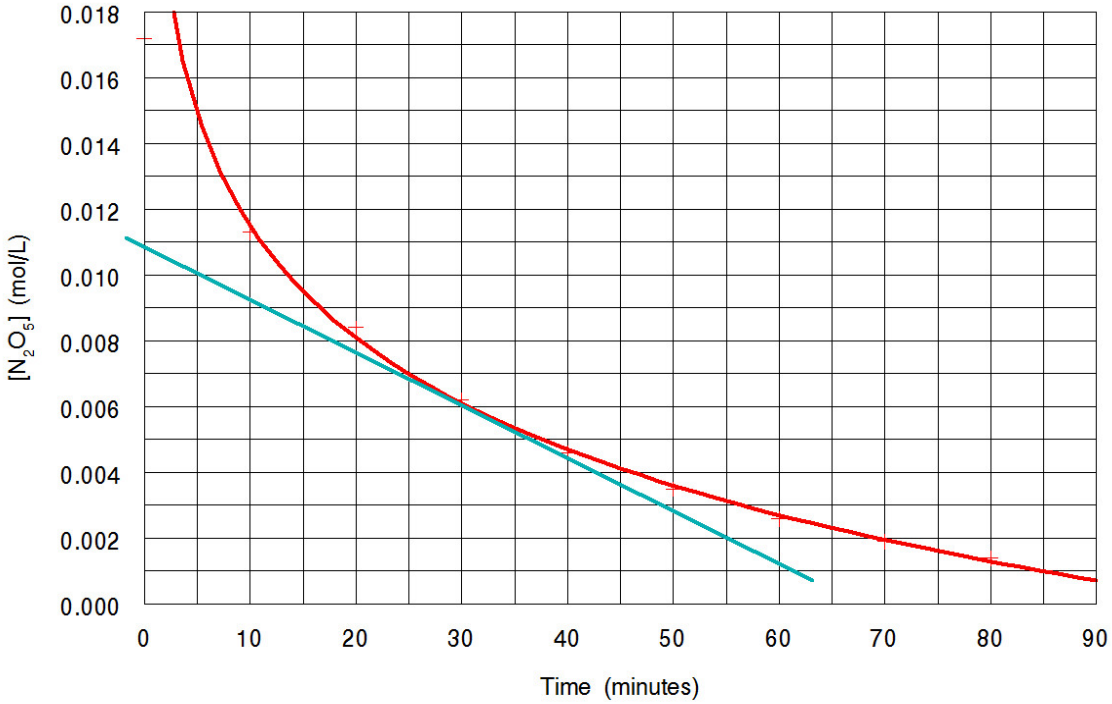
Kinetics Review Answers

1. Pressure, temperature, pH, conductivity, color, mass

2. To find the rate we need to calculate the slope of the tangent line at t=30 minutes.



$$\text{rate} = -\frac{\Delta[N_2O_5]}{\Delta t} = -\frac{(0.002-0.010)}{(55-5)} = 0.00016 \text{ mol/L min}$$

3. use the rate equation

a) $\frac{1}{2}\frac{\Delta[N_2]}{\Delta t} = \frac{1}{6}\frac{\Delta[H_2O]}{\Delta t}$

$\frac{1}{2}(0.27) = \frac{1}{6}\frac{\Delta[H_2O]}{\Delta t}$

$\frac{\Delta[H_2O]}{\Delta t} = 0.81 \text{ mol/Ls}$

b) $\frac{1}{2}\frac{\Delta[N_2]}{\Delta t} = \frac{1}{4}\frac{\Delta[NH_3]}{\Delta t}$

$\frac{1}{2}(0.27) = \frac{1}{4}\frac{\Delta[NH_3]}{\Delta t}$

$\frac{\Delta[NH_3]}{\Delta t} = 0.54 \text{ mol/Ls}$

c) $\frac{1}{2}\frac{\Delta[N_2]}{\Delta t} = \frac{1}{3}\frac{\Delta[O_2]}{\Delta t}$

$\frac{1}{2}(0.27) = \frac{1}{3}\frac{\Delta[O_2]}{\Delta t}$

$\frac{\Delta[O_2]}{\Delta t} = 0.405 \text{ mol/Ls}$

4. Surface area – an increased surface area provides more particles for collisions; more collisions means an increase in reaction rate

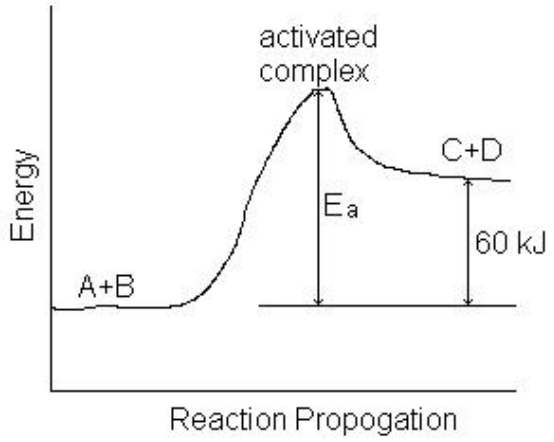
   Concentration – increased concentration means more particles are present; more particles means more collisions which means an increase in reaction rate

   Temperature – an increase in temperature increases the energy of the particles; increased energy means that more of the collisions will have sufficient energy to form the activated complex resulting in an increased reaction rate.

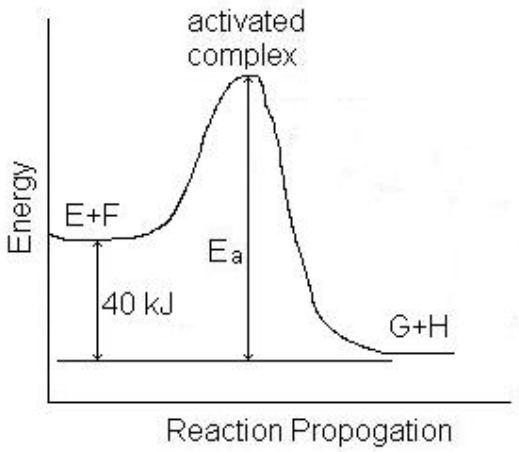
5. The amount of energy required for the colliding particles to form the activated complex

6.

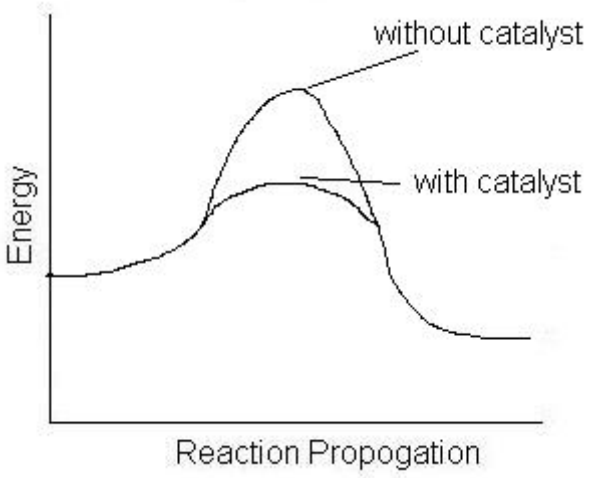
a)



b)



7. A catalyst lowers the activation energy required for the reaction.



8. Reaction mechanism – the complete sequence of elementary steps that make up a complex reaction

   Rate determining step – the slowest elementary step in a reaction mechanism

9.
   a) $2\ NO(g) + Cl_2(g) \rightarrow 2\ NOCl(g)$
   b) $NOCl_2$
   c) Step 2

10. [A]

$$\frac{\text{Trial 3 [A]}}{\text{Trial 2 [A]}} = \frac{0.40}{0.20} = 2$$

$$\frac{\text{Trial 3 rate}}{\text{Trial 2 rate}} = \frac{0.04080}{0.01020} = 4$$

$[A]^2$

[B]

$$\frac{\text{Trial 2 [B]}}{\text{Trial 1 [B]}} = \frac{0.3}{0.1} = 3$$

$$\frac{\text{Trial 2 rate}}{\text{Trial 1 rate}} = \frac{0.01020}{0.00340} = 3$$

$[B]^1$

Therefore, $\text{rate} = k[A]^2[B]$