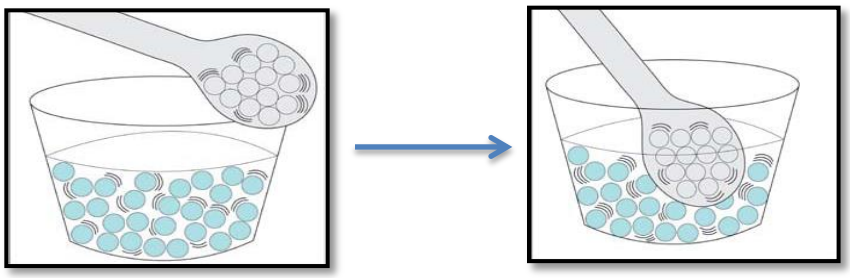
Student Sheet 1

LAB ACTIVITY:
HEAT, TEMPERATURE AND CONDUCTION

All things are made of atoms and molecules which are always in motion. When they are heated, they move faster and when they are cooled, they move slower. For example, if you put a room-temperature metal spoon into a hot liquid like soup or hot chocolate, the metal gets hotter. But what actually has to happen for the hot liquid to make the metal hotter: how do the atoms and molecules actually get heated and cooled?

To answer this question, you really have to think about the moving atoms and molecules as having ***energy***. Anything that has mass and is moving, like a train, a moving ball, or an atom has a certain amount of energy. The energy of a moving object is called ***kinetic energy.*** If the speed of the object increases, its kinetic energy increases. If the speed of the object decreases, its kinetic energy decreases. So if the atoms or molecules of a substance are moving fast, they have more kinetic energy than when they are moving more slowly.

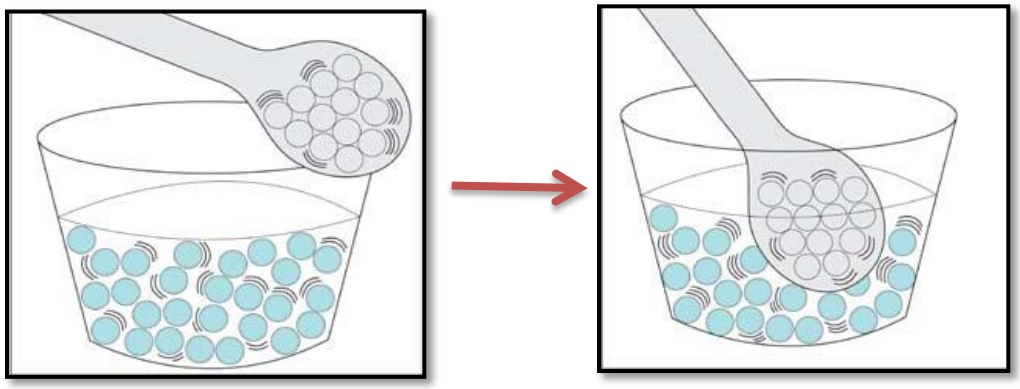
In the example of a spoon in hot liquid, the molecules of hot liquid are moving quickly so they have a lot of kinetic energy. When the room-temperature spoon is placed in the liquid, the fast moving molecules in the liquid contact the slower-moving atoms in the spoon. The fast-moving molecules hit the slower-moving atoms and speed them up. In this way, the fast-moving molecules transfer some of their kinetic energy to the slower atoms so that these slower atoms now have more kinetic energy. This process of transferring energy by direct contact is called ***conduction.***



Cool spoon to warmer liquid

Student Sheet 2

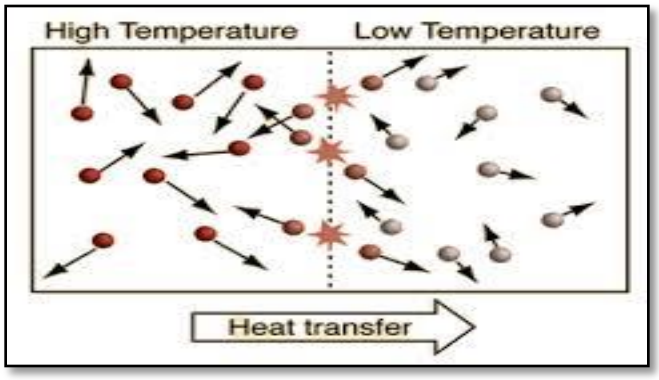
Cooling things by conduction works the same way as warming. This time, a hot metal spoon is put in room-temperature water. The faster-moving atoms in the spoon contact the slower-moving molecules in the water. The atoms in the spoon transfer some of their energy to the molecules in the water. The spoon will get cooler and the water will get a little warmer.



Hot spoon to cooler liquid

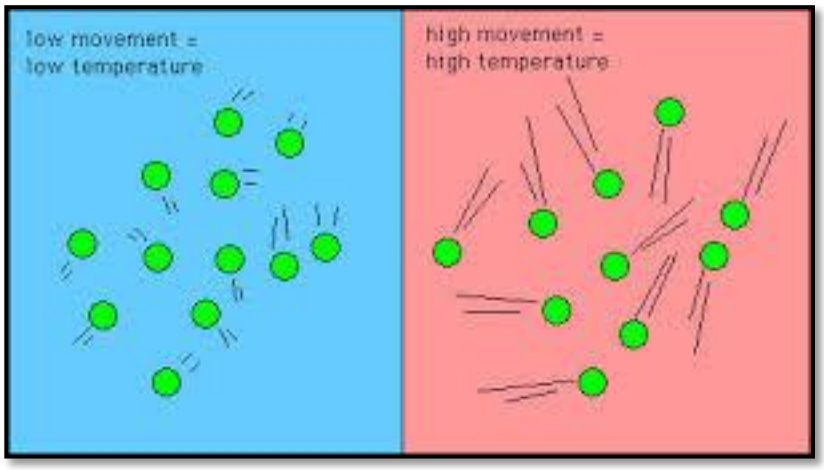
Another example is cans of room-temperature soda pop placed in a cooler filled with ice. Energy is transferred from the warmer metal can to the cooler ice making the can colder. Energy is then transferred from the warmer soda to the colder can. This transfer of energy from the soda results in decreased motion of the molecules of the soda, which can be measured as a lower temperature and colder soda.

The way to cool by something by conduction is for its energy to be transferred to something colder. ***Energy can only be transferred from something at a higher temperature to something at a lower temperature;*** it can't cool something by adding "coldness" to it. A substance can only be made colder by allowing its energy to be transferred to something colder.



Student Sheet 3

When speaking about temperature and heat it is important to understand what they are and how they are different. ***Temperature is a measure of the average kinetic energy of the atoms or molecules of a substance.*** It is commonly indicated in ***degrees (°C/°F).*** It is the measurement of the intensity of heat energy. By taking the temperature of something, you are actually getting information about the kinetic energy of its atoms and molecules, but not the kinetic energy of any particular one atom. There are more than a billion trillion atoms or molecules, in even a small sample of a substance that are constantly moving and bumping into each other and transferring little amounts of energy. So at any time, the atoms and molecules don't all have the same kinetic energy. Some are moving faster and some are moving slower than others, but most are about the same.



Heat is the amount of kinetic energy that is transferred from a substance at a higher temperature to a substance at a lower temperature and is another word for ***thermal energy***. Heat is measured in ***joules***. The scientific meaning of heat has to do with energy that is being transferred. During conduction, the energy transferred from faster-moving atoms to slower-moving atoms is called heat and actually causes temperature changes.

Student Sheet 4

LAB ACTIVITY: HEAT, TEMPERATURE AND CONDUCTION

PREDICTION:

DATA TABLE 1: Room-temperature washers placed in hot water

TEMPERATURE OF……..	BEFORE	AFTER
Water in your cup		
Water in control cup		
Washers		

Student Sheet 5

ANALYSIS: Complete the following questions in on notebook paper.

1. Explain, on the molecular level, how energy was transferred from the hot water to the room-temperature spoon

2. How did the temperature of the washers and water change in both parts of the activity?

3. Knowing what you do about heating and cooling atoms and molecules, why do you think the temperature changed?

4. Describe how the process of conduction caused the temperature of the washers and water to change in the activity.

5. Draw what the set-up looked like. Include motion lines to the "Before" and "After" illustration below and add descriptive words like "warmer" or "cooler" to describe the change in temperature of the water and the washers.

6. Explain how the motion of the atoms or molecules of a substance affect the temperature of the substance?

7. What is conduction?

8. Explain the difference and the relationship between heat and temperature.

*9. Develop an activity where a hot metal object is place in a container of room temperature water.
   - ✓ Identify the tools you would need.
   - ✓ Write out the steps you will need to take and why.
   - ✓ Draw a diagram of the activity.