

## Lab Preparation for "THE NEUTRALIZATION OF HCl WITH KOH"

### Equipment that must be available:

24 – 25 mL graduated cylinders (12 of them may be 10 mL cylinders)  
 12 – stands  
 12 – large rings  
 12 – metal gauze heating pads  
 12 – bunsen burners  
 12 – striker flints  
 24 – plastic droppers  
 12 – 250 mL beakers  
 24 – 100 mL beakers  
 12 – white ceramic evaporating dishes (medium)  
 12 – stirring rods  
 conductivity tester

### Solutions:

Bromthymol Blue: 12 dropper bottles

For 1 class (each of the following solutions is to be divided among 6 bottles)

500 mL 1 M HCl (dilute 43.0 mL concentrated HCl to exactly 500 mL)

500 mL 1 M KOH (dilute 29.3 g KOH to exactly 500 mL)

### Adjust the concentration of the KOH until 10 mL HCl just neutralizes 10 mL KOH as follows.

Place exactly 10.0 mL of 1 M HCl in a 250 mL beaker, add two drops of bromthymol blue. Place 15.0 mL of KOH solution in a 25 mL graduated cylinder and use a dropper to add quickly about 7 mL of KOH solution into the HCl in the beaker. At this point the solution should still be yellow. Now add the KOH solution drop by drop with constant stirring until the mixture just turns green (you may over shoot by 1 drop and have the mixture just turn blue – no problem if that happens). When the mixture turns green (or barely blue) squirt the remaining KOH in the dropper back into the graduated cylinder containing the KOH and read the volume left in the cylinder. Calculate the volume used as follows.

$$\text{Volume KOH used} = 15.0 - \text{volume remaining}$$

There are 3 situations which can occur. If you have to do procedure (b) or (c), retest the concentration after carrying out the procedure by redoing the addition of KOH to HCl carried out above (hopefully to find 10.0 mL of KOH is now needed to neutralize 10.0 mL of HCl).

- (a) **volume used is 10.0 mL** (actual range = 9.8 – 10.2 mL). This indicates the concentrations of HCl and KOH are effectively equal and no further action has to be taken.
- (b) **Volume used is less than 9.8 mL.** This means the KOH is too concentrated and must be diluted slightly by adding water to the remaining KOH stock solution according to the results of the following calculation.

$$\# \text{ of mL of water to be added} = \frac{4850}{\text{Volume KOH used}} - 485$$

For example: If 9.2 mL of KOH is used then

$$\# \text{ of mL of water to be added} = \frac{4850}{9.2} - 485 = 42.2 \text{ mL.}$$

- (c) **Volume used is more than 10.2 mL.** This means the KOH is too dilute and must have some extra KOH added to the remaining stock solution according to the results of the following calculation.

$$\text{Mass of KOH to be added} = 2.93 \times (\text{volume KOH used}) - 29.3$$

For example: If 11.4 mL of KOH is used then

$$\text{Mass of KOH to be added} = 2.93 \times 11.4 - 29.3 = 4.1 \text{ g.}$$