Physics Lab: Heat

Instructions: Follow the steps, and complete the lab. 4 minutes per station. Due Monday 03/31/25 by 11:59pm via Schoology.

1. **Pre-Lab**:
    a. Define heat and thermal energy, making clear how they are different.
        i. Heat:
        ii. Thermal Energy:
    b. Why does something feel “cold” on our skin?
    c. Why does something feel “hot”?

2. **Safety Discussion:**
    We will be using the following objects. Next to each object, describe steps you can take to safely use each of these potentially dangerous items.
    a. Hot Plate:
    b. Slippery solid water and liquid water:
    c. Glass:
    d. Infrared Incandescent Lamp:

3. **Lab Stations**
    For each station, you’ll complete an investigation of a heat-related phenomena. Answer the questions thoughtfully, and with full sentences. 4 minutes per station. You may need to put brief answers now, and then fill in those answers with details later.

    a. Can Cozies:
        i. What does the cozy do?
        ii. Would they work for hot beverages too? Why or why not?
        iii. What is the can cozy made out of that makes this possible?
        iv. Would a can cozy made of aluminum work very well?

    b. Insulated Thermometer:
        i. Before you look at the thermometers, do you think one thermometer will be warmer than the other?
        ii. Measure the temperature of the thermometer in air: __*C
        iii. Measure the temperature of the thermometer in the mitt: __*C
        place the thermometer back in the mitt when done
        iv. How did the temperatures compare? Why did this happen?

    c. Metal vs. Plastic Spoons:
        i. Prior to putting any ice in the spoons, does the plastic or metal spoon feel colder?

ii. Put a cube of ice in each spoon, and hold the spoons over the sink for 90 seconds, or place them gently on the table for 90 seconds. Describe what happens to the ice in each spoon in that time period.
iii. If you were to hold the two spoons for a long period of time, which ice cube do you think would melt the fastest?
iv. Why?
v. To see which cube melted more, you can pour the water from each spoon into two separate little puddles onto the table next to the sink. Which puddle is bigger? There's your evidence… Swipe the water into the sink. Put the ice cube back in the cup if it's still big. If it's small, put it in the sink too.
vi. Rank the conductivity of the spoons from the most conductive to the least conductive.

d. Blankets *(work quickly - time is tight for this station)*

i. Think about the warmest blanket you own; think about why it is so warm. What are common properties of warm blankets? What kinds of materials are they made out of?
ii. NASA developed a space blanket that is now used all over the world as an emergency blanket. It is made of silver reflective mylar, and is almost identical to the potato chip bag at your station.
iii. How does it work? (more info about mylar: LINK1 LINK2 LINK3)
iv. What are some advantages of mylar over the warm blanket you described in part "i"?
v. Without the mylar sheet in the way, put your hand about 20cm from the front of the light. How does the radiation feel?
vi. Now put the mylar in between your hand and the lamp. How does it feel now?
vii. Try putting the clear plastic sheet in front of the light. Does it block the energy?

e. Hot Plate/stove

i. Without touching the hot plate (it's **hot** - be careful), describe where the air around the hot plate is warm or hot. Also describe where the air is not warm/hot.
ii. Draw a side-view sketch of the hot and cold areas of air, take a photo of your sketch, and add it to your lab document. Alternatively, you can take a photo and do a Google Drawing, then add that directly below this question.

f. Leidenfrost Effect

i. Without touching the hot plate (it's **hot** - be careful), put a few (2-3) drops of water on a hot pan. What do the drops do?
ii. From where is the liquid water gaining energy?
iii. What's happening to the liquid water as it gains energy?
iv. Why doesn't the liquid water evaporate right away?
v. What is the Leidenfrost Effect?

g. Hot vs Cold:

i. List the four objects in order from what feels the coldest to what feels the hottest.
    1. Plastic
    2. Wood
    3. Metal
    4. Water (touch the actual water, not the cup/glass beaker)
ii. Why do these four feel like they are different temperatures?
iii. Are they different temperatures?

4. Conclusion Questions:

i. What are two things that affect how much and how quickly heat is transferred between two objects?

ii. Describe when you saw heat transferred via conduction in today's lab.

iii. Describe when you saw heat transferred via convection in today's lab.

iv. Describe when you saw heat transferred via radiation in today's lab.

v. Which items that you used today were conductors?

vi. Which items that you used today were insulators?