Concentration Molarity (M)

M : molarity $= \left[\frac{\text{moles}}{1\ L}\right]$

1 mole $= 6.02 \times 10^{23}$

FW = formula weight $\left[\frac{g}{\text{mole}}\right]$

example : prepare 375 mL of a 0.7 M NaCl.

$FW_{NaCl} = (22.9898) + (35.453) = 58.4428\ \frac{g}{\text{mole}}$

$C = 0.7\ M = 0.7\ \frac{\text{moles}}{1\ L}\left(\frac{58.449\ g}{\text{mole}}\right) = 40.91\ \frac{g}{L}$

$C = \frac{m_{NaCl}}{V_{total}}$

$40.91\ \frac{g}{L} = \frac{m_{NaCl}}{375\ mL}$

$m_{NaCl} = \frac{(375\ mL)(40.91\ g)}{1\ L}\left(\frac{1\ L}{1000\ mL}\right) = \boxed{15.3\ g_{NaCl}}$

example : prepare $20\ g_{MgSO_4}$ of a 0.2 M solution

$FW_{MgSO_4} = (24.305) + (32.065) + (4)(15.9994) = 120.37\ \frac{g}{\text{mole}}$

$C = 0.2\ M = 0.2\ \frac{\text{mole}}{L}\left(\frac{120.37\ g}{\text{mole}}\right) = 24.07\ \frac{g}{L}$

$C = \frac{m_{MgSO_4}}{V_{total}}$

$$\frac{24.07\ g}{1L} = \frac{20\ g_{MgSO_4}}{V_{total}}$$

$$V_{total} = \frac{(20\ g_{MgSO_4})(1L)}{(24.07\ g)} = \boxed{0.831\ L \left(\frac{1000\ mL}{1L}\right) = 831\ mL}$$

example: what is the molarity of $14\ g_{NaCl}$ / 200 mL.

$$FW_{NaCl} = (22.9898) + (35.453) = 58.4428\ g/mole$$

$$C = \frac{14\ g_{NaCl}}{200\ mL}\left(\frac{1000\ mL}{1L}\right) = 70\ g_{NaCl}/1L$$

$$C = \frac{70\ g_{NaCl}}{1\ L}\left(\frac{1\ mole}{58.4428\ g}\right) = 1.20\ mole/L$$

$$C = 1.20\ mole/L = \boxed{1.20\ M}$$