THERMAL MELTDOWN
A DEMONSTRATION OF SPECIFIC HEAT CAPACITY

Name:_____ Per:_____ Date:_____

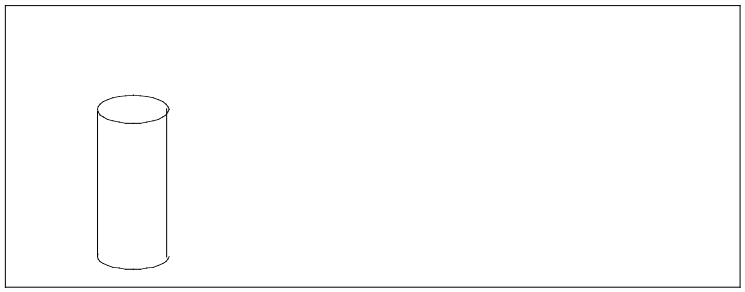
Consider 50g samples of aluminum (Al), iron (Fe), and lead (Pb).

Which has the highest density? Al Fe Pb Same for all

Which has the lowest density? Al Fe Pb Same for all

SKETCH
Based on this information, sketch the samples (which are all cylinders with equal diameters) to show relative size.

PONDER
Which sample has the most atoms? How do you know?



you can call me...

Al **Fe** **Pb**

Suppose all three samples are brought to the same temperature (say, 100°C).

The atoms in which sample will have the greatest *average kinetic energy*?

Al Fe Pb Same for all

The atoms in which sample will have the greatest *internal energy*? (Hint: *internal energy can be approximated as* KE_{avg} x N where N is the number of atoms in the sample.)

Al Fe Pb Same for all

HOW CAN YOU MEASURE THE AVERAGE KINETIC ENERGY OF THE ATOMS?
A thermometer measures temperature and therefore indicates the average kinetic energy of the atoms or molecules in a substance. Since all samples were heated to 100°C, all samples have the *same* average atomic kinetic energy.

HOW CAN YOU MEASURE THE INTERNAL ENERGY OF THE ATOMS?
This is more difficult since the thermometer tells you only the average kinetic energy—it indicates nothing about internal energy. The thermometer has no way of "knowing" how many atoms a sample contains.

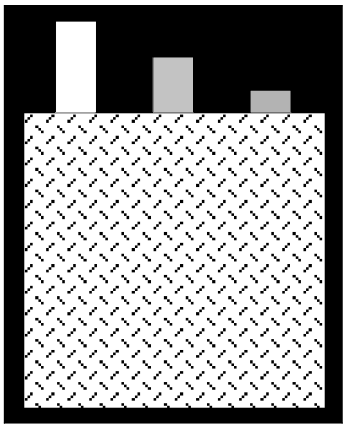
The thermometer also misses the energy associated with spinning molecules. A liquid or gaseous sample composed of molecules could store heat energy in molecular rotation. This does not result in an increase in temperature.

Nor does an increase in molecular vibrations (expanding and contracting of molecules). Again, energy can be stored this way without the thermometer ever detecting it.

Remember, rotation and vibration apply only to samples consisting of molecules; our samples are composed of atoms.

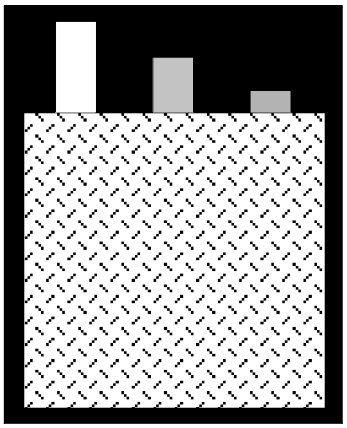
PREDICTION

Which sample will melt through the most wax and why? Draw the "melt trail" you predict for each sample on the diagram to the right.



OBSERVATION

Which sample did melt through the most wax and why? Draw the "melt trail" you observe for each sample on the diagram to the right.



QUESTIONS

1. Can you name any substances that would melt more wax than the "winner" of this competition? What is the basis for your answer?

2. Can you name any substances that would melt less wax than the "loser" of this competition? What is the basis for your answer?

3. Suppose the mass of one of the samples (the iron, for example) was doubled. What effect would this have on the amount of wax it melts?