C11 - 3.5 - Molarity/Dilution Notes

$c = \frac{n}{V}$

Conentration (c) = *Molarity* (M): *amount of substance in a given volume of solution.*

$$Molarity\ of\ Mixture = \frac{Total\ Moles\ of\ Chemicals}{Total\ Volume\ of\ Mixture}$$

$c = molarity\ (M)\ \frac{mol}{L}$

$n = number\ of\ moles, V = volume\ (L)$

Find the molarity of 2 moles of HCl in 5 L of solution?

$c = \frac{n}{V}$

$c = \frac{2}{5}$

$[HCl]\ 0.4\ M$

$c = 0.4\ M\ HCl$

Find the Concentration of each ion.

$3.0\ M\ H_2SO_4$

$[H^+] = 3\ M\ H_2SO_4 \times \frac{2\ H}{1\ H_2SO_4} = 6\ M$

$[SO_4^-] = 3\ M\ H_2SO_4 \times \frac{1\ SO_4}{1\ H_2SO_4} = 3\ M$

If 2 *L of* 4 *M HCl is added to* 8 *L of Water. Find the molarity of the Mixture.*

$2\ L$ [4 M HCl] $+ 8\ L$ [H_2O] $= 10\ L$ [$M = ?$]

$n = cV$

$n = 4 \times 2$

$n = 8\ mol\ HCl$

$c = \frac{n}{V}$

$c = \frac{8}{10}$

$c = 0.8\ M\ HCl$

Dilution

$c_1v_1 = c_2v_2$

$4 \times 2 = c_2 \times 10$

$c_2 = 0.8\ M$

Only if coefficients are 1

$[HCl] = 4.0\ M \times \frac{2\ L}{10\ L} = 0.8\ M$

$c_f = c_i \times \frac{V_i}{V_f}$

If 4 *L of* 0.5 *M HCl is added to* 6 *L of* 2 *M HCl find the molarity of the mixture.*

$4\ L$ [0.5M HCl] $+ 6\ L$ [2 M HCl] $= 10\ L$ [$M = ?$]

$n = cV$

$n = 0.5 \times 4$

$n = 2.0\ mol\ HCl$

$n = cV$

$n = 2 \times 6\ L$

$n = 12\ mol\ HCl$

$2 + 12 = 14\ mol\ HCl$

$c = \frac{n}{V}$

$c = \frac{14}{10}$

$c = 1.4\ M\ HCl$

Mixing

$c_1v_1 + c_2v_2 = c_3v_3$

$0.5 \times 4 + 2 \times 6 = c_3 \times 10$

$c_3 = 1.4\ M$

$v_1 + v_2 = v_3$

$V = 2 + 8 = 10$

$0.3\ L, 0.5\ M\ NaCl$ & $0.4\ L, 0.2\ M\ HCl$. *Find the final* $[Cl^-]$.

$n = cV$

$n = 0.5(0.3)$

$n = 0.15\ mol\ NaCl$

$n = cV$

$n = 0.2(0.4)$

$n = 0.08\ mol\ HCl$

$n = 0.15 + 0.08 = 0.23\ mol\ Cl$

$V = 0.3 + 0.4 = 0.7$

$c = \frac{n}{V}$

$c = \frac{0.23}{0.7}$

$c = 0.3286$

$[Cl^-] = 0.3286\ M$

$NaCl + HCl \rightarrow NaCl + HCl$

OR $c_1v_1 + c_2v_2 = c_3v_3$

$[Cl^-] = \frac{(0.3)(0.5) + (0.4)(0.2)}{0.7}$

$[Cl^-] = 0.3286\ M$

$0.2\ L, 0.5\ M\ NaCl$ & $0.3\ L, 0.2\ M\ CaCl_2$. *Find the final* $[Cl^-]$.

$c = \frac{n}{V}$

$n = 0.5(0.2)$

$n = 0.1\ mol\ NaCl$

$c = \frac{n}{V}$

$n = 0.2(0.3)$

$n = 0.06\ CaCl_2$

$0.06\ mol\ CaCl_2 \times \frac{2\ mol\ Cl}{1\ mol\ CaCl_2} = 0.12\ mol\ Cl$

$n = 0.1 + 0.12 = 0.22\ mol\ Cl$

$V = 0.2 + 0.3 = 0.5$

$c = \frac{n}{V}$

$c = \frac{0.22}{0.5}$

$c = 0.44$

$[Cl^-] = 0.44\ M$

$NaCl + CaCl_2 \rightarrow NaCl + CaCl_2$

OR

$[Cl^-] = \frac{(2)(0.3)(0.2) + (0.2)(0.5)}{0.5}$

$[Cl^-] = 0.44\ M$

$20\ mol \times \frac{3\ atoms\ K^+}{molecule\ K_3} = 60\ mol$