CH302 Spring 2009 Practice Quiz 5. The TA Version

1. Which of the following expressions would be equal to the rate of the reaction below?

$2\ KMnO_4 + 3\ Na_2SO_3 + H_2O \rightarrow 2\ MnO_2 + 3\ Na_2SO_4 + 2\ KOH$

1. $-(\Delta[KOH] / 2\cdot\Delta t)$
2. $-(\Delta[Na_2SO_4] / \Delta t)$
3. $(2\cdot\Delta[MnO_2] / \Delta t)$
4. $(\Delta[H_2O] / \Delta t)$
5. $-(\Delta[Na_2SO_3] / 3\cdot\Delta t)$
6. $-(\Delta[KMnO_4] / \Delta t)$

2. Consider the data below:

Experiment number	[A] M	[B] M	[C] M	[D] M	initial rate $M\cdot s^{-1}$
1	0.025	0.03	0.04	0.056	1.04×10^{-6}
2	0.025	0.12	0.04	0.056	4.16×10^{-6}
3	0.025	0.015	0.08	0.056	5.2×10^{-7}
4	0.075	0.03	0.01	0.056	9.36×10^{-6}
5	0.025	0.06	0.07	0.112	1.04×10^{-6}

What is the overall order of this reaction?

1. 1
2. 2
3. 3
4. 4
5. 5
6. 6

3. What would be the units of the rate constant (k) for the rate law below?

rate = $k\cdot[O_2]\cdot[CO]^{-1}\cdot[Cl_2]^1$

1. s^{-1}
2. $M^{-2}\cdot s^{-1}$
3. $M^{-1}\cdot s^{-1}$
4. $M^{1}\cdot s^{-1}$

4. Consider two hypothetical zero-order reactions. If reaction 1 is faster than reaction 2 at room temperature, but slower than reaction 2 at much higher temperatures, then reaction 1 must have the (larger/smaller) activation energy and must have the (larger/smaller) pre-exponential factor. (Hint: consider both the Arrhenius equation and combined Arrhenius equation.)

1. larger, smaller
2. larger, larger
3. smaller, smaller
4. smaller, larger

5. Consider the elementary reaction:

$H_2CO_3(aq) \rightarrow CO_2(aq) + H_2O(l)$

If $k = 3.6 \times 10^2\ s^{-1}$, and there is initially 0.781 M H_2CO_3, what is the $[H_2CO_3]$ after 1.2 ms have passed?

1. 0.507 M
2. 0.349 M
3. 0.584 M
4. 1.203 M

6. Consider the reaction:

$AgClO(aq) \rightarrow 1/2\ O_2(aq) + AgCl(s)$

If an aqueous system initially has a [AgClO] of 112 mM and 3 minutes later has a [AgClO] of 7 mM, what is the half life of $H_2O_2(aq)$?

1. 90 seconds
2. 180 seconds
3. 60 seconds
4. 45 seconds
5. not enough information

7. To which of the following reactions would collision state theory not apply? (Note: consider the direction of the arrow in arriving at the correct answer).

1. $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$
2. $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(g)$
3. $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$
4. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

8. Consider the reaction mechanism below:

step 1: $2\ NO_2(g) \rightarrow 2\ NO(g) + O_2(g)$

step 2: $Br_2(g) + NO(g) \rightarrow Br_2NO(g)$

step 3: $Br_2NO(g) + NO(g) \rightarrow 2\ BrNO(g)$

overall: $Br_2(g) + 2\ NO_2(g) \rightarrow 2\ BrNO(g) + O_2(g)$

If step 3 is the slow step, addition of which of the species below would slow down the observed rate of the reaction?

1. $NO(g)$
2. $BrNO(g)$
3. $Br_2(g)$
4. $O_2(g)$
5. $Br_2NO(g)$