Quiz 10.2 – Enthalpies of Phase Change and Heating Curves

Name: *Key*

Question 1

Solid paraffin wax has a specific heat of $2.5\dfrac{J}{g\,K}$. If $300.0\ J$ of heat are added to $15.25\ g$ of paraffin wax, how much will the temperature raise?

$q = mC\Delta T \qquad 300.0\ J = 15.25g \cdot 2.5\tfrac{J}{g°C} \cdot \Delta T$

Question 2

$\Delta T = 7.9\ k \quad (or\ 7.9\ °C)$

Paraffin wax has a melting point of $37\ °C$, and $\Delta H_{fus} = 210\dfrac{J}{g}$. How many J of heat are required to melt $5.75\ g$ of paraffin wax?

$q = m\Delta H \qquad q = 5.75g \cdot 210\tfrac{J}{g} = 1200\ J$

Question 3

Example Exercise 10.10 in Section 10.3 of your textbook gives the necessary values to answer this question $38.0\ kJ$ of heat are removed from a $\boxed{10.0\ g}$ → *0.555 moles* sample of steam (water vapor) at $250.0\ °C$. Give the total *heat* energy for each of the steps labeled A through E on the cooling curve below, and give the final phase and *remaining* temperature of the water

$C_{(g)} = 1.86\ \tfrac{J}{g°C}$

$C_{(l)} = 4.18\ \tfrac{J}{g°C}$

$C_{(s)} = 2.09\ \tfrac{J}{g°C}$

$\Delta H_{cond} = -\Delta H_{vap} = -40.67\ kJ/mol$

$\Delta H_{freez} = -\Delta H_{fus} = -6.01\ kJ/mol$

A) $q = mC\Delta T = 10.0g \cdot 1.86\tfrac{J}{g°C} \cdot -150.0°C = \boxed{-2790\ J}$ 35.21 kJ

B) $q = n\Delta H_{cond} = 0.555\ moles \cdot -40.67\ kJ/mol = \boxed{-22.6\ kJ}$ 12.6 kJ

C) $q = mC\Delta T = 10.0g \cdot 4.18\tfrac{J}{g°C} \cdot -100.0°C = \boxed{-4180\ J}$ 8.7 kJ

D) $q = n\Delta H_{freez} = 0.555\ moles \cdot -6.01\ kJ/mol = \boxed{-3.34\ kJ}$ $\boxed{5.1\ kJ}$

E) $q = mC\Delta T$

$-5,100\ J = 10.0g \cdot 2.09\ J/g°C \cdot \Delta T$

$\Delta T = -244\ °C$

Solid @ $T = -244°C$