Chem 101 lecture 6c

Admin:
Return tests

last time:
0) review of
i) acids ii) strong and weak acids
iii) net ionic equations
1) Bases
2) neutralization reactions/
balanced equations
Today:
1) concentrations: molarity

Lecture:

1) **Concentrations**: important to measure concentration quantitatively.

There are several units of concentration but the most important is the *molar*, M.

a) Molarity (**M**) = $\frac{\text{moles solute}}{\text{liters of solution}}$

Or sometimes convenient to use:

$$\mathbf{M} = \frac{\text{mmol solute}}{\text{mL solution}}$$

Very convenient to write:

$$\text{M} = \frac{\text{n}}{\text{V}}$$

where n = # moles solute
and V = volume of solution (in L)

Example (1): What is the molarity of a 100 mL solution containing 0.23 moles of acetic acid, HAc ?

Approach: $\text{M} = \frac{\text{n}}{\text{V}}$

$$= \frac{0.23\text{molHAc}}{100\text{mL}\,{}^{1\text{L}}\!/_{1000\text{mL}}} = 2.3\ \frac{\text{mol HAc}}{\text{L}}\ = 2.3\ \text{M}$$

Example (2) : How many grams of NaCl (58.5g/mol) are in 25.0 mLs of a 0.110M NaCl solution?

Approach: $M = \frac{n}{V} \Rightarrow n = MV$

So #g NaCl = (FW)(n) = (FW)MV =

$$\left(\frac{58.5 \text{ g NaCl}}{\text{mol NaCl}}\right)\left(\frac{0.110 \text{ mol NaCl}}{\text{L}}\right)(25.0 \text{ mL})\left(\frac{1 \text{ L}}{1000 \text{ mL}}\right) =$$

= 0.161 g NaCl

Example(3)
If a 0.020 M sucrose solution contains 0.10 moles of sucrose, what is its volume?

2) *Preparing solutions!*

Example: prepare 100. mLs of 0.0200 M glucose (180. g/mol).
Approach:
First determine the grams of solute needed

3) Diluting solutions!!!

$$M_1V_1 = M_2V_2$$

4) Titration

During titration, solutions are added until they JUST completely neutralize the other.

end point or *equivalence point* = point where neutralization is just completed.

Indicator =reagent which changes color to show endpoint is reached. Example: phenolphtalein (pink = base, colorless=acid)

at the **endpoint**: ("equivalence point")

moles H^+ donated= # moles H^+ accepted

equivalents H^+ = # equivalents H^+ accepted.

"equivalents" = # moles of H^+ accepted or donated.

$$\text{Molar (M)} = \frac{\text{moles solute}}{\text{liters of solution}} \quad (\text{units: } \frac{\text{mol}}{\text{L}})$$

$$\text{Normal (N)} = \frac{\text{equiv. solute}}{\text{liters of solution}} \quad (\text{units: } \frac{\text{eq.}}{\text{L}})$$

0.10 M HCl = .1mol HCl/L

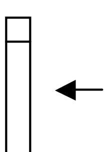
but each HCl produces a H^+

so, .10 M HCl = .1N HCl

0.25M H_2SO_4 = ____ N H_2SO_4

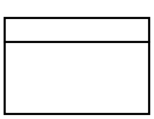
5) Titration examples:

example: volumetric analysis of a solution containing acid or base



.100 M HCl

suppose it takes 20 mL to reach end point (e.p.)



25 mL of NaOH

where [NaOH]=?

End point is reached when neutralization is "just completed".

2 ways to solve for [NaOH]:

first way, direct stoichiometry:
[NaOH]
= 20.0 x 10^{-3} L HCl x (.10 mol HCl/L HCl) (1mol NaOH/mol HCl) /25 x 10^{-3}L NaOH

= 0.080 M NaOH

second way:
In acid-base titrations, the end point is reached when
#mol H^+donated =#mol H^+accepted

$M_{H+}V_{H+} = M_{OH-}V_{OH-}$

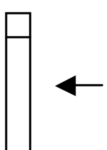
(0.10 M)(20mL)=M_{OH}(25mL)

M_{OH} = .10M(20/25) = .080M

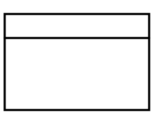
How about H_2SO_4 vs NaOH?

H_2SO_4 + NaOH →

Suppose



.100 M H_2SO_4
suppose it takes 20 mL to reach end point (e.p.)



25 mL of NaOH
[NaOH]= _______ ?

Concentrations:

Molarity (**M**) = $\frac{\text{mol solute}}{\text{Liter of sol'n}}$ = mmol/mL

Review:
a) *Preparing solutions!*
First determine the grams of solute needed

b) Diluting solutions!!!

$M_1V_1 = M_2V_2$