

# Introduction to Botany. Lecture 5

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September 2, 2016



## 1 Questions and answers

- Quiz

## 2 Basics of life

- Chemistry of life
- Molecules of life



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# Questions and answers

## Quiz



# Final question (1 point)

What is a molecular weight of sulfuric acid,  $\text{H}_2\text{SO}_4$ ?



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# Basics of life

## Chemistry of life



# Very basics of chemistry

- Atoms
  - Protons
  - Neutrons
  - Electrons
- Atomic weight
- Isotopes
- Elements
- Periodic table: rows and columns
- Chemical bonds: ionic, covalent, hydrogen
- Valence and group
- Molecules
- Molecular weight





# Molar mass, mole and molar concentration

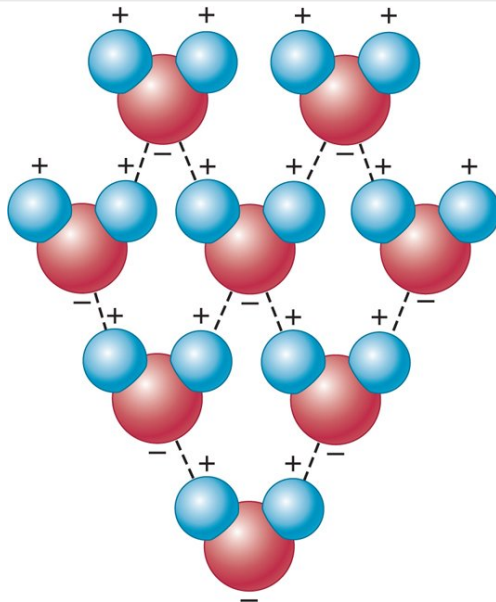
- Molar mass is a gram equivalent of molecular mass
- For example, molecular mass of salt (NaCl) is  $23 + 35^1 = 58$  Da. We take “Da” out and replace it with “g” (grams). Therefore, 1 mole of salt is 58 g.
- Every mole contains  $6.02214078 \times 10^{23}$  molecules (Avogadro’s number)
- Concentration is the density of dissolved substance
- In water solution, 1 M (1 molar) concentration of salt means that in 1 liter of distilled water 58 g of salt was diluted
- If we take half of this water, concentration will still be 1 M whereas amount of diluted salt will decrease twice

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<sup>1</sup> If we accept that atomic mass of chlorine is 35.



# Water with hydrogen bonds



# Acids and bases. Ions

- Acids: take out  $H^+$  cation (proton), like  
 $HCl \rightarrow H^+ + Cl^-$   
or  
 $H_2SO_4 \rightarrow 2H^+ + SO_4^{2-}$
- Bases: take out  $OH^-$  anion (hydroxyl)  
 $NaOH \rightarrow Na^+ + OH^-$



# Concentration of protons, and pH and acidity

- If concentration of protons is 0.1 M ( $1 \times 10^{-1}$ , 0.1 g of protons in 1 l of water), this is an extremely acidic solution
- In distilled water, concentration of protons is equal to  $1 \times 10^{-7}$  (0.0000001) M
- This is because water molecules can (rarely) dissociate:  $\text{H}_2\text{O} \rightarrow \text{H}^+ + \text{OH}^-$
- pH of distilled water is equal to  $-\log(10^{-7}) = -(-7) = 7$
- pH of the extremely acidic solution (first example) is 1



# Basics of life

## Molecules of life



# Organic chemistry: chemistry of carbon

- Carbon skeleton
- And H, O, N, P, S



# Four types of biomolecules

- Lipids: hydrophobic
- Carbohydrates (sugars): multiple –OH groups
- Amino acids: N + C + O and hydrogen
- Nucleotides: cycle with nitrogen (heterocycle), sugar and phosphoric acid



# Final question (2 points)





# Final question (2 points)

How do you characterize water with  $\text{pH} = 5$ ?



# Summary

- Most important bonds: polar and non-polar covalent (intramolecular) and hydrogen (intermolecular)
- Main biogenic elements: C, H, O, N, P
- Most important monomers: lipids, carbohydrates, amino acids, nucleotides
- Most important polymers: polysaccharides, proteins, nucleic acids



# For Further Reading



A. Shipunov.

*Introduction to Botany* [Electronic resource].

2016.

Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_154](http://ashipunov.info/shipunov/school/biol_154)

