Name: _____

chm112final2014

Short Answer

1. For a first-order reaction that has a rate constant of $1.9 \times 10^{-7}\ s^{-1}$;

   a) if the initial concentration of the only reactant is 1.25 M, what is the concentration after 30.0 min min?

   b) How long will it take for the concentration to decrease to 0.75 M?

   c) How long will it take for the reaction to be 90% complete?

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2. Two reactants, A and B, are mixed, and the reaction is timed until a color change occurs. The data from three experiments are as follows:

[A]	[B]	time (sec)
0.100	0.140	25
0.050	0.140	50
0.100	0.070	100

What is the order of the reaction with respect to A and B? What is the overall order of the reaction?

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3. A coffee machine has become coated with 10.0 g $CaCO_3$. If the machine is washed with 1.00 L of pure water until equilibrium is reached, what fraction of the precipitate is removed? K_{sp} for $CaCO_3$ is 5.05×10^{-9}.

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4.

Inhalation of carbon monoxide, CO, is fatal if about 20 % of the lung's hemoglobin output is "tied up" as the complex heme-CO.
The reaction can be expressed as:

$$CO + \text{heme-}O_2 \quad O_2 + \text{heme-CO} \quad Kc = 420$$

If a person is breathing air that is .0085 M O_2 (normal air), what concentration of CO will be fatal? (All species may be considered to be in the same phase)

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5.

The rate constants for a reaction were determined at two temperatures.
At 100.0 degrees K the rate constant is $2.0 \times 10^3\ s^{-1}$, and at 500 degrees K the rate constant is $4.0 \times 10^7\ s^{-1}$. Calculate the activation energy for the reaction.

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6. Consider the following gas phase reaction:

$$A \rightarrow B + C$$

These are the relevant thermodynamic data.

	$\Delta Hf°$, kJ/mol	$\Delta S°$, J/mol °K
A	135	197
B	-45	205
C	25	214

Shoe by calculation;
Is this reaction spontaneous at 25 C and 1 atm pressure ?

Will the reaction become spontaneous or nonspontaneous as temperature increases ?

At what temperature will the system be in equilibrium at 1 atm ?

What is the value of K

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7. 252.0 mL of a 0.980 M solution of a base with K_b 1.48 x 10^{-5} was titrated with 1.55 M HCl. What is the pH after 159.3 mL of acid is added?

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8. What is the pH of a solution of weak acid after 25% titration with strong base?
   $K_a = 1.81 \times 10^{-6}$

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9. Calculate the standard free energy change $\triangle G^o$ for this reaction using standard reduction potentials E^o.

   $F_2\,(g) + Sn(s) \rightarrow 2\,F^-(aq) + Sn^{2+}(aq)$

10.

What is the voltage of the following cell?

$Cl_2(g) \mid Cl^-(aq)(.2M) \mid\mid Br^-(aq)(.04M) \mid Br_2(l)$

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