National Board of Examiners in Optometry

2005 Content Outline
(Part I, II, III and TMOD)
PART I (BASIC SCIENCE)

Basic Science tests/measures a candidate's fundamental knowledge and understanding of the scientific principles upon which optometric practice is based so that subsequent mastery of clinical content, both systemic and ocular, can occur. In addition, this test assesses those basic science areas that relate to the safe and effective treatment of ocular diseases as well as providing a basis for life-long learning in optometry. Basic Science is composed of four major subject areas, which parallel four of the Clinical Science subject areas. The subject areas and their relative emphases are shown below.

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Number* of Items</th>
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<tr>
<td><strong>A. Human Biology-195 Items (45%)</strong></td>
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<tr>
<td>1. Gross Anatomy</td>
<td>8-12</td>
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<td>2. Histology</td>
<td>14-22</td>
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<td>3. Neuroscience</td>
<td>19-27</td>
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<td>4. General Biochemistry</td>
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<td>5. General Physiology</td>
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<td>6. General Microbiology</td>
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<td>8. General Pharmacology</td>
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<td>9. General Pathology</td>
<td>23-35</td>
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<td><strong>B. Ocular/Visual Biology-90 Items (21%)</strong></td>
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<td>1. Anatomy of the Eye, Ocular Adnexa and Visual Pathway</td>
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<td>2. Ocular and Visual Pathway Development</td>
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<td>3. Ocular Physiology/Neurophysiology</td>
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<td>4. Ocular Pharmacology</td>
<td>13-21**</td>
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<td><strong>C. Theoretical, Ophthalmic, and Physiological Optics-125 Items (29%)</strong></td>
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<td>2. Physical Optics</td>
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<td>3. Ophthalmic Optics</td>
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<td>4. Visual Optics</td>
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<td>5. Visual Perception</td>
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<td>6. Ocular Motility</td>
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<td><strong>D. Psychology-25 Items (6%)</strong></td>
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<tr>
<td>1. Psychophysical Methodology</td>
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<td>2. Human Development</td>
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</tbody>
</table>

**TOTAL 435**

* The number of items indicates the actual number for each of the four major subject areas, and a range for each content area within a subject. The range specifies the minimum and maximum number of items in each content area that will be administered on the test. The percentage of items indicates the actual percentage for each of the four major subject areas, rounded to the nearest integer.

** Items on the applied, clinical aspects of ocular pharmacology and ocular microbiology and immunology are distributed throughout the Clinical Science content as appropriate to the condition being tested.
A. Human Biology - 195 Items (45%)

"Human Biology" covers the fundamental knowledge and scientific principles of the biomedical sciences which are applied in the recognition and management of systemic conditions that can present to the optometrist by patients seeking primary eye care. It also covers the fundamental knowledge of the biomedical sciences that provides an understanding of the prevention, diagnosis, treatment and management of ocular diseases. It is composed of nine major subdivisions: Gross Anatomy, Histology, Neuroscience, General Biochemistry, General Physiology, General Microbiology, General Immunology, General Pharmacology, General Pathology.

1. Gross Anatomy (8-12 Items)

A. Head and neck
1. Skull (e.g., bones, sutures, fossae, foramina)
2. Superficial and deep arteries, veins and lymphatics
3. Muscles of facial expression and mastication
4. Muscles of the neck
5. Peripheral nerve distributions
6. Cervical triangles and their contents, root of neck, thyroid and parathyroid glands
7. Salivary glands
8. Nose
9. Paranasal sinuses and their relations to the orbit and orbital contents
10. Ear (e.g., outer ear, middle ear, walls, muscles, inner ear)
11. Dural venous sinuses; meninges; cerebrospinal fluid

B. Thorax
1. Lungs (e.g., lobes)
2. Pulmonary circulation
3. Heart (e.g., surfaces)
4. Superior mediastinum (e.g., trachea, esophagus)

C. Abdomen/pelvis
1. Liver (e.g., concept of a portal system)
2. Accessory digestive organs (e.g., gallbladder, pancreas)
3. Other internal organs (e.g., spleen, kidney)
4. Gastrointestinal system (e.g., stomach)

D. Systemic circulation of blood and lymph

2. Histology (14-22 Items)

A. Generalized cell
1. Molecular components, unit membrane
2. Organelles (e.g., plasma membrane, endoplasmic reticulum)
3. Inclusions (e.g., pigments)
4. Nucleus
5. Cytoskeleton (e.g., microtubules)

B. Tissue types
1. Epithelium
   a. Lining epithelium
      1) Simple, stratified, pseudostratified
      2) Squamous, cuboid, columnar
      3) Surface specializations (e.g., microvilli)
      4) Cell junctions (e.g., zonula occludens)
      5) Basal lamina
   b. Secretory epithelium
      1) Unicellular vs. multicellular
      2) Exocrine, endocrine, paracrine, autocrine
      3) Secretory unit, mode of secretion
      4) Connective tissue element
2. Connective tissue
   a. Connective tissue proper
      1) Types: dense, loose, elastic, reticular
      2) Cells
      3) Fibers (e.g., collagen)
      4) Matrix
   b. Specialized connective tissues
      1) Blood
         a) Plasma
         b) Cells
         c) Platelets
      2) Bone
      3) Cartilage and synovial joints
      4) Fat: multilocular, unilocular

3. Muscle
   a. Smooth
   b. Striated
   c. Cardiac
   d. Receptors (e.g., muscle spindles)

4. Nervous Tissue
   a. Neuron
   b. Ganglia
   c. Neural coverings (e.g., myelin, perineurium)
   d. Neuroglia
   e. Synapse
   f. Terminals

C. Organ systems
   1. Integumentary system
      a. Skin (e.g., layers, cell types, hair)
      b. Cutaneous glands: sebaceous, sweat
      c. Receptors
         1) Free nerve endings
         2) Encapsulated nerve endings (e.g., pacinian corpuscles)
   2. Cardiovascular system
      a. Heart
         1) Tissue layers
         2) Valves
         3) Conduction system
      b. General histology of blood vessels
         1) Capillaries
         2) Arteries
         3) Arterioles
         4) Veins
   3. Lymphatic system
      a. Lymph vessels
      b. Lymph nodes
      c. Spleen
      d. Thymus
      e. Tonsils
      f. Lymphatic tissue associated with mucous membrane
4. Respiratory system
   a. Nose
   b. Paranasal air sinuses
   c. Nasopharynx
   d. Larynx
   e. Trachea
   f. Lungs
   g. Blood vessels associated with the respiratory system

5. Digestive system
   a. Oral cavity
   b. Esophagus
   c. Stomach
   d. Small intestine
   e. Large intestine
   f. Salivary glands
   g. Pancreas
   h. Liver, gallbladder
   i. Blood vessels associated with the digestive system

6. Urinary system
   a. Kidney
   b. Ureter, bladder, urethra
   c. Blood vessels associated with the urinary system

7. Endocrine System
   a. Thyroid
   b. Islets of Langerhans
   c. Pituitary
   d. Adrenal gland
   e. Gonads

3. Neuroscience (19-27 Items)
   A. Neurohistology
      1. Histogenesis in the nervous system
         a. Neural plate, neural fold, neural groove, neural tube, neural vesicles
         b. Derivatives of neural crest (e.g., ganglia, adrenal medulla)
         c. Layers of neural tube (e.g., ependymal, mantle, marginal)
      2. Degeneration and regeneration in the nervous system

   B. Electrophysiology of the nerve cell
      1. Basis of resting potential (e.g., ionic balance, transport mechanisms)
      2. Basis of action potential (e.g., ionic balance)
      3. Action potential conduction
      4. Synapses, classification, transmission, neurotransmitters
      5. Membrane physiology, receptors, membrane channels
      6. Inhibitory and excitatory postsynaptic potentials (including concepts of spatial and temporal summation)
      7. Strength - duration curve
C. Neuroanatomy (including functions and connections)

1. Spinal cord
   a. Gray matter (e.g., nuclei, local reflex arcs)
   b. White matter (e.g., ascending pathways, descending pathways)
   c. Spinal nerves and sensory ganglia

2. Autonomic nervous system
   a. Parasympathetic
   b. Sympathetic
   c. Neurotransmitters (e.g., types, locations)

3. Medulla
   a. Level of motor decussation
   b. Level of sensory decussation
   c. Level of inferior olives
   d. Level of open medulla
   e. Dorsal and ventral cochlear nuclei
   f. Vestibular nuclei

4. Pons
   a. Low or caudal pons
   b. Abducens nerve
   c. Mid pons
   d. Trigeminal nerve
   e. Facial nerve

5. Midbrain
   a. Level of inferior colliculus
   b. Trochlear nerve
   c. Level of superior colliculus
   d. Oculomotor nerve
   e. Level of pretectum (e.g., light reflex)

6. Diencephalon
   a. Dorsal thalamus
   b. Hypothalamus
   c. Epithalamus
   d. Subthalamus

7. Cerebrum
   a. Gray matter (e.g., cytoarchitecture (layers), Brodmann’s cortical areas)
   b. White matter (e.g., projections, internal capsule, optic radiations, commissural fibers, associational fibers)
   c. Functions

8. Cerebellum

9. Blood supply
   a. Surface arteries
   b. Circle of Willis and its branches

D. Neurophysiology

1. Integration of nerve signals (e.g., synaptic processes, reflexes, feedback, adaptation and habituation)
2. Sensory coding (e.g., receptive field concept)
3. Somatosensory system
4. Auditory system
5. Vestibular system
6. Motor pathways
7. Autonomic nervous system
8. Significance of evoked potentials, CT and PET scanning, and MRI
4. General Biochemistry (21-31 Items)

A. Cellular biochemistry
   1. Compartmentalization
   2. Cell organelles
   3. Intracellular/extracellular
   4. Cell communication
   5. Bonds and molecular interactions

B. Proteins
   1. Structure and types
      a. Alpha amino acids, peptide bond
      b. Primary, secondary, tertiary and quaternary structure
      c. Multimers
      d. Globular/fibrous
      e. Enzymes
      f. Antibodies
      g. Connective-tissue/collagen
      h. Hemoglobins
   2. Mechanism of enzyme action
      a. Biocatalysis
      b. Activation energy
      c. Michaelis-Menten model (e.g., Michaelis-Menton equation, Lineweaver-Burk plot)
      d. Allosteric interaction/positive and negative feedback modulation
      e. Reversible covalent modification/enzyme cascades
      f. Proteolytic activation
      g. Stimulation and inhibition by control/regulatory proteins

C. Bioenergetics and energy storage
   1. Free energy/entropy/enthalpy/equilibrium
   2. Endergonic, exergonic and coupled reactions
   3. Oxidation-reduction
   4. pH and Henderson-Hasselbalch equation, biological buffers
   5. ATP and other nucleotide phosphates
   6. NADH and FADH
   7. NADPH
   8. Acetyl CoA

D. Carbohydrate biochemistry
   1. Structure and function
      a. Monosaccharides, oligosaccharides, polysaccharides
      b. Glycosaminoglycans
      c. Proteoglycans
      d. Glycoproteins
   2. Glycolysis/glucose metabolism
   3. TCA cycle
   4. Pentose phosphate pathway
   5. Gluconeogenesis
   6. Glycogen synthesis, storage and breakdown/utilization
   7. Electron transport system and oxidative phosphorylation
      a. Mitochondrial structure/function/DNA
      b. Electron transport/pH coupling
E. Lipid biochemistry
1. Structure and function
   a. Fatty acids/icosanoids
   b. Triacylglycerols
   c. Phosphoglycerides
   d. Sphingolipids
   e. Sterol derivatives
   f. Isoprenoids
2. Digestion, absorption, and transport of lipids (e.g., types of lipoproteins)
3. Fatty acid metabolism (e.g., beta-oxidation, ketone bodies, gluconeogenesis)
4. Cholesterol and steroid metabolism
5. Membrane biochemistry
   a. Unit membrane/lipid bilayer
   b. Fluid mosaic model
   c. Membrane proteins and lipids/structure and function

F. Molecular Biology
1. DNA structure and function
   a. Deoxynucleotides and synthesis
   b. Base pairing/double helix
   c. Genetic code/introns, exons
   d. Chromosome structure
2. RNA Structure and function
   a. Ribonucleotides and synthesis
   b. Messenger RNA synthesis and function
   c. Ribosomal RNA synthesis and function
   d. Transfer RNA synthesis and function
3. DNA replication
4. Protein synthesis
   a. Ribosome function
   b. Initiation, elongation, and termination
   c. Post-translational modification/protein sorting
5. Gene expression and regulation
6. Mutations and repair
7. Oncogenes/proto-oncogenes/tumor suppressor genes
8. Tools of recombinant DNA technology (e.g., polymerase chain reaction, chromosome analysis, Southern blot)
9. Molecular therapy (e.g., gene therapy, anti-sense therapy)
10. Cell cycle
11. Genomics
12. Proteomics
13. Apoptosis

G. Nutrition
1. Digestion of proteins, carbohydrates and lipids
2. Essential amino acids
3. Vitamins
   a. Classification
   b. Function
4. Minerals
5. Oxygen toxicity/antioxidants/control of free radicals, peroxide, and superoxides
5. General Physiology (20-28 Items)

A. Cellular functions
   1. Cytoplasm and cytoskeleton (e.g., microtubules, microfilaments)
   2. Functions of organelles (e.g., endoplasmic reticulum)
   3. Intracellular and extracellular environment
   4. Membrane potential and transport mechanisms
   5. Membrane receptors and postreceptor events

B. Respiration
   1. Mechanics of breathing
   2. Gas exchange in the lungs
   3. Diffusion of oxygen and carbon dioxide
   4. Oxygen transport and hypoxia, carbon dioxide transport
   5. Regulation of respiratory rate
   6. Acid-base balance

C. Gastrointestinal activity
   1. Absorption
   2. Motility
   3. Nervous and hormonal regulation
   4. Associated structures (e.g., liver, pancreas, salivary glands)

D. Muscle
   1. Neuromuscular junctions
   2. Conduction and contraction
   3. Types of contraction (e.g., isometric, isotonic)
   4. Reflex arc (e.g., muscle spindles, Golgi tendon organ)
   5. Smooth muscle

E. Body fluids
   1. Composition of body fluids
   2. Control systems of the body (e.g., exchange of water and electrolytes between body compartments)
   3. Regulation of volume and osmolarity of extracellular fluid

F. Renal system and body fluids
   1. Nephron, tubular reabsorption and secretion
   2. Regulation of glomerular filtration
   3. Functional characteristics of renal blood vessels
   4. Renal regulatory mechanisms
   5. Renal control of blood pressure and water balance
   6. Renal control of plasma sodium and potassium levels
   7. Regulation of acid-base balance

G. Circulatory system
   1. Mechanical events of cardiac cycle
   2. Electrical activity of the heart (e.g., pacemaker potentials, action potentials and spread of activity)
   3. Significance of EKG
   4. Hemodynamics (e.g., pressure and resistance relationships)
   5. Regulation of blood flow and pressure (e.g., autonomic)
   6. Lymph formation and function
   7. Blood and its functions (e.g., hemostasis)
H. Endocrine system
1. Hormones (e.g., synthesis, mechanism of action)
2. Hypothalamic control of pituitary gland
3. Pituitary control of endocrine glands
4. Functions and regulations of adrenal cortex (e.g., glucocorticoids, mineral corticoids)
5. Functions and regulation of adrenal medulla (e.g., epinephrine)
6. Functions and regulation of thyroid gland (e.g., TSH, T₃, T₄)
7. Functions and regulation of pancreatic insulin and glucagon
8. Regulation of blood sugar levels
9. Functions and regulation of vitamin D, parathyroid hormone and calcitonin
10. Functions and regulation of endorphin, enkephalin and growth hormone blood levels

I. Reproductive system
1. Functions and regulation of reproductive hormones
2. Pregnancy, birth and lactation

6. General Microbiology (11-17 Items)
A. Bacteriology
1. Eukaryotic vs. prokaryotic cells
2. Bacterial cell structures and cell wall morphology
   a. Biochemical composition
   b. Gram(+) vs. Gram(-) characteristics
   c. Function in pathogenesis
3. Physiological processes of bacterial growth
   a. Life cycle
   b. Anaerobic vs. aerobic
   c. Spore formation
4. Genetic mechanisms of bacteria
5. Normal body flora
6. Disease states, transmission, pathogenic mechanisms, symptoms, diagnosis and immunity of infections by
   a. Gram(+) and Gram(-) cocci and rods
   b. Spirochetes
   c. Actinomycetes
   d. Mycobacteria
   e. Chlamydia
   f. Rickettsia
   g. Mycoplasma
7. Laboratory isolation, culture and identification of bacteria
8. Procedures for antibiotic susceptibility testing
9. Quality control/sterilization and disinfection

B. Virology
1. Virus particle chemistry and morphology
2. Classification scheme for viruses
   a. DNA vs. RNA types
   b. Double-stranded vs. single-stranded
   c. Envelopes
3. Genetic mechanisms of viruses
4. Viral replication in host cells
   a. DNA and RNA viruses, with or without envelopes
5. Disease states, transmission, pathogenic mechanisms, symptoms, diagnosis and immunity of infections by viruses
6. Laboratory isolation, culture and identification of viruses
7. Virus-like structures (e.g., prions)
C. Mycology
   1. Biology of fungi
      a. Yeast and mold morphology
      b. Asexual and sexual reproduction/structures
   2. Disease states, transmission, pathogenic mechanisms, symptoms, diagnosis and immunity of infections by
      a. Superficial mycoses
      b. Cutaneous mycoses
      c. Subcutaneous mycoses
      d. Systemic mycoses
      e. Opportunistic yeasts and molds
   3. Laboratory isolation, culture and identification of fungi

D. Parasitology
   1. Disease states, life cycles, transmission, pathogenic mechanisms, symptoms, diagnosis and immunity of infections by protozoans, trematodes, cestodes, nematodes and arthropods
   2. Laboratory identification of parasites

7. General Immunology (10-16 Items)
   A. Antigens, chemistry and origin
   B. Antibodies
      1. Chemical structure
      2. Classification
      3. Immunological functions
      4. Genetics/clonal selection
   C. Antigen-antibody interactions
   D. Complement chemistry, function, and pathways
   E. Cytokines, origin and function
   F. Nonspecific immunity
      1. Anatomical barriers
      2. Phagocytic cell types and inflammation
      3. Role of complement and antibody
      4. Interferon, lysozyme
      5. Natural killer cells
   G. Specific immunity
      1. Cell types, markers and function
      2. Cell-cell interactions in the immune response
      3. Humoral immunity
      4. Cellular immunity
      5. Primary and secondary immune responses
   H. Tissue transplantation and graft rejection (mechanisms)
   I. Autoimmunity
   J. Tumor immunology
   K. Immunological tests
8. General Pharmacology (30-46 Items)*

A. General principles of pharmacology and toxicity
   1. Pharmacodynamics
      a. Concept of receptors
      b. Dose-response relationships
   2. Pharmacokinetics
      a. Absorption, distribution, metabolism and excretion of drugs
      b. Quantitative aspects
      c. Influencing factors (e.g., age, gender, pathology, genetics, diet)
   3. Drug interactions (e.g., drug, food, alcohol)

B. Autonomic and/or neuromuscular junction drugs
   1. Drugs affecting neurohumoral transmission: autonomic and somatic motor nervous systems
   2. Adrenergic agonists
   3. Adrenergic antagonists
   4. Cholinergic agonists
   5. Cholinergic antagonists
   6. Cholinesterase inhibitors
   7. Ganglionic agonists and antagonists
   8. Neuromuscular transmission agonists and antagonists

C. Autacoid agonists and antagonists

D. Drugs affecting the respiratory system
   1. Bronchodilators
   2. Mast cell stabilizers
   3. Mucolytics

E. Gastrointestinal agents

F. Chemotherapeutic agents
   1. Antimicrobial agents
      a. Antiseptics and disinfectants
      b. Antibacterial
      c. Antifungal
      d. Antiparasite
   2. Antiviral agents
   3. Antineoplastic agents

G. Immunopharmacological agents

H. Anti-inflammatory agents
   1. Steroids
   2. Non-steroids

I. Major drugs acting on the central nervous system
   1. Neurotransmitters
   2. Opioid and non-opioid analgesics
   3. Sedative hypnotics
   4. Anxiolytics
   5. Antipsychotics
   6. Antiparkinsonians
   7. Antidepressants
   8. Anticonvulsants
   9. Skeletal muscle relaxants
   10. Hallucinogens and drugs of abuse
J. General and local anesthetics

K. Major drugs acting on the endocrine system
   1. Adenohypophyseal hormones
   2. Thyroid and antithyroid drugs
   3. Insulin and synthetic antidiabetics
   4. Estrogens, progestins and androgens

L. Major cardiovascular drugs
   1. Antihypertensives
   2. Agents used to treat CHF (e.g., inotropic agents, vasodilators)
   3. Antiarrhythmics
   4. Antianginal agents
   5. Anticoagulants and thrombolytics
   6. Antihyperlipidemic agents

M. Major drugs acting on the kidneys
   1. Diuretics
   2. Uricosuric agents

N. Toxicology

O. Drug use and metabolism in pregnancy and breast feeding

*Note
Principles of general pharmacology and drug actions on general systems, excluding pharmacologic principles specific to the eye and the clinical use of drugs in optometric practice. Drugs are generally referenced by generic name only.
9. General Pathology (23-35 Items)

A. Inflammation and repair
1. Vascular and cellular changes in acute inflammation
2. Causes of histological changes in chronic inflammation
3. Causes and features of granulomatous inflammation
4. Resolution of acute and chronic inflammation
5. Events and local factors affecting wound healing and repair
6. Systemic factors affecting the rate of wound healing

B. Immunopathology
1. Hypersensitivity
   a. Anaphylactic (Type I)
   b. Cytotoxic (Type II)
   c. Immune-complex-mediated (Type III)
   d. Cell-mediated (Type IV)
2. Autoimmune diseases
3. Diseases of immunodeficiency

C. Host defenses and responses to infection
1. PMN, macrophage and eosinophil function
2. Chemotaxis, phagocytosis, and bactericidal activity of these cells
3. Role of antibody in phagocytosis and destruction of microorganisms

D. Cellular disease
1. Cell injury (reversible and irreversible)
2. Morphological and functional changes associated with cell injury or death (by necrosis or apoptosis)
3. Cell cycle

E. Genetic principles and disorders
1. Chromosomal disorders (e.g., Down syndrome)
2. Monogenic disorders
   a. Autosomal dominant
   b. Autosomal recessive
   c. X-linked
3. Multifactorial disorders
4. Mitochondrial disorders

F. Neoplasia
1. Histogenesis of neoplasms
2. Classification of neoplasms
3. Causes of neoplasms
4. Differences between benign and malignant tumors
5. Effects of tumor on host, oncogenes, agents
6. Genetics of neoplasia

G. Integumentary system
1. Infectious diseases
2. Neoplastic diseases
3. Pigmented lesions
H. Hematopoietic and lymphoid system
   1. Non-neoplastic disorders of blood cells
   2. Neoplastic disorders of blood cells
   3. Non-neoplastic disorders of lymph nodes
   4. Neoplastic disorders of lymph nodes

I. Respiratory system
   1. Chronic obstructive pulmonary disease (COPD) and emphysema
   2. Infectious diseases of the lung
   3. Neoplastic diseases of the lung
   4. Interstitial diseases including pneumoconiosis

J. Gastrointestinal system
   1. Disorders of the stomach (e.g., gastritis, ulcers)
   2. Disorders of the intestines and colon (e.g., enteritis, colitis)
   3. Neoplastic disorders of the gastrointestinal tract
   4. Diseases of the liver, biliary tract, and pancreas

K. Cardiovascular hemodynamic disorders
   1. Congestion, edema
   2. Hemorrhage, shock
   3. Thromboembolism
   4. Systemic hypertension
   5. Atherosclerosis
   6. Aneurysms
   7. Vasculitis

L. Heart disease
   1. Coronary artery disease
   2. Hypertensive heart disease
   3. Streptococcal infections and their nonsuppurative sequelae (e.g., rheumatic fever, glomerulonephritis)
   4. Cardiomyopathies

M. Endocrine diseases
   1. Diabetes
   2. Hyperthyroidism (e.g., Graves' disease)
   3. Hypothyroidism
   4. Goiters
   5. Hyperparathyroidism
   6. Hypoparathyroidism
   7. Hyperpituitarism
   8. Hypopituitarism
   9. Hypercorticism (e.g., Cushing's disease)
   10. Hypocorticism (e.g., Addison's disease)
   11. Disorders of adrenal medulla (e.g., pheochromocytoma)
N. Nervous system and neuromuscular diseases
   1. Cerebrovascular diseases
   2. Headaches
   3. Infectious diseases of the central nervous system
   4. Nervous system neoplasms
   5. Muscular atrophy, muscular dystrophy
   6. Demyelinating diseases
   7. Leukodystrophies, gangliosidoses
   8. Neurodegenerative diseases (e.g., Alzheimer’s disease, Parkinson’s disease)
   9. Trauma; closed head injuries

O. Kidney disease
   1. Acute renal failure
   2. Chronic renal failure
   3. Glomerulonephritis
   4. Pyelonephritis

P. Diseases of the reproductive system

Q. Nutritional disorders
   1. Malabsorption
   2. Alcoholism
   3. Vitamin deficiencies and toxicities
   4. Trace minerals

R. Congenital and neonatal anomalies (e.g., cerebral palsy, fetal alcohol syndrome, infant drug addiction, hypoxia)
B. Ocular/Visual Biology - 90 Items (21%)  
"Ocular/Visual Biology" covers the fundamental knowledge and scientific principles that support the application of these principles in the prevention, diagnosis, treatment and management of ocular diseases and traumatic conditions that can present to the optometrist by patients seeking primary eye care. It is composed of four major subdivisions: Anatomy of the Eye, Ocular Adnexa, and Visual Pathway; Ocular and Visual Pathway Development; Ocular Physiology/Neurophysiology; Ocular Pharmacology.

1. Anatomy of the Eye, Ocular Adnexa and Visual Pathway (26-34 Items)

A. Orbit
   1. Contents (extraocular muscles, nerves, blood vessels, fat compartments, fascia)
   2. Anatomical relationships among orbital structures
   3. Bones of the orbit
   4. Foramina and openings of the orbit (location, contents)

B. Extraocular muscles
   1. Names
   2. Origins
   3. Insertions
   4. Innervation, blood supply
   5. Relationship to other orbital structures

C. Blood supply
   1. Branches of internal and external carotid arteries related to the orbit, eyelid and upper face
   2. Branches of the internal and external jugular veins
   3. Dural sinuses

D. Ocular and orbital nerves
   1. Cranial nerves I, III, IV, V, VI, VII (intracranial and extracranial course, branches, functions, tissue innervated)
   2. Parasympathetic nerves (course, branches, tissue innervated)
   3. Sympathetic nerves (course, branches, tissue innervated)

E. Eyelid
   1. Anatomic boundaries
   2. Layers
   3. Muscles (actions)
   4. Glands (secretions, functions)
   5. Blood supply and drainage, lymphatic drainage
   6. Innervation

F. Eyebrow (structure and function)

G. Conjunctiva
   1. Location
   2. Composition (layers, cell types, glands, Palisades of Vogt)
   3. Relationship to tarsal plate, extraocular muscles, sclera, vagina bulbi (Tenon's capsule), cornea
   4. Blood supply and venous drainage, lymphatic drainage
   5. Innervation
   6. Plica similunaris (composition)
   7. Caruncle (composition)
H. Lacrimal system
   1. Lacrimal gland (structure, innervation, blood supply)
   2. Accessory lacrimal glands (location, function)
   3. Distribution of tears (role of eyelids)
   4. Drainage of tears; nasolacrimal duct (cellular lining); lacrimal papillae (location); lacrimal puncta; canaliculi (relationship to Horner's muscle); lacrimal sac (relationship to medial palpebral ligament, Horner's muscle, orbicularis oculi; septum orbitale)
   5. Lacrimal fossa (bony structure)
   6. Nasolacrimal canal (bony composition, relationship to maxillary sinus)

I. Cornea
   1. Normal dimensions including diameter, radii of curvature (anterior and posterior) and thickness (central and peripheral)
   2. Epithelium (histology and ultrastructure)
   3. Basal lamina (relationship to epithelium)
   4. Anterior limiting lamina (Bowman's layer) (relationship to stroma, basal lamina, and epithelium)
   5. Stroma (composition, ultrastructure)
   6. Posterior limiting lamina (Descemet's membrane) (relationship to stroma and endothelium)
   7. Endothelium (composition, ultrastructure)
   8. Limbus
   9. Innervation
   10. Regeneration

J. Sclera
   1. Size
   2. Radius of curvature
   3. Thickness
   4. Color
   5. Relationship to conjunctiva, Tenon's capsule, suprachoroidal space
   6. Emissaria (contents, location)
   7. Composition
   8. Lamina cribrosa (structure)

K. Anterior chamber and angle
   1. Shape and volume
   2. Boundaries
   3. Diameter and depth
   4. Trabecular meshwork (components, ultrastructure)
   5. Juxtacanalicular tissue (components, ultrastructure)
   6. Schlemm's canal (location, size, ultrastructure of wall, afferent and efferent connections)
   7. Scleral spur (composition, location)
   8. Schwalbe's ring (composition, location)
L. Iris
1. Gross landmarks, zones
2. Diameter
3. Coloration (factors controlling)
4. Anterior border (composition, ultrastructure)
5. Stroma (composition)
6. Sphincter muscle (type, composition, innervation)
7. Anterior epithelium (ultrastructure)
8. Dilator muscle (type, composition, innervation)
9. Posterior epithelium (relationship to lens, anterior epithelium, pupil margin)
10. Blood supply, venous drainage
11. Innervation
12. Size and location of pupil

M. Posterior chamber
1. Size and volume
2. Boundaries

N. Ciliary body
1. Gross morphology
2. Dimensions
3. Relationship to sclera, anterior chamber, iris, posterior chamber, lens and retina
4. Pars plana (location, components)
5. Pars plicata (location, components)
6. Stroma (components)
7. Ciliary muscle (components, relations, action, innervation)
8. Pigmented epithelium (basal lamina, ultrastructure)
9. Non-pigmented epithelium (basal lamina, ultrastructure, relationship to pigmented epithelium)
10. Blood supply and venous drainage
11. Innervation

O. Lens, zonule
1. Zonule
2. Location of lens
3. Epithelium (capsule, ultrastructure)
4. Cortex (composition of lens fibers, ultrastructure)
5. Nuclei (various names and locations)
6. Sutures (location)

P. Choroid
1. Extent
2. Thickness
3. Relationship to lamina fusca of sclera
4. Choriocapillaris (ultrastructure, type of capillaries)
5. Stroma
6. Blood supply
7. Venous drainage
8. Innervation
9. Bruch's membrane (location, composition)
Q. Vitreous
1. Volume
2. Shape
3. Attachments to retina and lens (ultrastructure)
4. Patellar fossa (location)
5. Anterior hyaloid (location)
6. Posterior hyaloid (location)
7. Cortex (composition)
8. Hyaloid canal (location, origin)

R. Retina
1. Layers (components of each, ultrastructure)
2. Relationship between retinal pigment epithelium and Bruch's membrane
3. Relationship between retinal pigment epithelium and photoreceptor outer segments
4. Synaptic connections within retina
5. Glial cells (name, location, function)
6. Blood supply
7. Anatomical areas (location, size, composition) of area centralis, parafovea, fovea, foveola, macula lutea, ora serrata (ultrastructure)

S. Optic Nerve
1. Surface features
2. Prelaminar portion (composition, blood supply)
3. Laminar portion (composition, blood supply)
4. Retrolaminar portion (composition, blood supply)
5. Central retinal artery and vein (location)
6. Optic disc/cup

T. Visual pathway
1. Localization of retinal fibers along visual pathway; optic nerve, chiasm (crossing), optic tract, lateral geniculate body, optic radiations, visual cortex
2. Layers of lateral geniculate body (afferents, efferents)
3. Layers of visual cortex; areas
4. Blood supply
5. Anatomy related to visual pathology

2. Ocular and Visual Pathway Development (8-12 Items)

A. Orbit
1. Development of bones of orbit (closure of sutures)
2. Abnormalities (faulty development of facial bones)

B. Extraocular muscles
1. Condensation of mesenchyme (bilateral condensation)
2. Motor innervation development
3. Insertion of extraocular primordia into anterior sclera
4. Late development

C. Eyelid
1. Tissue origin
2. Lid folds
3. Fusion of eyelid
4. Ectodermal derivatives (skin, glands, conjunctiva)
5. Mesodermal derivatives (tarsus, orbital septum, orbicularis oculi, aponeurosis of levator, smooth muscle)
D. Conjunctiva
   1. Ectodermal specialization forming conjunctiva and glands

E. Lacrimal apparatus
   1. Tissue origin of lacrimal glands (main, accessory)
   2. Tissue origin of lacrimal and nasal passages
   3. Abnormalities

F. Cornea
   1. Inductive mechanisms
   2. Ectodermal components (epithelium, primary stroma)
   3. Mesenchymal components (waves)
   4. Corneal nerve development (origin)
   5. Factors affecting corneal size, curvature, transparency

G. Sclera
   1. Inductive mechanisms
   2. Tissue origin
   3. Comparison with cornea

H. Anterior chamber and angle
   1. Creation of anatomical space
   2. Factors that promote growth of anterior chamber
   3. Creation of angle (atrophy theory, cleavage theory, reorganization theory, rarefaction theory)
   4. Differentiation of Schlemm's canal, scleral spur, trabecular meshwork
   5. Endothelial membrane

I. Iris/Pupil
   1. Development of iris stroma (anterior leaf, posterior leaf)
   2. Development of pars iridica retinae (epithelial layer)
   3. Development of dilator and sphincter muscles
   4. Pupillary membrane (atrophy)
   5. Cilio-iridic circulation
   6. Development of iris pigmentation

J. Posterior chamber

K. Ciliary body
   1. Tissue origin (mesoderm, neural crest)
   2. Development of pars ciliaris retinae (epithelial layers)
   3. Development of ciliary processes, ciliary muscles, ciliary vessels

L. Lens, zonules
   1. Zonule development
   2. Tissue origin
   3. Tissue induction and interaction (effect on development of vitreous, iris, cornea, retina)
   4. Mechanism of lens fiber orientation
   5. Stages of lens development (lens placode, lens pit, lens vesicles)
   6. Stages of lens fiber development
   7. Developmental nuclei (embryonic, fetal, infantile)
   8. Zones of development of lens epithelium
M. Choroid
  1. Tissue origin (paraxial mesoderm, neural crest cells)
  2. Development of choroidal vasculature (3 stages)
  3. Development of Bruch's membrane

N. Vitreous
  1. Primary vitreous (hyaloid canal, tissue origin, tissue characteristics)
  2. Secondary vitreous (tissue origin, tissue characteristics)
  3. Tertiary vitreous (tissue origin, tissue characteristics; hyaloid vasculature remnants)

O. Retina
  1. Development of optic cup
  2. Analogies between development of retina and central nervous system
  3. Fetal fissure (formation, function, fusion, failure to fuse)
  4. Retinal differentiation (Stages I, II, III, proliferation, migration, differentiation)
  5. Macular differentiation
  6. Retinal circulation development (hyaloid system, central retinal artery/vein, hyaloid vasculature remnants)
  7. Postnatal events

P. Optic nerve and visual pathway
  1. Developmental stages of lower visual pathway, before lateral geniculate body (differences between crossed and uncrossed fibers)
  2. Myelination of the visual pathway (lower visual pathway vs. upper visual pathway)
  3. Relationship between development of upper visual pathway and central vision
  4. Physiological cupping

3. Ocular Physiology/Neurophysiology (29-37 Items)

A. Circulation
  1. Hemodynamic patterns (resistance, transmural pressure, flow rate, critical closing pressures)
  2. Autoregulation
  3. Autonomic nervous system control
  4. Unique environment of the eye (high extravascular pressure)
  5. Uveal blood flow: choroid, ciliary body, iris (unique characteristics of each, functions of each)
  6. Retinal blood flow (unique characteristics, dual supply, functions)

B. Eyelids
  1. Normal closure of eyelids (forced, spontaneous)
  2. Blink reflexes (spontaneous, menace, auditory, touch, dazzle)
  3. Role of eyelids in production, distribution and drainage of tears
  4. Protective functions of eyelids
C. Tears and lacrimal apparatus
   1. Functions of tears
   2. Production of tears
      a. Sources
      b. Neural control
   3. Composition of tears
      a. Electrolytes
      b. Low molecular weight organics (glucose, amino acids)
      c. High molecular weight organics (proteins, lipids, glycoproteins)
      d. Cells
      e. Physiological variations (e.g. aging, open vs. closed eye, contact lens wear) in tear constituents
   4. Tear film distribution, structure and stability
   5. Elimination of tears
      a. Nasolacrimal drainage apparatus
      b. Evaporation and absorption
   6. Physico-chemical properties of tears
      a. Osmotic pressure
      b. pH and buffering
      c. Temperature and viscosity

D. Cornea
   1. Physical characteristics (water content, protein content, cells, resistance to trauma)
   2. Permeability characteristics of various layers
   3. Metabolic characteristics of various layers
   4. Theories of corneal transparency
   5. Factors influencing corneal thickness/hydration (osmolarity of tears, integrity of epithelium and endothelium, epithelial and endothelial pumps)
   6. Physiological parameters necessary to maintain corneal integrity (oxygen level, glucose level, pH, etc.)
   7. Epithelial regeneration (normal and response to trauma)
   8. Physiological characteristics of corneal nerves
   9. Aging changes of the cornea

E. Intraocular pressure
   1. Methods of measurement
   2. Normative values
   3. Factors controlling aqueous production and outflow
   4. Nervous system regulation of IOP
   5. Factors influencing IOP (body position, corneal thickness, blood pressure)

F. Aqueous
   1. Functions of aqueous
   2. Volume, osmolarity, viscosity
   3. Formation (ultrafiltration, active transport)
   4. Factors influencing rate of flow
   5. Composition
   6. Blood aqueous barriers (location, ultrastructure, function)

G. Pupillary pathways
   1. Sympathetic pathway to iris
   2. Parasympathetic pathway to iris
   3. Functional relationships between pupillary pathways and central nervous system
H. Lens
1. Functions of lens
2. Composition of lens
3. Difference in composition between lens and aqueous
4. Metabolism of lens (various pathways essential to the lens)
5. Types of lens proteins
6. Factors which regulate size and solubility of lens proteins (vitamin C, glutathione)
7. Theories of lens transparency
8. Mitotic activity of lens epithelium
9. Aging changes in composition of the lens

I. Uvea
1. Functions of ciliary body
2. Functions of iris
3. Functions of choroid

J. Vitreous
1. Functions
2. Composition
3. Metabolism
4. Aging changes in composition
5. Physical characteristics (volume, water content, transparency)

K. Retina
1. Composition of disc outersegments
2. Formation of disc outersegments (disc renewal, disc shedding)
3. Composition of visual pigments
4. Formation of visual pigments
5. Stages of visual cycle
6. Photoreceptor electrophysiology (membrane potentials, dark current role of sodium, calcium, etc.)
7. Retinal neurotransmitters
8. Function of bipolar, horizontal, amacrine and ganglion cells (receptive fields)
9. Retinal neural mechanisms of color vision (spatial, temporal and chromatic)
10. Physiological relationships in the choroid and the retina, including retinal metabolism

L. Visual pathway
1. Function of lateral geniculate body
2. Receptive fields of cells in lateral geniculate body (relationship to color vision, binocularity, space perception, etc.)
3. Function of visual cortex
4. Receptive field properties (single cell properties)
5. Functional organization
6. Physiology of binocular vision
7. Mechanism of feature detection
8. Gross electrical potentials
   a. EOG
   b. ERG
   c. VEP (VER)

M. Extraocular muscles
1. Vestibular control mechanisms
2. Supranuclear control of eye movements
3. Agonist-antagonist relationships
4. Primary action, and secondary and tertiary actions
5. Fields of action
6. Conduction and contraction
4. Ocular Pharmacology (13-21 Items)*

A. General principles
   1. Factors affecting ocular drug bioavailability
   2. Routes of ocular drug administration

B. Autonomic drugs
   1. Functional concepts and ocular receptor types
   2. Ocular cholinergic agents
   3. Ocular adrenergic agents

C. Antiglaucoma drugs
   1. Parasympathetic agonists
   2. Sympathetic agonists
   3. Sympathetic antagonists
   4. Carbonic anhydrase inhibitors
   5. Prostaglandins and analogues
   6. Serotonin antagonists

D. Properties of topical ocular anesthetics (non-injectable)

E. Antihistamines

F. Anti-inflammatory agents
   1. Steroids
   2. Non-steroids (including mast cell stabilizers)

G. Anti-infective agents

H. Dyes
   1. Topical diagnostic agents
   2. Oral and intravenous agents

I. Hyperosmotic agents
   1. Topical ocular agents
   2. Systemic agents

J. Lubricants and tear substitutes

K. Preparations used with contact lenses

L. Toxicology
   1. Ocular effects from topical ocular drug administration
   2. Ocular effects from systemic drug administration
   3. Systemic effects from ocular drug administration
   4. Systemic effects from systemic drugs that are used to treat ocular disease

*Note: Specific basic pharmacology related to the eye and adnexa only. Clinical use of drugs tested in appropriate areas of Clinical Science. Drugs are generally referenced by generic name only.
C. Theoretical, Ophthalmic, and Physiological Optics-125 Items (29%)
"Theoretical, Ophthalmic, and Physiological Optics" covers the fundamental knowledge and scientific principles that support the application of these principles in the prevention, diagnosis, treatment and management of refractive, oculomotor and sensory integrative conditions, that can present to the optometrist by patients seeking primary eye care. It is composed of six major subdivisions: Geometrical Optics; Physical Optics; Ophthalmic Optics; Visual Optics; Visual Perception; Ocular Motility.

1. Geometrical Optics (15-19 Items)

A. Refraction at single spherical or plane surfaces
   1. Curvature and sagitta
   2. Refractive index and rectilinear propagation
   3. Vergence and dioptric power
   4. Object-image relationships, including apparent depth
   5. Ray tracing, nodal point, and nodal ray
   6. Lateral (translinear) and angular magnification
   7. Snell's law of refraction

B. Thin lenses
   1. Vergence: dioptric and effective power
   2. Object-image relationships
   3. Lateral (translinear) and angular magnification
   4. Thin lens systems
   5. Prismatic effect (Prentice's rule and prism effectivity)
   6. Ray tracing, optical center, and optic axis

C. Thick lenses
   1. Cardinal points
   2. Vertex power and equivalent power
   3. Lateral (translinear) and angular magnification
   4. Reduced systems

D. Aberrations
   1. Spherical
   2. Coma
   3. Oblique astigmatism
   4. Curvature of field
   5. Distortion
   6. Chromatic (longitudinal and lateral)

E. Stops, pupils and ports
   1. Entrance and exit pupils (size and location)
   2. Depth of focus, depth of field, hyperfocal distance
   3. Field of view and half illumination

F. Spherocylindrical lenses
   1. Location of foci, image planes, principal meridians, and circle of least confusion
   2. Obliquely crossed spherocylindrical lenses
   3. Transposition
   4. Prismatic effect

G. Thin prisms
   1. Unit of measurement (prism diopter)
   2. Prism deviation
   3. Combination of thin prisms
   4. Resolution of oblique prisms into horizontal and vertical components
   5. Total internal reflection
H. Mirrors
   1. Planar and spherical reflection
   2. Proportion of light reflected from a surface (Fresnel's law)
   3. Focal power, focal length, and curvature
   4. Object-image relationships
   5. Magnification
   6. Lens/mirror systems
   7. Ray tracing

I. Ophthalmic and optical instruments
   1. Direct and indirect ophthalmoscopes
   2. Retinoscope
   3. Lensometer
   4. Biomicroscope
   5. Radiuscope
   6. Keratometer
   7. Diagnostic lenses (gonioscopic, fundus, etc.)

2. Physical Optics (5-7 Items)

A. Wave optics
   1. Characteristics of wave motion
   2. Classifications of the electromagnetic spectrum
   3. Total and partial coherence
   4. Diffraction (single slit, circular aperture, limits of resolution, zone plates)
   5. Interference (double slit, multiple slits, thin film, anti-reflective coatings, holography)
   6. Scattering (Rayleigh vs. Tyndall)
   7. Dispersion

B. Interaction of light and matter
   1. Atomic energy levels, absorption and emission line spectra
   2. Continuous spectra (Black body radiator and gray body radiator characteristics)
   3. Fluorescence (photons, energy levels)
   4. Lasers (theory of operation, speckle pattern)
   5. Spectral transmission

C. Polarization
   1. Linearly polarized light
   2. Circular and elliptical polarization
   3. Polarization by reflection (glare reduction, Brewster's law)
   4. Effects of scattering on polarization
   5. Transmission through successive polarizers (stress analysis, Malus' law)

D. Image quality
   1. Resolving power
   2. Point and line spread function
   3. Modulation transfer function (Fourier optics)
3. Ophthalmic Optics (16-20 Items)

A. Physical characteristics of ophthalmic lenses
   1. Geometry of lens surfaces (spherical, cylindrical, toric, aspheric)
   2. Base curves (form of lenses)
   3. Lens thickness (center, edge, gradients, iso-thickness curves)
   4. Specification of lens size and shape
   5. Materials (refractive index, dispersion, hardness, specific gravity)

B. Optical characteristics of ophthalmic lenses
   1. Locations of, and relationships between the optic axis, optical center, geometric center,
      and major reference points
   2. Principles of corrected curve lens design
   3. Verification of lens prescriptions (lensometer, lens gauge, and hand neutralization)
   4. Writing and transposing lens prescriptions
   5. Effect of lens tilt (spheres and spherocylinders about a principal meridian)
   6. Effective power (for near and for changes in vertex distances)
   7. Spectacle lens processing

C. Ophthalmic prisms and prismatic effects of lenses
   1. Thickness differences across a prism
   2. Prismatic effects in the periphery of a lens (spheres, spherocylinders)
   3. Decentration (prism from decentration, decentering to obtain prism, interpupillary
distance)
   4. Correction of vertical prism effect
      a. Slab-off (front, back, top, bottom, reverse)
      b. Double slab-off
      c. Dissimilar segments
      d. Compensated R segments
      e. Prism segments
      f. Multiple corrections
      g. Contact lenses
      h. Fresnel prisms
      i. Fresnel Adds

D. Multifocal lenses
   1. Types (fused, 1-piece, progressive additions and blended lenses)
   2. Methods of producing Add powers
   3. Segment center location
   4. Differential displacement (jump)
   5. Total displacement, horizontal and vertical imbalance
   6. Placement of distance and multifocal optical center
   7. Optical and physical characteristics of segments (design and calculations, progressive
      Adds, aberrations, surface characteristics)
   8. Specifying multifocal height, size, shape and location of segment

E. Physical characteristics and biological compatibility of frame materials

F. Specification and nomenclature of frames

G. Optical and frame consideration of high powered lenses: spheric, aspheric, and high refractive
   index materials

H. Spectacle magnification
   1. Shape and power factors
   2. Iseikonic lens design
I. Methods of remedying reflections and ghost images

J. Absorptive lenses
   1. Specification of lens tints and absorptive coatings (including spectral transmission curves)
   2. Characteristics of photochromic lenses
   3. Relationship between lens thickness and spectral transmission
   4. Special occupational requirements

K. Impact resistance
   1. Degrees of resistance of ophthalmic lens materials
   2. Methods of rendering materials impact resistant
   3. Methods of verifying impact resistance
   4. Performance of materials upon, and after, impact
   5. Specifications of occupational safety lenses

L. Optical tolerances and physical requirements of ophthalmic lenses and frame materials (FDA, ANSI Z80 and Z87, OSHA)

M. Optical characteristics of contact lenses
   1. Surface characteristics of the lens and the cornea
   2. Specification of the lens (power, base curve, thickness, and edge characteristics)
   3. Effective power considerations of contact lenses
   4. Tear-lens optical considerations
   5. Prismatic effects
   6. Fabrication, inspection, and verification

N. Optical characteristics of low vision devices
   1. Magnification, field of view, and working distance
   2. Simple magnifiers
   3. Telescopes
   4. Loupes
   5. Microscopes


A. Schematic eye models
   1. Dioptic components
   2. Cardinal points, entrance and exit pupils
   3. Ametropia: far point, near point, correction
   4. Accommodation: amplitude and effectivity
   5. Astigmatism, including correction
   6. Retinal image size, spectacle magnification, and relative spectacle magnification

B. Dioptrics of the eye
   1. Characteristics of components (curvature, thickness, separation, refractive indices, and axial length)
   2. Reference angles and axes
   3. Catoptric (Purkinje) images
   4. Retinal image size
   5. Optical function of the pupil

C. Entoptic phenomena
   1. Characteristics and origin of various phenomena (involving the cornea, lens, and vitreous)
   3. Vascular and circulatory phenomena (Purkinje tree, capillary circulation)
   4. Phenomena associated with central vision (Maxwell's spot, Haidinger's brushes)
   5. Phenomena associated with retinal distention or other forms of retinal activity (Moore's lightning streaks, blue arcs of the retina, phosphenes)
D. Quality of the retinal image
   1. Aberrations (spherical, chromatic, coma, curvature, oblique astigmatism, distortion, wavefront sensing aberrometry)
   2. Diffraction
   3. Stray light
   4. Point and line spread functions

E. Refractive state of the eye
   1. Emmetropia
   2. Myopia
   3. Hyperopia
   4. Astigmatism
   5. Anisometropia and aniseikonia
   6. Accommodation
   7. Aphakia and pseudophakia (optics of intraocular implants)
   8. Empty field and night myopia

F. Mechanisms of presbyopia
   1. Effects of aging on the ciliary muscle and accommodation

G. Radiation and the eye
   1. Radiometry (radiant intensity, radiance, and irradiance)
   2. Photometry (luminosity function, luminous intensity, luminance, and illuminance, Lambertian surfaces- cosine laws)
   3. Spectral transmission of the ocular media
   4. Retinal illumination
   5. Effects of incoherent radiation (e.g., infrared, visible, ultraviolet) on tissue
      Mechanisms of damage
      Wavelength, energy levels, thresholds for reactions
      Protective measures
   6. Effects of coherent radiation (lasers) on tissue
      a. Mechanisms of damage
      b. Wavelength, energy levels, thresholds for reactions
      c. Ophthalmic applications (argon, excimer, YAG, helium neon, krypton, holmium)
      d. Protective measures


A. Color perception
   1. Chromatic discrimination (hue and saturation) for normal and defective color vision
   2. Color mixture and appearance
   3. Color contrast, constancy, and adaptation
   4. Color specification and colorimetry (CIE)
   5. Spectral sensitivity of normal and defective color vision
   6. Mechanisms of color deficiencies

B. Space perception
   1. Direction and depth discrimination (monocular and binocular cues, oculocentric and egocentric localization)
   2. Characteristics of sensory function (binocular interactions including summation, binocular suppression and rivalry; corresponding points including horopter criteria)
   3. Development of sensory fusion and binocular vision
   4. Disturbances of perceived direction and distance (aniseikonia and amblyopia)
   5. Sensory-motor interactions (fixation disparity, past pointing, visually guided behavior, body posture and perceived orientation, and self-motion)
C. Form perception
   1. Static visual acuity (including test configurations, various acuity tasks, and factors influencing acuity including blur, intensity and contrast); specification of visual acuity
   2. Spatial contrast sensitivity function (including factors influencing the function)
   3. Illusions, constancies, and figure-ground relations
   4. Simultaneous contrast and spatial interactions (Mach bands)

D. Light perception
   1. Detection characteristics at the absolute light threshold (including spectral, spatial, and temporal aspects)
   2. Brightness-difference thresholds at various adaptation levels (Weber's and DeVries-Rose laws); specification of contrast
   3. Dark and light adaptation processes and theories
   4. Spatial and temporal summation characteristics (Ricco's, Piper's and Bloch's laws)

E. Motion perception
   1. Factors involved in the detection of real and apparent motion, detection of displacements
   2. Motion after-effects
   3. Dynamic visual acuity, visual performances with a moving object, and visual performances with a moving observer

F. Temporal perception
   1. Critical flicker fusion frequency, including factors influencing test object (size, location and adaptation level)
   2. Subfusional flicker phenomena (Bartley brightness enhancement)
   3. Successive contrast and masking
   4. Temporal contrast sensitivity function
   5. Stabilized retinal images and monocular suppression (Troxler effect)
   6. Saccadic suppression

6. Ocular Motility (16-22 Items)
   A. Pupil and Accommodation
      1. Purposes and roles for vision
      2. Dynamics of muscle action
      3. Biomechanics of pupillary and accommodative reflexes
      4. Interrelationships between pupillary changes, accommodation, and convergence (the near reflex)
      5. Factors affecting pupil size
   B. Eye Movements
      1. Purpose and roles for vision
      2. Dynamics and kinematics of eye movements
      3. Specification of direction of gaze and ocular orientation (torsion)
      4. Reflex movements, including compensatory movements
      5. Small movements associated with steady fixation
      6. Versional movements (pursuits and saccades)
      7. Vergence movements (tonic, accommodative, including models of accommodative/vergence interaction, fusional, and proximal)
      8. Optokinetic nystagmus
      9. Vestibulo-ocular reflex and vestibular nystagmus
   C. Eyelid Function
      1. Purposes and roles for vision
      2. Characteristics
      3. Lid reflexes
D. Psychology - 25 Items (6%)
"Psychology" covers the fundamental knowledge and scientific principles that apply when conducting a vision examination and in the recognition and management of those changes in human behavior associated with milestones in human development that can present to the optometrist by patients seeking primary care. It is composed of two major subdivisions: Psychophysical Methodology; Human Development.

1. Psychophysical Methodology (3-7 Items)
   A. Basic psychophysical methods and theory
      1. Measurement of absolute and difference thresholds
      2. Threshold determination (e.g., limits, adjustment, constant stimuli, forced choice, yes/no)
   B. Psychophysical scaling methods and theory
   C. Signal detection methods and theory

2. Human Development (18-22 Items)
   A. Normal vision development in the infant and child
      1. Spatial vision
      2. Refractive error
      3. Color vision
      4. Spectral transmission of the ocular media
      5. Accommodation and convergence
      6. Light sensitivity
      7. Binocular vision and stereopsis
      8. Form reproduction and perception
      9. Temporal vision
     10. Visual fields
     11. Motion perception
   B. Normal motor development in the infant and child
      1. Gross motor/language developmental milestones
      2. Oculomotor system
      3. Visual perceptual-motor skills
   C. Normal cognitive and social development in the infant and child
   D. Effects of early environmental restrictions
      1. Plasticity of the system
      2. Animal models
      3. Light and pattern deprivation
      4. Monocular and binocular deprivation
      5. Refractive error
      6. Strabismus
      7. Cataract
   E. Normal changes in vision with aging
      1. Spatial vision
      2. Refractive error
      3. Color vision
      4. Spectral transmission of the ocular media
      5. Accommodation and convergence
      6. Light sensitivity
      7. Glare (disability and discomfort)
      8. Dark adaptation, glare recovery
      9. Visual fields
     10. Temporal vision
     11. Oculomotor system
     12. Motion perception
     13. Visual attention
BASIC SCIENCE
TEST BLUEPRINT SUMMARY

Below is a summary of the Test Blueprint used by the Examination Development Committees when constructing the Basic Science examination. This provides candidates with summary information on the distribution of test items by subject area, and by cognitive skill in Basic Science.

Test Blueprint Item Distribution Summary

<table>
<thead>
<tr>
<th>Cognitive Skill</th>
<th>Knowledge of Facts and Principles</th>
<th>Use and Interpretation of Data; Evaluation of Problems</th>
<th>Total Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part I (Basic Science)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Human Biology</td>
<td>115–155</td>
<td>40–80</td>
<td>195</td>
</tr>
<tr>
<td>B. Ocular/Visual Biology</td>
<td>50–70</td>
<td>20–40</td>
<td>90</td>
</tr>
<tr>
<td>C. Theoretical, Ophthalmic and Physiological Optics</td>
<td>33–55</td>
<td>70–92</td>
<td>125</td>
</tr>
<tr>
<td>D. Psychology</td>
<td>8–18</td>
<td>7–17</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>206–298</td>
<td>137–229</td>
<td>435</td>
</tr>
</tbody>
</table>
**Part II (Clinical Science)**

Clinical Science tests/measures a candidate’s application of the knowledge of Basic Science to the prevention, diagnosis, treatment and management of clinical conditions within the scope of optometric practice.

Clinical Science is composed of six major subject areas, four or which parallel the four Basic Science subject areas. Conditions identified in parenthesis ( ) are provided as examples for clarification, and are not an exhaustive list of conditions to be tested under the specified category. The subject areas and their relative emphases are shown below.

<table>
<thead>
<tr>
<th>A. Systemic Conditions - 70 Items (16%)</th>
<th>Number of Items**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General Health</td>
<td>5-9</td>
</tr>
<tr>
<td>2. Neurological System</td>
<td>3-5</td>
</tr>
<tr>
<td>3. Musculoskeletal System</td>
<td>1-3</td>
</tr>
<tr>
<td>4. Skin and Hair</td>
<td>1-3</td>
</tr>
<tr>
<td>5. Head and Neck</td>
<td>2-6</td>
</tr>
<tr>
<td>6. Hematopoietic System</td>
<td>2-4</td>
</tr>
<tr>
<td>7. Immunologic System</td>
<td>3-7</td>
</tr>
<tr>
<td>8. Cardiovascular System</td>
<td>4-10</td>
</tr>
<tr>
<td>9. Renal and Urogenital System</td>
<td>3-7</td>
</tr>
<tr>
<td>10. Gastrointestinal System</td>
<td>2-4</td>
</tr>
<tr>
<td>11. Liver and Biliary Tract</td>
<td>1-3</td>
</tr>
<tr>
<td>12. Endocrine/Metabolic System</td>
<td>5-9</td>
</tr>
<tr>
<td>13. Reproductive System</td>
<td>1-3</td>
</tr>
<tr>
<td>14. Respiratory System</td>
<td>4-10</td>
</tr>
<tr>
<td>15. Nutrition</td>
<td>1-3</td>
</tr>
<tr>
<td>16. Mental Illness and Behavioral Disorders</td>
<td>1-3</td>
</tr>
<tr>
<td>17. Infectious Diseases</td>
<td>3-5</td>
</tr>
<tr>
<td>18. Congenital/Hereditary Conditions</td>
<td>1-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Ocular Disease/Trauma - 180 Items (41%)***</th>
<th>Number of Items**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Orbit, Adnexa, Lacrimal System</td>
<td>22-34</td>
</tr>
<tr>
<td>2. Cornea/External Disease</td>
<td>42-60</td>
</tr>
<tr>
<td>3. Glaucoma</td>
<td>20-30</td>
</tr>
<tr>
<td>4. Lens/Cataract</td>
<td>5-11</td>
</tr>
<tr>
<td>5. Uveitis, Sclera/Episclera</td>
<td>18-28</td>
</tr>
<tr>
<td>6. Retina/Vitreous</td>
<td>19-29</td>
</tr>
<tr>
<td>7. Neuro-Ophthalmic Disorders</td>
<td>16-26</td>
</tr>
</tbody>
</table>
### C. Refractive/Oculomotor/Sensory Integrative Conditions 125 Items (29%)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Number of Items**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anomalies of Refraction: Ametropia</td>
<td>21-27</td>
</tr>
<tr>
<td>2. Anomalies of Refraction: Presbyopia</td>
<td>8-10</td>
</tr>
<tr>
<td>3. Anomalies of Refraction: Aphakia, Pseudophakia, and Aniseikonia</td>
<td>5-9</td>
</tr>
<tr>
<td>4. Low Vision</td>
<td>10-14</td>
</tr>
<tr>
<td>5. Sensory Anomalies of Binocular Vision/Strabismus</td>
<td>16-20</td>
</tr>
<tr>
<td>6. Anomalies of Eye Movement</td>
<td>10-14</td>
</tr>
<tr>
<td>7. Anomalies of Accommodation and Accommodative Vergence</td>
<td>10-14</td>
</tr>
<tr>
<td>8. Refractive Correction Applications</td>
<td>28-34</td>
</tr>
</tbody>
</table>

### D. Perceptual Conditions - 33 Items (8%)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Number of Items**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anomalies of Child Development</td>
<td>10-14</td>
</tr>
<tr>
<td>2. Anomalies of the Aging Adult</td>
<td>10-14</td>
</tr>
<tr>
<td>3. Anomalies Secondary to Acquired Neurological Impairment</td>
<td>4-8</td>
</tr>
<tr>
<td>4. Anomalies of Color Vision (Inherited, Acquired)</td>
<td>2-4</td>
</tr>
</tbody>
</table>

### E. Public Health - 15 Items (3%)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Number of Items**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Epidemiology</td>
<td>4-7</td>
</tr>
<tr>
<td>2. Biostatistics and Measurement</td>
<td>2-3</td>
</tr>
<tr>
<td>3. Environmental Vision</td>
<td>1-3</td>
</tr>
<tr>
<td>4. Health Care Policy and Administration</td>
<td>4-6</td>
</tr>
</tbody>
</table>

### F. Legal and Ethical Issues - 12 Items (3%)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Number of Items**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Licensure and Governmental Regulation of Optometry</td>
<td>1-2</td>
</tr>
<tr>
<td>2. Standards of Professional Ethics</td>
<td>1-2</td>
</tr>
<tr>
<td>3. Patient Records</td>
<td>2-4</td>
</tr>
<tr>
<td>4. Confidentiality of Patient Information</td>
<td>1-2</td>
</tr>
<tr>
<td>5. Professional Liability</td>
<td>2-4</td>
</tr>
<tr>
<td>6. Visual Disability</td>
<td>1-2</td>
</tr>
</tbody>
</table>

**TOTAL** 435
* On Clinical Science items, it is assumed that normative values for the following should be known by the candidate:

- Serum glucose: fasting and random
- Total cholesterol and HDL cholesterol
- Westergren sedimentation rate
- Vital signs (i.e., blood pressure, pulse rate, respiratory rate, body temperature)

When data for any of the above are presented in a Clinical Science item, the data will be presented without any normative values in parentheses. However, when laboratory data other than those mentioned above are presented in a Clinical Science item, the data will be accompanied by normative values in parentheses.

** The number of items indicates that actual number for each of the six major subject areas, and a range for each content area within a subject. The range specifies the minimum and maximum number of items in each content area that will be administered on the test. The percentage of items indicates the actual percentage for each of the six major subject areas, rounded to the nearest integer.

*** Candidates will receive a subscore that is equivalent to a performance score on the stand-alone Treatment and Management of Ocular disease (TMOD®) examination required by over 40 states for therapeutic privileges. This subscore is based on 90 treatment/management items embedded within the Ocular Disease/Trauma section. There is no need for a candidate who passes the TMOD® exam embedded in Clinical Science to take the stand-alone TMOD® examination unless specifically required by the state board(s) of the state(s) to which the candidate plans to apply for licensure. The content of the equivalent embedded and stand-alone TMOD® tests includes the use of both topical and oral medications for the treatment of ocular diseases, and requires knowledge of the interaction between ocular and systemic systems.
A. Systemic Conditions - 70 Items (16%)
"Systemic conditions" applies the knowledge of Basic Science to the detection and management of systemic conditions as they may relate to the practice of optometry. This includes a general understanding of the common signs, symptoms, diagnoses, and courses of systemic diseases, and a general knowledge of treatments prescribed by other health care practitioners for common conditions that could impact the optometrist’s patient. Systemic conditions are composed of 18 major subdivisions, the general knowledge of which is the responsibility of the optometrist as a licensed primary health care provider.

1. General Health (5-9 Items)
   A. Epidemiology
   B. Detailed history with regards to differential diagnosis of fatigue, weight loss, fever, headache, dizziness, and malaise
   C. Presentations involving abnormal body habitus and demeanor
   D. Deviation from physical developmental norms and standards for all ages
   E. Common systemic side effects of medications
   F. Principles of basic cardiac life support
   G. Preventative medicine
   H. Medical laboratory tests for screening
   I. Probable diagnoses and general treatment approaches

2. Neurological System (3-5 Items)
   A. Epidemiology
   B. Detailed assessment of the signs and symptoms associated with non-ocular neurological conditions (e.g., myasthenia gravis, multiple sclerosis, CVA, neoplasia, parkinsonism)
   C. Medical laboratory tests and diagnostic imaging
   D. Probable diagnoses and general treatment approaches

3. Musculoskeletal System (1-3 Items)
   A. Epidemiology
   B. Symptoms and signs of the various arthritic syndromes (e.g., SLE, JRA, RA, ankylosing spondylitis)
   C. Medical laboratory tests and diagnostic imaging
   D. Probable diagnoses and general treatment approaches

4. Skin and Hair (1-3 Items)
   A. Epidemiology
   B. Skin manifestation of systemic disorders
   C. Skin lesions in the phakomatoses
   D. Common dermatoses including allergic manifestations
   E. Benign, premalignant, and malignant skin lesions
   F. Medical laboratory tests
   G. Probable diagnoses and general treatment approaches

5. Head and Neck (2-6 Items)
   A. Epidemiology
   B. Symptoms and signs of diseases of the nasopharynx, sinuses, salivary glands, lymph nodes, carotid and temporal arteries, skin and temporomandibular joint
   C. Auscultation of carotid arteries, skull and orbits for bruits and venous hum
   D. Potential significance of dysarthria, dysphagia, dysphonia and hoarseness
   E. Medical laboratory tests and diagnostic imaging
   F. Probable diagnoses and general treatment approaches
6. Hematopoietic System (2-4 Items)
   A. Epidemiology
   B. Symptoms and signs of common blood disorders (e.g., anemias, pancytopenia, thrombocytopenia, leukopenia, leukocytosis, thrombocytosis, hyperviscosity syndromes, neoplasias including leukemia, lymphoma, multiple myeloma)
   C. Medical laboratory tests and diagnostic imaging
   D. Probable diagnoses and general treatment approaches

7. Immunologic System (3-7 Items)
   A. Epidemiology
   B. Symptoms and signs of immunodeficiency syndromes (e.g., AIDS)
   C. Symptoms and signs of hypersensitivity reactions
   D. Symptoms and signs of common granulomatous diseases (e.g., sarcoidosis)
   E. Medical laboratory tests and diagnostic imaging
   F. Probable diagnoses and general treatment approaches

8. Cardiovascular System (4-10 Items)
   A. Epidemiology
   B. Risk factors for atherosclerotic heart disease
   C. Symptoms and signs of coronary artery disease
   D. Significance of palpitations, syncope, murmurs, dyspnea and claudication
   E. Pulse and blood pressure: norms, indications, and techniques for evaluation
   F. Signs and symptoms of heart failure
   G. Medical laboratory tests and diagnostic imaging (e.g., echocardiography and duplex ultrasonography)
   H. Probable diagnoses and general treatment approaches

9. Renal and Urogenital System (3-7 Items)
   A. Epidemiology
   B. Symptoms and signs of urogenital and renal disorders (e.g., sexually transmitted diseases, glomerulonephritis, cystitis, pyelonephritis)
   C. Symptoms and signs of renal failure
   D. Medical laboratory tests
   E. Probable diagnoses and general treatment approaches

10. Gastrointestinal System (2-4 Items)
    A. Epidemiology
    B. Symptoms and signs of common gastrointestinal disorders (e.g., inflammatory bowel disease, peptic ulcer disease, pancreatitis, malabsorption syndromes, neoplasia)
    C. Medical laboratory tests and diagnostic imaging
    D. Probable diagnoses and general treatment approaches

11. Liver and Biliary Tract (1-3 Items)
    A. Epidemiology
    B. Symptoms and signs of liver disorders (e.g., cirrhosis, hepatitis, liver failure)
    C. Biliary tract disorders
    D. Medical laboratory tests and diagnostic imaging
    E. Probable diagnoses and general treatment approach

12. Endocrine/Metabolic System (5-9 Items)
    A. Epidemiology
    B. Symptoms and signs of endocrine disorders (e.g., hypothalamic-pituitary dysfunction, thyroid dysfunction, diabetes mellitus, abnormal calcium metabolism, adrenal dysfunction, pheochromocytoma)
    C. Medical laboratory tests and diagnostic imaging
    D. Probable diagnoses and general treatment approaches
13. Reproductive System (1-3 Items)
   A. Epidemiology
   B. Symptoms and signs of pregnancy
   C. Complications of pregnancy (e.g., pre-eclampsia, eclampsia)
   D. Use of medications and abuse of drugs
   E. Implication of breast feeding
   F. Medical laboratory tests and diagnostic imaging
   G. Probable diagnoses and general treatment approaches

14. Respiratory System (4-10 Items)
   A. Epidemiology
   B. Symptoms and signs of respiratory disorders (e.g., COPD, asthma, respiratory failure)
   C. Significance of common respiratory symptoms (e.g., cough, hemoptysis, wheezing, shortness of breath)
   D. Symptoms and signs of anaphylaxis
   E. Medical laboratory tests, diagnostic imaging, and spirometry
   F. Probable diagnoses and general treatment approaches

15. Nutrition (1-3 Items)
   A. Epidemiology
   B. Symptoms and signs of nutritional abnormalities (e.g., hypo- and hyper-vitaminosis, malnutrition, obesity)
   C. Eating disorders (e.g., anorexia, bulimia)
   D. Medical laboratory testing
   E. Probable diagnoses and general treatment approaches

16. Mental Illness and Behavioral Disorders (1-3 Items)
   A. Epidemiology
   B. Symptoms and signs of mental illness (e.g., depression, suicide, anxiety, schizophrenia, bipolar disorder)
   C. Symptoms and signs of behavioral disorders (e.g., substance abuse; child, spouse and elder abuse)
   D. Psychological tests
   E. Probable diagnoses and general treatment approaches

17. Infectious Diseases (3-5 Items)
   A. Epidemiology
   B. Symptoms and signs of common infectious diseases (e.g., tuberculosis, subacute bacterial endocarditis, sepsis, opportunistic infections)
   C. Medical laboratory tests and diagnostic imaging
   D. Probable diagnoses and general treatment approaches

18. Congenital/Hereditary Conditions (1-3 Items)
   A. Epidemiology
   B. Symptoms and signs of common genetic disorders (e.g., Down syndrome, cystic fibrosis, congenital anomalies)
   C. Symptoms and signs of common congenital disorder (e.g., fetal alcohol syndrome, rubella, syphilis, toxoplasmosis)
   D. Medical laboratory tests and diagnostic imaging
   E. Probable diagnoses and general treatment approaches
B. Ocular Disease/Trauma - 180 Items (41%)
"Ocular disease/trauma" applies the knowledge of Basic Science to the prevention, diagnosis, treatment and management of ocular pathologic conditions that can present to the optometrist by patients seeking primary eye care. It is composed of 7 major subdivisions, each having a common 4-part format (epidemiology, history and symptoms; observation, inspection, recognition of signs, and techniques and skills required; pathophysiology and diagnosis; treatment and management options, and prognosis). Treatment options include the use of both topical and systemic medications for ocular disease. A list of the generic/brand name equivalents, containing most but not all of the commonly prescribed medications, is provided on this web site and will also be reproduced in front of the test booklet.

1. Orbit, Adnexa, Lacrimal System (22-34 items)
   A. Epidemiology, history and symptom inventory
   B. Observation, inspection, recognition of signs, and techniques and skills
   C. Pathophysiology and diagnosis
   D. Treatment and management options, and prognosis

2. Cornea/External Disease (42-60 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation, inspection, recognition of signs, and techniques and skills
   C. Pathophysiology and diagnosis
   D. Treatment and management options, and prognosis, including peri-operative care for laser or refractive surgery patients

3. Glaucoma (20-30 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation, inspection, recognition of signs, and techniques and skills
   C. Pathophysiology and diagnosis
   D. Treatment and management options, and prognosis

4. Lens/Cataract (5-11 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation, inspection, recognition of signs, and techniques and skills
   C. Pathophysiology and diagnosis
   D. Treatment and management options, and prognosis

5. Uveitis, Sclera/Episclera (18-28 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation, inspection, recognition of signs, and techniques and skills
   C. Pathophysiology and diagnosis
   D. Treatment and management options, and prognosis

6. Retina/Vitreous (19-29 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation, inspection, recognition of signs, and techniques and skills
   C. Pathophysiology and diagnosis
   D. Treatment and management options, and prognosis

7. Neuro-Ophthalmic Disorders (16-26 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation, inspection, recognition of signs, and techniques and skills
   C. Pathophysiology and diagnosis
   D. Treatment and management options, and prognosis
C. Refractive/Oculomotor/Sensory Integrative Conditions - 125 Items (29%)
"Refractive/oculomotor/sensory integrative conditions" applies the knowledge of Basic Science to the diagnosis, treatment and management of those refractive, oculomotor and/or sensory integrative conditions that can present to the optometrist by patients seeking primary eye care. It is composed of 8 major subdivisions, the first 7 having a common 3-part format (epidemiology, history and symptoms; observation and recognition of clinical signs, and techniques and skills required; diagnosis, treatment and management, and prognosis) with the final subdivision dealing with the use of refractive correction applications to manage the conditions in this section

1. Anomalies of Refraction: Ametropia (21-27 Items)
   C. Epidemiology, history and symptom inventory
   D. Observation and recognition of clinical signs, and techniques and skills including determination of:
      1. Interpupillary distance
      2. Visual acuity
      3. Corneal curvature and thickness
      4. Objective static and dynamic refractive status, including automatic refractive devices
      5. Standard subjective refraction procedures, including astigmatic dials, crossed cylinders, stenopadic slit, fogging methods, bichrome, and accommodation balance (equalization) techniques
      6. Binocular subjective refraction procedures, including Turville Infinity Balance and vectographic (Polaroid) techniques
      7. Cycloplegic subjective and objective techniques
      8. Automatic computer assisted subjective procedures, laser refraction and variations in procedures for the various ametropias
   E. Diagnosis, treatment and management using spectacle and contact lenses (see also (8) below), and prognosis

2. Anomalies of Refraction: Presbyopia (8-10 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation and recognition of clinical signs, and techniques and skills for determining the near add including:
      1. Amplitude of accommodation
      2. Crossed cylinders
      3. Trial lenses
      4. PRA/NRA
   C. Diagnosis, treatment and management with spectacle and contact lenses (see also (8) below), and prognosis

3. Anomalies of Refraction: Aphakia, Pseudophakia, and Aniseikonia (5-9 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation and recognition of clinical signs and phenomena associated with aphakia and pseudophakia:
      1. Magnification
      2. Field of view
      3. Spatial distortion
      4. Convergence demands
      5. Sensitivity to glare
   Techniques and skills for determining, evaluating and/or verifying:
      1. Types and characteristics of intraocular lenses and aphakic spectacle and contact lenses
      2. Intraocular lens power
      3. Special refraction techniques
      4. Aphakic lens prescriptions
C. Observation and recognition of clinical signs, and techniques and skills associated with aniseikonia including:
   1. Detection of aniseikonia
   2. Measurement of aniseikonia

D. Diagnosis, treatment and management with spectacle and contact lenses (see also (8) below), and prognosis

4. Low Vision (10-14 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation and recognition of clinical signs, and techniques and skills for determining a correction:
      1. Visual acuity
      2. Special refraction techniques
      3. Visual fields
      4. Reading skills
      5. Effects of illumination
      6. Magnification determination
      7. In-office evaluation with low vision devices
   C. Diagnosis, treatment and management of low vision patients, and prognosis
      1. Analysis and interpretation of personal, social, vocational, and psychological patient needs and factors
      2. Prescribing low vision devices (e.g., simple magnifiers, telescopes, loupes, and microscopes) with reference to magnification, full field of view, and working distance
      3. Patient education and training
      4. Roles and relationships with other disciplines
      5. Prognostic factors and follow-up care (see also (8) below)

5. Sensory Anomalies of Binocular Vision/Strabismus (16-20 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation and recognition of clinical signs, and techniques and skills to test:
      1. Monocular fixation
      2. Amblyopia
      3. Sensory fusion and stereopsis
      4. Anomalous correspondence
      5. Suppression
   C. Diagnosis, treatment and management procedures, and prognosis
      1. Spectacle and contact lens applications, including prisms (see also (8) below)
      2. Vision therapy

6. Anomalies of Eye Movements (10-14 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation and recognition of clinical signs, and techniques and skills to test:
      1. Comitance
      2. Deviations and measurements thereof
      3. Diplopia
      4. Motor fusion
      5. Paralytic syndromes
      6. Fixation disparity
      7. Nystagmus
   C. Diagnosis, treatment and management of eye movement anomalies, and prognosis
      1. Spectacle and contact lens applications, including prisms (see also (8) below)
      2. Vision therapy
7. Anomalies of Accommodation and Accommodative Vergence (10-14 Items)
   A. Epidemiology, history and symptom inventory
   B. Observation and recognition of clinical signs, and techniques and skills to test:
      1. Amplitude range, facility of accommodation
      2. Analysis of accommodation and vergence relationships
   C. Diagnosis, treatment and management of accommodation and accommodative vergence
      anomalies, and prognosis
      1. Spectacle and contact lens applications, including prisms and AC/A applications
         (see also (8) below)
      2. Vision therapy

8. Refractive Correction Applications (28-34 Items)
   A. Treatment and management of refractive/oculomotor/sensory integrative conditions using
      spectacle lenses:
      1. Ametropic spectacle lens prescriptions
      2. Lens problems of aberrations, weight, thickness, limits of field, ghost images,
         magnification, jump and displacement
      3. Frame and lens design, including types of single vision and multiple focal lenses, kinds of
         lens materials, base curves and cylinder forms, character and placement of multifocals,
         optical centers, and frame specifications.
      4. Evaluation of lenses and frames, via lensometer, lens gauge, and observation, for optical
         center positioning, powers, and other specifications of design
      5. Fitting and adjusting frames
      6. Patient counseling information associated with the dispensing of prescriptions for different
         ametropias
   B. Treatment and management of refractive/oculomotor/sensory integrative conditions using
      contact lenses:
      1. Lens types and materials: hard lenses; haptics; lathe-cut, molded, and spin-cast soft
         lenses
      2. Optics of contact lenses: curves, zones, widths and tear lens effects, sagittal depth; center
         and edge thickness; flex, asphericity and toric designs
      3. Basic theories and methods of fitting: lens design, specifications of orders, lens verification
         and evaluation, insertion and removal techniques, design of wearing schedules, fluorescein
         evaluation and fitting criteria
      4. Patient selection based upon history, analysis of primary care data, correlations of data,
         facial physiognomy, and contraindications; and management based upon education and
         patient handling and control
      5. Contact lens selection from presently available types and forms of lenses
      6. Care of lenses; handling; cleaning; preservatives available; disinfection methods and
         solutions
      7. Follow-up care; adaptation, physiologic and post-fitting complications, allergic responses,
         lens changes and mechanical problems
      8. Bifocal and astigmatic contact lenses; types, basis of selection and adaptation, techniques
         of fitting, and care for each
      9. Specially designed lenses and fitting procedures for keratoconus and irregular corneas,
         sports vision, diseased and traumatic corneas, cosmetic (prosthetic) use, iris color changes
         and color vision deficiencies
   C. Laser or surgical management of refractive conditions:
      1. Patient selection criteria
      2. Patient counseling information
      3. Peri-operative patient care
D. Perceptual Conditions - 33 Items (8%)

"Perceptual conditions" applies the knowledge of Basic Science to the prevention, diagnosis, treatment and management of those perceptual anomalies that can present to the optometrist by patients seeking primary eye care. It is composed of 4 major subdivisions: Anomalies of Child Development; Anomalies of the Aging Patient; Anomalies Secondary to Acquired Neurological Impairment; and Anomalies of Color Vision.

1. Anomalies of Child Development (10-14 Items)
   A. Epidemiology; history and signs/symptoms manifest by patients in the age ranges noted below in (B)
   B. Clinical techniques and tests to assess the development of an infant (birth to 18 months), toddler (18-36 months), pre-schooler (3-5 years), and school-age child
      1. Fine and gross motor development
      2. Speech-language development
   C. Clinical characteristics of children who deviate from normal patterns of development, and epidemiology of developmental disorders
   D. Vision problems which may be associated with deviations from normal patterns of development
   E. Tests used by optometrists to determine a child’s level of visual-perceptual development
      1. Visual attention and discrimination
      2. Visual-motor integration
      3. Intersensory integration
      4. Bilateral integration and laterality
   F. Role of the optometrist and other disciplines in screening, evaluating, managing and referring children who deviate from normal patterns of development

2. Anomalies of the Aging Adult (10-14 Items)
   A. Clinical characteristics of changes in perceptual function (non-visual) associated with aging
      1. Hearing
      2. Coordination
      3. Cognition
      4. Psycho-social status
   B. Symptom profiles, clinical procedures, and tests identifying changes in vision function of the aging patient
   C. Diagnosis, treatment, and management of aging patients
   D. Assessment of the need for referral and consultation with other disciplines

3. Anomalies Secondary to Acquired Neurological Impairment (4-8 Items)
   A. Adaptations to clinical techniques and tests to allow the assessment of the visual abilities of patients with acquired systemic conditions (CVA, multiple sclerosis, etc.) and traumatic brain injury (TBI) which result in neurological impairment and subsequent vision perceptual dysfunction
      1. Non-concomitancy
      2. Field loss and neglect
      3. Loss of accommodation
      4. Loss of fusion
      5. Vision perception-motor deficiencies
   B. Role of the optometrist in screening, evaluating, managing and referring patients within the multi-disciplinary rehabilitation team concerning sequelae of neurological impairment
   C. Modification of optometric treatment for the patient with acquired neurological impairment
      1. Lenses and prisms
      2. Forms of occlusion (nasal, temporal, full, etc.)
      3. Vision therapy
      4. Counseling and education of patients and their families
4. Anomalies of Color Vision (Inherited, Acquired) (2-4 Items)
   A. Inherited anomalies of color vision
      1. Classification
      2. Inheritance patterns
      3. Color vision tests (e.g., pseudoisochromatic tests, arrangement tests, anomaloscope)
   B. Acquired anomalies of color vision
      1. Classification
      2. Etiology
      3. Color vision tests
   C. Conditions for color vision testing
   D. Societal implications of color vision anomalies
      1. School
      2. Vocational requirements
      3. Patient interest
   E. Patient management strategies
      1. Counseling
      2. Special aids
E. Public Health* - 15 Items (3%)

"Public health" is the application of knowledge to the identification of society's health needs, and government and private initiatives that address those needs. It includes the optometrist's responsibilities in health promotion and in managing primary health and eye care conditions in populations of people who need optometric services. It is composed of 4 major subdivisions, each dealing with health concerns related to groups of patients, as contrasted with individual direct patient care issues.

1. Epidemiology (4-7 Items)
   A. Quantitative measures
      1. Incidence
      2. Prevalence
      3. Odds ratio
      4. Relative risk
      5. Indices of health
   B. Screening concepts
      1. Sensitivity
      2. Specificity
      3. Predictive value
      4. Yield
   C. Major epidemiological studies
      1. Orinda Vision Screening Study (1957-1959)
      2. Framingham Eye Study
      3. NIH/NEI studies
      4. Baltimore Eye Study
      5. Beaver Dam Eye Study
   D. Research design
      1. Sampling and randomization
      2. Observational vs. experimental studies
      3. Case-control vs. cohort studies
      4. Prospective vs. retrospective studies
      5. Cross-sectional studies
      6. Research ethics
   E. Morbidity and mortality in the United States
      1. General morbidity and mortality patterns
      2. General distribution of eye and vision disorders
      3. Legal blindness in the United States (age-specific causes, age-specific rates)

2. Biostatistics and Measurement (2-3 Items)
   A. Measures of central tendency and variability
   B. Parametric vs. nonparametric measures
   C. Statistical significance
   D. Causal inference
   E. Validity and reliability
   F. Bias

3. Environmental Vision (1-3 Items)
   A. Visual demands and ocular hazards
      1. Work
      2. Home
      3. Recreation
   B. Materials and/or procedures designed for safety or to improve visual performance
      1. Work
      2. Home
      3. Recreation
   C. Influence of environmental changes on visual performance
4. Health Care Policy and Administration (4-6 Items)

A. Organization of health services
   1. Levels of care (primary, secondary, tertiary)
   2. Types of providers (skills and credentials of other providers, referral patterns among providers)
   3. Types of practice (solo/private, group, interdisciplinary)
   4. Delivery settings (offices/clinics, hospitals, health departments, co-management centers, long-term care facilities)
   5. Alternative delivery and managed care systems (HMOs, IPAs, PPOs, VSPs)

B. Planning and regulation
   1. Federal, state and local government
   2. Private agencies
   3. Professional associations

C. Health economics and financing
   1. National health care expenditures
   2. Cost of eye and vision care
   3. Payment mechanisms (fee for service, capitation, prospective payment, retrospective reimbursement, resource based relative value systems)
   4. Cost control measures
   5. Insurance and government sponsored programs

D. Health care personnel
   1. Supply and distribution
   2. Utilization and productivity

E. Health promotion, disease prevention and community optometry
   1. Levels of prevention (primary, secondary, tertiary)
   2. Infection control
   3. Population trends and emerging needs
   4. Eye and vision care needs of high-risk populations
   5. School and community screening programs

F. Quality assurance
   1. Monitoring and evaluation (structure, process, outcome)
   2. Utilization review (retrospective, concurrent, prospective)
   3. Public and private programs

*Note: Test items on the content areas of Public Health will be integrated within and across the four major Clinical Science subdivisions (Systemic Conditions; Ocular Disease/Trauma; Refractive/Oculomotor/Sensory Integrative Conditions; Perceptual Conditions) where appropriate and relevant.
F. Legal and Ethical Issues* - 12 Items (3%)

"Legal and Ethical Issues" is the application of fundamental legal and ethical principles to optometric responsibilities in patient care and management. It is composed of 4 major subdivisions, each dealing with a specific issue that can affect optometric practice.

1. Licensure and Governmental Regulation of Optometry (2-4 Items)
   A. State laws, regulations, and administrative agencies
      1. Powers and duties of state boards of optometry (licensure and discipline)
   B. Federal laws, regulations, and administrative agencies
      1. Food and Drug Administration (FDA)
      2. Occupational Safety and Health Administration (OSHA)
      3. Drug Enforcement Administration (DEA)
      4. Americans with Disabilities Act (ADA)
      5. Title VII of the Civil Rights Act (discrimination and harassment)
      6. Visual disability
      7. Health Insurance Portability and Accountability Act (HIPAA)

2. Standards of Professional Ethics (1-2 Items)
   A. Basic principles of health care ethics
   B. Standards of professional conduct
   C. The Optometric Oath

3. Doctor-patient relationship (3-6 Items)
   A. Confidentiality of patient information
      1. Doctor-patient privilege
      2. Liability of optometrists
         a. Defamation
         b. Invasion of privacy
         c. Breach of confidentiality
   B. Patient records
      1. Ownership
      2. Entries and corrections
      3. Documentation of patient management
      4. Federal Trade Commission (FTC) eyeglass prescription release requirements
      5. Release of information
      6. Retention of records

4. Professional Liability (2-4 Items)
   A. Doctor-patient relationship
   B. Malpractice
   C. Ophthalmic materials (ANSI standards)
   D. Equipment and premises
   E. Employees (vicarious liability)
   F. Informed consent
   G. Management of general and ocular emergencies

*Note: Test items on the content areas of Legal and Ethical Issues will be integrated within and across the four major Clinical Science sub-divisions (Systemic Conditions; Ocular Disease/Trauma; Refractive/Oculomotor/Sensory Integrative Conditions; Perceptual Conditions) where appropriate and relevant.
CLINICAL SCIENCE
TEST BLUEPRINT SUMMARY

Below is a summary of the Test Blueprint used by the Examination Development Committees when constructing the Clinical Science examination. This provides candidates with summary information on the distribution of test items by subject area, and by cognitive skill in clinical application in Clinical Science.

### Clinical Application

<table>
<thead>
<tr>
<th></th>
<th>Epidemiology/History/Symptoms</th>
<th>Clinical Signs/Techniques (Clinical Testing)</th>
<th>Diagnosis/** Management/Treatment/Prognosis</th>
<th>Public Health</th>
<th>Legal and Ethical Issues</th>
<th>Total Number of Items</th>
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<tr>
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<td>A. Systemic Conditions</td>
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<td>B. Ocular Disease/Trauma</td>
<td>13–25</td>
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<td>C. Refractive/Oculomotor/ Sensory Integrative Conditions</td>
<td>11–17</td>
<td>41–55</td>
<td>54–72</td>
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<td>D. Perceptual Conditions</td>
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<td>11–19</td>
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* Of this total, the 15 items in Public Health and the 12 items in Legal and Ethical Issues, while displayed here against A, B, C, and D, are referenced in the Content outline under E, and F, respectively. Consequently, the item totals in the Content Outline for A, B, C, and D are less than those indicated above, as the items for Public Health and Legal and Ethical Issues are not included.

** For Ocular Disease/Trauma, Diagnosis includes Clinical Pathophysiology.
Part III - Patient Care

Part III, unlike the Basic Science and Clinical Science examinations, which assess cognitive skill (i.e., knowledge), assesses a candidate's ability to examine actual patients, evaluate actual clinical data, and render patient care decisions. This multifaceted examination consists of two administratively distinct sections and formats: a 5-station Clinical Skills performance (i.e., practical) test, and a written test in Patient Assessment and Management (PAM).

In the Clinical Skills section, the candidate examines a patient at each of 5 stations in the performance of 19 clinical skills. Although this section measures primarily psychomotor skills, it contains an assessment of affective (i.e., clinical habits and attitudes) and communication skills, as well as some interpretation of clinical findings. This test section is administered in one 3.5 hour session; however, because of the limited number of candidates who may be examined per session, multiple sessions are scheduled.

The Patient Assessment and Management (PAM) section consists of 40 abridged patient scenarios, each of which is followed by three multiple-choice items. Each item, which contains as many as ten options, focuses on resolving assessment and management such as diagnosis, interpretation and correlation of clinical data, treatment, follow-up, prognosis, and patient education. The Clinical Skills section accounts for 60% of the Part III score, while the PAM section accounts for 40%.

Student candidates are permitted to take Part III (both sections) just before they graduate from a COE accredited institution. However, an individual candidate's official score report containing Part III scores will not be released until the National Board has received official notification that the candidate has graduated. Also, no official score reports containing Part III scores will be released to any candidate until the dates for Release of Score Reports. If the National Board has not received written notification of a candidate's graduation from his/her school or college by March 1st of the year following the test administration, the candidate's Part III scores will be nullified. Candidates are required to take both sections (i.e., Clinical Skills and PAM) in one administration (i.e., spring or fall). However, candidates who have previously passed Part III may take either individual section alone at their own discretion if they wish to improve a prior score.

A. Clinical Skills - Practical Exam with 5 Stations and 19 skills (60%)

Station 1:
1. Case History/Patient Communication
2. Near Cover Test Evaluation
3. Pupil Testing
4. Extraocular Motility Evaluation
5. Blood Pressure Measurement

Station 2:
6. Biomicroscopy
7. Goldmann Applanation Tonometry
8. Gonioscopy
9. Collagen Implant Insertion and Removal Station

Station 3:
10. Retinoscopy
11. Distance Subjective Refraction
12. Accommodation Testing
13. Heterophoria and Vergence Testing at Near
Station 4:
14. Patient Communication/Education and Prescription Writing in Ocular Disease Management
15. Ophthalmic Materials Evaluation

Station 5:
16. Binocular Indirect Ophthalmoscopy
17. Non-Contact Fundus Lens Evaluation
18. Soft Contact Lens Insertion, Evaluation, and Removal
19. Rigid Gas Permeable Contact Lens Insertion, Evaluation, and Removal

B. Patient Assessment and Management Exam (PAM) - 40 Patient Scenarios (40%)
1. Ocular Disease/Trauma - Diagnosis, Data Interpretation, Clinical Correlation
2. Ocular Disease/Trauma - Treatment, Pathophysiology/Etiology, Follow-Up, Prognosis
3. Refractive/Functional Conditions - Diagnosis, Data Interpretation, Clinical Correlation
4. Refractive/Functional Conditions - Treatment, Pathophysiology/Etiology, Follow-Up, Prognosis
The Treatment and Management of Ocular Disease (TMOD) examination is endorsed by the Association of Regulatory Boards of Optometry (ARBO). This 150-item examination primarily assesses the candidate's knowledge regarding the appropriate use of medications to treat and manage eye diseases as defined by the broadest scope of current optometric practice statutes. The specific test items relate to ocular conditions for which expanded responsibilities allow optometric therapeutic management.

The TMOD examination focuses primarily on the administration of prescription drugs. However, some items include the use of over-the-counter medications, and other items involve non-pharmacologic interventions. In addition, some items may test the candidate's knowledge of whether additional diagnostic data are needed before initiating treatment. These additional considerations are part of optometrists' responsibilities where the scope of practice has been expanded.

The majority of questions on the TMOD examination are presented in a "case scenario" format. The candidate is given a patient's signs and/or symptoms along with any pertinent clinical data and patient history information, and is asked to make a treatment/management decision regarding the patient. The candidate must form a diagnosis to determine the patient's proper treatment/management; however, items on the TMOD examination do not require the candidate to state a diagnosis.

An understanding of systemic conditions that have a clinical correlation to ocular signs and symptoms and an understanding of systemic conditions/medications that may contraindicate certain ocular therapies are integral to the therapeutic management of ocular disease. Therefore, up to 30% of the items on the TMOD examination may include systemic considerations to reflect these clinical interrelationships. However, items on the TMOD examination do not test directly the pathophysiology or treatment of specific systemic diseases.

The TMOD test is composed of two sets of categorical breakdowns. The first breakdown consists of 13 major anatomical subdivisions of the eye and adnexa. The second breakdown represents five areas of clinical application. Each test item is classified within an anatomical subdivision and a clinical application category. Each category contains numbers in parentheses that indicate the range of items (minimum and maximum) that will appear on the examination. These ranges are included to inform candidates of the relative emphasis placed on each anatomical subdivision and clinical application. The percentage indicated is for the number represented by the mid-point of the range.

The National Board is aware that some practitioners, as well as some student clinicians, may be more familiar with the trade names of drugs than with the generic names. For this reason, on both the TMOD examination and the Part II (Clinical Science) examination, the National Board has a longstanding policy of providing both the generic and the trade names for those generic drugs that have commonly used trade names (e.g., acetazolamide as a generic name and Diamox as the commonly used trade name). However, to avoid having to print both the generic and the trade names of such drugs each time they are referenced on an examination, the National Board has developed a list of generic names and corresponding trade name equivalents for those drugs that have commonly used trade names. The candidate is referred to the table Generic Names and Trade Name Equivalents for a listing of these drugs. This list also is reprinted on the inside front covers of the TMOD and Clinical Science test booklets.

It is important to note that many generic drugs appearing on the TMOD and Clinical Science examinations are not included in the Generic Drugs and Trade Name Equivalents listing, because these drugs are generally referred to only by their generic names. Examples of such drugs include erythromycin, homatropine, and prednisone.

It should also be noted that, because this Examination Guide went to publication prior to the completion of the selection process for the 2002 examinations, it is possible that a drug with a commonly used trade name may appear on the exam although it does not appear on the drug list in
this guide. If this situation should occur, the drug list that appears in the test booklet will be updated to include any such drugs.

**Special Note to TMOD Candidates**
Candidates for the TMOD exam should be aware that the National Board neither endorses nor has any affiliation with any agency, company, educational institution, or individual educator offering continuing education or other courses that claim to prepare candidates for the TMOD exam. Although the National Board recognizes the effectiveness of books and other materials for studying, the Board does not endorse any specific book or other study aid in preparing for the test.

**Student Candidates for Part II (Clinical Science)**
The Part II (Clinical Science) examination includes a subtest equivalent to the Treatment and Management of Ocular Disease (TMOD) examination. The TMOD subtest contains 90 items embedded within the Ocular Disease/Trauma Section of Part II (Clinical Science). A candidate who passes the TMOD examination embedded within Clinical Science does not need to take the stand-alone TMOD examination unless specifically required by the state board(s) of the state(s) to which the candidate plans to apply for licensure. Candidates who pass Part II (Clinical Science) but do not receive a scaled score at or above 75 on the TMOD subtest will be eligible to take the TMOD stand-alone examination at a later date. Candidates who fail Part II (Clinical Science) must repeat the entire Part to achieve a passing status for the Part. Candidates who fail Part II (Clinical Science) but who attain a scaled score at or above 75 on the TMOD subtest will retain a passing score for the TMOD examination.

<table>
<thead>
<tr>
<th>TMOD Content Outline</th>
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<tbody>
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<td>Content Area</td>
<td># of Items</td>
<td>% of Questions</td>
<td>Clinical Application</td>
<td># of Items</td>
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<tr>
<td>1. Orbit, Adnexa, Lacrimal System</td>
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<td>22</td>
<td>A. Section of treatment/management, including systemic considerations</td>
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<td>2. Cornea/External Disease</td>
<td>46-60</td>
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<td>B. Dose, form, schedule, and duration of treatment</td>
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<td>3. Glaucoma</td>
<td>22-32</td>
<td>18</td>
<td>C. Contraindications and side effects of medication, including systemic considerations</td>
<td>15-25</td>
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<td>4. Lens/Cataract</td>
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<td>5. Uveitis, Sclera/Episclera</td>
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<td>D. Follow-up and prognosis, including reassessment of diagnosis after initiating treatment</td>
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<td>6. Retina/Vitreous</td>
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<td>E. Treatment and management of ocular emergencies and urgencies</td>
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<td>7. Neuro-Ophthalmic Disorders</td>
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| % of Questions | |
|----------------||
| 60 | |
| 7 | |
| 13 | |
| 13 | |
| 7 | |
TMOD

(2005 Generic Drugs & Trade Name Equivalents)
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<td>Naprosyn and Aleve</td>
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<td>Prostigmin</td>
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<td>nifedipine</td>
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<td>Mycostatin</td>
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<td>prednisolone-gentamicin</td>
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<td>Kwell</td>
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<td>Ophthain</td>
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<td>propoxyphene</td>
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<td>OptiPranolol</td>
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<td>Sulamyd</td>
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<td>sulfacetamide-phenylephrine</td>
<td>Vasosulf</td>
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<td>Singulair</td>
<td>sulfacetamide-prednisolone</td>
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<td>Microsulfan</td>
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<td>Aristocort or Kenalog</td>
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<td>trifluridine</td>
<td>Vioptic</td>
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<td>*Polytrim</td>
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<td>Coumadin</td>
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<td>Retrovir</td>
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1This listing contains only those drugs that may appear on the TMOD and Clinical Science examinations *that have commonly used trade names*. It is important for candidates to note that many other drugs will appear on the TMOD and Clinical Science examinations, but are excluded from the list above because they are generally referenced by their generic names only. Examples of such drugs are erythromycin, homatropine, and prednisone.

To reduce the verbiage on the TMOD and Clinical Science tests, most individual drugs will be referenced by generic name only, and a combination drug, such as polymyxin B-bacitracin, will be referenced by its trade name, Polysporin. The trade names of combination drugs are marked on the drug list with an asterisk (*) to designate that the trade name of these drugs, rather than the generic name, will appear on the examinations. This drug list, which will be reproduced on the inside front cover of the TMOD and Clinical Science test booklets and will fold out for easy reference, is intended to assist those practitioners and student clinicians who may be more familiar with the trade names of some drugs rather than the generic names. The drug list is *not* intended to be a syllabus or study guide.

It should be noted that the National Board's Part I (Basic Science) test typically references drugs by generic name only. The drug list is not included in the test booklets for the Basic Science exam.