Conceptual Physics Review Packet – Chapters 21, 22, and 23

Chapter 21 – Temperature, Heat, and Expansion

- Define temperature in terms of kinetic energy and describe the common temperature scales.
- Define heat.
- Define thermal equilibrium.
- Distinguish between internal energy and heat.
- Compare the specific heat capacities of different substances.

Chapter 22 – Heat Transfer

- Explain conduction and its effects.
- Distinguish between conduction and convection.
- Explain how heat can be transmitted through empty space.

Chapter 23 – Change of Phase

- Explain why evaporation of water is a cooling process.
- Explain why condensation is a warming process.
- Explain why a person with wet skin feels chillier in dry air than in moist air at the same temperature.
- Distinguish between evaporation and boiling.
- Explain the effect of atmospheric pressure on the boiling point of a liquid.
- Explain why food cooked in boiling water takes longer to cook at high altitudes.
- Explain why water with substances dissolved in it freezes at a lower temperature than pure water.
- Describe the conditions under which a substance might boil and freeze at the same time.
- Describe how a substance can absorb or release energy with no resulting change in temperature.
- Define the heat of fusion for water.
- Define the heat of vaporization for water.
- Define specific heat capacity.
- Calculate the quantity of heat energy either released or absorbed when a certain amount of water changes phase.
- Calculate the quantity of heat energy either released or absorbed when water (or ice or steam) changes temperature.

Other Materials

- Review all written homework problems.
- Review the phase change lab.
- Review Worksheets 23-1 and 23-2

Sample Calculations (Remember to write a formula first)

1. How much energy is needed to melt 5.0 kg of ice at 0 °C?

2. How much energy is released when 2.5 g of steam condenses at 100 °C?

3. How much energy is needed to melt a 3.0-gram ice cube at 0.0 °C and then warm the resulting water to room temperature (20.0 °C)?

4. How much energy is needed to convert 50.0 grams of ice at -30.0 °C to steam at 140.0 °C? (This one takes several steps!)

5. How much energy is released when 25.0 grams of water at 0.0 °C freezes and then drops to -15.0 °C?

6. 10.0 mL of 80.0 °C water is poured into a cavity in a large block of ice, how much energy is released by the water as it cools to 0.0 °C? How much of the ice melts as a result?

7. Explain why it does not hurt to touch a hot iron (briefly) if you wet your finger first.

8. Consider two metals A and B, each having a mass of 100 grams and an initial temperature of 20 °C. The specific heat of A is larger than the specific heat of B. Under the same heating conditions, which metal would take longer to reach a temperature of 21 °C? Explain your answer.

9. Give one example each of conduction, convection, and radiation.

10. A piece of copper with mass 35.4 grams was placed in hot water and absorbed 47.0 J of energy from the water. The temperature of the copper rose by 3.45 °C. What is the specific heat of copper?

11. A Styrofoam cup contains 361 g of orange juice at 23.0 °C. A 152 gram piece of ice is added to the orange juice. Some of the ice melts, and the orange juice is cooled to 0.0 °C.

a. Ignore any heat lost to the Styrofoam cup, and calculate the amount of heat lost by the orange juice when it cooled. Assume the specific heat capacity of orange juice is the same as that of water.

b. The amount of energy released by the orange juice was absorbed by the ice, causing some of it to melt. Calculate how much of the ice melted.

c. What is the mass of the remaining piece of ice that is in thermal equilibrium with the 0.0 °C orange juice?

12. A 283-gram iron bar (specific heat capacity = 0.45 J/g°C) was first chilled in a freezer and then placed in 187 mL of water which had an initial temperature of 20.0 °C. the final temperature at thermal equilibrium was 16.0 °C. What was the initial temperature of the iron bar?