2) $CO + Cl_2 \rightarrow COCl_2$ $\quad R_P(mol/min) = \frac{8.75\, C_{CO} C_{Cl_2}}{(1 + 55.6\, C_{Cl_2} + 34.3\, C_{COCl_2})}$

let A = CO $\quad A + B \rightarrow C$ $\quad$ @ T = 303.8 K w/ 1g charcoal

B = Cl_2

C = $COCl_2$

a) V = 3L $\quad$ 40% mol Cl_2

T = 303.8K $\quad$ 60% mol CO

P = 1atm

$PV = nRT$

$(1)(3) = n(0.0821)(303.8\,K)$ $\quad \rightarrow (n)(0.4) = 0.0723$ mol Cl_2 (B)

$n = 0.12043$ mol (total) $\quad (n)(0.6) = 0.0481$ mol CO (A)

$P_A = X_A P$ $\quad P_{Cl_2} = 0.4$ atm, $P_{CO} = 0.6$ atm

Intial conditions / concentration

$PV = nRT$

$Cl_2 \rightarrow (0.4)(1) = (C_{Cl_2 0})(0.0821)(303.8)$

$C_{Cl_2 0} = 0.01605$ mol/L

$CO \rightarrow (0.6)(1) = C_{0}(0.0821)(303.8)$

$C_{0} = 0.02407$ mol/L

} initial concentrations

$C_{CO} = 0.02407 - C_P(t)$

$C_{Cl_2} = 0.01605 - C_P(t)$

b) $R_f = \dfrac{8.75\, C_{Cu}\, C_{Cl_2}}{(1 + 58.6 C_{Cl_2} + 34.3 (C_{CuCl_2})^2}$ — plug in values from part a)

let V = 3 $\quad \dfrac{d C_{CuCl_2} V}{dt} =$ //

$$3 \frac{dC_{CuCl_2}}{dt} = \frac{8.75 (0.02407 - C_p)(0.01605 - C_p)}{(1 + 58.6(0.01605 - C_p) + 34.3 C_p)^2}$$

$$= \frac{2.92 (0.02407 - C_p)(0.01605 - C_p)}{(1 + 0.941 - 58.6 C_p + 34.3 C_p)^2}$$

$$\frac{dC_p}{dt} = \frac{2.92 (0.02407 - C_p)(0.01605 - C_p)}{(1.941 - 24.3 C_p)^2}$$

$\frac{dC_p}{dt} = 0$, $t = 0$

c) 75% of limiting reactant

$$\int \frac{(1.941 - 24.36 C_p)^2}{2.92 (0.02407 - C_p)(0.01605 - C_p)}\, dC_p = \int dt$$

$$t = \int_0^{(0.012)} \frac{(1.941 - 24.36 C_p)^2}{2.92 (0.02407 - C_p)(0.01605 - C_p)}\, dC_p$$

d) Real Answer from Calculator: 89.6698