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Solutions Review

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Solutions are homogeneous mixtures

- Solvent- substance present in greatest amount. Usually is water (aq)
- Solute- substance present in a lesser amount.
- Solution: combination of solute(s) and solvent.

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Molar Concentrations

- **In solutions, moles of solute (substance dissolved) are dispersed in a larger volume.**
- **Molarity allows u to express the relationship between the moles of solute and the volume of the solution.**
- **Molarity (M)=mol solute/L soln**

Thus, moles solute (n)=Volume (L)*Molarity (M)

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Example

- What is the molarity of a solution created by dissolving 10.2g KNO_3 in enough water to make 350 mL solution?
- M=n/L

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Example 2

What mass of KNO_3 are found in 25.33 mL of .0500M solution?

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Alternately: M=m/(MM*L)

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Dilution

- Addition of solvent to a solution creates a less concentrated solution.
- Moles solute constant, hence $n_{dilute}=n_{concentrated}$
- $C_{stock}V_{stock}=C_{new}V_{new}$

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Note that the amount of solute is constant if only solvent is added. The concentration changes, though.
"stock" here refers to the more highly concentrated solution (the one that you had in stock)
Note that dilution can also occur when a non-reacting solution is added.

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Glassware

Volumetric pipette- used to transfer solution from one place to another. This is a very precise piece of glassware, hence the solution may be known to a high precision

Volumetric Flask- used to contain the new solution that is prepared. This is a calibrated piece of glassware, so mixing inside is not allowed- it will scratch the sides and change the volume! The shape also means that heat is not a good idea- the narrow neck means that the buildup of vapor might cause explosion. Once filled to the calibration mark, the volume inside is known very precisely.

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http://www.dartmouth.edu/~chemlab/techniques/pipet.html
http://www.umd.umich.edu/casl/natsci/slc/pipet.swf
http://www.dartmouth.edu/~chemlab/techniques/vol_flasks.html

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Example

What volume of 12.1M HCl are needed to create 250. mL of 3.2 M HCl?

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Note glassware here: Volumetric Pipettes used to transfer the stock solution. The final solution should be prepared in a volumetric flask so that the final volume is known.

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25 mL of 6 **M** HCl are diluted to 500 mL with water. What is the molarity of the resulting solution?

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Example with a Twist

- **25 mL of 6M HCl are added to 25 mL of 3 M HCl. What is the resulting concentration of HCl?**

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Solution Stoichiometry

- **Really no different than other Stoichiometry problem.**
- **Difference arises only in how we calculate moles of reacting substance.**
- **Solids: n=mass/MM**
- **Solutions: n=M*L**

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What volume of 2M HCl is needed to react 25.2 g Na_2CO_3 completely?

	HCl	Na_2CO_3
Start	**2M, ? L**	**25.2g**
Moles		
Stoich.		

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Need balanced equation to start any stoichiometry problem:
$Na_2CO_3(aq) + 2HCl_{(aq)} \rightarrow H_2O_{(l)} + CO_{2(g)} + 2\ NaCl(aq)$
Find moles of known, uses stoichiometric ratio to find unknown.

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Titration

- **Titration is the controlled addition of one reactant (Titrant) to another (titrate) until the stoichiometric requirement is met.**
- **Endpoint: The volume of Titrant necessary to achieve stoichiometric ratio.**
- **Problem solving is the same as for any stoichiometry problem**

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Indicator: substance added to a titration mixture that changes color when the reaction is complete.

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Titrations problems:

Are really stoichiometry problems:

1. Write the balanced chemical equation
2. Set up stoichiometry chart, allowing moles to be calculated from L and M *or* mass & MM

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Titration ex.

If 35.00 mL are titrated, what concentration of NaOH can be titrated using 50 mL of 0.1M HCl?

- $Na_2CO_{3(s)} + 2\ HCl_{(aq)} \rightarrow H_2O_{(l)} + CO_{2(g)} + 2NaCl_{(aq)}$

		Starting quantity
		Moles
		Stoichiometry

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