

General Chemistry 232 Quiz 2

Sign your name agreeing to the following term: *During this quiz, I will not enlist the help of anyone else and I will not either actively or passively aid anyone with this quiz.*

Signature: _____

Write down the following statement: *I am good at chemistry and I will do well on my own.*

Review of previous material

- 1) James performs a calorimetry experiment where he adds 0.127 g of $\text{Mg}_{(s)}$ to 200.0 mL of 0.500 M HCl at 23.12 degrees C in a closed 500.0 mL container. Assume density = 1g/mL and perfectly insulated.
 - a) Write the reaction
 - b) What is the pressure of the gas produced by this reaction?
 - c) Is this an isolated or open system? What is the difference between the two?
 - d) Upon addition of Mg, the water increases to 28.15 °C. Calculate q_{solution} . Is this reaction endothermic or exothermic? Heat capacity of water is 4.184 J/g °C.
 - e) Calculate q_{rxn} . Is this endothermic or exothermic? Calculate q_{cal} if a q_{cal} of 85.5 Joules is reported.
 - f) Calculate ΔH_{rxn} for this reaction (for Mg)
 - g) How much thermal energy is released from this reaction?
 - h) What is the density of the gas?
- 2) Condensation is an exothermic process where thermal energy is released from system to surroundings.
 $\text{H}_2\text{O}(g) \rightarrow \text{H}_2\text{O}(l) \quad \Delta H_{\text{rxn}} = -44\text{kJ}$

Today, James' signature DutchBro's drink, *the usual*, is iced and the initial temperature of the cup is 12 degrees C. The longer James holds his cup, the more thermal energy is being transferred to the surroundings, causing water vapor to condense into liquid droplets.

- a) If on his way back to the dorm, the cup warms by 0.85 degrees C and assuming the mass of the cup is 10 grams and has a heat capacity of 3.8 J/g °C, how much water is collected onto the cup?
- b) If during this time 8.5 kJ of energy were removed from his 600 mL drink (heat capacity = 4.184 J/g°C), and his drink was initially 10 degrees C, what will the final temperature of his drink be?

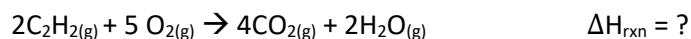
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Calculating Enthalpy

- 1) Octane can be used as a fuel source for generators by its combustion with excess oxygen. Every day, in the district of Jamestown, the citizens use 5.5×10^{12} kilojoules of energy by harvesting the combustion of liquid octane, C_8H_{18} . Write a reaction and calculate the ΔH_{rxn} for this combustion and determine how many kilograms of C_8H_{18} is required to power Jamestown every day.

Reactant/Product	ΔH_f (kJ/mol)
Octane	-250.1
Carbon Dioxide	-393.5
Water	-241.8

- 2) Acetylene (C_2H_2) combusts according to the following reaction:



- a) Find ΔH_{rxn} given the following reaction steps and subsequent H values. Assume all gas phase.



- b) Why does the method used above work? Explain using definitions earlier defined about state. Could I use this same approach to find heat?

- 3) Consider a reaction producing NF_3 at 298K. Approximate the average bond enthalpy of a F – F bond if the reaction takes place with $\Delta H_{rxn} = -211 \text{ kJ/mol}$

Bond	Average Bond Enthalpy kJ/mol
N=N	418
N≡N	946
N-F	272
F-F	?

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Gasses and their Behavior

- 1) What are the conditions of STP?
- 2) 15 grams of gaseous oxygen, fluorine and chlorine are released under STP conditions. Which will occupy the least volume assuming ideal gas behavior?
- 3) At the same temperature and pressure, equal volumes of gaseous O_2 , CO , and CO_2 will have the same what?
- 4) Consider O_2 , CO and CO_2 gas. Under STP, relate these gasses in terms of velocity and average kinetic energy.
- 5) For each of the following, answer the question and provide a law or equation that goes along with the scenario:

What happens to volume if temperature decreases and pressure is constant?

What happens to pressure if volume increases and temperature is constant?

What happens to volume if pressure increases and temperature is constant?

What happens to temperature if volume increases and pressure is constant?

What happens to pressure if temperature increases and volume is constant?

What happens to temperature if pressure increases and volume is constant?

Gas Calculations

- 6) Alex has a body temperature of 35°C . On a cold day, what volume of air at 278K must Alex with a lung capacity of 3.5 L breathe in to completely fill his lungs?
- 7) As James is writing this question at 12:57 am 1/21/2021, the barometric pressure of Corvallis is 30.4 inches of mercury. James goes outside and collects air in one of his DutchBros cups that is 1200 ml. The temperature is currently 3.9°C . How many moles of air does James have? $1\text{ inch}=2.54\text{ cm}$
- 8) What will be the volume of 113 grams of gaseous butanol (C_4H_9OH) at 565 torr and 25°C ?