Kai Wang
8th Grade Science
Measurement: Heat Transfer

AGENDA: Students should be able to understand the concepts of heat transfer. This includes measuring temperature off a given system and applying their data to calculate the amount of heat gained for the specific system.

STANDARD 1: Recognize, interpret, and be able to read a thermometer and understand the different units of measurement (Fahrenheit and Celsius).

STANDARD 2: Describe the process and concept of heat transfer: Earth systems have both internal and external sources of energy, both of which create heat. the sun is the major external source of energy.

STANDARD 3: Present and explain data and findings using multiple representations, including tables, graphs, mathematical and physical models, and demonstrations.

Time Frame: 1 class period (45 min)

Materials: 2 hot plates, two beakers, water, sand, hot gloves, two thermometers, stopwatches

1) Activator: Question/Answer session on what students think heat transfer is
Brief overview of heat transfer including fundamental concepts and key equation for amount of heat gained:

Heat Gained (J) = Specific Heat material * mass * change in Temperature

(No more than 10 minutes)

2) Instruction/Interaction:
   a) Split up class into two teams (about 10 people per team)

   b) Designate one team to use measure water, the other team to measure sand

   c) Each team goes to their respective set up station where there will be the following materials:
      1 hot plate
      1 thermometer
      1 hot glove
      1 stopwatch
      1 beaker of water (approx. 50-60 mL depending on which beaker we use)

d) Have the students heat up their respective materials:
2 students should be reading off the temperature off the thermometers
All students should be recording the data in their notebooks
1 student with stopwatch will tell the "readers" to read off the temperatures every 30 sec. for 10 minutes (or up to a certain temperature, say 50^{o} C depending on time)

e) After heating up their respective materials, students will then turn off hot plates and measure for every 30 sec the cooling rate of their material and record data in their notebooks

(ideally approx 20 min)

3) Discussion/Results: Have the two teams trade off their data with one another and make some observations about which material was able to heat up/cool down faster. If time allows, ask similar questions about heat transfer between oil and water, baking soda and water, vinegar and water, 50mL of water compared with 100mL of water, etc.

(approx 10min)

4) Wrap Up / Assessment: For homework, students are to graph their data, both of the water and of the sand, and complete an assessment worksheet of 5 questions which tests their knowledge of the concept being taught

(approx 5min)

5) Worksheet Questions:

a) What is the difference between Celsius and Fahrenheit?

b) What were your final temperature changes before your material heated up and after you material heated up?

c) What is the mass of your material?

d) Based on your observations, which material was able to store the heat energy better, water or sand?

e) Given that the specific heat of water is 4.186 joule/ (gram*°C), calculate the amount of heat gained by your material.

f) If you were given a beaker of water at 50mL and another at 100mL and heated them up, which one do you think would be heat up faster? Why?

Bonus: convert your final measurements from Celsius to Fahrenheit