

Introduction to Botany

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Lecture 5

1 Questions and answers

- Quiz

2 Basics of life

- Chemistry of life

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 - Quiz
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 - Chemistry of life

Questions and answers

Quiz

Quiz question (3 points)

What is the number of protons, electrons and neutrons in niobium atom?

Quiz question (3 points)

What is the number of protons, electrons and neutrons in niobium atom?

41 protons, 41 electrons, and 52 or 51 (likely, rare) neutrons.

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

Mole: the example

To cook one molecule of water (H_2O), we need one molecule of hydrogen (H_2) and half molecule of oxygen (O_2)

To cook one **mole** of water, we need one **mole** of hydrogen and half a **mole** of oxygen

To cook 18 grams ($2 \times 1 + 16$) of water, we need 2 grams (2×1) of hydrogen and 16 grams ($\frac{16 \times 2}{2}$) of oxygen

To cook 180 grams of water, we need 20 grams of hydrogen and 160 grams of oxygen

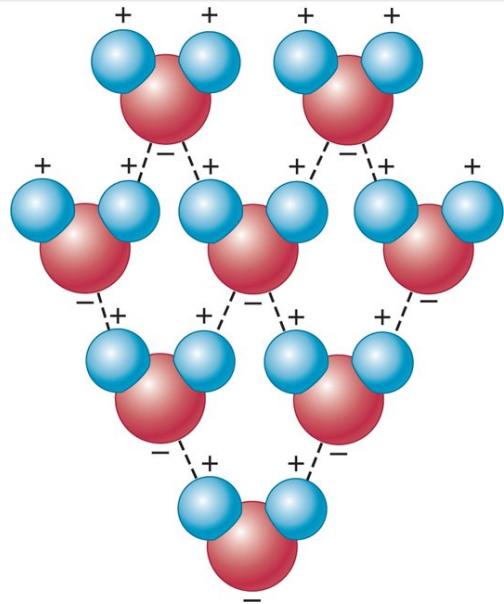
... and so on

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

¹ 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 (1×10^{-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 1×10^{-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

Final question (2 points)

Final question (2 points)

What is a molecular weight of hydrochloric acid, HCl?

Summary

- Most important bonds: polar and non-polar covalent (intramolecular) and hydrogen (intermolecular)

For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

Mode of access:

http://ashipunov.info/shipunov/school/biol_154