Quiz 13.5–part of 13.6, includes material prior to 13.5

Name________________________________ 39 pts

1) For a reaction, what generally happens if the temperature is increased? (1pt)
   A) an increase in k occurs, which results in a slower rate
   B) an increase in k occurs, which results in a faster rate
   C) a decrease in k occurs, which results in a faster rate
   D) a decrease in k occurs, which results in a slower rate
   E) there is no change with k or the rate

2) Which rate law is termolecular? (1pt)
   A) rate = $k [A][B]^3$
   B) rate = $k [A][B][C][D]$
   C) rate = $k[A][B]^2$
   D) rate = $k [A]^2$
   E) rate = $k [A]^4$

3) Which rate law is bimolecular? (1pt)
   A) rate = $k [A][B][C][D]$
   B) rate = $k [A]^3$
   C) rate = $k[A][B]^2$
   D) rate = $k [A][B]$
   E) rate = $k [A]^2[B]$

4) Which of the following reactions would you predict to have the smallest orientation factor? (1pt)
   A) $NOI_2 + NO \rightarrow 2\ NOI$
   B) $C + O_2 \rightarrow CO_2$
   C) $X_2 + Y_2 \rightarrow 2\ XY$
   D) $N_2 + O_2 \rightarrow 2\ NO$
   E) All of these reactions should have nearly identical orientation factors.

5) Which of the following reactions would you predict to have the largest orientation factor? (1pt)
   A) $Br_2(g) + H_2C{=}CH_2(g) \rightarrow H_2BrC{-}CBrH_2(g)$
   B) $H(g) + I(g) \rightarrow HI(g)$
   C) $NH_3(g) + BCl_3(g) \rightarrow H_3N{-}BCl_3(g)$
   D) $NOF(g) + NOF(g) \rightarrow 2NO(g) + F_2(g)$
   E) All of these reactions should have nearly identical orientation factors.

6) The aquation of tris(1,10–phenanthroline)iron(II) in acid solution takes place according to the equation:

$$Fe(phen)_3^{2+} + 3\ H_3O^+ + 3\ H_2O \rightarrow Fe(H_2O)_6^{2+} + 3\ phenH^+.$$

If the activation energy, E_a, is 126 kJ/mol and the rate constant at 30°C is 9.8×10^{-3} min^{-1}, what is the rate constant at 45°C? (6 points)

7) A particular first–order reaction has a rate constant of 1.35×10^2 s^{-1} at 25.0°C. What is the magnitude of k at 101°C if E_a = 55.5 kJ/mol? (6 points)

8) Define activation energy. (2 pts)

9) Define the frequency factor. (2 pts)

10) Explain what the exponential factor in the Arrhenius equation represents. (2 pts)

11) Given the following balanced equation, determine the rate of reaction with respect to $[O_2]$. If the rate of O_2 loss is 2.64×10^{-3} M/s, what is the rate of formation of SO_3? (4 pts)

$$2\ SO_2(g) + O_2(g) \rightarrow 2\ SO_3(g)$$

12) Determine the rate law and the value of k for the following reaction using the data provided. (6 pts)

$$2\ N_2O_5(g) \rightarrow 4\ NO_2(g) + O_2(g)$$

$[N_2O_5]_i$ (M)	Initial Rate (M/s)
0.123	6.40×10^{-4}
0.186	9.67×10^{-4}
0.279	1.45×10^{-3}

13) The isomerization of methylisonitrile to acetonitrile

$$CH_3NC(g) \rightarrow CH_3CN(g)$$

is first order in CH_3NC. The half life of the reaction is 5.20×10^1 s at 545 K. The rate constant when the initial [CH_3NC] is 0.030 M is ________ s^{-1}. (4 pts)

14) Given the following balanced equation, determine the rate of reaction with respect to [H_2] in **generic terms** (2pts)

$$N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$$

Answer Key
Testname: QUIZ 13.5 - HALF OF 13.6, INCLUDES MATERIAL PRIOR TO 13.5

1) B
2) C
3) D
4) A
5) B
6) $1.1 \times 10^{-1}\ \text{min}^{-1}$
7) $1.28 \times 10^{4}\ \text{s}^{-1}$
8) The activation energy shows the energy of the molecule as the reaction proceeds.
9) The frequency factor represents the number of approaches to the activation barrier per unit time.
10) The exponential factor depends on both the activation energy of the reaction and the temperature at which it is done. Using this information, the exponential factor determines what fraction of collisions will have enough energy to overcome the activation energy and result in products.
11) 5.28×10^{-3} M/s
12) Rate = $5.2 \times 10^{-3}\ \text{s}^{-1}[N_2O_5]$
13) 0.0133
14) Rate = $-\frac{1}{3}\frac{\Delta[H_2]}{\Delta t}$