AL- MUSTAQBAL UNIVERSITY
College Of Health And Medical Techniques
Prosthetic Dental Techniques Department
Second Grade
Second Semester

Advanced chemistry

Lecture 1 (The theoretical part)

(Cells & Biomolecules)

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Giving the lecture

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Biochemistry:

Cells & Biomolecules:

The body of different living organisms consists of cells that consist of different organelles. Each organelle do an important functions as shown in the table:

Water & pH

Organelles	major functions
Nucleus	site of chromosomes – transcription
Mitochondrion	citric acid cycle – oxidative phosphorylation
Ribosome	Site of protein synthesis (translation of mRNA into protein)
Endoplasmic Reticulum	Synthesis of various lipids – support ribosome-Oxidation of many xenobiotics (cytochrome.p450)
Lysosome	site of many hydrolysis enzymes for catalyzing & degradation reactions)
Pl.memb.	1-Tramsport of molecules in & out of cells 2-Intracellulaur adhesion comwion
Golgi apparatus	Intracellular storage of protein-Glycosylation & sulfatation reactions
Peroxisome	1-Degradation of certain fatty acids & amino acids 2-production & degradation of H_2O_2
Cytosol	Enzymes of glycolysis – FA synthesis
Cytoskeletion	Microfilaments- microtubules- intermediate filaments.

*Biomedical importance: 55-65 % of men body weight
45-55 % of women body weight

Note: $\frac{2}{3}$ of total body water is in the intracellular fluid (ICF)

$\frac{1}{3}$ of total body water is in the extracellular fluid (ECF)

*Homeostasis: The maintenance of the composition of the internal environment that is essential for health.

*Regulation of water balance: depends on

1-Hypothalamic mechanisms of controlling thirst
2-Antidiuretic hormone (ADH) =vasopressin
3-Retention or excretion of water by kidney.

*pH of extracellular fluid (plasma) =7.35-7.45 (controlled mainly by bicarbonate buffer system). The change in blood pH affects body functions & the are two types of changes:

1-Acidosis= (blood PH< 7.35) include diabetic ketoacidosis.

2-Alkalosis= (blood PH >7.45) include vomiting or with treatment with diuretic.

*Water is a dipole molecule because the charge (electrons) unequally distributed about its structure.
*Hydrogen bond: the electrostatic interaction between the nucleus (hydrogen ion) of one water molecule with unshared electron pair of another is termed a H-bond
eng.

*water exhibit a slight but physiologically important tendency to dissociate into hydronium ion & hydroxide ion

$$H_2O + H_2O \leftrightarrow H_3O^+ + OH^- \qquad (H_3O^+ \text{ usually written } H^+)$$

Dissociation constant $k = \frac{[H^+][OH^-]}{[H_2O]} \Rightarrow K[H_2O] = [H^+][OH^-]$

(Because the high conc. of water 55.56 molar is not significantly affected by dissociation)

(ion product)= $K[H_2O] = KW = [H^+][OH^-] = 10^{-7} * 10^{-7} = 10^{-14}$ (at 25°C)

*pH=the negative logarithm of hydrogen ion molar conc. (power of acidity)

pH=-log[H^+] , pH+pOH=14

NOTE: weak acids dissociate in water have dissociation constants

$$R - CO_2H \leftrightarrow RCO_2^- + H^+ \qquad K = \frac{[H^+][RCO_2^-]}{[RCO_2H]}$$

$$R - NH_3^+ \leftrightarrow R - NH_2 + H^+ \qquad K = \frac{[R - NH_2][H^+]}{[R - NH_3^+]}$$

*pK=-log [k]

*Henderson–Hasselbalch's equation: $PH = PK + \log\frac{[A^-]}{[HA]}$

*Buffering: the tendency of a solution to resist more effectively a change in pH following addition of strong acid or base.
*Important physiological buffers: HCO_3^-/H_2CO_3 and $H_2PO_4^-/HPO_4^{-2}$
Intracellular pr. /wate = tris buffer ( ) used in experiments of biochemistry.