles are doing at each temperature to cause the phenomenon you are viewing.

6. Write down data of what you found and draw a diagram of what you saw happen.

The hot water floated on the room temperature and the cold water.

The cold water sank to the bottom.

The room temperature water was in the middle.

Reasoning:

1. Analyze your data and construct an explanation of why you think this phenomenon happened for each temperature.

The hot water floated on the room temperature and the cold water since it is lightest in weight being less dense.

The cold water sank to the bottom since it is heaviest in weight be most dense.

The room temperature water was in the middle being less lighter in weight than the cold water being less dense and being heavier than the hot water being more dense.

2. Make a model to explain what is happening at the atomic level to show your explanation of the phenomenon.

The students are to draw a picture of the cup with the three temperatures of water labeled hot, room temperature, and cold. The students then put dots in the three temperatures of water.

1. The hot water dots are spread far apart showing the particles are less dense.
2. The cold water dots are very close together showing the particles are more dense.
3. The room temperature water dots are farther apart than the cold water and closer than the hot water showing it is less dense than the cold water and more dense than the hot water.

3. Develop an argument by using your explanation and model of the arrangement and motion and the particles that caused this phenomenon to happen.

Students make an argument of how density of the three temperatures of water will separate themselves out.