



IDX 10 [Biology][S]

Study Guide Issue #3

By [Gorden], Edited by [Editor]

NOTE: This is an official document by Index Academics. Unless otherwise stated, this document may not be accredited to individuals or groups other than the club IDX, nor should this document be distributed, sold, or modified for personal use in any way.

Contents: chapter 9

CHEMICAL ENERGY AND FOOD

- All organisms make energy by breaking down food
- Unit: calorie
- 1 calorie = amount of energy needed to raise the water 1 degree
- 1Calorie = 1000 calorie
- Carbohydrates & protein: 4000 calorie
- Fat: 9000 calorie

OVERVIEW OF CELLULAR RESPIRATION

- The controlled release of energy from food molecules in cells to form ATP in the release of oxygen
- Stages: glycolysis -> krebs cycle -> ETC

ELECTRON CARRIERS

- A compound that can accept a pair of high energy electrons and transfer them, along with most of their energy to another molecule
- $\text{NAD}^+ + 2\text{e}^- + \text{H}^+ \rightarrow \text{NADH}$
- $\text{FAD}^+ + 2\text{e}^- + \text{H}^+ \rightarrow \text{FADH}$

GLYCOLYSIS

- Total net yield: 2 pyruvic acid + 2ATP + 2NADH
- Use 2 ATP to produce 2ATP, net production: 2 ATP
- Advantage: fast, anaerobic

THE KREBS CYCLE

- Stage 1: citric acid production
 - 2 pyruvic acid \rightarrow 2 acetyl CoA + 2NADH + 2CO₂
 - 2 Acetyl CoA \rightarrow 2 citric acid
- Stage 2: energy extraction
 - 2 citric acid \rightarrow 6NADH + 2FADH₂ + 4CO₂ + 2ATP
- Total net yield: 2pyruvic acid \rightarrow 2ATP + 8NADH + 6FADH₂ + 6CO₂

ETC AND ATP SYNTHESIS

- use high energy electron carried by NADH and FADH₂ from glycolysis and krebs cycle to form ATP
- This process if called chemiosmosis - the cell uses the potential energy from charge difference built up as a result of electron transport
- high energy electrons released by NADH and FADH₂ are passed along electron transport chain, As e- transport down the ETC, their energy is used to pump H⁺ across the inner membrane, H⁺ diffuse back across inner membrane through ATP synthase and cause it to rotate. The rotation of ATP synthase cause ADP and P to form ATP
- Total net yield: release 32 or 34 ATP. (NADH = 3ATP, FADH₂ = 2ATP)

ALCOHOLIC FERMENTATION

- Step 1: glucose + 2NAD⁺ \rightarrow 2 pyruvic acid + 2ATP + 2NADH
- Step 2: 2 pyruvic acid + 2NADH \rightarrow 2 alcohol + 2CO₂ + 2NAD⁺
- Help produce bread, beer, and wine

LACTIC ACID FERMENTATION

- Step 1: glucose + 2NAD⁺ \rightarrow 2 pyruvic acid + 2ATP + 2NADH
- Step 2: 2 pyruvic acid + 2NADH \rightarrow 2 NAD⁺ + 2lactic acid
- In bacteria (cheese, yogurt)

OXYGEN DEBT

- Cells require extra O₂ to break down the lactic acid (by-product) built