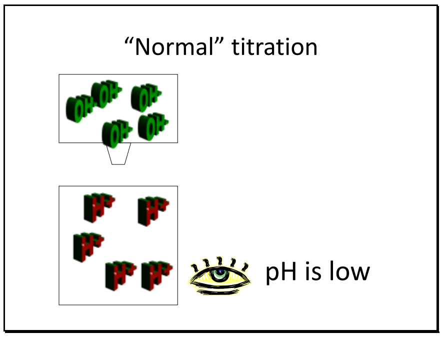
Slide 1

Slide 2



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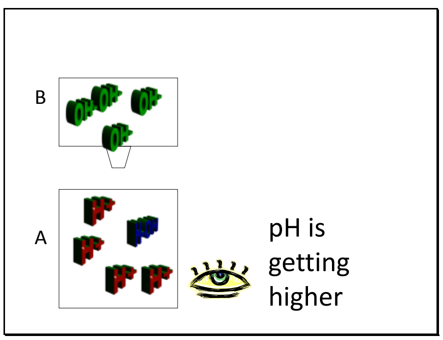

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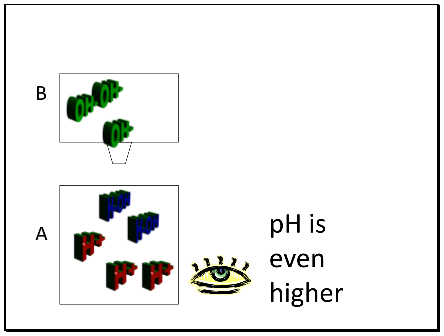

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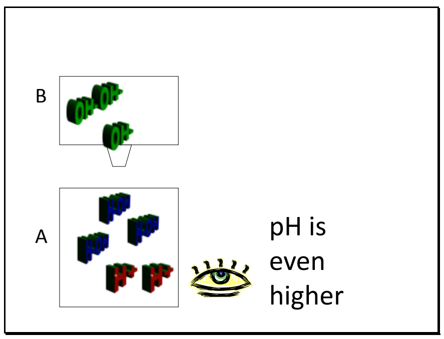

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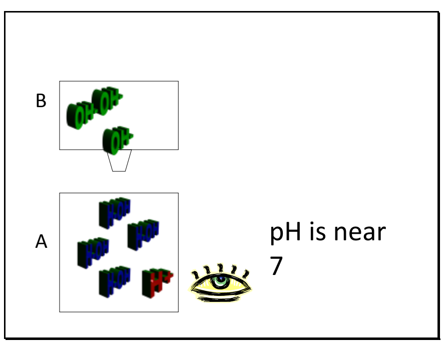

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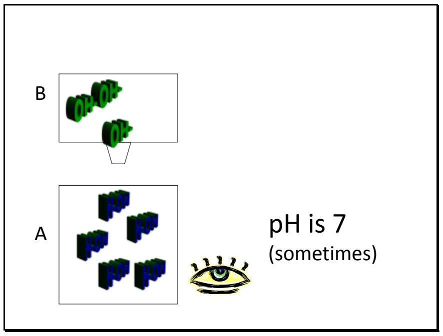

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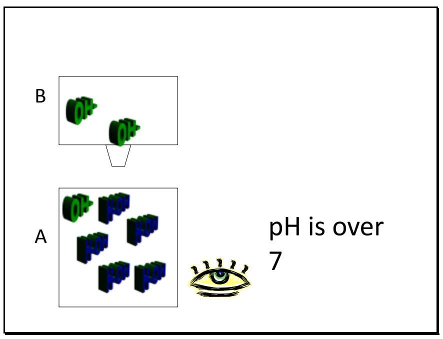

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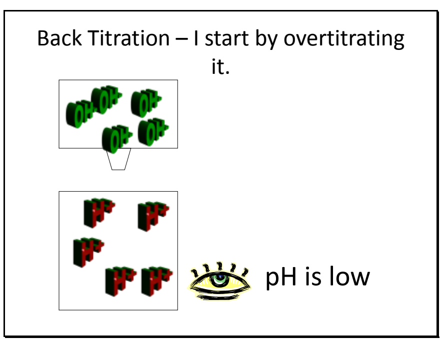

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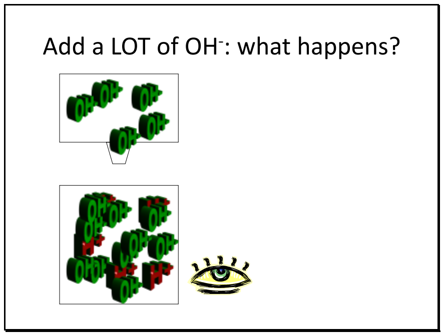

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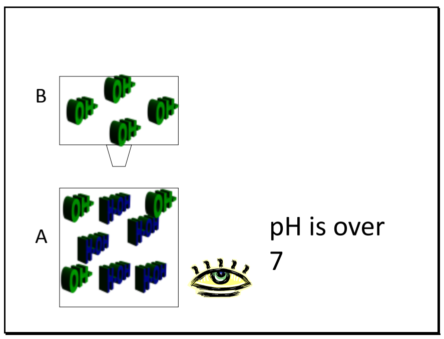

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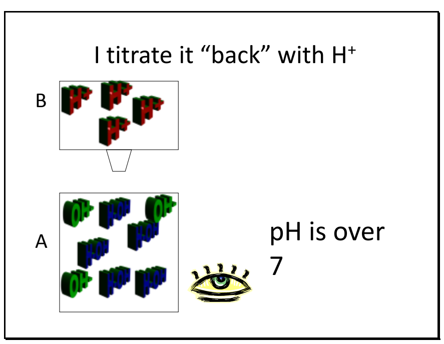

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MOLES! MOLES! MOLES!

Like all titrations, the issue is one of molar equivalence.

In a normal titration, you simply add base (OH-) to acid (H+) – or the reverse – and at equivalence:

Moles of base added Ξ Moles of acid added

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Moles of base = Moles of base

$$Moles\ of\ base = Moles\ of\ acid\,\frac{moles\ of\ base}{moles\ of\ acid}$$

Sometimes this is written as:
$M_1V_1 = M_2V_2$
This is really a SPECIAL CASE where the stoichiometry is 1:1
Really it's:
M_1V_1=M_2V_2xstoichiometry

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$i_1A + i_2B$ = products

The stoichiometry is i_1/i_2

$$M_1V_1 = M_2V_2\,\frac{i_1}{i_2}$$

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For a back titration, still all about moles

Except in this case we actually have an extra step

I start with moles of acid:
$M_{acid}V_{acid}$=moles acid
I then added a bunch of base to it…moles of base
$M_{base}V_{base}$=moles of base

So, what do I then have in the beaker?

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Neutralized acid and leftover base

Moles base added – moles acid = moles of extra base.

I then titrate the moles of extra base with acid
$M_{acid\ titrated}V_{acid\ titrated}$ = moles of acid titrated = moles of extra base.

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Of course in the titration I don't actually know the moles of acid I started with – or why would I titrate it?

I do know the moles of base I added. And I know how much acid I had to add to titrate to the endpoint.

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Sample problem

25.00 mL of 0.500 M NaOH is added to a 25.00 mL sample of unknown acid. It takes 13.45 mL of 0.250 M HCl to reach the endpoint. What is the original concentration of the unknown acid?

0.250 M HCl (13.45 mL) = 3.3625 mmol HCl

0.500 M NaOH(25.00 mL) = 12.5 mmol NaOH

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Sample problem

0.250 M HCl (13.45 mL) = 3.3625 mmol HCl

0.500 M NaOH(25.00 mL) = 12.5 mmol NaOH

The 3.3625 mmol of HCl represent the leftover NaOH

$$3.3625\ mmol\ HCl \frac{1\ mol\ NaOH}{1\ mol\ HCl} = 3.3625\ mmol\ NaOH$$

12.5 mmol NaOH added – 3.625 mmol NaOH = 9.1375 mmol NaOH that reacted with acid

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So there must have been the equivalent of 9.1375 mmol of the acid.

Stoichiometry is unknown so I ASSUME it is monoprotic.

$$\frac{9.1375\ mmol\ acid}{25.00\ mL} = 0.3655\ M$$