Unit conversion and working with equations

Unit analysis

$$x = \frac{\left(3.65 \ {}^{\text{g}}\!/_{\text{L}}\right)}{\left(4.3 \ {}^{\text{mol}}\!/_{\text{L}}\right)}$$

- Given the equation above, what are the units of x?
  - 1) g
  - 2) L
  - 3) mol/g
  - 4) mol/L
  - 5) g/mol

Unit analysis

$$x = \frac{\left(3.65\ {}^{\text{g}}\!/\!_{\cancel{\text{L}}}\right)}{\left(4.3\ {}^{\text{mol}}\!/\!_{\cancel{\text{L}}}\right)}$$

- Given the equation above, what are the units of x?
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  - 2) L
  - 3) mol/g
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Unit analysis

- Let's start using an easier book keeping nomenclature.

$$x = \frac{\left(3.65\ {}^{\text{g}}\!/\!_{\text{L}}\right)}{\left(4.3\ {}^{\text{mol}}\!/\!_{\text{L}}\right)}$$

$$x = \frac{\left(3.65\ \text{g L}^{-1}\right)}{\left(4.3\ \text{mol L}^{-1}\right)}$$

Unit analysis

- Given the equation at right, what are the units of x?
  - 1) g
  - 2) L
  - 3) mol g^{-1}
  - 4) mol L^{-1}
  - 5) g mol^{-1}

$$x\left(3.65\ \mathrm{mol\ L^{-1}}\right)=\left(4.3\ \mathrm{g\ L^{-1}}\right)$$

Unit analysis

- Given the equation at right, what are the units of x?
  - 1) g
  - 2) L
  - 3) mol/g
  - 4) mol/L
  - 5) g/mol

$$x\left(3.65\text{ mol L}^{-1}\right)=\left(4.3\text{ g L}^{-1}\right)$$

$$\frac{x\left(3.65\text{ mol L}^{-1}\right)}{\left(3.65\text{ mol L}^{-1}\right)}=\frac{\left(4.3\text{ g L}^{-1}\right)}{\left(3.65\text{ mol L}^{-1}\right)}$$

$$x=\frac{\left(4.3\text{ g }\cancel{\text{L}^{-1}}\right)}{\left(3.65\text{ mol }\cancel{\text{L}^{-1}}\right)}$$

Unit conversion

$$x = \left(5.0 \text{ mol mL}^{-1}\right)$$

- Given the equation above, what is the value of x in units of molarity (mol L^{-1})?
  - 1) 5.0 mol L^{-1}
  - 2) 5.0 x 10^{-3} mol L^{-1}
  - 3) 5.0 x 10^{3} mol L^{-1}
  - 4) 5.0 x 10^{-6} mol L^{-1}
  - 5) 5.0 x 10^{6} mol L^{-1}

Unit conversion

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  - 5) 5.0 x 10^{6} mol L^{-1}

$$x = \left(5.0 \text{ mol } \cancel{\text{mL}}^{-1}\right)\left(10^{3} \ \cancel{\text{mL}} \ \text{L}^{-1}\right)$$

$$x = 5.0 \text{ x } 10^{3} \text{ mol L}^{-1}$$

$$1 \text{ mL} = 10^{-3} \text{ L}$$

$$1 = \frac{(1 \text{ mL})}{\left(10^{-3} \text{ L}\right)} = 10^{3} \text{ mL L}^{-1} \quad \text{or} \quad 1 = \frac{\left(10^{-3} \text{ L}\right)}{(1 \text{ mL})} = 10^{-3} \text{ L mL}^{-1}$$

Unit analysis

$$x\left(25.0\ \mu\text{mol L}^{-1}\right) = \left(5.0\ \text{mg L}^{-1}\right)$$

- Given the equation above, what is the value of x in units of g mol^{-1}?
  - 1) 2.0 g mol^{-1}
  - 2) 2.0 x 10^{2} g mol^{-1}
  - 3) 2.0 x 10^{-3} g mol^{-1}
  - 4) 5.0 g mol^{-1}
  - 5) 5.0 x 10^{-3} g mol^{-1}

Unit analysis

$$x\left(25.0\ \mu\text{mol L}^{-1}\right) = \left(5.0\ \text{mg L}^{-1}\right)$$

- Given the equation above, what is the value of x in units of g mol^{-1}?
  - 1) 2.0 g mol^{-1}
  - 2) 2.0 x 10^{2} g mol^{-1}
  - 3) 2.0 x 10^{-3} g mol^{-1}
  - 4) 5.0 g mol^{-1}
  - 5) 5.0 x 10^{-3} g mol^{-1}

$$x = \frac{\left(5.0\ \text{mg L}^{-1}\right)}{\left(25.0\ \mu\text{mol L}^{-1}\right)}$$

$$x = \frac{\left(5.0\ \text{mg L}^{-1}\right)}{\left(25.0\ \mu\text{mol L}^{-1}\right)}\left(\frac{\mu\text{mol}}{10^{-6}\ \text{mol}}\right)\left(\frac{10^{-3}\text{g}}{mg}\right)$$

Remember:

$$1\ \mu\text{mol} = 10^{-6}\ \text{mol}$$

$$1\ mg = 10^{-3}\text{g}$$

$$x = 0.2\ \text{x}\ 10^{3}\ \text{g mol}^{-1}$$

$$x = 2.0\ \text{x}\ 10^{2}\ \text{g mol}^{-1}$$