

PSC1341

Chapter 12

Chapter 12

- A. Acids and bases
- B. pH scale
- C. Buffer systems
- D. Organic compounds
- E. Writing organic structures
 - a. Condensed formulas
 - b. Stick figures
- F. Naming simple organic molecules
- G. Functional groups
- H. Functional groups in drugs

Acids and Bases

Part A

Arrhenius

- Acid: A substance that make H^+ (H_3O^+) when dissolved in water.
- Base: A substance that makes OH^- when dissolved in water.
- An acid/base reaction occurs when and H^+ from an acid reacts with an OH^- from a base.

Acids

- Strong acids: Dissociate completely when dissolved in water.
 - HCl, HNO_3
- Weak acids only dissociate a little bit.
 - CH_3CO_2H , H_2CO_3

Base

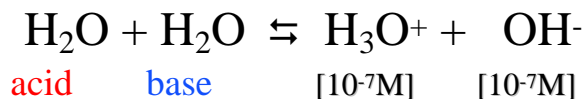
- Strong base: dissociates completely when dissolved in water.
 - NaOH, KOH
- Weak base: Makes only a little bit of OH^-
 - NH_3 , HCO_3^-

ACIDS AND BASES

Acids	Bases
HCl (hydrochloric acid or muriatic acid)	Cl ⁻ (chloride ion)
H ₂ SO ₄ (sulfuric acid)	SO ₄ ²⁻ (sulfate ion)
H ₃ O ⁺ (hydronium ion)	H ₂ O (water)
CH ₃ CO ₂ H (acetic acid)	CH ₃ CO ₂ ⁻ (acetate ion)
H ₂ CO ₃ (carbonic acid)	HCO ₃ ⁻ (bicarbonate)
NH ₄ ⁺ (ammonium ion)	NH ₃ (ammonia)
H ₂ O (water)	OH ⁻ (hydroxide ion)

Water

•Water auto-ionizes

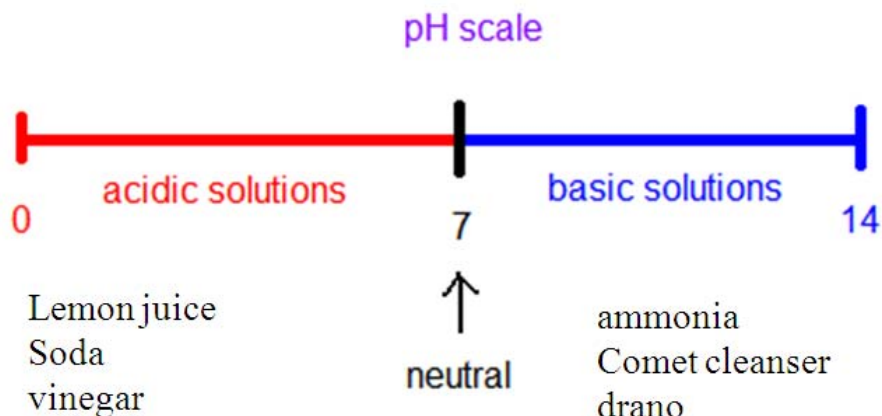


$$K = \frac{[\text{H}_3\text{O}^+][\text{OH}^-]}{[\text{H}_2\text{O}]^2} = [\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$$

The big six

1. [H⁺][OH⁻] = 10⁻¹⁴
2. pH = -log [H⁺]
3. pOH = -log [OH⁻]
4. [H⁺] = 10^{-pH}
5. [OH⁻] = 10^{-pOH}
6. pH + pOH = 14

pH scale



Quiz

- Is a blood solution with a pH of 7.26 acidic or basic? Answer: Basic
- Is “Clean Shower” with a pH of 5.00 acidic or basic? Answer: Acidic
- Would you expect an carbonic acid (H_2CO_3) solution to be acidic or basic? Acidic
- Would you expect an ammonia (NH_3) solution to be acidic or basic? basic

Buffer solution

A buffer solution keeps the pH approximately the same even upon the addition of a strong acid or strong base.

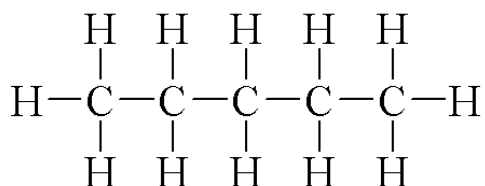
- Need a weak acid.
- Its conjugate base.
- Present in a large enough quantity to resist the pH changes.

$\text{CH}_3\text{CO}_2\text{H}/\text{CH}_3\text{CO}_2^-$

- If you add an acid, H^+ , The base of the buffer reacts.
 - $\text{H}^+ + \text{CH}_3\text{CO}_2^- \rightarrow \text{CH}_3\text{CO}_2\text{H}$
 - $\text{H}_3\text{O}^+ + \text{CH}_3\text{CO}_2^- \rightarrow \text{H}_2\text{O} + \text{CH}_3\text{CO}_2\text{H}$
- Of you add a base, OH^- , the acid of the buffer system reacts.
 - $\text{CH}_3\text{CO}_2\text{H} + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{CH}_3\text{CO}_2^-$

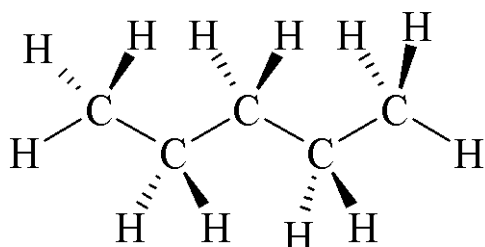
Organic Molecules

Lewis Structure



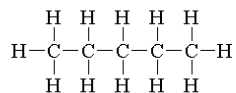
Carbon always has 4 bonds, hydrogen always has one bond.

VSEPR

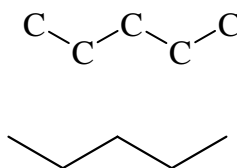
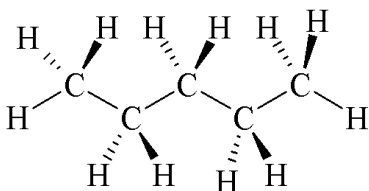


These carbons are tetrahedral and have bond angles of 109.5 degrees

Condensed Formula



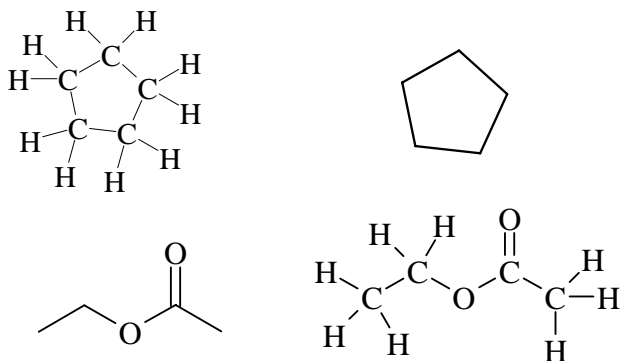
Stick figures



Stick Figures (Rules)

- Hydrogens attached to carbons are not shown. (Hydrogens attached to hetero-atoms are shown)
- Each vertex and terminus is a carbon.
- All hetero-atoms are shown explicitly.

Example



How many carbon atoms? 4

How many hydrogen atoms? 8

How many oxygen atoms? 2

Names of straight chain alkanes

Name	Formula	Condensed formula
methane	CH ₄	CH ₄
ethane	C ₂ H ₆	CH ₃ CH ₃
propane	C ₃ H ₈	CH ₃ CH ₂ CH ₃
butane	C ₄ H ₁₀	CH ₃ CH ₂ CH ₂ CH ₃
pentane	C ₅ H ₁₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃
hexane	C ₆ H ₁₄	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
heptane	C ₇ H ₁₆	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃



2-methyl pentane

Use **-ane** ending for the main chain and **-yl** ending for side chains

Table Prefixes used to show the presence of one to ten carbons in an unbranched chain.

Prefix	Number of Carbon atoms	Prefix	Number of Carbon atoms
meth-	1	hex-	6
eth-	2	hept-	7
prop-	3	oct-	8
but-	4	non-	9
pent-	5	dec-	10

Functional groups

- Ketone $\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{C}$
- Ester $\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{C}$
- Aldehyde $\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$
- Alcohol $\text{C}-\text{OH}$ (not carbonyl)
- Carboxylic Acid $\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$
- Amine $\text{C}-\text{N}-$ (not carbonyl)

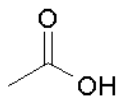
Functional groups in stick figures



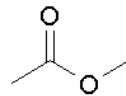
ketone



aldehyde



carboxylic acid



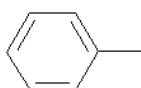
ester



alcohol

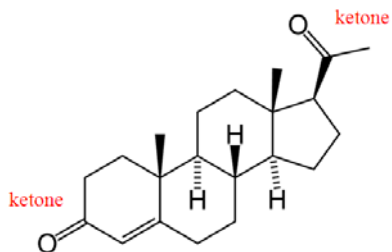


amine

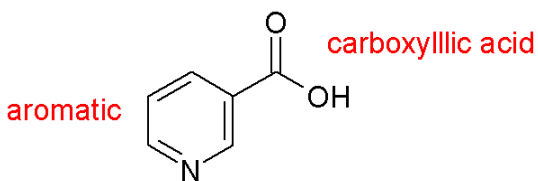


aromatic

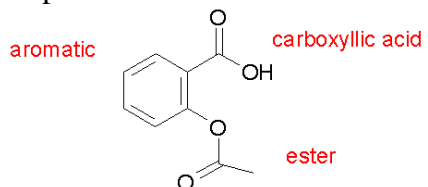
Progesterone



Niacin

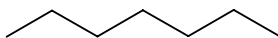


Asprin



Homework

1. Would you expect a solution of H_2CO_3 to be acidic or basic?
2. Would you expect a solution of HCO_3^- to be acidic or basic?
3. A solution has a pH of 11.0. Is the solution acidic or basic?
4. A solution has a pH of 4.30. Is the solution acidic or basic?



5. How many carbons in the above structure?
6. How many hydrogens in the above structure?
7. What is the name of this compound?

1. acidic 2. Basic, it is on the base side of the chart. 3. Basic, it is above seven. 4. Acidic, it is below seven. 5. Seven 6. Sixteen 7. heptane