

C11 - 3.5 - Molarity/Dilution Notes

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

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

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

$$c = \frac{n}{V} \quad c = \text{molarity (M)} \frac{\text{mol}}{\text{L}}$$

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

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

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

$$c = \frac{2}{5} \quad [\text{HCl}] \text{ } 0.4 \text{ M}$$

$$c = 0.4 \text{ M HCl}$$

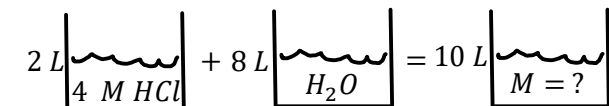
Find the Concentration of each ion.

$$[\text{H}^+] = 3 \text{ M H}_2\text{SO}_4 \times \frac{2 \text{ H}}{1 \text{ H}_2\text{SO}_4} = 6 \text{ M}$$

$$[\text{SO}_4^{2-}] = 3 \text{ M H}_2\text{SO}_4 \times \frac{1 \text{ SO}_4}{1 \text{ H}_2\text{SO}_4} = 3 \text{ M}$$

3.0 M H₂SO₄

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



$$n = cV$$

$$n = 4 \times 2$$

$$n = 8 \text{ mol HCl}$$

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

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

$$c = 0.8 \text{ M HCl}$$

Dilution

$$c_1 v_1 = c_2 v_2$$

$$4 \times 2 = c_2 \times 10$$

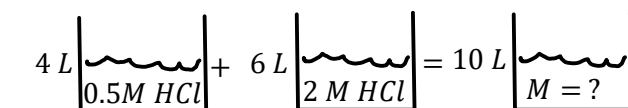
$$c_2 = 0.8 \text{ M}$$

Only if coefficients are 1

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

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

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



$$n = cV$$

$$n = 0.5 \times 4$$

$$n = 2.0 \text{ mol HCl}$$

$$n = cV$$

$$n = 2 \times 6 \text{ L}$$

$$n = 12 \text{ mol HCl}$$

$$2 + 12 = 14 \text{ mol HCl}$$

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

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

$$c = 1.4 \text{ M HCl}$$

Mixing

$$c_1 v_1 + c_2 v_2 = c_3 v_3$$

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

$$c_3 = 1.4 \text{ M}$$

$$v_1 + v_2 = v_3$$

$$V = 2 + 8 = 10$$

0.3 L, 0.5 M NaCl & 0.4 L, 0.2 M HCl. Find the final [Cl⁻].

$$n = cV$$

$$n = 0.5(0.3)$$

$$n = 0.15 \text{ mol NaCl}$$

$$n = cV$$

$$n = 0.2(0.4)$$

$$n = 0.08 \text{ mol HCl}$$

$$n = 0.15 + 0.08 = 0.23 \text{ mol Cl}^-$$

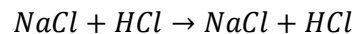
$$V = 0.3 + 0.4 = 0.7$$

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

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

$$c = 0.3286$$

$$[\text{Cl}^-] = 0.3286 \text{ M}$$



OR

$$c_1 v_1 + c_2 v_2 = c_3 v_3$$

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

$$[\text{Cl}^-] = 0.3286 \text{ M}$$

0.2 L, 0.5 M NaCl & 0.3 L, 0.2 M CaCl₂. Find the final [Cl⁻].

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

$$n = 0.5(0.2)$$

$$n = 0.1 \text{ mol NaCl}$$

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

$$n = 0.2(0.3)$$

$$n = 0.06 \text{ CaCl}_2$$

$$0.06 \text{ mol CaCl}_2 \times \frac{2 \text{ mol Cl}}{1 \text{ mol CaCl}_2} = 0.12 \text{ mol Cl}$$

$$n = 0.1 + 0.12 = 0.22 \text{ mol Cl}$$

$$V = 0.2 + 0.3 = 0.5$$

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

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

$$c = 0.44$$

$$[\text{Cl}^-] = 0.44 \text{ M}$$

OR ↓

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

$$[\text{Cl}^-] = 0.44 \text{ M}$$

$$\frac{3 \text{ atoms K}^+}{20 \text{ mol}} \times \frac{60 \text{ mol}}{\text{molecule K}_3} = 60 \text{ mol}$$

