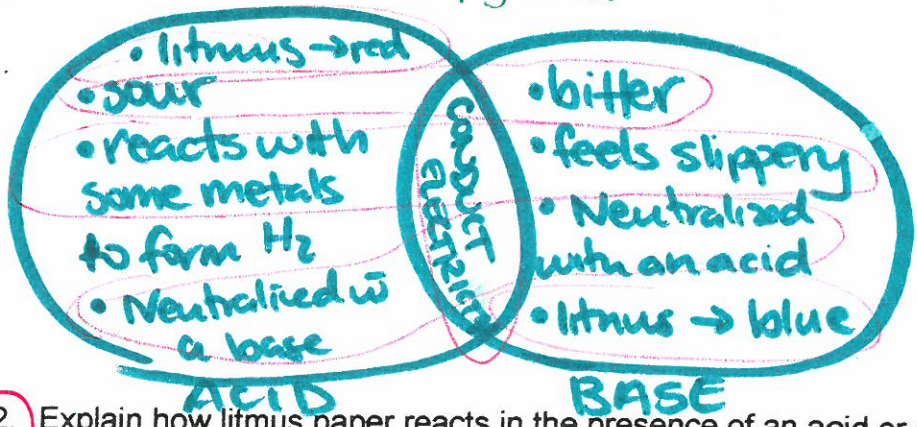
1/34

Read pgs 370-379

Key

PART ONE: INTRO TO ACID-BASE CHEMISTRY

1. Compare and contrast the characteristic properties of Acids & Bases from Table ~~20-1~~ 10.2 pg ~~560~~ 372.



1/5

2. Explain how litmus paper reacts in the presence of an acid or a base.

Acid Red Base Blue

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3. Solutions with a high $[H^+]$ are considered STRONG, an example is HCl. Solutions with low $[H^+]$ are considered WEAK, an example is CH_3COOH.

omit

1/4

4. One of the earliest definitions of an acid was proposed by Svente Arrhenius, according to Arrhenius, an acid is

a substance that produces H^+ ions in water.

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5. Here is an example of an acid-base reaction:

$$HCl\ (l) + H_2O\ (l) \text{-----} \rightarrow H_3O^+(aq) + Cl^-(aq)$$

Because H_3O^+ represents a HYDRATED PROTON (H^+) the notations H_3O^+ and H^+ are H_3O^+ equal!

$$\boxed{H_3O^+ = H^+}$$

1/1

1/13

6. The ionization of water is written $H_2O \rightarrow H^+ + OH^-$. Is water an acidic or basic solution? What test could you perform to gain evidence to support your hypothesis? Explain.

1/3 Water is Neutral, pH = 7. $H_2O \rightarrow H^+ + OH^-$
it produces both H^+ and OH^-
acid + base = neutral

7. Using the Arrhenius definition of a base, explain why sodium hydroxide is a base in solution, write the chemical formula.

A base produces OH^- ions in solution

1/2 $NaOH \longrightarrow Na^+ + OH^-$ ∴ a base

8. Define a Bronsted-Lowry acid and base, give an example of each.

Acid - any substance that can donate a proton (H^+)
Base - any substance that can accept a proton (H^+)

1/4 Acid = H_2O, HCl
Base = NH_3

9. Define the term AMPHIPROTIC, and give an example of an amphiprotic compound.

Amphiprotic: can act like an acid or a base

1/2 ex. water

10. Explain how NEUTRALIZATION occurs between an acid and a base.

Acid + Base react to form a salt and water

1/1 ex: $HCl + NaOH \longrightarrow NaCl + H_2O$

11. Write the equation to represent the formation of **IONS** for the following STRONG acids and bases in water, indicate whether the compound is an acid or a base.

1/5

1/17

example: $HClO_4 \rightarrow H^+(aq) + ClO_4^-(aq)$

ACIDS
- $HCl \rightarrow H^+ + Cl^-$
- $HBr \rightarrow H^+ + Br^-$
- $HI \rightarrow H^+ + I^-$
- $HNO_3 \rightarrow H^+ + NO_3^-$

BASES
- $LiOH \rightarrow Li^+ + OH^-$
- $NaOH \rightarrow Na^+ + OH^-$
- $KOH \rightarrow K^+ + OH^-$
- $RbOH \rightarrow Rb^+ + OH^-$
- $Ca(OH)_2 \rightarrow Ca^{2+} + 2OH^-$
- $Ba(OH)_2 \rightarrow Ba^{2+} + 2OH^-$

1/5

PART II: ACID- BASE TITRATIONS

394-401

Read pgs ~~591-595~~ and then answer the following questions:

1. When an acid, such as HCl, and a base, such as KOH combine, they react with each other to produce a salt + water.
   Write the chemical equation here:
   $HCl + KOH \rightarrow KCl + H_2O$ 1/2

2. When **moles** of protons DONATED by the acid and **moles** of protons ACCEPTED by the base are equal, neutralization occurs. 1/1

3. Define a "**SALT**": a compd formed from the cation of the base and anion of the acid ie KCl 1/1

Do REVIEW AND PRACTICE pg 595 #'s 1-5 and attach your answers to this booklet. Be sure to answer in FULL-COMPLETE sentences !!!!

1. $NaOH + HCl \rightarrow NaCl + H_2O$

$$0.0300\,L \times \frac{0.5\,mol\,HCl}{1\,L} = 0.015\,mol\,HCl \times \frac{1\,mol\,NaOH}{1\,mol\,HCl}$$

$$= \frac{0.015\,mol\,NaOH}{0.0500\,L} = \boxed{0.3\,M\,NaOH}$$

2. $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

$$\frac{0.56\,mol\,NaOH}{1\,L} \times 0.0325\,L = 0.0182\,mol\,NaOH$$

$$\therefore 0.0182\,mol\,CH_3COOH = \boxed{1.2\,M\,CH_3COOH}$$

Answers to Section Review pg 404

2. (a) $KOH_{(aq)} + HNO_{3(aq)} \rightarrow KNO_{3(aq)} + H_2O_{(l)}$
(b) $2HBr_{(aq)} + Ca(OH)_{2(aq)} \rightarrow CaBr_{2(aq)} + 2H_2O_{(l)}$
(c) $H_3PO_{4(aq)} + 3NaOH_{(aq)} \rightarrow Na_3PO_{4(aq)} + 3H_2O_{(l)}$
(d) $2HCl_{(aq)} + Mg(OH)_{2(aq)} \rightarrow MgCl_{2(aq)} + 2H_2O_{(l)}$

14

3. Equivalence point: point in a titration when the number of moles in the standard solution is stoichiometrically equal to the number of moles in the original solution. End-point: point in a titration when the indicator changes colour. End-point is visual, macroscopic; equivalence point is ionic, microscopic. End-point may be incorrectly read before or after the equivalence point and this reality introduces error into any careless titration. This is why it is important to decide on a standard colour before beginning.

4. $H_2SO_{4(aq)} + 2NH_4OH_{(aq)} \rightarrow (NH_4)_2SO_{4(aq)} + 2H_2O_{(l)}$
Amount of $NH_4OH_{(aq)}$ (in mol) added = $0.116 \text{ mol/L} \times 0.0328 \text{ L}$
$= 3.80 \times 10^{-3} \text{ mol}$
H_2SO_4 reacts with NH_4OH in a 1 : 2 ratio so there must be 1.90×10^{-3} mol of H_2SO_4.
$[H_2SO_{4(aq)}] = \frac{1.90 \times 10^{-3} \text{ mol}}{0.025 \text{ L}} = 7.6 \times 10^{-2} \text{ mol/L}$

8

5. $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$
Amount of HCl (in mol) added = $0.235 \text{ mol/L} \times 0.01000 \text{ L}$
$= 2.35 \times 10^{-3} \text{ mol}$
HCl and NaOH react in a 1 : 1 ratio so there must be 2.35×10^{-3} mol of NaOH.
$[NaOH] = \frac{2.35 \times 10^{-3} \text{ mol}}{2.202 \times 10^{-2} \text{ L}} = 0.107 \text{ mol/L}$

F = 23.08
I = 1.06
22.02 mL

6. Liquid in Erlenmeyer flask is usually a standard solution (known concentration) of known volume (25.0 mL) from a pipette, so it is not necessary to dry the flask.

7. (i) Wash hands immediately with water. Apply baking soda to affected area an thoroughly with water.
(ii) Remove lab coat and rinse in water. Add washing soda to the rinse water.
(iii) Pour baking soda or dilute solution of a strong base on lab bench. Wipe thoroughly. Rinse with water.

1. Acid + Base → Salt + water (1)

2. (1) see above

5. $HCl + NaOH \rightarrow NaCl + H_2O$ (1)

(1) $0.01000\text{L} \times \frac{0.235 \text{ mol HCl}}{1\text{L}} \times \frac{1 \text{ mol NaOH}}{1 \text{ mol HCl}} = 2.35 \times 10^{-3} \text{ mol NaOH}$

$[NaOH] = \frac{2.35 \times 10^{-3} \text{ mol NaOH}}{0.02202 \text{ L}} \Rightarrow 0.107 \text{ M NaOH}$