Name A. KEY Date

CONCEPTUAL Physics PRACTICE PAGE

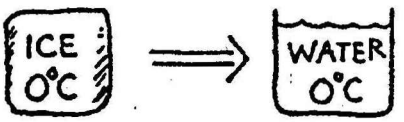
Chapter 17 Change of Phase

Ice, Water, and Steam

All matter can exist in the solid, liquid, or gaseous phases. The solid phase normally exists at relatively low temperatures, the liquid phase at higher temperatures, and the gaseous phase at still higher temperatures. Water is the most common example, not only because of its abundance but also because the temperatures for all three phases are common. Study "Energy and Changes of Phase" in your textbook and then answer the following:

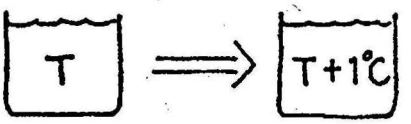
1. How many calories are needed to change 1 gram of 0°C ice to water?

   80 calories



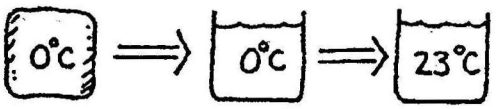
2. How many calories are needed to change the temperature of 1 gram of water by 1°C?

   1 calorie



3. How many calories are needed to melt 1 gram of 0°C ice and turn it to water at a room temperature of 23°C?

   80 calories + 23 calories = 103 calories



4. A 50-gram sample of ice at 0°C is placed in a glass beaker that contains 200 g of water at 20°C.

   a. How much heat is needed to melt the ice?

   4000 calories

   Since there is 50 g of ice, and 80 calories is required per gram, the heat required is 50 g x 80 cal/g = 4000 calories.

   b. By how much would the temperature of the water change if it gave up this much heat to the ice?

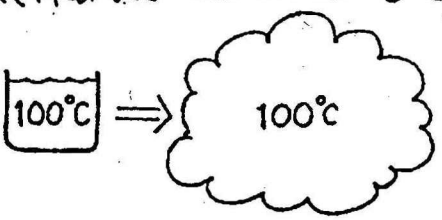
   By 20°C Since the water gives off 1 cal of heat for each 1°C decrease, 200 g of water gives off 2 cal for each 1°C decrease. If the water gives off 4000 cal, it decreases by: $\frac{4000\ cal}{200\ cal/°C} = 20°C$

   c. What will be the final temperature of the mixture?
   (Disregard any heat absorbed by the glass or given off by the surrounding air.)

   0°C If the heat needed to melt the ice all comes from the cooling of the water, the water will cool from 20°C to 0°C, so both it and water from the melted ice will be at 0°C.

5. How many calories are needed to change 1 gram of 100°C boiling water to 100°C steam?

   540 calories

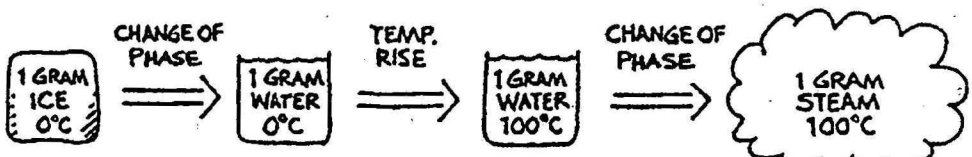


Hewitt Drew-it!

Chapter 17 Change of Phase

***Ice, Water, and Steam**—continued*

6. Fill in the number of calories at each step below for changing the phase of 1 gram of 0°C ice to 100°C steam.

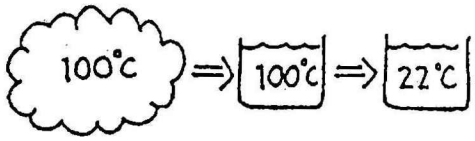


HEAT NEEDED = 80 CAL + 100 CAL + 540 CAL = 720 CAL

7. How many calories are given up by 1 gram of 100°C steam that condenses to 100°C water?

From $Q = mL$ = 540 calories

8. How many calories are given up by 1 gram of 100°C steam that condenses and drops in temperature to 22°C water?



From $Q = mL + mc\Delta T$ = [540 + (100 − 22)] calories = 618 calories

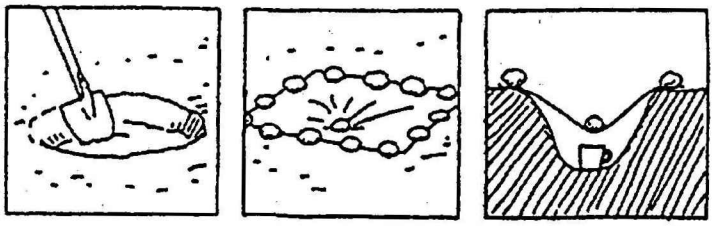
9. How many calories are given to a household radiator when 1000 grams of 100°C steam condenses and drops in temperature to 90°C water?

From $Q = mL + mc\Delta T$ = 1000[540 + (100 − 90)] calories = 550,000 calories

10. Why is it difficult to make tea on the top of a high mountain?

Water boils at a lower temperature, at it can get no hotter than its boiling temperature.

11. To get water from the ground, even in the hot desert, dig a hole about a half meter wide and a half meter deep. Place a cup at the bottom. Spread a sheet of plastic wrap over the hole and place stones along the edge to hold it secure. Weight the center of the plastic with a stone so it forms a cone shape.
Why will water collect in the cup? (Physics can save your life if you're ever stranded in a desert!)



Evaporated water vapor from the heated ground can't escape. It condenses on the underside of the plastic and runs into the cup. At night, condensation from the atmosphere collects on top of the plastic.

Hewitt Drew it!