ASSIGNMENT SHEET #6 APQ ANSWERS

6

a. $O_3 + O \rightarrow 2\,O_2$

b. Cl

c. ClO

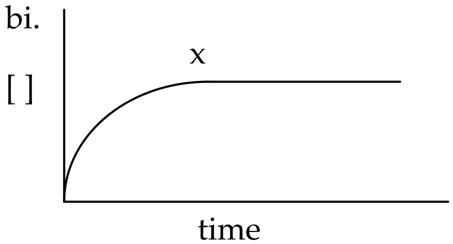
di. two

dii. $\frac{1}{M - time}$

diii. step #1, because the rate law of this step matches the overall rate law.

12

bi.



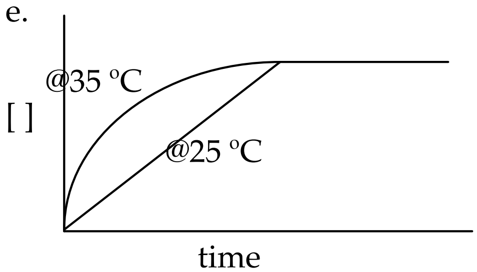
At point "x"

bii. Determine the slope of a line tangent to the curve at 20 minutes.

c. Hold one [reactant] constant, change the other reactant's concentration, and look at the change in the initial rate.

d. Since Rate = k $[A]^x[B]^y$, k = Rate ÷ $[A]^x[B]^y$

e.



note: the 25 °C curve looks linear here, but it would be curvier.

17

d. Rate = k $[O_3]^1[NO]^1$

e. step #1, because the rate law of this step matches the overall rate law.

22

a. $\frac{1}{2}$ the rate of appearance of NOBr = 1.62×10^{-4} M/s

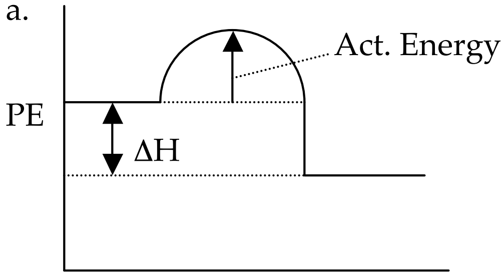
b. The reaction is 1st order wrt Br_2 and 2nd order wrt NO.

c. Rate = k $[NO]^2[Br_2]^1$ k = 105 M^{-2}-s^{-1}

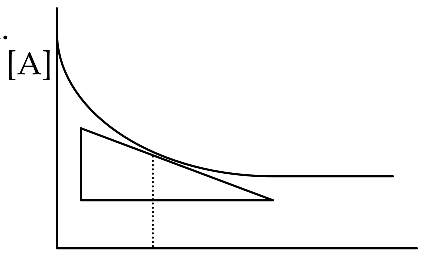
d. Not consistent; the RDS rate law is not the same as the overall rate law.

33

a.



bi.



bii. The slope of the tangent is the rate of the reaction at time "t".

biii. Since the reaction is 1st order wrt N_2O_5, $k = \frac{Rate}{[N_2O_5]}$

biv. There would be no effect on the value of the rate constant, k. Only activation energy and temperature have effects on the value of k.

ci. The line in the 2nd graph indicates that this reaction follows 1st order kinetics. Rate = k[A]
cii. The rate constant, k, is equal to the – slope.

37

a. The reaction is 1st order wrt A and 1st order wrt B.

b. Rate = k[A][B] $k = 2.3 \times 10^{-3}\ M^{-1}\text{-}min^{-1}$

c. Rate of A disappearing = 2 x rate of C appearing = 1.06×10^{-2} M/min

d. [B] = 2 M

e. Mechanism #2; the rate law for the RDS matches the overall rate law (via substitution).

56

a. $2\,NO + 2\,H_2 \rightarrow N_2 + 2\,H_2O$ (this is the sum of the steps)

b. N_2O_2 and N_2O; they appear in an earlier step and are consumed in a later step.

c. Conclusion 1 is correct (the sum of the individual orders is 3), but conclusion 2 is incorrect. The student's idea requires a tri-molecular step, which is virtually impossible to achieve in one effective collision. The intermediate N_2O_2 collides with H_2.

d. Consider the Arrhenius equation for this answer. Temperature is in the denominator of a negative exponent. If T increases, the overall exponent is less negative, which increases the value of the rate constant, k.

61

a. Rate = k $[NO]^2[H_2]$

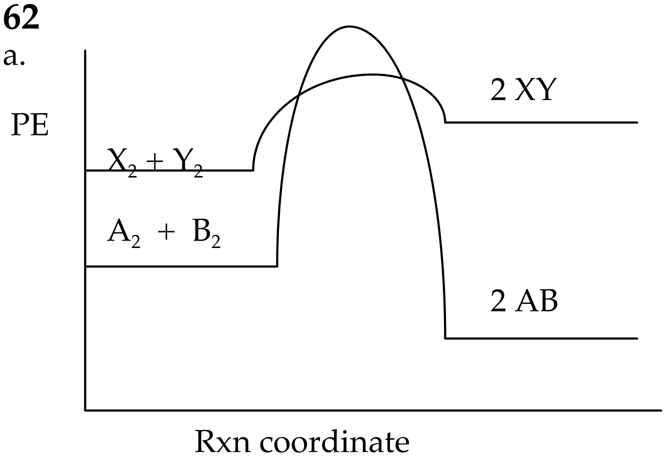
b. k = 5 x 10^3 M^{-2}-min^{-1}

c. [NO] = 0.005 M   Since they are in a 1:1 stoichiometric ratio, $\Delta[NO] = \Delta[H_2]$

d. Step 2; the rate law for step #2 matches the overall rate law (via substitution).

62

a.



b. If the temperature is increased, the rate will increase, but the ΔH will not be affected.

c. Describe an experiment in which you hold the concentration of one reactant constant while changing the concentration of the other reactant. Look at the change in the initial rate of the reaction to determine the order wrt to each reactant.

d. Reaction II will proceed faster due to its smaller activation energy.

601

a. You don't know if the reaction mechanism is one-step or multi-step.

b1. Rate = k [XY]

b2. $\frac{1}{time}$

b3. There are several correct ideas for a reasonable mechanism. Here's one:

step 1: $XY \rightarrow X + Y$ slow
step 2: $XY + X \rightarrow X_2 + Y$ fast
step 3: $Y + Y \rightarrow Y_2$ fast