Reaction Rate Review

1. C_5H_{12} Rate = (28.8 g C_5H_{12} / 30. S) (1 mole C_5H_{12} / 72.0 g C_5H_{12})
   = 0.013 mol C_5H_{12}/s

$C_5H_{12(g)}$	+	8 $O_{2(g)}$	→	5 $CO_{2(g)}$	+	6 $H_2O_{(g)}$
0.013 mol/s		0.10 mol/s		0.065 mol/s		0.078 mol/s

2. N_2 Rate = (112 L N_2 / 10. s) (1 mole N_2 / 22.4 L) = 0.50 mole N_2/s
   N_2 Rate = 14 g/s
   H_2 Rate = 3.0 g/s
   NH_3 Rate = 17 g/s

3. C_2H_6 Rate = (1 mole C_2H_6 / 30. g C_2H_6) (96 g C_2H_6 / 10. min) (1 min / 60 s)
   = 0.0053 mole C_2H_6/s
   C_2H_6 Rate = 0.16 g/s
   O_2 Rate = 0.42 g/s
   CO Rate = 0.31 g/s
   H_2O Rate = 0.29 g/s

4. NH_3 Rate = 25 L/min
   O_2 Rate = 43 L/min
   NO_2 Rate = 25 L/min
   H_2O Rate = not gaseous so no rate in L/min

5. Watch out for excess stoichiometry! HCl is limiting reagent!
   H_2 Rate = 3.4 L/min

6. The likelihood of 4 reactant particles having a simultaneous collision with appropriate energy and geometry is negligible. Reactions occur via collisions of 2 particles at a time. Two possible mechanisms are:

   $S + O_2 \rightarrow SO_2$
   $SO_2 + O_2 \rightarrow SO_3 + O$
   $H_2 + O \rightarrow H_2O$
   $SO_3 + H_2O \rightarrow H_2SO_4$

   Or

   $H_2 + O_2 \rightarrow H_2O_2$
   $S + O_2 \rightarrow SO_2$
   $SO_2 + H_2O_2 \rightarrow H_2SO_4$

This is far too involved for our 2020 TEST

7.

a) Fast: only electrons being exchanged, homogeneous phase initially, simple mechanism

b) Slow: many bonds to break and form, complex reaction mechanism (many particles)

c) Medium: simple mechanism with few bonds to break and form, but mixed phases will slow the reaction

d) Slow: non-reactive inert gas

e) Fast: only electrons being exchanged, homogeneous phase initially, simple mechanism

8. a) Rate order = 2 + 3 + (-1) = 4 (fourth order)

b) Rate order = ½ + x = 1 ∴ x = ½

9. Rate at 40 s = 0.68 M / 98 s = 6.9×10^{-3} M/s

Rate at 140 s = 0.10 M / 100. s = 1.0×10^{-3} M/s

A is a reactant. The slope, and therefore the reaction rate, is decreasing with time. This must be the result of reactants being consumed. As the concentration of reactants decreases, fewer particles collide successfully and the rate of reaction decreases.

NOT on OUR 2020 TEST