Chem 1063. Exam 1. J-Term 2009

Name_____

Show all work for credit! Remember sig figs!

Useful information: q= smΔT, s= 4.17J/g•ºC for water, R = 0.0821 L•atm/molK, 8.314 J/mol•K, PV=nRT, $\left(P+\frac{an^2}{V^2}\right)\left(V-nb\right)=nRT$, $u=\sqrt{\frac{3RT}{MW}}$, $\frac{rate1}{rate2}=\sqrt{\frac{MW2}{MW1}}$

(1)(4 points) What is the molecular weight of a gas that effuses 1.86x faster than Xe. What is a likely candidate for the identity of this gas?

(2)(4 points) A sample of gas is contained in a 2.50 L vessel at 28 ºC and 1.00 atm pressure. How hot would the sample need to be to cause the container to burst (at 6.50 atm)?

(3)(4 points) Use the van der Waals equation to calculate the pressure of 45.0 g of NH_3 gas in a 1.00 L container at 0 ºC. (a = 4.17 L^2•atm/mol^2 and b = 0.0371 L/mol).

(4)(3 points) Is heat absorbed by ice or released by ice when it melts? Is the process enothermic or exothermic? What is the sign of ΔH^o for the reaction?

(5)(4 points) One current use of used cooking oil is as a substitute for diesel fuel. Using the equation below, determine the ΔH^o for the combustion of a typical fat found in cooking oil, $C_{51}H_{88}O_6$. The ΔH^o_f is -1,310 kJ/mol for $C_{51}H_{88}O_6$

$$C_{51}H_{88}O_{6(l)} + 70\ O_{2(g)} \rightarrow 51\ CO_{2(g)} + 44\ H_2O_{(g)} \quad \Delta H^o = ?$$

(6)(4 points) What is q when 100.0 g of NH_4NO_3 is dissolved in water?

$$NH_4NO_{3(s)} \rightarrow NH_4NO_{3(aq)} \quad \Delta H^o = 25.7\ kJ$$

Does the water get colder or warmer?

(7)(4 points) When a certain sample of $CaCl_2$ was dissolved in 75.0 mL of water, q=-1.2 kJ for the reaction. If the initial water temperature was 20 ºC, what was the final temperature?

$CaCl_{2(s)}$ --> $CaCl_{2(aq)}$

(8)(8 points) What volume of methane is required to heat the water in a hot water heater (80 L) from 20 ºC to 70 ºC?

$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$ ΔH^o=?

(a) What is ΔH^o?

(b) How much energy is required to heat the water?

(c) How much methane in needed (in moles)?

(d) What volume of methane is this at 1.2 atm and 20 ºC?