/70 # Assignment # 2

(***Nelson*** text: Unit 3 Chapter 5 - pg 294 - 356 & Chapter 7 (7.7) page 494-498)

1. Write a balanced equation for the combustion of ethanol (C_2H_5OH). (/2)
2. Do question # 8, on page 302 (/2)
3. If a concrete wall of mass **4.5×10^7** g reached a temperature of **38°C** during the day, how much energy would it release if its temp dropped to **18°C** that night ? (c= 3.340 $kJ.kg^{-1}K^{-1}$ for concrete) (/3)
4. Given ☞ **$3\ C\ (s) + 2\ Fe_2O_3\ (s) + 462\ kJ \rightarrow 4\ Fe\ (s) + 3\ CO_2\ (g)$**
   Rewrite this equation representing the enthalpy change (ΔH) **of carbon** in 2 other ways. (/2)
5. Do questions # **2** on page 320 in your text. (/3)
6. Calcium is burnt according to the following eq'n **$Ca\ (s) + 1/2\ O_2\ (g) \rightarrow CaO\ (s)$** $\Delta H = -636$ ***kJ/mol Ca***
   How much heat would be produced by burning **12 g** of calcium? (/2)
7. Write the equation for the formation of the following, include $\Delta H°_f$. (/4)
   a) $HC_2H_3O_2$ b) H_2SO_4 c) $NaNO_3$ d) $Ba(ClO_3)_2$
8. Calculate ΔH_{rx} for : a) **$2\ Fe\ (s) + O_2\ (g) \rightarrow 2\ FeO\ (s)$** b) **$2\ NH_3\ (g) \rightarrow N_2\ (g) + 3\ H_2\ (g)$ (/2)**

9. Calculate $\Delta H°$ for the following - $2\ KCl\ (s) + H_2SO_4\ (l) \rightarrow 2HCl\ (g) + K_2SO_4\ (s)$ (/3)
   using:
   $HCl\ (g) + KOH\ (s) \rightarrow KCl\ (s) + H_2O\ (l)$ $\Delta H° = -203.6$ kJ
   $H_2SO_4\ (l) + 2\ KOH\ (s) \rightarrow K_2SO_4\ (s) + 2H_2O\ (l)$ $\Delta H° = -342.4$ kJ

10. Calculate $\Delta H°$ for the following - $HCl\ (g) + NaNO_2\ (s) \rightarrow HNO_2\ (l) + NaCl\ (s)$ (/5)
    using:
    $2NaCl\ (s) + H_2O\ (l) \rightarrow 2HCl\ (g) + Na_2O\ (s)$ $\Delta H° = +507.31$ kJ
    $NO\ (g) + NO_2\ (g) + Na_2O\ (s) \rightarrow 2\ NaNO_2\ (s)$ $\Delta H° = -427.14$ kJ
    $NO\ (g) + NO_2\ (g) \rightarrow N_2O\ (g) + O_2\ (g)$ $\Delta H° = -42.68$ kJ
    $2HNO_2\ (l) \rightarrow N_2O\ (g) + O_2\ (g) + H_2O\ (l)$ $\Delta H° = +34.35$ kJ

11. Calculate ΔH_{rx} for the following a) $2\ NH_3\ (g) + CO_2\ (g) \rightarrow CO(NH_2)_2\ (s)$ *(urea)* $+ H_2O\ (l)$ (/3)
    Note: $\Delta H°_{f\ urea} = -333.5$ kJ/mol

12. Do question # **3** on page 335 in your text. (/2)

13. **3.0 g** of hydrazine (N_2H_4) are burned in a bomb calorimeter causing **3.9 L** of water to increase its temperature by **3.5°C**. Calculate the heat of combustion (ΔH_{comb}) for hydrazine in kJ/mol. (/3)

14. a) Write the equation for the complete combustion of benzene (C_6H_6). (/1)
    b) **2.1 g** of benzene is burned in a metal bomb calorimeter containing **3800 mL** of water. The temperature rose from **22°C** to **27.2°C**. Calculate the **experimental** heat of combustion (ΔH_{comb}) for benzene with this data. (/4)
    c) Now use your data sheet to calculate the **theoretical** $\Delta H_{(combustion)}$ for benzene. **use water vapour (/2)
    d) Calculate % error. **(100 – experimental/theoretical x 100%) (/1)**

15. ***Entropy predictions***-Do **#3** + **#10** on pg 512 in your text. (/6)

Application Questions (text questions may ask for a report. Don't do this; a brief paragraph will suffice)

16. Do question 7ab on page 300. (/5)
17. Hot packs and cold packs use chemical reactions to produce or absorb energy. Briefly research and describe in a short paragraph how these products work in terms of transferring energy. (/5)

Lab (/10)

18. For the Hess's Law lab: Write the following:
    - **Purpose:** 2-3 sentences stating why we performed this lab
    - **Observations:** draw a table for lab 1 that includes all numerical values measured & calculated. **Repeat** this for lab 2.
    - **Sample calculations:** for calculations done, do **1 sample calculation** to show how values were determined
    - **Conclusion:** state overall results found and explain errors/discrepancies found in your experiments