CH 222 Final Exam Prep Worksheet Name: ______________________________

Worksheet due dates: **<u>At the time of your Lecture Final</u>** *(01, H1)* **, <u>Wed, 3/19</u>, 11:59 PM** *(W1, email)*. To complete, show ***detailed steps*** on how to get the given answer for each problem. *Failure to use this form for work and answers will result in a point penalty.*

Problem 1: The following data was collected for the reaction shown below. Determine the value of the rate constant (k). *Be sure to show the **orders** of each reactant in this reaction (and how you got them!)*

$$\mathbf{2\ MnO_4^{-1}(aq) + 5\ H_2C_2O_4(aq) + 6\ H^+(aq) \rightarrow 2\ Mn^{2+}(aq) + 10\ CO_2(g) + 8\ H_2O(l)}$$

$[MnO_4^{-1}]$	$[H_2C_2O_4]$	$[H^+]$	Rate (M/s)
$1 * 10^{-3}$	$1 * 10^{-3}$	1.0	$2 * 10^{-4}$
$2 * 10^{-3}$	$1 * 10^{-3}$	1.0	$8 * 10^{-4}$
$2 * 10^{-3}$	$2 * 10^{-3}$	1.0	$1.6 * 10^{-3}$
$2 * 10^{-3}$	$2 * 10^{-3}$	2.0	$1.6 * 10^{-3}$

Answer to Problem #1: **k = 2 * 10^5**

Problem 2: The decomposition of N_2O_5 ($2\ N_2O_5(g) \rightarrow O_2(g) + 4\ NO_2(g)$) is first order in N_2O_5 with $k = 1.0 * 10^{-5}\ s^{-1}$. If the initial concentration of N_2O_5 is $1.0 * 10^{-3}$ M, calculate the concentration of N_2O_5 after $1.0 * 10^5$ seconds.

Answer to Problem #2: **3.7 * 10^{-4} M**

Problem 3: The rate constant k for a reaction is $2.6 * 10^{-8}$ when the reaction proceeds at 300.0 K, and the activation energy is 98 kJ/mol. Determine the frequency factor, A, for the reaction. What is the value of k at 310 K?

Answer to Problem #3: **$A = 3.0 * 10^{9}$, $k = 9.2 * 10^{-8}$**

Problem 4: A sample of wood from an Egyptian mummy case gives a ^{14}C count of 9.4 cpm/gC (counts per minute per gram of carbon.) How old is the wood? (The initial decay rate of ^{14}C is 15.3 cpm/gC, and the ^{14}C half-life is 5730 years.)

Answer to Problem #4: **$4.0 * 10^{3}$ years**

Problem 5: One of the hopes for solving the world's energy problem is to make use of the following fusion reaction:

$$^{2}H + {}^{3}H \rightarrow {}^{4}He + {}^{1}n + \text{energy}$$

How much energy (in kJ) is released when one mole of deuterium is fused with one mole of tritium according to the above reaction? The masses of the atoms and neutrons are:

^{2}H: 2.0140 amu ^{3}H: 3.01605 amu ^{4}He: 4.002603 amu ^{1}n: 1.008665 amu

Answer to Problem #5: **$-1.69 * 10^{9}$ kJ**