Concentration Parts

X : Y : Z (parts of each component (solute or solvent))

- the sum of all parts (X + Y + Z) is the total amount (solution).
- units of X, Y, Z [parts]
- concentration = $\frac{\text{mass}}{\text{mass}}$ or $\frac{\text{volume}}{\text{volume}}$

example: prepare 450 g of a 3:2:2 NaCl : alcohol : water solution.

total parts = 3 + 2 + 2 = 7 parts

NaCl:

$$C_{NaCl} = \frac{m_{NaCl}}{m_{total}}$$ ← because we were given 450 g (mass)

$$\frac{3 \text{ parts}}{7 \text{ parts}} = \frac{m_{NaCl}}{450\ g}$$

$$m_{NaCl} = \frac{(450\ g)(3\ \cancel{\text{parts}})}{(7\ \cancel{\text{parts}})} = \boxed{192.9\ g_{NaCl}}$$

alchol:

$$C_{alcohol} = \frac{m_{alcohol}}{m_{total}}$$

$$\frac{2 \text{ parts}}{7 \text{ parts}} = \frac{m_{alcohol}}{450\ g}$$

$$m_{alchol} = \frac{(450\ g)(2\ \cancel{\text{parts}})}{(7\ \cancel{\text{parts}})} = \boxed{128.6\ g_{alchol}}$$

water

$$C_{water} = \frac{m_{water}}{m_{total}}$$

$$\frac{2 \text{ parts}}{7 \text{ parts}} = \frac{m_{water}}{450 \text{ g}}$$

$$m_{water} = \frac{(450 \text{ g})(2 \text{ parts})}{7 \text{ parts}} = \boxed{128.6 \text{ g}_{water}}$$

example: prepare 5.1 L of a 50:1 gas:oil solution.

total parts = 50 + 1 = 51 parts

gas

$$C_{gas} = \frac{V_{gas}}{V_{total}}$$

$$\frac{50 \text{ parts}}{51 \text{ parts}} = \frac{V_{gas}}{5.1 \text{ L}}$$

$$V_{gas} = \frac{(5.1 \text{ L})(50 \text{ parts})}{51 \text{ parts}} = \boxed{5 \text{ L}_{gas}}$$

oil

$$C_{oil} = \frac{V_{oil}}{V_{total}}$$

$$\frac{1 \text{ part}}{51 \text{ parts}} = \frac{V_{oil}}{5.1 \text{ L}}$$

$$V_{oil} = \frac{(5.1 \text{ L})(1 \text{ part})}{51 \text{ parts}} = 0.1 \text{ L} \left(\frac{1000 \text{ mL}}{1 \text{ L}}\right) = \boxed{100 \text{ mL}_{oil}}$$

Concentration parts per ____ or pp–

assume solvent is water so $1\ g_{H_2O} \cong 1\ mL_{H_2O}$

pph: parts per hundred

$$x\ \text{pph} = \frac{x\ \text{parts}}{100\ \text{parts}} = \frac{x\ g}{100\ g} \xrightarrow{\text{assume}} \frac{x\ g}{100\ mL} = \boxed{x\ \%}$$

ppt: parts per thousand

$$x\ \text{ppt} = \frac{x\ \text{parts}}{1000\ \text{parts}} = \frac{x\ g}{1000\ g} \xrightarrow{\text{assume}} \frac{x\ g}{1000\ mL} = \frac{x\ g}{1\ L} = \boxed{x\ \frac{g}{L}}$$

ppm: parts per million

$$x\ \text{ppm} = \frac{x\ \text{parts}}{10^6\ \text{parts}} = \frac{x\ g}{10^6\ g} \xrightarrow{\text{assume}} \frac{x\ g}{10^6\ mL} \xrightarrow{\text{unit convert}} \frac{x\ mg}{1\ L} = \boxed{x\ \frac{mg}{L}}$$

ppb: parts per billion

$$x\ \text{ppb} = \frac{x\ \text{parts}}{10^9\ \text{part}} = \frac{x\ g}{10^9\ g} \xrightarrow{\text{assume}} \frac{x\ g}{10^9\ mL} \xrightarrow{\text{unit convert}} \frac{x\ \mu g}{1\ L} = \boxed{x\ \frac{\mu g}{L}}$$