

Introduction to Biology. Lecture 4

Alexey Shipunov

Minot State University

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- 1 Where we are?
- 2 Origin of Earth. Basics of chemistry
 - Basics of chemistry



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Very basics of chemistry

- Atoms
 - Protons
 - Neutrons
 - Electrons
- Atomic weight
- **Isotopes**
- Elements and periodic table
- Chemical bonds
- Valence and group
- Molecules
- Molecular weight



1 IA																										18 VIIIA																							
1	1.0079																										2	4.0026																					
1	H															He																																	
Hydrogen															Helium																																		
2 IIA																		3 IIIA	4 IVA	5 VA	6 VIA	7 VIIA	8 VIIIA																										
3	6.941	9.0122																	5	10.811	12.011	14.007	15.999	18.998	20.180																								
2	Li	Be																	B	C	N	O	F	Ne																									
Lithium	Beryllium																	Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon																										
11	22.990	24.305																	13	26.982	28.086	30.974	32.065	35.453	39.948																								
3	Na	Mg	3 IIIA	4 IVB	5 VB	6 VIB	7 VIIB	8 VIIIB	9 VIIIB	10 VIIIB	11 IB	12 IIB	Al	Si	P	S	Cl	Ar																															
Sodium	Magnesium																	Aluminum	Silicon	Phosphorus	Sulphur	Chlorine	Argon																										
19	39.098	40.078	44.956	47.867	50.942	51.996	54.938	58.933	58.693	63.546	65.39	69.723	72.64	74.922	78.96	79.904	83.8	85.8																															
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr																															
Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton																																
37	85.468	87.62	88.906	91.224	92.906	95.94	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121.76	127.6	126.9	126.9	131.29																															
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe																															
Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon																																
55	132.91	137.33	89-103	178.49	180.95	183.84	186.21	190.23	192.22	195.08	196.97	200.59	204.38	207.2	208.98	209	210	222																															
6	Cs	Ba	Lanthanide	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn																															
Cesium	Barium	Lanthanide	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon																																
87	223	226	89-103	261	262	266	264	267	268	269	271	270	272	273	277	283	285	286																															
7	Fr	Ra	Actinide	Rf	Db	Sg	Bh	Hs	Mt	Ds	Dm	Rg	Cn	Uut	Fl	Uup	Lv	Uus	Uuo																														
Francium	Radium	Actinide	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Meitnerium	Darmstadtium	Roentgenium	Copernicium	Ununium	Flerovium	Unseptium	Livermorium	Unnonium	Unbinium	Untrium																															
<ul style="list-style-type: none"> Alkali Metal Alkaline Earth Metal Metal Metalloid Non-metal Halogen Noble Gas Lanthanide/Actinide 																																																	
<table border="1"> <tr> <td>57</td> <td colspan="1">138.91</td> <td colspan="1">140.12</td> <td colspan="1">140.91</td> <td colspan="1">144.24</td> <td colspan="1">145</td> <td colspan="1">147</td> <td colspan="1">150.36</td> <td colspan="1">151.96</td> <td colspan="1">157.25</td> <td colspan="1">158.93</td> <td colspan="1">162.50</td> <td colspan="1">164.93</td> <td colspan="1">167.26</td> <td colspan="1">168.93</td> <td colspan="1">173.04</td> <td colspan="1">174.97</td> </tr> <tr> <td colspan="1">Lanthanum</td> <td colspan="1">Cerium</td> <td colspan="1">Praseodymium</td> <td colspan="1">Neodymium</td> <td colspan="1">Promethium</td> <td colspan="1">Samarium</td> <td colspan="1">Europium</td> <td colspan="1">Gadolinium</td> <td colspan="1">Terbium</td> <td colspan="1">Dysprosium</td> <td colspan="1">Holmium</td> <td colspan="1">Erbium</td> <td colspan="1">Thulium</td> <td colspan="1">Ytterbium</td> <td colspan="1">Lutetium</td> </tr> </table>																		57	138.91	140.12	140.91	144.24	145	147	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.04	174.97	Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium
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Z	mass	name	made																																														
Smb	name	made																																															



Origin of Earth. Basics of chemistry

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Acids and bases

- Acids: take out H^+ (proton), like
 $HCl \rightarrow H^+ + Cl^-$
- Bases: take out OH^- (hydroxyl)
 $NaOH \rightarrow Na^+ + OH^-$



Molar mass 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.



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



Summary

- In chemistry, moles are using to make chemical reactions go without problems
- Concentration will not change if we trow away half of liquid



For Further Reading



Mole. Wikipedia.

[http://en.wikipedia.org/wiki/Mole_\(unit\)](http://en.wikipedia.org/wiki/Mole_(unit))

