

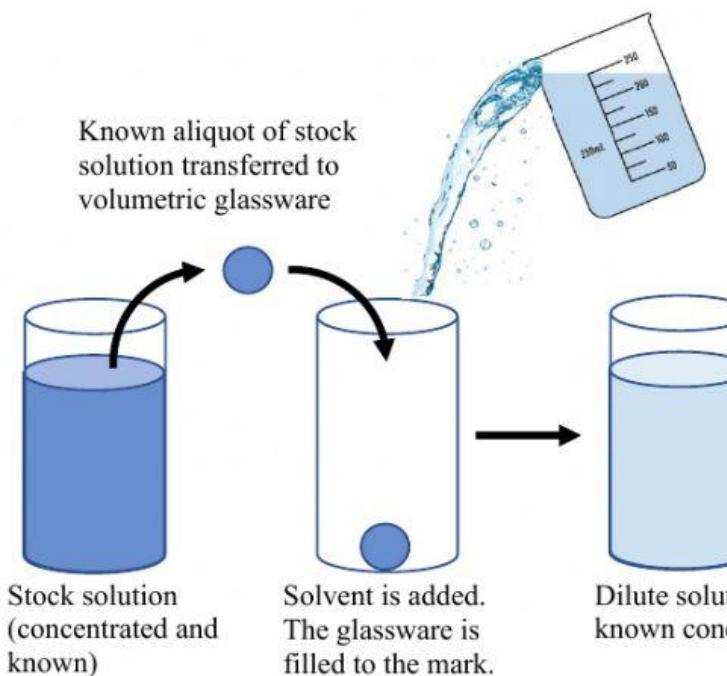
Name: _____ Date: _____

CHEMISTRY

Preparing Dilutions

What is a Dilution?

It is often necessary to make a stock solution. The stock solution is the concentrated and standardized main solution of a known quantity and well-known concentration. From the stock solution, more dilute standardized solutions are made. A dilution is a solution of a weaker or less concentrated version of the stock solution.



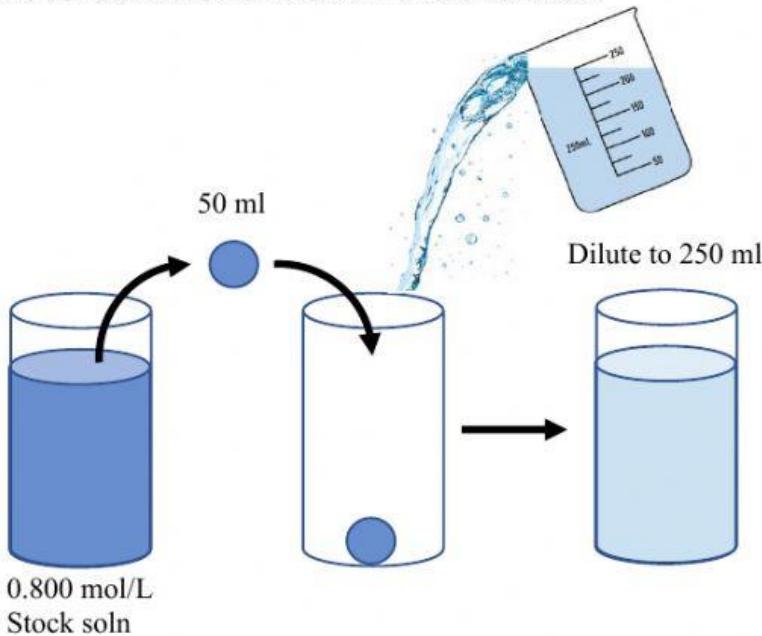
A known aliquot (slug of solution) of the concentrated stock solution is transferred by volumetric pipette from the stock solution to a clean volumetric glassware. Solvent is added to the volumetric glassware, and filled to the mark. The new solution is a dilution, a less concentrated version of the stock solution. The concentration of the dilution is known.

The equation below will calculate the concentration of the dilute solution. The aliquot is the amount of stock solution that must be transferred to the volumetric glassware to be diluted. The total volume is the final volume of the diluted solution.

$$[\text{Dilute solution}] = [\text{Stock solution}] \cdot \frac{\text{Aliquot of Stock Solution}}{\text{Total Volume to Make}}$$

Example #1

The stock solution has a concentration of 0.800 mol/L. You transfer 50 ml of the stock solution into a 250 ml volumetric flask, and fill the flask to the mark with solvent. What is the concentration of the new dilute solution?



$$[\text{Stock}] = 0.800 \text{ mol/L}$$

$$\text{Aliquot} = 50 \text{ ml}$$

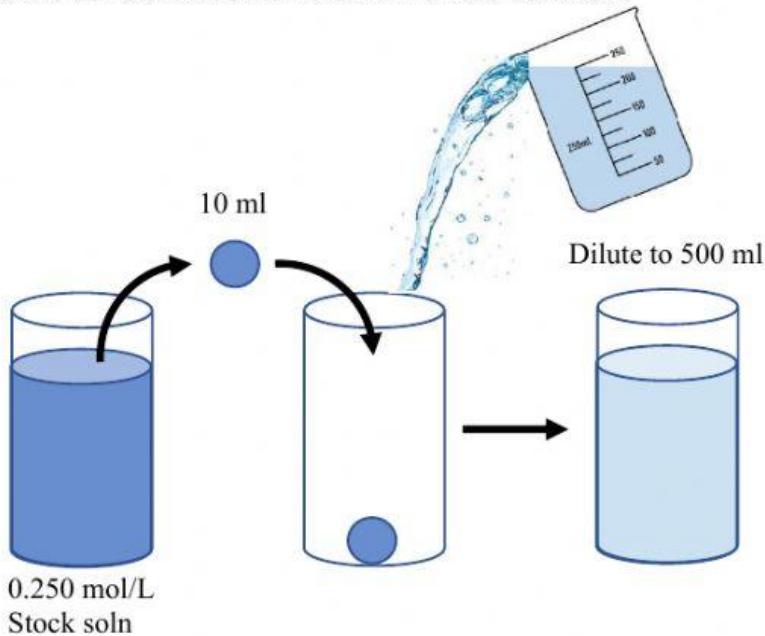
$$\text{Total volume} = 250 \text{ ml}$$

$$[\text{dilute soln}] = 0.800 \frac{\text{mol}}{1} \cdot \left(\frac{50 \text{ ml}}{250 \text{ ml}} \right) = 0.160 \frac{\text{mol}}{1}$$

The dilute solution will have a concentration of 0.160 mol/L.

Example #2

The stock solution has a concentration of 0.250 mol/L. You transfer 10 ml of the stock solution into a 500 ml volumetric flask, and fill the flask to the mark with solvent. What is the concentration of the new dilute solution?



$$[\text{Stock}] = 0.250 \text{ mol/L}$$

$$\text{Aliquot} = 10 \text{ ml}$$

$$\text{Total volume} = 500 \text{ ml}$$

$$[\text{dilute soln}] = 0.250 \frac{\text{mol}}{1} \cdot \left(\frac{10 \text{ ml}}{500 \text{ ml}} \right) = 0.00500 \frac{\text{mol}}{1}$$

The dilute solution will have a concentration of 0.00500 mol/l.

Calculate the Concentrations of the Diluted Solutions

1. Transfer 50 ml of a 1.50 mol/L stock solution into a 1000 ml volumetric flask. Dilute to the mark with solvent.
2. Transfer 25 ml of a 0.750 mol/L stock solution into a 100 ml volumetric flask. Dilute to the mark with solvent.
3. Transfer 100 ml of a 2.00 mol/L stock solution into a 2000 ml volumetric flask. Dilute to the mark with solvent.
4. Transfer 60 ml of a 3.00 mol/L stock solution into a 500 ml volumetric flask. Dilute to the mark with solvent.

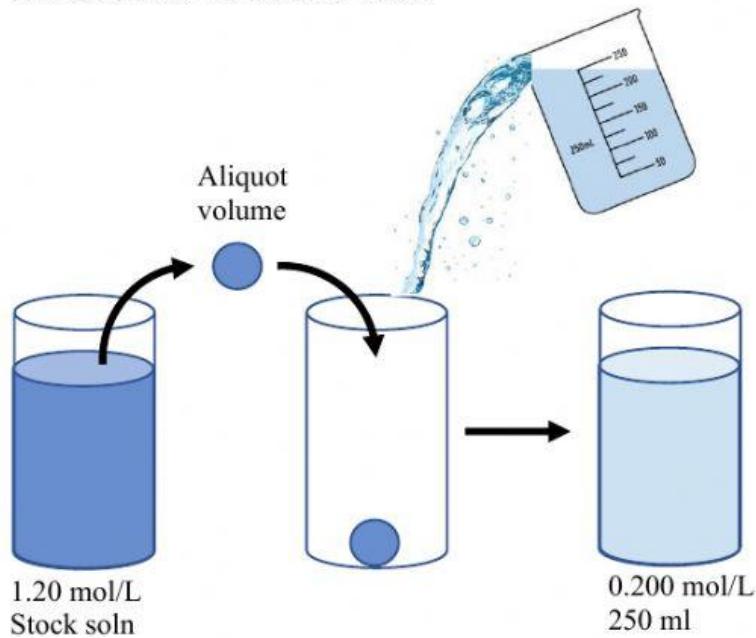
How Much Stock Solution Should I Transfer? Aliquot Volume

The equation below will calculate the aliquot needed to prepare a solution of a given concentration. How much must be transferred from the stock solution into the volumetric glassware to make the diluted concentration.

$$\text{Aliquot of Stock Solution} = \frac{\text{Total Volume} \cdot [\text{Dilute solution}]}{[\text{Stock solution}]}$$

Example #3

You want to prepare a 0.200 mol/L solution with a volume of 250 ml. The stock solution has a concentration of 1.20 mol/L. Calculate the aliquot volume that must be transferred to the 250 ml volumetric flask.



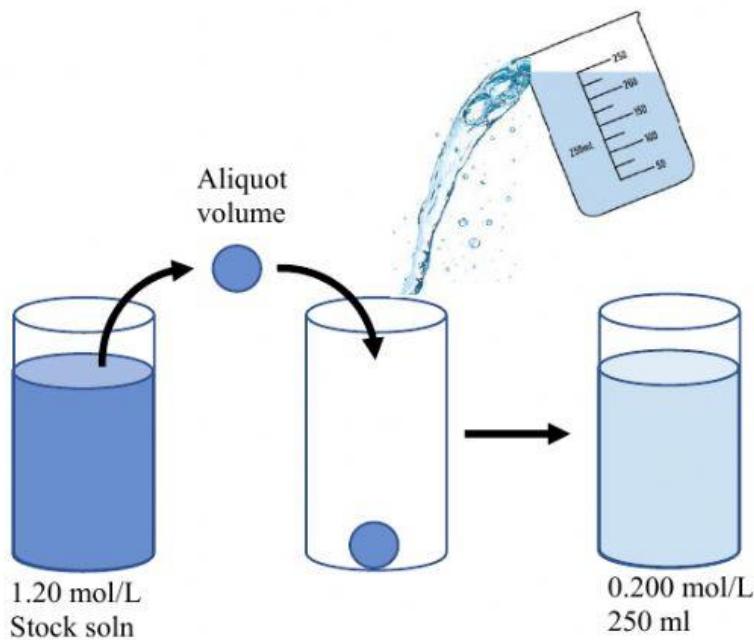
[Stock] = 1.20 mol/L
[Dilute] = 0.200 mol/L
Total volume = 250 ml

$$\text{Aliquot} = \frac{(250 \text{ ml}) \cdot (0.200 \frac{\text{mol}}{\text{L}})}{1.20 \frac{\text{mol}}{\text{L}}} = 41.7 \text{ ml}$$

41.7 ml of the stock solution must be transferred to the 250 ml flask and diluted to the mark.

Example #4

You want to prepare a 0.050 mol/L solution with a volume of 500 ml. The stock solution has a concentration of 0.750 mol/L. Calculate the aliquot volume that must be transferred to the 500 ml volumetric flask.



$$[\text{Stock}] = 0.750 \text{ mol/L}$$

$$[\text{Dilute}] = 0.050 \text{ mol/L}$$

$$\text{Total volume} = 500 \text{ ml}$$

$$\text{Aliquot} = \frac{(500 \text{ ml}) \cdot (0.050 \frac{\text{mol}}{\text{L}})}{0.750 \frac{\text{mol}}{\text{L}}} = 33.3 \text{ ml}$$

33.3 ml of the stock solution must be transferred to the 500 ml flask and diluted to the mark.

**Calculate the Aliquot Volume that must be transferred to the glassware
for the dilution**

5. You want to prepare 500 ml of 0.500 mol/l solution. The stock solution concentration is 4.00 mol/L.

6. You want to prepare 250 ml of 0.200 mol/l solution. The stock solution concentration is 5.00 mol/L.

7. You want to prepare 1000 ml of 0.060 mol/l solution. The stock solution concentration is 3.00 mol/L.

8. You want to prepare 2000 ml of 1.50 mol/L solution. The stock solution concentration is 8.00 mol/L.