Thermochemistry Review

Name_____Key_____
Date_____Period_____

Vocabulary

Energy	Heat
Exothermic	Endothermic
Conservation of Energy	Calorimetry
Specific Heat	Joule
Kinetic Energy	Potential Energy
Kelvin	Absolute Zero
System	Surroundings

1. If the temperature of 34.4 g of ethanol increases from 25°C to 78.8°C, how much heat has been absorbed by the ethanol? The specific heat of ethanol is 2.44 J/g°C.

$$q = mc\Delta T = 34.4(2.44)(78.8-25) = \boxed{4515 \text{ J}}$$

2. A 4.50 g nugget of pure gold absorbed 276 J of heat. What was the final temperature of the gold if the initial temperature was 25.0°C? The specific heat of gold is 0.129 J/g°C.

$$q = mc\Delta T \qquad 276 = 4.5(.129)(T_f - 25) \qquad T_f = \boxed{500°C}$$

3. Calculate the heat required to melt 25.7 g of solid methanol at its melting point. ΔH_{fus} for methanol is 3.22 kJ/mol. (CH_3OH)

$$q = \Delta H \cdot mol = 3.22\left(\frac{25.7}{32}\right) = \boxed{2.58 \text{ KJ}}$$

4. How much heat is evolved (given off) when 275 g of ammonia gas (NH_3) condenses to a liquid at its boiling point? ΔH_{vap} for ammonia is 23.3 kJ/mol.

$$q = \Delta H \cdot mol = \frac{275}{17}(23.3) = \boxed{397 \text{ KJ}}$$

Where on the graph is the substance a liquid at its boiling point?   D

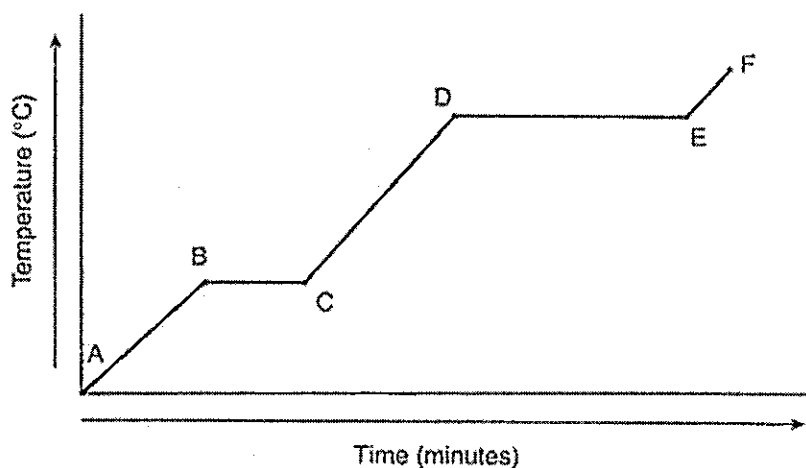Where on the graph is the substance a liquid at its freezing point?   C

What region represents solid heating?   A - B

What region represents vapor cooling?   F - E

What region represents equilibrium between solid and liquid?   B - C

What region represents equilibrium between liquid and vapor?   D - E

Where on the graph is the substance a solid at its melting point?   B

A student performed a food calorimetry experiment to find the number of Calories per gram in a gummy bear. The student collected the following data.

Mass of empty can	28.5 g
Mass of can with water	45.8 g
Mass of gummy bear before burning	1.61 g
Mass of gummy bear after burning	1.48 g
Initial temperature of the water	22.0°C
Final temperature of the water	33.5°C

The student also knows the following information.

Specific heat of water: 4.184 J/g°C
1 calorie = 4.184 J
1 food Calorie = 1000 calorie

Heat lost by gummy bear = heat gained by water

The package says that gummy bears have 2.7 Calories/gram.

a. What was the mass of the water? $45.8 - 28.5 = \boxed{17.3 g}$

How much did the temperature of the water change?
$33.5 - 22 = \boxed{11.5°C}$

b. Using the information in (a) calculate the heat gained by the water in joules.
$q = m c \Delta T$ $q = 17.3 (4.184)(11.5) = \boxed{832 J}$

c. Based on your answer to (b), calculate the number of calories gained by the water and then how many food calories were gained.
$\dfrac{832 J}{\times} \left| \dfrac{1 cal}{4.184 J} \right| \dfrac{1 Cal}{1000 cal} = \boxed{0.199 \text{ food calories}}$

d. How many food calories were lost by the gummy bear?
$\boxed{0.199 \text{ food Calories}}$

e. According to the data, how many food calories do gummy bears have per gram?
$0.199 \text{ Cal} \Big/ (1.61 - 1.48) = \boxed{1.53 \text{ food Calories}}$

f. Based on what the package states, what is the percent error?
$100 \times \left| \dfrac{1.53 - 2.7}{2.7} \right| = \boxed{43.3\%}$

g. What are some possible sources of error?

Heat lost to the surroundings, ie. the air, the calorimeter.