Enthalpy Calculations Review

Name: _____ Period: _____

1. Determine the sign (+ or -) ΔS in the processes below:
   a. $FeS\ (s) \rightarrow Fe^{2+}\ (aq) + S^{2-}\ (aq)$ _____
   b. $2C_2H_6\ (g) + 7O_2\ (g) \rightarrow 4CO_2\ (g) + 6H_2O\ (g)$ _____
   c. $2\ NH_3\ (g) \rightarrow N_2\ (g) + 3\ H_2\ (g)$ _____
2. Which has more entropy: a sugar cube dissolved in water or a sugar cube? Explain.

Substance	Specific Heat (J/g x °C)
H_2O (s)	2.03
H_2O (l)	4.184
H_2O (g)	2.01

Water
ΔH_{fus} = 6.01 kJ/mol
ΔH_{vap} = 40.7 kJ/mol

3. How much energy is need to condense 12.6 g of water?

4. What is the initial temperature of a 10.5 g piece of copper (c = 0.385) that has a final temperature of 85.0°C and absorbs 130.2 J of energy?

5. How much energy is required to melt 18.6 g of water?

6. How much energy is released when the temperature of 12.2 g of water decreases from 92.5°C to 65.0°C?

7. Calculate the change in enthalpy using the standard enthalpy of formation for the reaction below:

$2H_2O\ (l) \rightarrow 2H_2\ (g) + O_2\ (g)$

8. Use the standard enthalpy of formation to calculate the enthalpy change for the reaction below.

$CH_4(g) + 2O_2(g) \text{---> } CO_2(g) + 2H_2O(l)$

9. Estimate the enthalpy change (ΔHrxn) for the reaction using bond energies: **$CH_4(g) + 2\ O_2(g) \text{---> } CO_2(g) + 2\ H_2O(l)$**

Average Bond Energies (kJ/mol)

H–H	436 kJ/mol	C–H	413 kJ/mol	C=C	614 kJ/mol
H–Cl	431 kJ/mol	C–C	348 kJ/mol	C≡C	839 kJ/mol
H–F	567 kJ/mol	C–N	293 kJ/mol	C=O	799 kJ/mol
N–H	391 kJ/mol	C–O	358 kJ/mol	O=O	495 kJ/mol
N–O	201 kJ/mol	C–F	485 kJ/mol	C≡O	1072 kJ/mol
O–H	463 kJ/mol	C–Cl	328 kJ/mol	C=N	615 kJ/mol
O–O	146 kJ/mol	C–S	259 kJ/mol	N=N	418 kJ/mol
F–F	155 kJ/mol	Cl–Cl	242 kJ/mol	N≡N	941 kJ/mol
				C≡N	891 kJ/mol

10. How much heat is released when 12.5 g of ethanol burns? $C_2H_5OH\ (l) + 3O_2 \rightarrow 2CO_2\ (g) + H_2O\ (g)$ $\Delta H = -1235$ kJ

11. A reaction has a ΔH of -57 kJ and a Δ S of 21 J/K. Is the reaction spontaneous at 25 °C?