ITPD Competency Exam Study Guide

Applicants are required to pass a pharmacy foundations competency exam comprised of multiple topics, provided as four separate exams (biochemistry, medicinal chemistry, pharmaceutics, pharmacology). Applicants will need to pass each exam. The exams will assure baseline knowledge in coursework typically provided in the first and second years of the entry-level Doctor of Pharmacy program and likely provided in the applicant's BS in Pharmacy coursework.

The examinations will take place as a requirement prior to admission. Results of the competency exams will be valid for 2 years (or two admission cycles). Applicants will be limited to sitting for the exams twice per admission cycle. After sitting for the competency exams four times, restrictions may be placed on any subsequent registration. Read through the documents below to learn more about the exam.

**Learning Objectives and Study Guide** – The learning objectives and suggested resources all applicants should use to prepare for the exam.

Biochemistry

1. Describe why pharmacists need to know biochemistry
2. Discuss the four levels of protein structure (primary, secondary, tertiary, and quaternary)
3. Describe how protein structure determines protein function and explain the underlying mechanisms such as allostery and cooperativity
4. Discuss how diseases are triggered by affecting protein stability, folding, and aggregation
5. Explain the biochemical and genetic similarities and differences in disease trigger mechanisms of various diseases associated with protein defects.
6. Define what enzymes are and how they work
7. Describe the principles of enzyme inhibition and the drug development for various diseases
8. Identify different lipid assemblies
9. Discuss the mechanisms by which mRNA delivered
10. Describe the biochemistry of biologic therapeutics
11. Describe fundamental biochemical mechanisms related to DNA replication
12. Identify key therapeutic interventions related to genetic mutations and cancer
13. Explain how transcription and translation regulate key cellular functions.
14. Discuss therapeutic approaches targeted toward transcriptional and translational processes
15. Apply the two laws of thermodynamics to metabolic pathways
16. Define the central role of ATP and other high-energy intermediates in regulating energy metabolism
17. Relate the metabolism of sugars and proteins to fat accumulation, metabolic diseases and disorders
18. Apply the mechanism of lipid metabolism to starvation and diabetes

Medicinal Chemistry

1. Define and distinguish structure, properties, biological functions, applicable kinetics, and metabolic fate of macromolecules essential to life (e.g. proteins and nucleic acids).
2. Identify endogenous targets for drug therapy based on drug structure or its mechanism of action.
3. Rationalize and distinguish drug design strategies
4. Define and recognize basic principles, mechanisms, functional changes, and metabolic sequelae of human disease impacting cells, organs, and systems.
5. Define and apply the core concepts of Medicinal Chemistry
6. Relate chemical basis of drug action and compare behavior in vivo and in vitro
7. Characterize and differentiate pharmacophore models
8. Apply and distinguish physicochemical properties, structure-activity relationships intermolecular drug-receptor interactions and metabolism to therapeutic decision-making
9. Recognize and distinguish the genetic basis for disease and individual differences in metabolizing enzymes, transporters and other biochemicals impacting drug disposition and action that underpin the practice of personalized medicine
10. Apply knowledge of physicochemical and kinetic principles and parameters to therapeutically important issues, such as drug delivery, disposition, therapeutic effectiveness
11. Define and distinguish mechanisms of therapeutic and adverse drug actions and interactions
12. Evaluate the therapeutic value, safety and regulation of pharmacologically active natural products and dietary supplements.

Pharmaceutics

1. Solve for various foundational pharmaceutical calculations required to accurately prepare prescriptions, including pH, milliequivalents, patient-specific drug dosing and more.
2. Characterize USP and FDA requirements and the events in history that led to current U.S. laws and regulations.
3. Identify and apply key physical chemistry properties in the development and delivery of pharmaceutical products.
4. Differentiate various formulations, manufacturing of these formulations including excipients, and delivery methods of the formulations.
5. Describe how biological aspects of the body interact with the physiochemical properties of the drug, the dosage form in which the drug is given, and pharmacokinetic properties such as absorption and distribution.

Pharmacology & Toxicology

1. Identify the components of basic neuroanatomy.
2. Compare and contrast the structure and function of neurons and glial cells.
3. Identify the similarities and differences between different types of neuronal receptors and explain the molecular basis of their activity.
4. Explain what membrane potentials, action potentials, and synaptic potentials are, and how they integrate in neurotransmission.
5. Explain how the dose-response curve of a drug can provide information about potency, efficacy, and safety predictability.
6. Distinguish between agonists (full, partial, and inverse) and antagonists (competitive, reversible, noncompetitive and irreversible), and the resultant consequences for their use.
7. Illustrate the difference between drug potency and drug efficacy.
8. Describe the basic functions of the endogenous opioid system.
9. Provide examples of classes of opioid drugs, their mode of action, and the disease states for which they are used.
10. Chart the anatomical projections of the sympathetic and parasympathetic autonomic nervous system (ANS).
11. Connect the concepts of homeostasis, fight-or-flight, and rest-and-digest to the associated physiology of the ANS.
12. Integrate the mechanism of action of ANS drugs with their physiologic response, and the resultant effect on the associated disease conditions.
13. Explain the fundamental concepts and importance of cellular defense mechanisms in protecting cells from various internal and external threats.
14. Apply knowledge of cellular injury mechanisms to differentiate between reversible and irreversible changes in cells under different injurious conditions.
15. Explain the sequence of events in acute inflammation, including vasodilation, increased vascular permeability, cellular migration, and tissue repair mechanisms.
16. Apply knowledge of inflammatory pathways to predict the cellular and molecular changes that occur during specific inflammatory conditions, such as infections or tissue injuries.
17. Explain the biochemical pathways affected by NSAIDs, particularly the inhibition of COX enzymes.
18. Utilize understanding of steroid mechanisms to propose therapeutic applications in managing inflammatory conditions or immune-related disorders.
19. Apply knowledge of liver physiology and toxicology to predict the potential hepatotoxic effects of specific drugs or environmental toxins.
20. Analyze the pathways and mechanisms involved in drug metabolism that can lead to the generation of reactive metabolites causing liver toxicity.
21. Explain the mechanisms by which certain drugs, toxins, and diseases induce kidney toxicity.
22. Provide examples of career paths for PharmDs in clinical toxicology.
23. Calculate expected blood concentrations of ingested drugs.
24. Evaluate the impact of ethanol metabolism on the body, including its implications for alcohol tolerance, dependence, and withdrawal.
25. Explain the DSM-5 criteria for alcohol use disorders.
26. Illustrate the toxic effects of acute and chronic alcohol consumption on the CNS.

**Suggested Study Resources**

* Suggested Textbooks for Biochemistry
  + “Lehninger Principles of Biochemistry”, by David L. Nelson and Michael M. Cox, Eighth Edition.
  + “Biochemistry” by Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto, Jr., and Lubert Stryer, Ninth Edition
* Suggested Textbooks for Medicinal Chemistry
  + Foye’s Principles of Medicinal Chemistry 7th edition. Thomas L. Lemke. Lippincott Williams & Wilkins; 2012
  + Foye’s Essentials in Medicinal Chemistry
* Suggested Textbooks for Pharmaceutics
  + Applied Pharmaceutics in Contemporary Compounding, Third Edition. Robert P. Shrewsbury, Ph.D.
* Suggested Textbook for Pharmacology
  + Lange Brunton L L, Blumenthal D K, Murri N, Dandan R H, Knollmann B C. Goodman & Gilman's The Pharmacological Basis of Therapeutics. 12th ed. New York: McGraw-Hill, 2011
* The APhA Complete Review for the FPGEE by Dick R. Gourley