Molar Enthalpy Worksheet - side A Q=mΔH

(Q= energy or heat in KJ, m=moles, ΔH=molar enthalpy)

●A change in enthalpy (ΔH) is a measurement of energy transfer in the form of heat. **Molar enthalpy** is the enthalpy change per mole of a substance involved in a transformation. Examples of transformations are phase changes, dissolving, and chemical reactions.

●The units are generally expressed as kJ/mole. Thus, the molar enthalpy of ***fusion*** for water is the energy in kilojoules required to ***melt*** one mole of ice at its melting point. Positive molar enthalpies **(+ΔH) indicate that energy is being gained** by the substance, whereas negative molar enthalpies **(-ΔH) indicate that energy is lost**.

ΔH for Water:

$\Delta H_{(fus)}$ **for** H_2O= 6.01 kJ/mol	$\Delta H_{(vap)}$ **for** H_2O= 40.79kJ/mol
$\Delta H_{(solid)}$ **for** H_2O= -6.01 kJ/mol	$\Delta H_{(con)}$ **for** H_2O= -40.79kJ/mol

1. How much energy is released to the environment by 302.0 grams of condensing water vapor? Is this Endothermic or Exothermic?

-685kJ

2. Is melting endothermic or exothermic? Explain.

Exo

3. Calculate the amount of heat needed to melt 35.0 kg of ice at 0 ºC. Is this Endothermic or Exothermic?

11,686kJ, Endo

4. Calculate the molar enthalpy of condensation ($\Delta H_{condensation}$) for ammonia when 50.0g of NH_3 gas turn into a liquid at its boiling point. 68,500J of energy are released in the process**.**

-23.3 KJ/mol
(This should be a negative number think about it!)

5. Calculate the energy absorbed when $2.0x10^3$g of dry ice (CO_2) sublimate at the normal sublimation point. The molar enthalpy of sublimation is 8.647kJ/mol.

393 KJ

6. Methane (CH_4) has a normal boiling point of -161.6˚C. At this temperature, the $\Delta H_{condensation}$ = -8.17kJ/mol. If 16.5g of liquid methane vaporize, how much energy is absorbed?

8.4 KJ

7. How much energy is required to melt a 20.0 lb bag of ice at 0˚C? A pound (lb.) of ice is equivalent to 0.4536 kg. The ΔH_{fusion} of ice is +6.009kJ/mol.

3028.5 KJ

8. When water vaporizes at its normal boiling point, its $\Delta H_{vaporization}$ = +40.79kJ/mol. Calculate the number of moles of water that condense if -3456kJ of energy are released.

84.7 mol

Molar Enthalpy Worksheet - side B Q=mΔH

(Q= energy or heat in KJ, m=moles, ΔH=molar enthalpy)

$\Delta H_{(fus)}$ **for** H_2O= 6.01 kJ/mol	$\Delta H_{(vap)}$ **for** H_2O= 40.79kJ/mol

1. What is the molar heat of solidification for water? $\Delta H_{(solid)}$ **for** H_2O= _____ (look above and just make negative)

2. What is the molar heat of condensation for water? $\Delta H_{(con)}$ **for** H_2O= _____ (look above and just make negative)

3. Is melting endothermic or exothermic? Explain.

4. How much energy is released to the environment by 50.0 grams of condensing water vapor?

Is this Endothermic or Exothermic? -113.3KJ, Exo

5. Calculate the amount of heat needed to melt 35.0 g of ice at 0 ºC. Express your answer in joules.

Is this Endothermic or Exothermic? 11.67KJ = 11670J, Endo

6. How much energy is absorbed by 300g of methanol, CH_3OH, as it evaporates? The molar heat of vaporization is 35.3kJ/mol.

Is this Endothermic or Exothermic? 330.9 KJ, Endo

7. If 540g of water condenses on a car during a cool night, calculate the amount of energy released to the air during this condensation.

Is this Endothermic or Exothermic? -1223.7 KJ, Exo

8. Calculate the mass of methanol, CH_3OH, needed to release 650 KJ of energy as the methanol condenses. The molar heat of vaporization is 35.3kJ/mol.

Is this Endothermic or Exothermic? 589g, Exo

9. What **mass** of aluminum metal would absorb 250.0 kJ when it melted at its melting point? The molar enthalpy of fusion for aluminum is +10.71kJ/mol. (your answer will be in moles, convert to grams)

630g