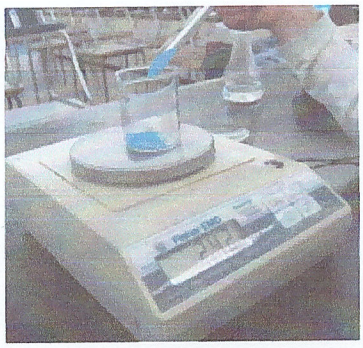
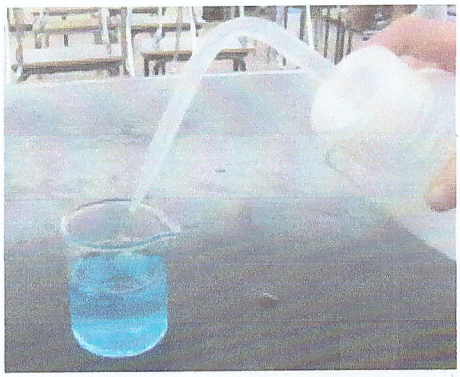
Preparing a Standard Solution

- A solution of known concentration is called a **standard solution**
- There are two ways to make a solution of known concentration
    1. Dissolve a measured amount of pure solute in a certain volume of solvent
    2. Dilute a standard solution to a desired concentration
- To prepare a solution of known concentration from a solid solute, we follow the steps outlined below.
    1. Calculate the mass of the solute required to achieve a specific concertation and volume. $c = n/v$ & $m = Mn$
    2. Using an electronic balance, measure the mass of solute you calculated in step 1 into a 100mL beaker.

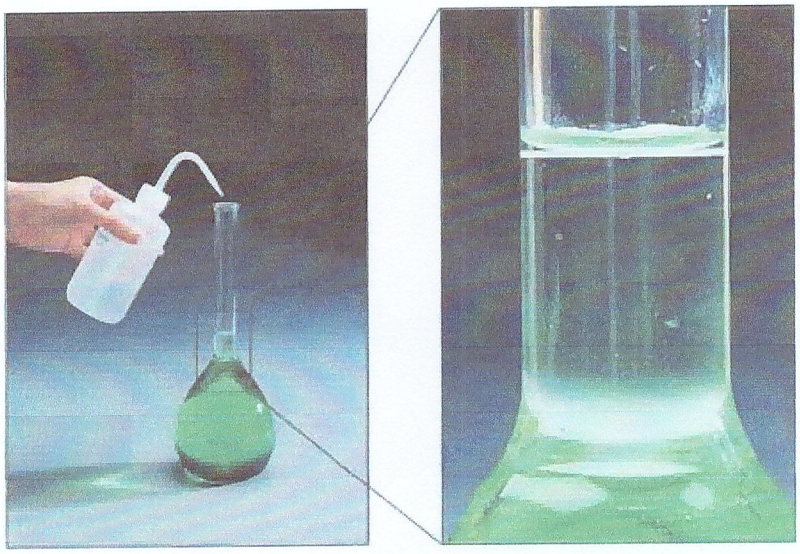


    3. Add no more than half of the required volume of distilled water to the solute in the 100mL beaker. Stir with a stir rod until the solute is completely dissolved.



    4. Transfer your solution to a volumetric flask with the desired volume using a funnel.
    5. ✳ Triple rinse the beaker and stir rod into the funnel with distilled water. Triple rinse the funnel into the volumetric flask.

6. Add distilled water until the bottom of the meniscus reaches the etched line on the volumetric flask.



↙ bottom of meniscus to fill line

7. Stopper the flask, keeping your thumb on the stopper, and invert several times to mix solution.

- EXAMPLE: Calculate the mass of $KMnO_{4(s)}$ required to prepare 100mL of a 0.220mol/L solution.

$m = ?$

$V = 100\,mL \times \left(\frac{10^{-3}\,L}{1\,mL}\right)$

$V = 0.100\,L$

$C = 0.220\,mol/L$

$m = Mn$ ②

$C = \frac{n}{V}$ ①

① $n = Cv = (0.220\,mol/L)(0.100\,L)$

$n = 0.0220\,mol$

② $m = Mn$

$m = (158.04\,g/mol)(0.0220\,mol)$

$m = 3.47688\,g$

$\boxed{m = 3.48\,g}$

aside

$M = 39.10\,g/mol + 54.94\,g/mol + (16.00\,g/mol)\,4$

$158.04\,g/mol$

*****Now try Practice Problems *****

Practice Problems

1. Calculate the mass of calcium acetate, $Ca(CH_3COO)_{2(aq)}$, required to prepare a 0.250L solution of 0.250mol/L. **[9.89 g]**

2. A 0.205 mol/L solution of sodium fluoride, $NaF_{(aq)}$, needs to be prepared. If you use 2.0g of solute, what volume of solution can you prepare? **[232 mL]**

3. Calculate the mass of $Ni_2(SO_4)_{3(s)}$ required to prepare 100mL of a 0.0800mol/L solution. **[3.24 g]**

4. A student made the following errors while preparing solutions. Describe how the errors will affect the resulting solution; will it be more concentrated or more dilute than expected? Explain what the student should have done.
    a. The student dissolves the solute in a beaker and transfers the solution to a volumetric flask but forgets to rinse the beaker and add the rinse to the volumetric flask.
    b. The student fills the volumetric flask so that the top of the meniscus is at the fill line.

Answers:

2.

a. The solution will be more dilute than expected because some of the solute that was dissolved in the rinse never made it into the volumetric flask. The student should have added the rinse to the volumetric flask.
b. The solution will be more concentrated than expected because not enough solvent was added. The student is supposed to fill to the bottom of the meniscus, not the top of the meniscus.