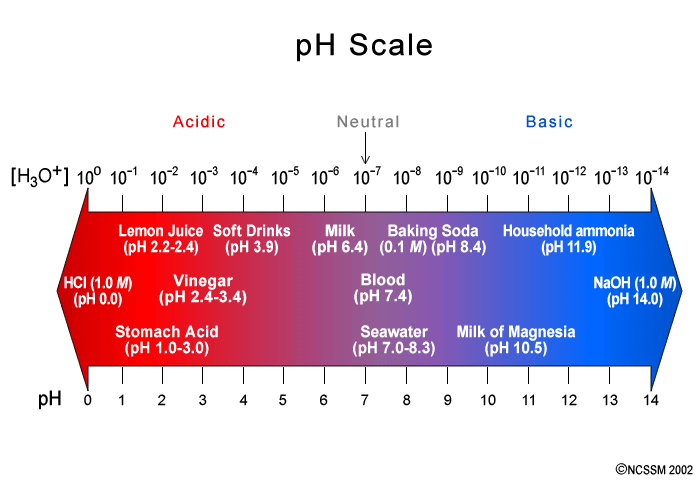
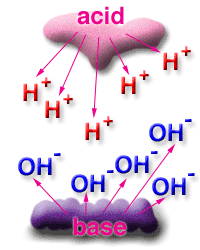
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**Acids**

**and**

**Bases**

***Textbook:*** Chapter

***Homework:*** \_\_\_\_\_\_\_\_\_\_\_\_

***Exam Dates:***

Free Response: \_\_\_\_\_\_\_\_\_\_\_\_

Multiple Choice: \_\_\_\_\_\_\_\_\_\_\_\_

**Acids, Bases & Salts Study Guide**

**Properties of Acids and Bases**

**Acids:**

* produce H+ ions in water
* aqueous solutions of acids will conduct electricity (are electrolytes and produce ions)
* react with metals (Ex. Zn, Mg) to form H2 gas (any metal above Hydrogen on Chart J will react with acid)
* turn Litmus from blue → red
* taste sour
* [H+] > [OH-]
* are covalent compounds that produce hydronium ions (H3O+) in water
* monoprotic –HCl(aq), diprotic - H2SO4(aq) or triprotic acids - H3PO4 (aq)
* strong acids vs weak acids – Table K

**Bases:**

* aqueous solutions of bases will conduct electricity (are electrolytes due to free ions)
* turn litmus from red → blue
* taste bitter
* are caustic
* feel slippery/soapy
* produce OH- ions (hydroxyl ions) in water
* [OH-] > [H+]
* strong bases (Group 1 and 2 metal hydroxides) vs weak bases

Naming Acids: General formula: HX (See Table K)

* binary acids hydro\_\_\_\_\_\_ic acid Ex. HCl – hydrochloric acid, HBr – hydrobromic acid, HI – hydroiodic acid
* ternary acids – name the polyatomic ion and change the ending

(-ate → -ic ; -ite → -ous) Ex: HNO3 – nitric acid, H2SO3 – sulfurous acid

Naming Bases**:** General Formula: MOH M= metal + hydroxide (See Chart L)

Arrhenius Theory

* Acids give off H+ ions as the only positive ions. Ex. HCl
* Bases give off OH- ions as the only negative ions. Ex. NaOH

Bronsted – Lowry Theory

* Acids donate a proton (H+) during a reaction
* Bases accept a proton (H+) during a reaction
* Conjugate acid-base pairs (1 reactant, 1 product that differ by one H+)
* strong acids produce weak conjugate bases

weak acids produce strong conjugate bases

* amphiprotic or amphoteric substances: can act like an acid and donate a proton or act like a base and accept a proton.

Indicators

* substances that change color in the presence of acids or bases
* Ex. litmus, phenolphthalein
* pH and the range of color change for indicators – Chart M

Neutralization

* Neutralization reactions:

acid + base → salt + water

* Titrations and end points: MAVA = MBVB  M = molarity V = volume (Table T)
* Hydrolysis reactions:

salt + water → acid + base

(look on table L for strengths of acids, group 1 & 2 metals create strong bases)

pH and the ionization Constant for Water (Kw)

* Kw = 1 x 10-14 = [H+] x [OH-]
* For a neutral solution, [H+] = 1 x 10-7 [OH-] = 1 x 10-7
* pH = -log[H+]
* determining the pH from the [H+]
* determining the pH from the [OH-]

**Vocabulary**

acids

bases

indicators

hydronium ions

litmus

titration

pH

Kw

endpoint

phenolphthalein

standard solution

hydroxyl ions

Arrhenius theory

indicators

Bronsted-Lowry Theory

neutralization

conjugate acid-base pairs

hydrolysis

amphiprotic/amphoteric

**Acids, Bases & Salts Homework**

**I. Naming Acids and Bases**

A. Write the name or the formula for each of the following binary acids*:*

1. HCl 🡪 Hydrochloric Acid 3. hydrofluoric acid 🡪 HF

2. H2Se 🡪 HydroSelenic Acid 4. hydrobromic acid 🡪 HBr

B. Write the name or the formula for each of the following ternary acids:

1. HClO4 🡪 Perchloric Acid 4. carbonic acid 🡪 H2CO3

2. H2SO4  🡪 Sulfuric Acid 5. nitric acid 🡪 HNO3

3. H3PO4 🡪 Phosphoric Acid 6. sulfurous acid 🡪 H2SO3

C. Write the name or the formula for each of the following bases:

1. Cu(OH)2 🡪 Calcium Hydroxide 4. calcium hydroxide 🡪 Ca(OH)2

2. Al(OH)3 🡪 Aluminum Hydroxide 5. iron(II)hydroxide 🡪 Fe(OH)2

3. NaOH 🡪 Sodium Hydroxide 6. aluminum hydroxide 🡪 Al(OH)3

**II. pH, Neutralization and Titration**

1. What are the concentrations of H+ and OH- in the following solutions?

1. An HCl solution whose pH is 6. [H+] = 1 x 10-6 [OH-] = 1 x 10 -8

2. AnLiOH solution whose pH is 10. [H+] = 1 x 10-10 [OH-] = 1 x 10 -4

3. A NaHCO3 solutions whose pH is 12. [H+] = 1 x 10-12 [OH-] = 1 x 10-2

4. A H2SO4 solution whose pH is 2. [H+] = 1 x 10-2 [OH-] = 1 x 10-12

1. Complete the following chart:

|  |  |  |  |
| --- | --- | --- | --- |
| **[H+]** | **[OH-]** | **pH** | **Acidic or Basic** |
| 1x 10-5 | 1 x 10-9 | 5 | acidic |
| 1 x 10-10 | 1 x 10-4 | 10 | basic |
| 1 x 10-3 | 1 x 10-11 | 3 | acidic |
| 1 x 10-12 | 1 x 10-2 | 12 | basic |
| 1 x 10-7 | 1 x 10-7 | 7 | neutral |

Page 655 #10 D 🡪 Neutral

Page 655 #11 🡪 1 x 10 -11 ; basic

Page 657 # 13 A. pH = 12 B. pH = 4

Page 662 # 18 [H+] x [OH-] = 1 x 10 - 14 ; When [H+] increases [OH-] decreases and vice versa

Page 662 # 19 A. Basic greater than 7 B. acidic less than 7 C. neutral pH = 7

Page 662 # 21 As pH increases the [H+] concentration decreases

Page 684 #55

1. 2Li + 2H2O 🡪 2LiOH + H2

1. Ba + 2H2O 🡪 Ba(OH)2 + H2

Page 684 #59 H2O 🡨🡪 H+  + OH -

**III. Neutralization & Titration***~ For the following titration problems show all work, include answers with proper units.*

A. If 40.0 mL of a 6.0M hydrochloric acid solution neutralizes 20.0 mL of lithium hydroxide, what is the concentration of the base?

MAVA = MBVB

6.0M (40.0mL) = x (20.0mL)

B. A 0.40 M sulfuric acid [H2SO4] is used to neutralize 328 mL of a 1.25 M barium hydroxide [Ba(OH)2]. What is the volume of the acid?

MAVA = MBVB

.40M(x) = 1.25M (328mL)

X=

C. A sample of HCl was exactly neutralized by 13.5 mL of 1.0M KOH. How many moles of HCl will be needed to neutralize the KOH.

MAVA = MBVB ***\*\* remember Molarity = Moles /Liters***

*(moles of acid) = (moles of base)* ***So…… Molarity x Volume = moles***

MOLES of acid = 1.0M (13.5mL)

X=

D. What is the molarity of a Al(OH)3 solution if 15.0 mL is exactly neutralized by 7.5 mL of 0.02M HC2H3O2 solution?

MAVA (# H) = MBVB (#OH) ***\* remember to include the # of H’s & OH’s if unequal***

.02M(7.5mL)(1) = X ( 15.0mL) (3)

X=

Page 675 # 37 ~ SHOW ALL WORK

MAVA = MBVB

.45M (x) = 1.00M(25.0mL)

x= 56mL HCl

Page 675 # 38 ~ SHOW ALL WORK

MAVA (#H) = MBVB (#OH)

x(15.0mL(3) = .150M (38.5mL (1)

x = .128M H3PO4

Page 675 # 39 ~ a salt & water

Page 675 # 40 ~ the number of moles of H+ ions = number of moles of OH- ions

Page 675 # 41 a .03 moles

Page 675 # 42

A H2SO4 + KOH 🡪 2 H2O + K2SO4

B 2 H3PO4 + 3Ca(OH)2 🡪 6 H2O + Ca3(PO4)2

C 2HNO3 + Mg(OH)2 🡪 2H2O + Mg(NO3)2

Page 684 # 71

A HNO3 + KOH 🡪 KNO3 + H2O

B 2 HCl + Ca(OH)2 🡪 CaCl2 + 2H2O

C H2SO4 + 2 NaOH 🡪 Na2SO4 + 2H2O

Page 685 # 91

A 2HCl + Mg(OH)2 🡪 MgCl2 + 2H2O

B 2HCl + CaCO3 🡪 H2O + CO2 + CaCl2

C Al(OH)3 + 3HCl 🡪 AlCl3 + 3H2O

IV. Strengths of Acids and Bases

Page 669 #27 ~ the degree to which they ionize in water

Page 669 #31 ~ HX will be greater than H+ at equilibrium

Page 685 #95 ~ B, C, D, A

**V. Defining Acids and Bases**

*For each of the following reactions, identify the Bronsted Lowry conjugate acid-base pairs (two pairs for each reaction). Identify by circling the chemical formula of two different substances that would be considered amphiprotic.*

1. NH4+ + H2O  H3O+ + NH3 A/B pair #1~ H2O & H3O+ A/B pair #2 ~ NH4+ & NH3

2. NH3 + HSO4-  NH4+ + SO4-2A/B pair #1~ NH4+ & NH3 A/B pair #2~ HSO4- & SO4- 2

3. HPO42- + HPO42-  H2PO4-1 + PO43-  A/B pair #1~H2PO4-1 & HPO42- A/B pair #2 HPO42- & PO43-

4. H2O + NH3  NH4+ + OH- A/B pair #1 ~ H2O & OH- A/B pair #2 ~ NH4+ & NH3

Page 652 #3 ~ An acid gice Hydrogen ions(H+) , a base give hydroxide ions (OH-)

Page 652 #4 ~ Acids are Hydrogen Ion donors and bases are hydrogen ion acceptors

Page 652 #7

A Diprotic

B triprotic

C monoprotic

D diprotic

Page 652 #9 ~ The reaction of NaOH with Aluminum generates heat, which softens greases and oils and

hydrogen which agitates the mixture.

Page 684 # 53

a base b acid c acid d base e acid f acid

Page 684 # 56

a HNO3 Acid, H2O base

c H2O acid, NH3 base

Page 684 # 57

A ~ HNO3/NO3 & H2O/H3O+ B ~ CH3COOH/CH3COO- & H2O/H3O+

C ~ H2O/ OH- & NH3/NH4+ D ~ H2O/ OH- & CH3COOH/CH3COO-

Page 685 # 84 B ~ NH3 Ammonia D ~ HSO3- Hydrogen Sulfite ion

Page 685 # 85 B ~ H3O+ Hydronium Ion D ~ NH4+ ammonium ion

**VI. Hydrolysis**

*Each of the following salts will undergo hydrolysis when added to water. Complete the equations, balance the equations and then determine if the original salt is acidic, basic or neutral.*

SALT

(Acidic, basic, neutral**)**

1. FeCl2 + H2O → Fe(OH)2  + HCl Acidic

2. MgSO4 + H2O → Mg(OH)2 + H2SO4 Neutral

3. Na3PO4 + H2O → Na(OH) + H3(PO4) Basic

4. KC2H3O2­ + H2O → K(OH) + H(C2H3O2) Basic

5. SrCl2 + H2O → Sr(OH)2 + HCl Neutral

6. Al2(SO4)3 + H2O → Al(OH)3 + H2(SO4) Acidic

7. Na2SO4 + H2O → Na(OH) + H2SO4 Neutral

Page 680 #46 acidic salt🡪 weak base & strong acid; basic salt 🡪 strong base & weak acid

Page 680 #48 d strong acid & weak base

Page 684 #74 salts that dissolve in water will create cations and anions

Page 684 #77

a basic b acid c neutral

d basic e acid f neutral

**VII. Cumulative Chemistry Review**

**Page 688 #119**

A K2O

B CaS

C AlF3

Page 688 #120

87.4g xg

2 S + 3O2 🡪 2 SO3

64g 96g

X= 131 g O2

Page 688 #121 liquid

Page 688 #125 C 🡪 SiO2

Page 688 #128

M = moles/L

.680M = x/.4L

X=.272 moles of KOH (molar mass = 39 + 16 + 1 = 56g/mole)

.272 moles x 56g/mole = 15.2 g of KOH add water until it

Dissolve 15.2 g of KOH and add water until it reaches .4L (or 400 mL)

Page 688 #130 B, C, D

Page 688 #135

A B

Keq = [CO]2 [O2]

[CO2]2

Keq = [NH3]2

[H2]3 [N2]

Page 688 #138

A Shift Right

B No Change

C Shift Right

D Shift Right

E Shift Right

Page 689 #2 B

Page 689 #3 C

Page 689 #6 A

Page 689 #7 B

Page 689 #12 c,a,b

Page 689 #13 one (b)