KEY

Chemistry Pretest
Chapters 10 & 11

$\Delta T = 87.6 - 18 = 69.6°C$

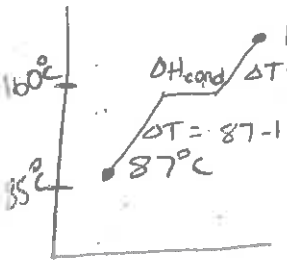
1. What mass of water could be heated from 18.0 °C to 87.6 °C by 36.5 kJ of energy?

$q = mC\Delta T$ $\quad m = \frac{q}{C\Delta T}$

$$m = \frac{36500J}{(4.18J/g°C)(69.6°C)} = \boxed{125g}$$

2. Use the following information to find the amount of energy released when 20.0 grams of element X is cooled from 196 °C to 87.6 °C.

Boiling point = 160 °C $\quad$ Melting point = 85.0 °C $\quad$ H_{vap} = 1160 J/g
H_{fus} = 300 J/g $\quad$ C_{solid} = 1.7 J/g °C $\quad$ C_{liquid} = 4.6 J/g °C
C_{gas} = 1.2 J/g °C



(1) cooling vapor $\quad q = (20.0g)(1.2J/g°C)(-36°C) = -864J$

(2) phase change (condensation) $\quad 20.0g\left(\frac{-1160J}{1g}\right) = -23200J$

(3) cooling liquid $\quad q = (20.0g)(4.6J/g°C)(-72.4°C) = -6660.8J$

$(-864J) + (-23200J) + (-6660.8J) = -30728J = \boxed{-30.7\ kJ}$

3. 10.0 grams of a liquid at its boiling point absorbed 375 kJ of energy which vaporized some of the gas. If the mass of the liquid remaining after the energy was absorbed is 5.70 grams, calculate the heat of vaporization of the liquid.

$10.0g - 5.70g = 4.3g$ of liquid vaporized.

$\Delta H = \frac{J}{g} \Rightarrow \frac{375\ kJ}{4.3g} = \boxed{\Delta H_{vap} = 87.2\ kJ/g}$

4. A 27.2 gram sample of Millerium (named after some fabulous chemistry teacher) is placed in a 200.0 mL sample of water. The water temperature is changed from 12.0 °C to 25.0 °C. If the heat capacity of Mi is 0.588 Cal/g °C, what was the original temperature of the Mi?

$q_{Mi} = -q_{surr}$ $\quad q = mC\Delta T$ $\quad 1mL = 1g\ H_2O$

$mC\Delta T_{metal} = -mC\Delta T_{H_2O}$

$$(27.2g)(0.588\ cal/g°C)(\Delta T) = (200.0g)(1\ cal/g°C)(13°C)$$

$$\Delta T = \frac{(200.0g)(1\ cal/g°C)(13°C)}{(27.2g)(0.588\ cal/g°C)}$$

$\Delta T = -162.6°C = T_f - T_i = 25°C - T_i \quad T_i = 162.6 + 25 = \boxed{187.6°C}$

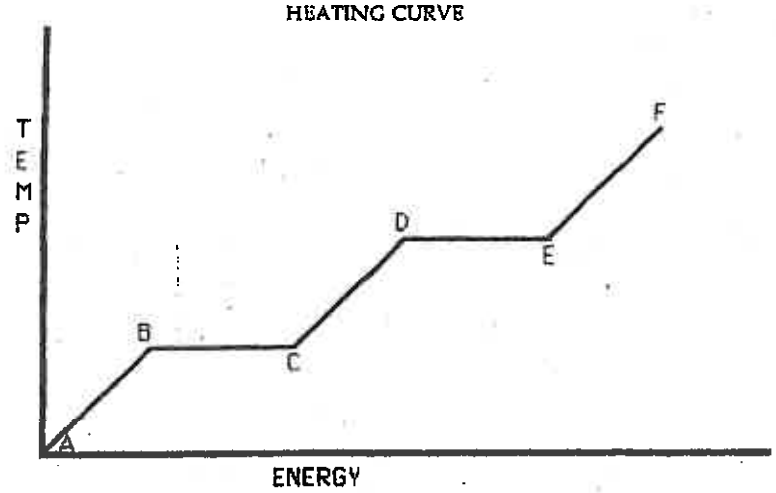
5. How much heat energy is required to convert 25.0 grams of water at 60.0 °C to a gas at 100 °C? ΔH_v = 2300 J/g $\quad \Delta H_f$ = 340 J/g
C_{solid} = 2.04 J/g°C $\quad C_{liquid}$ = 4.18 J/g°C $\quad C_{gas}$ = 2.00 J/g°C

(1) heating liquid $\quad q = (25.0g)(4.18J/g°C)(40°C) = 4180J$

(2) phase change vaporize $\quad 25.0g\left(\frac{2300J}{1g}\right) = 57500J$

total heat added = $4180J + 57500J = \boxed{61.68\ kJ}$

HEATING CURVE



Answer the following questions using the heating curve provided. There may be more than one answer per question!

10. Between what two points would you find both a liquid and a gas? D-E

11. What section or sections would you find a phase change taking place? B-C & D-E

12. Between what two points would you find translational motion? E-F (movement through space)

13. At what point would you find a liquid at its freezing point? C

14. Water boils at 100 °C at normal atmospheric pressure which is about 101.3 kPa at sea level. What would you expect boiling temperature of water to be in Denver, Colorado, a city with an elevation of 5280 ft? What about in Death Valley, CA which is located well below sea level?

15. Use the following data, obtained from a calorimeter lab, to calculate the heat capacity of the metal. $q_{sys} = -q_{surr}$ $mC\Delta T_{metal} = -mC\Delta T_{H_2O}$ $C_{metal} = \frac{-mC\Delta T_{(H_2O)}}{m\Delta T_{(metal)}}$

Variable	Trial 1
Mass of metal	106.7 g
T_i of water	17.7 °C
T_f of water	29.4 °C
T_i of metal	78.9 °C
Volume of water	250 mL = 250 g

$\Delta T_{H_2O} = 11.7\ ^\circ C$

$\Delta T_{metal} = -49.5\ ^\circ C$

$$C_{metal} = \frac{-(250\,g)(4.18\,J/g^\circ C)(11.7\,^\circ C)}{(106.7\,g)(-49.5\,^\circ C)} = \frac{-12226.5\,J}{-5281.65\,^\circ C}$$

$$C_{metal} = 2.31\ J/g^\circ C$$