

Name: Key  
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**Chemistry 12**  
**ACID BASE PART II Lesson # 18 CONTINUED**

THERE ARE THREE TYPES OF TITRATIONS:

1. **STRONG ACID / STRONG BASE**
2. **weak acid / STRONG BASE**
3. **weak base / STRONG ACID.**

In a chemistry laboratory a titration between HCl and NaOH was carried out and the following DATA was collected. Use this data to graph "pH vs Volume of Base".

| Volume of NaOH added (L) | [H <sup>+</sup> ] after NaOH addition | pH    | pOH   |
|--------------------------|---------------------------------------|-------|-------|
| 0.0000                   | 1.000                                 | 0.00  | 14.00 |
| 0.2500                   | 0.600                                 | 0.22  | 13.88 |
| 0.5000                   | 0.333                                 | 0.48  | 13.62 |
| 0.7500                   | 0.143                                 | 0.85  | 13.15 |
| 0.9000                   | 5.26 x 10 <sup>-2</sup>               | 1.28  | 12.72 |
| 0.9900                   | 5.03 x 10 <sup>-3</sup>               | 2.30  | 11.70 |
| 0.9990                   | 5.00 x 10 <sup>-4</sup>               | 3.30  | 10.70 |
| 0.9999                   | 5.00 x 10 <sup>-5</sup>               | 4.30  | 9.70  |
| 1.0000                   | 1.00 x 10 <sup>-7</sup>               | 7.00  | 7.00  |
| 1.0001                   | 5.00 x 10 <sup>-5</sup>               | 9.70  | 4.30  |
| 1.0010                   | 5.00 x 10 <sup>-4</sup>               | 10.70 | 3.30  |
| 1.0100                   | 4.98 x 10 <sup>-3</sup>               | 11.70 | 2.30  |
| 1.1000                   | 4.76 x 10 <sup>-2</sup>               | 12.68 | 1.32  |
| 1.2500                   | 0.111                                 | 13.05 | 0.95  |
| 1.5000                   | 0.200                                 | 13.30 | 0.70  |
| 1.7500                   | 0.273                                 | 13.44 | 0.56  |
| 2.0000                   | 0.333                                 | 13.52 | 0.48  |

a. At what pH range is the pH changing most rapidly?

*Btwn 3-12*

b. Was the solution acidic, basic or neutral at the equivalence point?

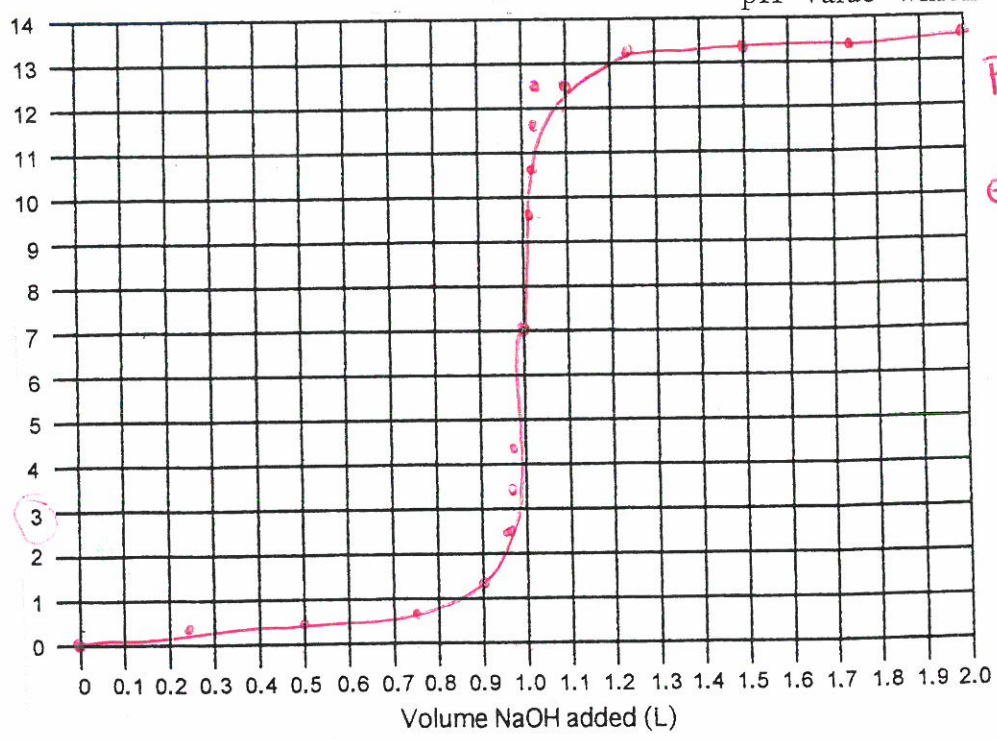
*Neutral; pH = 7*

c. A chem student choose phenolphthalein as the indicator for this titration. Why did the student get good results even though the pKa value differs from the pH value which "should exist"?

*phenolphthalein  
 pKa = 9.1  
 equivalence pt = 7.0  
 OK b/c pH is in rapid pH range!*

*(4)*

*pH*



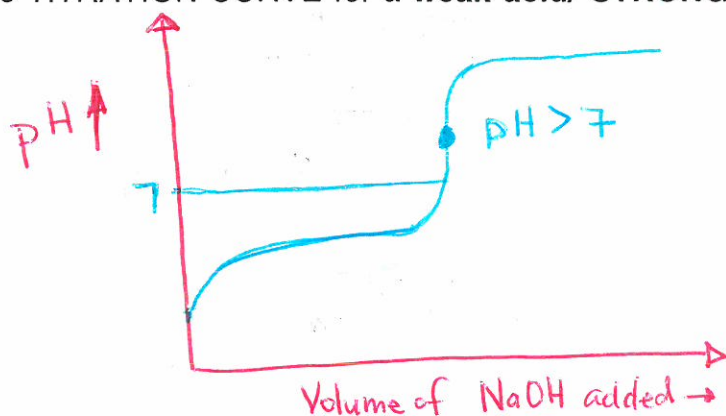
The graph that you have just plotted is typical of all titration curves. The Equivalence point is observed rapid change in pH ∴ pH = 7 STRONG ACID / STRONG BASE in the middle of the

To select an INDICATOR for any type of titration the pKa should coincide with the Equivalence Point of the titration.

For a STRONG ACID/STRONG BASE titration the equivalence point is reached at a pH of 7, therefore the following indicators are acceptable: (pKa close to 7)

Bromthymol blue (pKa = 6.8), Phenol red (pKa = 7.3)  
Neutral red (pKa = 7.4)

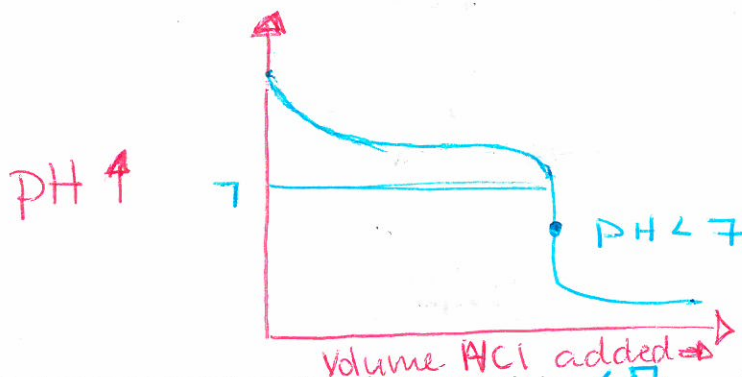
Below is the TITRATION CURVE for a weak acid/ STRONG BASE titration:



The equivalence point on the above graph is > 7. Appropriate Indicators to use for a weak acid/STRONG BASE titration include: pKa range 8-10

Thymol blue (pKa 8.8), Phenolphthalein (pKa 9.1),  
Thymolphthalein (pKa = 10)

Below is the TITRATION CURVE for a weak base/ STRONG ACID titration:



The equivalence point on the above graph is < 7. Appropriate Indicators to use for a weak base/STRONG ACID titration include: pKa range 4-6

Bromocresol green (pKa 4.6), Methyl red (pKa 5.4),  
Chlorophenol red (pKa 6.0)

SEATWORK/HOMEWORK: Exercise 125 pg 176

PLO's : P1 (TITRATION CURVES + INDICATORS) + P6