2. \(\text{a}) \ \frac{3.0 \text{mg Cl}}{1L \text{ H}_2\text{O}} \times \frac{1L \text{ H}_2\text{O}}{1000g \text{ H}_2\text{O}} \times 100 = \frac{3.0 \times 10^{-3} \text{ g Cl}}{1000 \text{ g H}_2\text{O}} \times 100 = 3.0 \times 10^{-4} \% \)

B) \(\frac{3.0 \times 10^{-3} \text{ g Cl}}{1000 \text{ g H}_2\text{O}} \times 10^6 = \text{ p.p.m} \)

\(\frac{3.0 \times 10^{-3} \text{ g Cl}}{1000 \text{ g H}_2\text{O}} \times 10^9 = \text{ p.p.b billion} \)

P. 312 #17

P. 310 #14

Vinegar 5% (v/v)

\(\frac{15 \text{ mL}}{15 \text{ mL} + \text{ x mL}} \times 100\% = 5\% \)

Solute: 15 mL

Solution: 15 mL + x

\(\frac{15}{15 + x} = 0.05 \)

\(15 = 0.05(15 + x) \)

\(15 = 0.75 + 0.05x \)

\(0.05x = 0.05 \times \frac{15 - 0.75}{0.05} = 0.05 \times \frac{28.5}{0.05} \)

\(285 \text{ mL} = x \)

\(\therefore 285 \text{ mL of H}_2\text{O should be added.} \)
Goal
Prepare a solution of a given molar concentration

\[ (\text{mol/L}) = M \]

Molar Concentration

The method of measuring concentration used most often in chemistry is molar concentration. Ex. 3.0 mol/L HCl

\[
\text{Molar} = \frac{\text{Moles of solute (mol)}}{\text{Volume of the solution (L)}}
\]
Preparing Molar Solutions in the Lab

There are 2 ways to prepare a standard solution.

Method 1- Make a solution from a solid solute

\[ C = \frac{n}{V} \]

\( C = \text{concentration (mol/L)} \)
\( n = \text{moles (mol)} \)
\( V = \text{volume (L)} \)

Method 2- Dilute a concentrated solution

\[ C_1V_1 = C_2V_2 \]

\( C_1: \text{concentration of solution more concentrated} \)
\( V_1: \text{volume of solution more concentrated} \)
\( C_2: \text{concentration of solution more diluted} \)
\( V_2: \text{volume of solution more diluted} \)

You should be able to solve for any of these variables.

Calculations for Method 1

**Dissolving a Solid**

Ex. 1
Find the molar concentration of a 3.0 L solution with 4 moles of NaCl dissolved in it.

\[ C = \frac{n}{V} \]
\( n = 4 \text{ mol} \)
\( V = 3.0 \text{ L} \)
\( C = \frac{4}{3.0} = 1 \text{ M} \)

Ex. 2
Find the molar concentration of solution with 32.0 g C₆H₁₂O₆ dissolved in 25 mL of water.

\[ n = \frac{\text{mass}}{\text{molar mass}} \]
\( n = \frac{32.0 \text{ g}}{180.16 \text{ g/mol}} = 0.18 \text{ mol} \)
\( V = 25 \text{ mL} = 0.025 \text{ L} \)
\( C = \frac{n}{V} = \frac{0.18 \text{ mol}}{0.025 \text{ L}} = 7.2 \text{ M} \)
Ex.3
The molar concentration of sugar cane, C₁₂H₂₂O₁₁, in a 355 mL can of Coke is 0.32 mol/L.

a) Find the number of moles of sugar in the can.

\[
C = \frac{n}{V}
\]
\[
n = CV = (0.32 \text{ mol/L})(0.355 \text{ L}) = 0.11 \text{ mol}
\]

b) If you drank the whole can, what mass of sugar would you consume?

\[
0.11 \text{ mol} \times \frac{342.34 \text{ g}}{\text{mol}} = 37.65 \text{ g}
\]

See p.314-315 for more sample problems.
Making a Solution in the Lab

1. Clean a volumetric flask with lab soap and rinse it well with distilled water.
2. Calculate how much solute you need to add to your volumetric flask.
3. In a small clean beaker measure out the amount solute you calculated.
4. Fill the volumetric flask about 1/3 full with distilled water.
5. Add the solute in the beaker to the water in the volumetric flask.
6. Make sure all solute is transferred from the beaker to the flask by rinsing the beaker with distilled water and adding the rinse water to the volumetric flask.
7. Swirl the mixture in the flask until the solute is dissolved.
8. Add distilled water to the flask until the bottom of the meniscus is just below the line on the neck of the flask.
9. Use a wash bottle or eye dropper to add water drop by drop until the bottom of the meniscus is exactly on the line.
10. Stopper and invert the volumetric flask 20 times.
11. Label your solution in mol/L. Include your name, the recipe and the date prepared on the label.

The Kool Aid Challenge!!!!

Your goal is to prepare a solution of a certain molar concentration.

With a partner, sign up for a molar concentration to make. Select a volumetric flask to work with and start calculating!!!

Label your solution including the names of both partners and hand it in.

HOMEWORK
p.316 # 19-24
The Kool Aid Challenge!!!!

<table>
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<tr>
<th>Partners</th>
<th>C (mol/L)</th>
<th>V (L)</th>
<th>n (mol)</th>
<th>m (g)</th>
</tr>
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<td></td>
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<td></td>
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</table>

Calculations for Method 2
Diluting a Concentrated Solution

Many chemicals are available as a solution instead of a solid. Chemists often need to dilute a stock solution in order to get a desired concentration.

\[ C_1 V_1 = C_2 V_2 \]
Ex. 1  You are given a concentrated solution of 1.25 mol/L sodium chloride in water. What volume of this concentrated solution must you add to make 50 mL 1.00 mol/L NaCl solution.

\[ C_1 = 1.25 \text{ mol/L} \]

\[ V_1 = ? \]

\[ C_1 V_1 = C_2 V_2 \]

\[ V_1 = \frac{C_2 V_2}{C_1} \]

\[ V_1 = \frac{(1.00 \text{ mol/L})(0.050 \text{ L})}{1.25 \text{ mol/L}} \]

\[ V_1 = 0.04 \text{ L} \]

Ex. 2  You are given a 0.45 mol/L concentrated sugar solution. How much concentrated sugar solution do you need to add to a 25 mL volumetric flask to make a 0.25 mol/L solution?

\[ C_1 = 0.45 \text{ mol/L} \]

\[ C_2 = 0.25 \text{ mol/L} \]

\[ V_1 = ? \]

\[ \frac{C_1 V_1}{C_1} = \frac{C_2 V_2}{C_1} \]

\[ V_1 = \frac{C_2 V_2}{C_1} \]

\[ V_1 = \frac{(0.25 \text{ mol/L})(25 \text{ mL})}{0.45 \text{ mol/L}} \]

\[ V_1 = 13 \text{ mL} \]
Ex. 3
If I have 340 mL of a 0.5 mol/L NaBr solution, what will the concentration be if I add 560 mL more water to it?

\[
\frac{C_1 V_1}{V_2} = \frac{C_2 V_2}{V_2}
\]

Homework
p. 321 #25, 26, 27
Lab Prep must be done before class tomorrow!