

## Examples of Making Solutions

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### Making 250 mL of 3 M NaNO<sub>3(aq)</sub> solution from Solid NaNO<sub>3</sub>

1. mols of NaNO<sub>3</sub> = (0.250 L)(3 M) = 0.75 mols NaNO<sub>3</sub>
2. mass of NaNO<sub>3</sub> = (0.75 mols)(85 g/mol) = 63.75g NaNO<sub>3</sub>
3. Obtain 63.75 g of NaNO<sub>3</sub>
  - Use analytical balance for accuracy
  - Use top loading balance for approximate
4. Mixing the solution:
  - Accurate:
    - i. Fill about 125 mL of water in to a 250 mL volumetric flask
    - ii. Add the 63.75 g of NaNO<sub>3</sub> to volumetric
    - iii. Mix until dissolved
    - iv. Add enough water to fill to the 250 mL mark
    - v. Cap and invert to mix
  - Approximate:
    - i. Add the 63.75 g of NaNO<sub>3</sub> to a vessel that holds more than 250 mL of water.
    - ii. Add 250 mL of water
    - iii. Mix

### Making 250 mL of 1 M HCl<sub>(aq)</sub> solution from 12.3 M HCl<sub>(aq)</sub>

1. mols of HCl = (0.250 L)(1 M) = 0.25 mols HCl
2. Vol of 12.3 M HCl = 0.25 mols HCl / 12.3 M HCl = 0.020325 L of 12.3 M HCl = 20.325 mL of 12.3M HCl
3. Obtaining the Volume of 12.3 M HCl
  - Accurate: Do the least amount of transfers
    - i. Obtain 20 mL of the 12.3 M HCl using a 20 mL volumetric pipet
    - ii. Obtain 0.325 mL of the 12.3 M using a graduated pipet
  - Approximate:
    - i. Obtain 20.325 mL of the 12.3 M using a graduated cylinder
4. Mixing the solution:
  - Accurate:
    - i. Fill about 125 mL of water in to a 250 mL volumetric flask
    - ii. Add the 20 mL of the 12.3 M HCl from the volumetric pipet to the volumetric
    - iii. Add the 0.325 mL of the 12.3 M from the graduated pipet to the volumetric
    - iv. Mix
    - v. Add enough water to fill to the 250 mL mark
    - vi. Cap and invert to mix
  - Approximate:
    - i. Add the 20.325 mL of the 12.3 M from the graduated cylinder to a vessel that holds more than 250 mL of water.
    - ii. Add about 229.675 mL of water
    - iii. Mix

### Making 100 mL of 0.000015 M NaCl from 1 M NaCl

If you were to calculate the amount of 1 M NaCl you would need to obtain it would be 0.015 mL. This amount is too small to obtain using “normal” glassware. You can however do a series of dilutions.

1. First Dilution: Creates 100 mL of 0.01 M NaCl
  - a. Obtain 1 mL of 1 M NaCl using a volumetric pipet.
  - b. Add the 1 mL of 1 M NaCl from the volumetric pipet to a 100 mL volumetric flask
  - c. Add water to the 100 mL mark on volumetric flask
  - d. Cap
  - e. Invert to mix

***Math***

$$\frac{\text{Mols Used}}{\text{Total Volume}} = \frac{(0.001\text{L})(1\text{M})}{0.100\text{ L Total}} = 0.01\text{ M}$$

2. Second Dilution: Creates 100 mL of 0.0001 M NaCl
  - a. Obtain 1 mL of 0.01 M NaCl using a volumetric pipet.
  - b. Add the 1 mL of 0.01 M NaCl from the volumetric pipet to a 100 mL volumetric flask
  - c. Add water to the 100 mL mark on volumetric flask
  - d. Cap
  - e. Invert to mix

***Math***

$$\frac{(0.001\text{L})(0.01\text{M})}{0.100\text{ L Total}} = 0.0001\text{ M}$$

3. Second Dilution: Creates 100 mL of 0.000015 M NaCl
  - a. Obtain 15 mL of 0.0001 M NaCl using a volumetric pipet.
  - b. Add the 15 mL of 0.0001 M NaCl from the volumetric pipet to a 100 mL volumetric flask
  - c. Add water to the 100 mL mark on volumetric flask
  - d. Cap
  - e. Invert to mix

***Math***

$$\frac{(0.015\text{ L})(0.0001\text{M})}{0.100\text{ L Total}} = 0.000015\text{ M}$$