Contents

SECTION 1: BASIC CHEMISTRY

Branches of Chemistry *2*

1. Elementary Knowledge of Inorganic Chemistry **3**

Structure of Atom *4*
Key Terms in Chemistry *5*
Acids, Bases, and Salts *7*
pH *10*
Solutions and Dilutions *19*
Isotope and Radioisotope *25*

2. Elementary Knowledge of Organic Chemistry **39**

Organic Compounds *39*
Aliphatic and Aromatic Compounds *41*
Functional Groups *42*
Hydrocarbons *44*
Homologous Series *47*

3. Elementary Knowledge of Physical Chemistry **50**

Osmosis and Diffusion *50*
Colloids *52*
Surface Tension *54*

4. Elementary Knowledge of Analytical Chemistry **59**

Balances *60*
Centrifuge *67*
pH Meter *69*
Colorimeter *73*
Spectrophotometer *78*
Differences between Colorimeter and Spectrophotometer *81*
Fluorimeter *82*
Flame Photometer *85*

Urinometer *88*
Densitometer *89*

5. Elementary Knowledge of Biostatistics **92**
Common Statistical Terms *92*
Notations for a Population and Sample Values *94*
Types of Data *95*
Presentation of Data *97*
Measures of Central Tendencies *99*
Measures of Variability *103*
Estimation Statistics *112*
Hypothesis Test *114*
t-Test *117*
Chi-Square Test for Population Standard Deviation *118*

SECTION 2: FUNDAMENTALS OF BIOCHEMISTRY

6. Aim and Scope of Biochemistry **125**
History of Biochemistry *125*
Scope of Biochemistry *126*
Aims/Objectives of Clinical Biochemistry *128*

7. Structure of Cell **130**
Cell Organelles *131*
Cell Membrane *131*
Cytoplasm *131*
Nucleus *131*
Ribosomes *132*
Endoplasmic Reticulum *132*
Lysosomes *132*
Centrosomes *133*
Vacuoles *133*
Golgi Bodies *133*
Mitochondria *133*
Peroxisomes *134*
Cytoskeleton *134*
Functions of the Animal Cell *134*
Types of Cells *136*

8. Study of Carbohydrates **139**
Classification *139*
Detective Tests for Carbohydrate *141*
Metabolism *142*
Carbohydrate Metabolism *144*
Comparisons between Glycolysis and Krebs Cycle *151*
Disorders of Carbohydrate Metabolism *151*
Biochemical Importance of Carbohydrate *155*

9. Study of Proteins **159**
Classifications *159*
Detective Tests for Proteins *162*
Metabolism of Protein *162*
Diseases Related to Protein Metabolism *171*
Biochemical Importance of Proteins *175*

10. Study of Lipids **178**
Classifications *178*
Detective Tests for Lipids *180*
Lipid Metabolism *180*
Diseases Related to Lipid Metabolism *185*
Disorders of Lipid Metabolism *186*
Biochemical Importance of Lipids *189*

11. Study of Nucleic Acids **192**
Components of Nucleic Acids *192*
Structure of DNA *193*
Structure of RNA *195*
Comparisons of DNA and RNA *196*
DNA Replication *197*
Genetic Disorders *204*
Biological Importance of Nucleic Acid *207*

SECTION 3: CLINICAL BIOCHEMISTRY

12. Introduction to Clinical Biochemistry **211**
Biochemistry Laboratory *211*
Standard International Units *213*
Laboratory Glassware *220*

Collection of Samples Used in Biochemistry Laboratory *226*
Reporting and Interpretation of Results *236*

13. Advanced Analytical Techniques–I **242**
Chromatography *242*
Mass Spectroscopy *255*

14. Advanced Analytical Techniques–II **261**
Immunoassay *261*
Electrophoresis *269*
Blotting Techniques *271*

15. Enzyme Assay **281**
Properties of Enzyme *281*
Unit of Enzyme *282*
Coenzymes and Cofactors *282*
Factors Affecting Enzyme Reaction *287*
Importance of Enzymes *288*
Amylase *290*
Serum Lipase *294*
Serum Lactate Dehydrogenase *297*
Phosphates *299*
Reactions *300*
Creatine Phosphokinase Isoenzymes Test *302*
Method of Diagnosis for Creatine Kinase Isoenzymes *304*
Reagent Composition *305*
Procedure *305*
Calculations *306*

16. Water and Mineral Metabolism **311**
Distribution of Water in the Body *311*
Water Balance *312*
Physiological Functions of Water *313*
Regulation of Passage of Water *314*
Thirst *314*
Minerals *314*

17. Inborn Errors of Metabolism **325**
Carbohydrate Metabolism *326*
Pyruvate Metabolism *331*
Protein Metabolism *332*

Lipid Metabolism *336*
Nucleic Acid Metabolism *339*
Diagnosis of Inborn Errors of Metabolism *340*

18. Endocrine Glands and Hormones **344**
Functions of Hormones *344*
Chemical Nature of Hormones *345*
Mechanism of Hormone Action *346*
Control of Hormone Secretion *348*
Endocrine Glands *353*
Hormones Secreted by Organs *368*

19. Thyroid Function Tests **376**
Location and Morphology of Thyroid Gland *376*
Synthesis and Release of Thyroid Hormones *377*
Hormones of Thyroid Gland *378*
Parathyroid Gland *379*
Thymus *380*
Thyroid Function Tests *380*
Thyroid-Stimulating Hormone Test *380*
T_3 and T_4 Tests *384*
Clinical Interpretation *387*
Thyroid Function Tests in Pregnancy *387*

20. Diabetic Profile **391**
Types of Diabetes *392*
Diagnosis of Diabetes *396*

21. Liver Function Tests **418**
Morphology and Functions *418*
Serum Bilirubin *420*
Transaminases *426*
Serum Proteins *431*
Alkaline Phosphatase *434*
Urine Analysis: Bile Salt, Bile Pigment, and Urobilinogen *437*

22. Renal Function Tests **444**
Structure and Functions of Kidney *444*
Renal Function Tests *447*

23. Cardiac Function Tests **469**
Structure and Function of Heart *469*
Cardiac Function Tests *471*
Total Lipids *479*

24. Electrolytes **484**
Introduction and Classification *484*
Serum Sodium and Potassium *485*
Urine Sodium and Potassium *491*
Serum and Urine Chloride *492*
Serum and Urine Phosphorus *495*
Serum and Urine Calcium *498*

25. Body Fluids **502**
Seminal Fluid *502*
Amniotic Fluid *507*
Cerebrospinal Fluid *510*
Pericardial Fluid *512*
Pleural Fluid *515*
Peritoneal Fluid *518*
Synovial Fluid *523*

26. Blood pH and Buffer System **529**
Importance of Maintaining Blood pH *529*
Measurement of pH *530*
pH Meter *530*
Procedure and Precaution of Measurement of Blood pH *533*
Need of Buffer System *533*
Buffer Systems in the Body *534*

27. Arterial Blood Gases **541**
Collection of Arterial Blood Specimen *542*
Arterial Blood Gas Analysis *543*
Blood Gas Analyzer *554*
Acid-Base Balance *555*

28. Vitamin Assay **561**
Purpose of Vitamin Deficiency Testing *566*
Essential Vitamins *566*

29. Tumor Markers **596**
Types of Tumor Markers *596*
Uses of Tumor Markers *598*
List of Tumor Markers *599*
Testing of Tumor Markers *607*
Limitations of Tumor Markers *609*

30. Therapeutic Drug Monitoring **612**
Indications for Drug Level Determination *613*
Drugs for Therapeutic Drug Monitoring *613*
Information Required for Therapeutic Drug Monitoring *614*
Collection of Sample *615*
Pharmacokinetic Analysis *616*
Target Drug Concentration Range *617*

31. Automation in Clinical Biochemistry **619**
Steps in Automated Analysis *620*
Classification of Analyzers *623*
Care and Maintenance of Analyzers *628*
Routine Biochemistry Analyzers *630*
Total Laboratory Automation *636*
Biosensors *638*
Nanotechnology *640*

Index *643*