Chem 122 Rybolt Exam 1 Spring 2009 Name_____
Numerical constants may be listed below. Other needed information is given in the problem or written on the board or found in the periodic tables you will use during exam. For numerical problems, be sure to **show your work**, include units and circle your final answer. If several choices are given, **circle the correct answer**. Your written answers should be brief and to the point. You can use your own calculator on the exam, but no notes, books, external information, or other electronic devices are to be used. No cell phone is to be used in Exam room.

1 cal = 4.184 J $c = 3.00 \times 10^8$ m/s 1 atm = 760 torr = 1.01×10^5 N/m^2 $h = 6.63 \times 10^{-34}$ Js
R = 0.08206 (L atm/ mol K) or R= 8.31J/mol K 1 g = 6.02×10^{23} amu
$^oC=(^oF-32)/1.8$ $K=^oC+273$

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1) Some Coca-Cola is made with high fructose corn syrup. This Coca-Cola has 39 g of fructose sugar per 355mL of Cola solution. The sugar fructose has a molar mass of 180.2g/mol. What is the molarity of the fructose solution in Coca-cola?

2) If a solution of sodium chloride NaCl(aq) has a molarity of 4.00M then what is the molality of this solution? The density of the solution is 1.15g/mL. You can assume you have 1000mL of solution.

3) The freezing point depression constant for water is $K_f = -1.86^oC/m$ so therefore a 4.4 molal solution of NaCl(aq) (made of negative and positive ions) would have a freezing point depression of $\Delta T =$

4) The vapor pressure of pure water is 24.0 torr at room temperature. According to Raoult's law if 1.0 mole of sugar is dissolved in 4.0 moles of water then the vapor pressure of the water in the sugar-water mixture should be _____ torr. Recall that Raoult's law in general can be written as $P_A = X_A P^o_A$

5) Red blood cells that are placed in a hypertonic solution that has a very high concentration of sugar. The red blood cells are observed for 16 hours and found to

remain unchanged in size become larger become smaller

6) The presence of a biological catalyst (enzyme) causes the energy of activation to be reduced to one-half of its normal E_a value when no catalyst is present. Before the rate of the catalyzed reaction is determined you are asked to predict how fast it might be relative to the initial (uncatalyzed rate). You suggest that it will

be about 2 times faster 2 times slower 10 times faster 1,000,000 times faster

7) Sugar is burned in a bomb calorimeter and gives a temperature rise from 24.1^{o}C to 28.1^{o}C. The heat capacity for the calorimeter and water combined is 2500 J/^{o}C. The energy (kJ) released by this combustion is

8) What is the heat (J) absorbed by 2.00L of water with a density of 1.00g/mL if the temperature of the water increases from 25.0 to 50.0 ^{o}C and the specific heat of water is 4.184J/(g^{o}C)?

9) ΔH for a reaction (NH_3 + HCl $\rightarrow$ NH_4Cl) was found to be -177 kJ and ΔS= - 285J/K at a temperature of 300K. The value for ΔG (kJ) for this reaction is

10) Given the following bond energies H-H 432kJ/mol, O=O 494kJ/mol, and H-O 459kJ/mol, find the enthalpy change for the reaction

$2H_2 + O_2 \rightarrow 2H_2O$

11) ΔG for a reaction is -400kJ therefore this reaction must
occur rapidly occur slowly not occur occur but may be fast or slow

Use the following thermodynamic data for problems 12 and 13

	$N_2(g)$	$O_2(g)$	NO(g)
ΔH_f(kJ/mol)	0	0	90
S(J/mol K)	192	205	211

12) What is ΔH for the reaction $N_2(g) + O_2(g) \rightarrow 2NO(g)$

13) What is ΔS for the reaction $N_2(g) + O_2(g) \rightarrow 2NO(g)$

14) If ΔH= 50 kJ and ΔS = 100J/K for a reaction that is not spontaneous at room temperature and these values remain constant as the temperature is changed, then at what temperature would ΔG for the reaction be equal to zero indicating that above this temperature the reaction would become spontaneous.

15) If a reaction is spontaneous then ΔG for this reaction must be negative(-), zero, or positive (+)

16) What is the rate law for the <u>balanced chemical equation</u>
$N_2 + O_2 \Leftrightarrow 2NO$

$k [N_2][O_2]^2$ $k [N_2][O_2]$ cannot determine without more information

17) For a single <u>step</u> in a mechanism
$NO + F_2 \rightarrow ONF + F$
what is the rate law for the production of nitrosyl fluoride, ONF? Rate =

k[NO] $k [NO][F_2]$ k [F][NO] k[ONF][F] cannot determine

18) Given the following data from three expts, determine the order of the reaction with respect to NO :
zero first second third

[NO]	$[F_2]$	initial rate
0.020	0.010	3.0
0.040	0.010	6.0
0.040	0.020	12.0

19) Which of the following if plotted versus time should give a straight line plot for a first order reaction?
[conc] = the concentration of the reactant molecule

[conc] versus time ln [conc] versus time 1/[conc] versus time

20) Write a single bimolecular step (show reactants and products) in a mechanism that shows the reaction between a chlorine atom Cl• free radical and an ozone molecule

21) A reaction involving chlorine gas in a stainless steel chamber at a temperature of 500 K and a pressure of 8.0 atm follows first order kinetics. If the initial concentration of chlorine is 16 mmol per liter then after a time period of 3 half-lives pass, the concentration of chlorine will be