

BIOCHEMISTRY- BP203T

UNIT: 1 BIOENERGETICS

CLASS: 7

TOPIC: ENERGY RICH COMPOUNDS

Energy-Rich Compounds: Definition and Classification

Definition

Energy-rich compounds are molecules that store and transfer large amounts of energy, typically in the form of high-energy phosphate bonds or thioester bonds. They play a central role in metabolism, fueling biochemical reactions like muscle contraction, biosynthesis, and active transport.

Characteristics:

- Contain unstable bonds that release significant energy upon hydrolysis.
- Serve as intermediates in metabolic pathways.
- Commonly found in ATP, GTP, NADH, etc.

Classification of Energy-Rich Compounds:

Class	Examples	Key Features
1. Phosphagens	ATP, GTP, CTP, creatine phosphate	High-energy phosphate bonds (~7.3 kcal/mol released per mole of ATP hydrolyzed)
2. Thioesters	Acetyl-CoA, Succinyl-CoA	Energy from sulfur-carbon bond; key in metabolism

Class	Examples	Key Features
3.Reduced Coenzymes	NADH, FADH ₂ , NADPH	Store energy as electrons; used in redox reactions and respiration
4. Enol Phosphates	Phosphoenolpyruvate (PEP)	Extremely high-energy; key in glycolysis
5. Acyl Phosphates	1,3-Bisphosphoglycerate	Energy-rich intermediates in glycolysis
6. Other High-Energy Compounds	UTP (in carbohydrate metabolism), S-adenosylmethionine (in methyl transfer)	Specialized biochemical roles

Example: ATP (Adenosine Triphosphate)

- Releases energy by hydrolysis:



- Standard free energy change (ΔG°): about -30.5 kJ/mol (-7.3 kcal/mol)

Role in Metabolism

- Link catabolic (energy-releasing) and anabolic (energy-consuming) pathways.
- Provide chemical energy for biosynthetic reactions and cellular work.