

Topics of Competitive and Comprehensive Exams for Doctoral Degree Program (Order of topics is in accordance with Voet D and Voet JG, Biochemistry, 4th edition, 2011). However, there is a list of recommended readings: Harper's Illustrated Biochemistry, Lehninger Principles of Biochemistry, Lippincott Illustrated Reviews: Biochemistry, Pearson's Biochemistry.

Chapter 5: Nucleic Acids, Gene Expression, and Recombinant DNA Technology

Section 1: Nucleotides and Nucleic Acids

- A. Nucleotides, Nucleosides, and Bases**
- B. The Chemical Structures of DNA and RNA**

Section 2: DNA Is the Carrier of Genetic Information

- A. Transforming Principle Is DNA**
- B. The Hereditary Molecule of Many Bacteriophages Is DNA**

Section 3: Double Helical DNA

- A. The Watson–Crick Structure: B-DNA**
- B. DNA Is Semiconservatively Replicated**
- C. Denaturation and Renaturation**
- D. The Size of DNA**

Section 4: Gene Expression and Replication: An Overview

- A. RNA Synthesis: Transcription**
- B. Protein Synthesis: Translation**
- C. DNA Replication**

Section 5: Molecular Cloning

- A. Restriction Endonucleases**
- B. Cloning Vectors**
- F. The Polymerase Chain Reaction**

Chapter 6: Techniques of Protein and Nucleic Acid Purification

Section 1: Protein Isolation

- A. Selection of a Protein Source**
- B. Methods of Solubilization**
- C. Stabilization of Proteins**
- D. Assay of Proteins**
- E. General Strategy of Protein Purification**

Section 2: Solubilities of Proteins

- A. Effects of Salt Concentrations**
- B. Effects of Organic Solvents**
- C. Effects of pH**
- D. Crystallization**

Section 3: Chromatographic Separations

- A. Ion Exchange Chromatography**
- B. Gel Filtration Chromatography**
- C. Affinity Chromatography**

Section 4: Electrophoresis

- B. Gel Electrophoresis**
- C. SDS–PAGE**
- D. Isoelectric Focusing**

Section 6: Nucleic Acid Fractionation

- A. Solution Methods**
- B. Chromatography**
- C. Electrophoresis**

Chapter 7: Covalent Structures of Proteins and Nucleic Acids

Section 1: Primary Structure Determination of Proteins

- A. End Group Analysis: How Many Different Types of Subunits?**
- B. Cleavage of the Disulfide Bonds**
- C. Separation, Purification, and Characterization of the Polypeptide Chains**
- D. Specific Peptide Cleavage Reactions**
- E. Separation and Purification of the Peptide Fragments**
- F. Sequence Determination**
- G. Ordering the Peptide Fragments**
- H. Assignment of Disulfide Bond Positions**

Section 2: Nucleic Acid Sequencing

- A. The Sanger Method**
- B. Genome Sequencing**
- C. Next Generation DNA Sequencing Technologies**
- D. Nucleic Acid Sequencing versus Amino Acid Sequencing**

Chapter 14: Rates of Enzymatic Reactions

Section 2: Enzyme Kinetics

A. The Michaelis–Menten Equation

B. Analysis of Kinetic Data

C. Reversible Reactions

Section 3: Inhibition

A. Competitive Inhibition

B. Uncompetitive Inhibition

C. Mixed Inhibition

Section 4: Effects of pH

Chapter 16: Introduction to Metabolism

Section 1: Metabolic Pathways

Please note that you need to be aware about the Map of the major metabolic pathways in a typical cell. The following topics are required: glycolytic pathway, Krebs' cycle, pentose phosphate pathway, gluconeogenesis, glycogenesis, glycogenolysis, amino acids biosynthesis, amino acids degradation (transamination, deamination, decarboxylation), urea cycle.

Section 2: Organic Reaction Mechanisms

A. Chemical Logic

B. Group-Transfer Reactions

C. Oxidations and Reductions

Chapter 22: Electron Transport and Oxidative Phosphorylation

Section 1: The Mitochondrion

A. Mitochondrial Anatomy

B. Mitochondrial Transport Systems

Section 2: Electron Transport

A. Thermodynamics of Electron Transport

B. The Sequence of Electron Transport

C. Components of the Electron-Transport Chain

Section 3: Oxidative Phosphorylation

A. Energy Coupling Hypotheses

B. Proton Gradient Generation

C. Mechanism of ATP Synthesis

Chapter 25: Lipid Metabolism

Section 1: Lipid Digestion, Absorption, and Transport

Section 2: Fatty Acid Oxidation

A. Fatty Acid Activation

B. Transport Across the Mitochondrial Membrane

C. Oxidation

D. Oxidation of Unsaturated Fatty Acids

E. Oxidation of Odd-Chain Fatty Acids

F. Peroxisomal Oxidation

G. Minor Pathways of Fatty Acid Oxidation

Section 3: Ketone Bodies

Section 4: Fatty Acid Biosynthesis

A. Pathway Overview

B. Acetyl-CoA Carboxylase

C. Fatty Acid Synthase

D. Transport of Mitochondrial Acetyl-CoA into the Cytosol

E. Elongases and Desaturases

F. Synthesis of Triacylglycerols