Meeting of the College Council - Teleconference
DRAFT AGENDA
Date: Monday November 5, 2018
Meeting begins at 9:10 p.m.

Agenda Item	Page No.	Action Required	Item Lead	Approx. Time (mins.)
1. Call to Order/Attendance			Hemami, P.	1
2. Adopt the Agenda a. Conflict of Interest Declaration		Decision	Hemami, P.	1
3. Alternate Entry to Practice Exam -Council may go **in camera** under Section 7(2)(b) and (e) of the *Health Professions Procedural Code,* which is Schedule 2 to the *Regulated Health Professions Act,* 1991-	2	Discussion	Hemami, P.	30
4. Dates of Upcoming Council Meetings a. Friday, January 18, 2019 b. Wednesday, April 24, 2019 c. Monday, June 24, 2019				
5. Adjournment		Decision	Hemami, P.	1

Date: November 1, 2018

To: Council

Cc: Dr. Patrick Quaid, Chair, Registration Committee; Ms. Hanan Jibry, Assistant Registrar

From: Pooya Hemami, President on behalf of the Executive Committee

Re: Recommendation for Council to Approve National Board of Examiners in Optometry (NBEO) Examination as an Alternate Standards Assessment Required for Registration in Ontario.

Background

In 2015 and 2016, the College expressed, to OEBC (at the time, called CEO-ECO), its disapproval and disagreement with some aspects of the proposed OEBC exam.[1] The College issued a request-for-proposals (RFP) for the development of an alternate Canadian examination in late 2016. OEBC launched its new examination in spring 2017.

Several provincial regulators, including Ontario, felt that a process was lacking for OEBC's members (owners) to have any tangible control over broad aspects of the organization and its main product (the OEBC exam). The College, and certain other regulators, believed that placing provincial registrars, or their optometric regulatory council representatives, on the Board of Directors of OEBC would be the best way to effect substantial changes in the OEBC OSCE examination. The OEBC members hence decided in June 2018 to replace the entire OEBC Board with provincial registrars from each province (in Quebec, the chair of Quebec's Registration committee was elected to the board).

Unfortunately, there is little evidence that the College's concerns are being considered by the new OEBC board, and it has become apparent that the majority of OEBC's directors may not share the College's view regarding the OEBC exam. At this juncture, it appears unlikely that definitive changes to the exam will be undertaken to address the College's concerns within its desired timeframe.

Given this backdrop, the Executive committee has decided to revisit accepting the NBEO as an alternate standards assessment option, in order to provide candidates with improved choice, accessibility and flexibility. This is not a new concept, as over the last number of years, the College has already considered accepting the NBEO exam as either an alternate entry to practice exam or as the only exam approved by Council. In June 2013, a motion to accept NBEO was defeated by Council by a single vote,

[1] From the OEBC Candidate Instructions & Written Guide, *"The OSCE involves no direct contact on the standardized patient. If there are required tests or procedures in an OSCE station they will be performed on a model."*

but the concept continued to be alive over the subsequent years. Over the past eight years, over 44% of new registrants that are graduates of ACOE optometry schools received their optometric education in US optometry schools. Further, given that BC and QC already accept the NBEO as an entry-to-practice exam, graduates who pass this exam can already apply to register in Ontario (through labor mobility provisions) without completing the OEBC exam. Accordingly, there may now be a stronger argument to accept the NBEO for fairness and accessibility considerations than in previous years, provided that Council is confident that the NBEO is a robust, valid and defensible entry-to-practice examination. The Registration Committee reviewed the NBEO when it sent some of its members to visit their clinical testing facility in August 2017. In addition, the NBEO has broad acceptance by all 50 US states (including those with broader scopes of practice than Ontario), and the exam has robust oversight through NBERC. On October 22, 2018, I wrote to the Registration Committee and asked it to compare the NBEO and OEBC exams and to determine if a candidate who successfully challenged the NBEO exam would be reasonably expected to provide, at a minimum, a similar assurance of entry-level optometric practice competency, as a candidate who successfully challenges the entirety of the OEBC examination (OEBC written + OSCE). The Registration Committee's conclusion is included in this package.

Based on the forgoing, the Executive Committee recommends that Council approve the NBEO examination for registration purposes as a standards assessment approved by the College. (see **OPTION 2 below**). Applicants could choose between challenging either the NBEO or OEBC exam for the purposes of registration with the College. This decision provides an alternative exam for applicants.

Potential scenarios for Council to consider		
	Advantages	Disadvantages
1. Status-quo (only accept the OEBC Exam as the standards assessment required for registration)	- Minimal adjustments to College's current relationship with current stakeholders - The College would continue to sit on the OEBC Board of Directors.	- The College will continue to accept an examination that does not fully satisfy Council's preferences. - There is no assurance that the OEBC examination will change to address the College's concerns or preferences - QC and BC already accept NBEO, we estimate that OEBC exam's "market share" of new Canadian registrants is declining
2. Approve the NBEO examination[2] as a standards assessment that meets registration requirements (so that applicants have the option of completing either the OEBC exam or the NBEO exam to register in Ontario). ***Recommendation of the Executive committee***	- Provides an alternative exam option to applicants thereby providing increased accessibility to the practice of the profession - Satisfies the RC's concerns and has demonstrated extensive external oversight (through ARBO's National Board of Examiners Review Committee (NBERC)) and high standards of transparency, security, validity, defensibility o Some RC members and I attended an on-site visit to NBEO's National Center for Clinical Testing in Optometry (NCCTO) in August 2017 in Charlotte, NC, and we were satisfied that we observed evidence of a valid and defensible entry level competency exam. NBEO representatives responded to RC queries effectively in a very transparent manner, including queries on possible security breaches, and where RC was permitted to view live NBEO Part III exam administrations. o NBEO is a well-recognized exam used by all 50 US states, including those with broader scopes of practice than any Canadian province	- Decision may result in higher OEBC exam fees for those who choose to write it, if many applicants choose to write NBEO instead of OEBC exam. - NBEO currently requires all candidates to travel to Charlotte NC (USA) to perform the Part III exam; this could be a potential accessibility barrier to some candidates o Currently mitigated by allowing OEBC alternative - NBEO examination is not currently available in French o Currently mitigated by allowing OEBC alternative - , The College has less direct oversight over NBEO exam than with OEBC (although Ontario could potentially obtain a seat on NBERC) - Certain FORAC members may be dissatisfied by Ontario's decision, although Ontario's position would be no different from that of BC or QC -

[2] The NBEO exam is comprised of 3 separate parts. These are: Part 1- Applied Basic Science (ABS), Part II- Patient Assessment and Management (PAM) and Part III Clinical Skills Exam (CSE). Details of the exam can be found on the NBEO website by clicking here. Both Part I and Part II are administered by computer at Pearson-Vue testing centres. Part III is administered at NBEO's National Center for Clinical Testing in Optometry (NCCTO) in Charlotte North Carolina.

	○ Given its size, NBEO has comparably large resources (staff, question writers, exam question banks, etc.) compared to OEBC ○ Video recording and storage of applicant interactions during NBEO Part III provides high defensibility when dealing with appeals - Formalizes a process that was already available to candidates previously (candidates already become registered in BC or QC with NBEO exam and apply to transfer to Ontario using labour mobility provisions without needing to write OEBC exam) - NBEO option provides advantages to applicants to registration compared to OEBC ○ Lower cost (US$2175 for all three NBEO parts vs C$5900 for OEBC Written & OSCE) ○ Allows students to write NBEO Part I in their third year and complete all three Parts before graduation ○ Eliminates double-testing for applicants having completed US residencies[3] - NBEO infrastructure (electronic testing) can potentially be used for other assessments that may be considered in the future - The College can continue to sit on the OEBC Board of Directors	
3. Accept NBEO exam and discontinue accepting OEBC exam as standards assessment required for registration (i.e. the NBEO would be the ONLY exam accepted for applicants wishing to register in Ontario) ***Not recommended by the Executive committee***	- Most Advantages from Option 2 are also applicable to Option 3 - Provides stronger assurance that all registrants will have demonstrated performance of skills on live subjects in a controlled/standardized setting	- Given the requirement to travel to a foreign country (US) for NBEO Part III and that the exam (all parts) is only currently available in English, Fairness issues can be raised for French applicants or those unwilling/unable to travel to the US ○ An alternate (interim) assessment process will need to be available for such candidates (at minimum)
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[3] A graduate of an optometry degree program must successfully challenge the NBEO examination in order to apply for a residency position at an ACOE School.

From:	Paula Garshowitz
To:	Hanan Jibry
Cc:	Patrick Quaid (drptquaid@gmail.com); Pooya Hemami (hemamip@gmail.com)
Subject:	Memo to Registration Committee
Date:	Monday, October 22, 2018 8:58:00 AM
Attachments:	2018-10-22 Memo to Registration Committee from Dr. Hemami Re Request for NBEO Review.pdf

Dear Hanan:

Attached please find a memo from Dr. Hemami to the Registration Committee in advance of its meeting on Friday, October 26. In his memo, Dr. Hemami is seeking an opinion from the Registration Committee regarding standards assessments for entry-to practice.

In addition to the memo, Dr. Hemami has asked that the following documents be made available to the Registration Committee today through the virtual boardroom, to assist in its review:

NBEO Documents:

Complete Exam Content Matrix

Part 1-Applied Basic Science (ABS)
- Exam Content Outline
- Exam Content Matrix

Part II-Patient Assessment and Management (PAM)
- Exam Content
- Exam Content Matrix

Part III-Clinical Skills (CSE)
- Candidate Guide
- Exam Content Matrix
- Candidate Orientation Video
- CSE Preparation Video

OEBC Documents:

OEBC competency profile
OEBC Exam Blueprint
OEBC Candidate Guide (in particular Appendix A: Equipment Images
OSCE Administration Video
OSCE Station Video

Please let me know if you have any questions.

Best regards
Paula

Paula L. Garshowitz, OD
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COLLEGE OF Optometrists OF ONTARIO

MEMO

Date: October 22, 2018

To: Dr. Patrick Quaid, Chair, Registration Committee

Cc: Ms. Hanan Jibry, Assistant Registrar

From: Dr. Pooya Hemami, President

Re: Consideration by Registration Committee of National Board of Examiners in Optometry (NBEO) Examination

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The Executive Committee is in the process of reviewing the College's involvement with the Optometry Examining Board of Canada (OEBC), of which it is a member. To facilitate the Executive Committee's review, it is seeking information on the NBEO examination to help inform future decision-making in terms of how the College's relationship with OEBC evolves, and if necessary, could potentially provide the College with an alternate option to consider for the entry to practice competency assessment required for registration.

In order to facilitate this review, Executive seeks an opinion from the Registration Committee as to whether it believes that a candidate, who successfully challenges the entirety of the NBEO examination (Part 1-Applied Basic Science, Part II- PAM-Patient Assessment and Management, and Part III-Clinical Skills), would be reasonably expected to provide, at a minimum, a similar assurance of entry-level optometric practice competency, as a candidate who successfully challenges the entirety of the OEBC examination (OEBC written + OSCE). In other words, is the Registration Committee confident that an individual who has passed the NBEO examination has demonstrated the same, or higher, level of competency to practice optometry safely as an individual who has passed the OEBC examination.

In addition, the Registration Committee is being asked for its opinion on whether or not it believes that the OEBC examination provides a more robust, valid, comprehensive and defensible assessment of the knowledge, skills, and judgement (or competencies) required for safe and effective entry-level optometry practice in Canada than the NBEO examination.

The Registration Committee is asked not to factor into its analysis any consideration for possible outcomes or effects on OEBC or other parties that could result should Council approve the NBEO examination for registration in Ontario. The presence or absence of Canadian regulator oversight on NBEO should also not influence its analysis.

COLLEGE OF
Optometrists
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MEMORANDUM

Date: Oct. 27, 2018

To: Dr. Pooya Hemami, President

CC: Ms. Hanan Jibry, Assistant Registrar & Support Staff, Registration Committee

From: Dr. Patrick Quaid, Chair, Registration Committee

Re: **Consideration of National Board of Examiners in Optometry (NBEO) Examination**

The Registration Committee met yesterday to consider your request in your memorandum dated Oct. 22, 2018, with respect to the above.

In order to determine whether an individual who has passed the National Board of Examiners in Optometry (NBEO) examination has demonstrated the same, or higher, level of competency to practise optometry safely as an individual who has passed the Optometry Examining Board of Canada (OEBC) examination, the Committee used OEBC's Competency Profile which was mapped to the overall Competency Matrix of Part I, II and Part III of the NBEO examination. The goal was to identify whether the scopes were comparable, and to identify any significant gaps between the OEBC and NBEO examinations.

Based on a high-level assessment of the scopes, the Registration Committee agrees that the competency matrix for NBEO is comparably mapped to the competency profile of OEBC with no material gaps. [redacted]

As for the question of whether the OEBC examination provides a more robust, valid, comprehensive and defensible assessment of the knowledge, skills, and judgement required for safe and effective entry-level optometry practice in Canada than the NBEO examination, the Committee has insufficient information to ascertain this as it has not had adequate access to the technical skills portion of the OEBC examination. There is no video recording making the defensibility of the OEBC examination somewhat of a concern in the event of an appeal. Although there are differing opinions, the general consensus among clinical exam methodologies is that live subjects should be used for critical technical skills, for example, gonioscopy, tonometry, and fundus examination. It is the Committee's impression that currently live subjects are not being used in the critical OEBC technical skills component.

In conclusion, it is the overall opinion of the Registration Committee that based on a high-level review of the OEBC's Competency Profile, the NBEO Content Matrix, and general clinical skills assessed (directly/indirectly), that the NBEO examination is at least comparable to the current OEBC examination process. However, this opinion must be tempered by the fact that the Committee has not been permitted unfettered and direct observation of the OEBC OSCE component occurring in real time. While it is appreciated that this may be a logistical challenge in terms of not interrupting candidates, other organizations have been able to accommodate it in a professional manner without interruption to candidates taking the examination.

Click HERE or anywhere on the Part I Matrix for an enlarged view, discipline and condition item ranges, and views of the related content.

	PART I Applied Basic Science Items: 350 Sessions: 2					PART II Patient Assessment and Management Format: Case-based, Image Intensive Items: 350 Sessions: 2					PART III Clinical Skills Format: Performance Test Items: ≥ 350 Skills: 20			
	A. ANATOMY (Gross, Neuroanatomy, Histology, and Development)	B. BIOCHEMISTRY / PHYSIOLOGY	C. IMMUNOLOGY / MICROBIOLOGY / PATHOLOGY	D. OPTICS (Geometrical, Physical, Ophthalmic, and Physiological)	E. PHARMACOLOGY	F. CLINICAL PRESENTATION (History, Signs, Symptoms)	G. CLINICAL CORRELATION OF BASIC SCIENCE PRINCIPLES	H. DIAGNOSIS	I. TREATMENT / MANAGEMENT	J. LEGAL ISSUES / ETHICS / PUBLIC HEALTH	K. COMMUNICATION SKILLS	L. AFFECTIVE SKILLS	M. PSYCHOMOTOR SKILLS	N. CLINICAL OBSERVATION & REPORTING SKILLS
Conditions related to:														
REFRACTIVE STATUS/ SENSORY PROCESSES / OCULOMOTOR PROCESSES														
Ametropia														
Ophthalmic Optics / Spectacles														
Contact Lenses														
Low Vision														
Accommodation / Vergence / Oculomotor Function														
Amblyopia / Strabismus														
Perceptual Function / Color Vision														
Visual and Human Development														
NORMAL HEALTH / DISEASE / TRAUMA														
Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit														
Conjunctiva / Cornea / Refractive Surgery														
Lens / Cataract / IOL / Pre- and Post-Operative Care														
Episclera / Sclera / Anterior Uvea														
Retina / Choroid / Vitreous														
Optic Nerve / Neuro-Ophthalmic Pathways														
Glaucoma														
Emergencies / Trauma														
Systemic Health														

PART I (APPLIED BASIC SCIENCE)

Applied 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. Applied Basic Science is composed of two major condition areas (i.e., Refractive Status / Sensory Processes / Oculomotor Processes and Normal Health / Disease / Trauma), and seventeen specific condition areas. The condition areas and their relative emphases are shown below.

	Number of Items *
REFRACTIVE STATUS / SENSORY PROCESSES / OCULOMOTOR PROCESSES - 122 Items	
Ametropia	29 – 39
Ophthalmic Optics / Spectacles	17 – 25
Contact Lenses	8 – 14
Low Vision	5 – 9
Accommodation / Vergence / Oculomotor Function	10 – 18
Amblyopia / Strabismus	9 – 17
Perceptual Function / Color Vision	10 – 18
Visual and Human Development	6 – 10
NORMAL HEALTH / DISEASE / TRAUMA - 228 Items	
Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit	20 – 28
Conjunctiva / Cornea / Refractive Surgery	34 – 50
Lens / Cataract / IOL / Pre- & Post-Operative Care	8 – 14
Episclera / Sclera / Anterior Uvea	16 – 24
Vitreous / Retina / Choroid	17 – 25
Optic Nerve / Neuro-Ophthalmic Pathways	14 – 22
Glaucoma	13 – 21
Emergencies / Trauma	8 – 14**
Systemic Health	55 – 75
TOTAL	**350**

* The number of items indicates the range for each condition area within a two major categories of Refractive Status / Sensory Processes / Oculomotor Processes and Normal Health / Disease / Trauma headings. The range specifies the minimum and maximum number of items in each condition area that will be administered as scored items on the test.

** Items in Emergencies / Trauma are embedded within the other condition areas in Normal Health / Disease / Trauma.

NBEO PART I

ANATOMY (GROSS): Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit

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

B. Eyebrow (structure and function)

C. 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 muscle); lacrimal sac (relationship to medial palpebral ligament, Horner muscle, orbicularis oculi; septum orbitale)
5. Lacrimal fossa (bony structure)
6. Nasolacrimal canal (bony composition, relationship to maxillary sinus)

D. 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)

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

F. 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

ANATOMY (GROSS): Conjunctiva / Cornea / Refractive Surgery

A. 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 layer): relationship to stroma, basal lamina, and epithelium
5. Stroma (composition, ultrastructure)
6. Posterior limiting lamina (Descemet membrane): relationship to stroma and endothelium
7. Endothelium (composition, ultrastructure)
8. Limbus
9. Innervation
10. Regeneration

B. Conjunctiva
1. Location
2. Composition (layers, cell types, glands, Palisades of Vogt)
3. Relationship to tarsal plate, extraocular muscles, sclera, fascia bulbi (Tenon capsule), cornea
4. Blood supply and venous drainage, lymphatic drainage
5. Innervation
6. Plica similunaris (composition)
7. Caruncle (composition)

ANATOMY (GROSS): Lens / Cataract / IOL / Pre- and Post-Operative Care

A. 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)

ANATOMY (GROSS): Episclera / Sclera / Anterior Uvea

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

B. 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 canal (location, size, ultrastructure of wall, afferent and efferent connections)
7. Scleral spur (composition, location)
8. Schwalbe line (composition, location)

C. 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

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

E. 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

ANATOMY (GROSS): Vitreous / Retina / Choroid

A. 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 membrane (location, composition)

B. 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)

C. Retina
1. Layers (components of each, ultrastructure)
2. Relationship between retinal pigment epithelium and Bruch 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)

ANATOMY (GROSS): Optic Nerve / Neuro-Ophthalmic Pathways

A. 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)

B. 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

C. Visual pathway
   1. Localization of retinal fibers along visual pathway: optic nerve, chiasm, 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

ANATOMY (GROSS): Glaucoma

Gross Anatomy of the eye as it relates to primary open-angle glaucoma, angle-closure glaucoma, and secondary glaucoma (e.g., pigmentary dispersion glaucoma, pseudoexfoliation glaucoma, etc.)

A. Anterior chamber and angle

B. Ciliary body

C. Choroid

D. Vitreous

E. Retina

F. Optic Nerve

G. Cornea

H. Lens

ANATOMY (GROSS): Systemic Health

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

ANATOMY (NEUROANATOMY): Systemic Health

A. Spinal cord
1. Gray matter (e.g., nuclei, local reflex arcs)
2. White matter (e.g., ascending pathways, descending pathways)
3. Spinal nerves and sensory ganglia

B. Autonomic nervous system
1. Parasympathetic (course, branches, functions tissue innervated)
2. Sympathetic (course, branches, functions tissue innervated)
3. Neurotransmitters (e.g., types, locations)

C. Medulla
1. Level of motor decussation
2. Level of sensory decussation
3. Level of inferior olives
4. Level of open medulla
5. Dorsal and ventral cochlear nuclei
6. Vestibular nuclei
7. Glossopharyngeal nerve
8. Vagus nerve
9. Spinal accessory nerve
10. Hypoglossal nerve

D. Pons
1. Low or caudal pons
2. Abducens nerve
3. Mid pons
4. Trigeminal nerve
5. Facial nerve
6. Vestibulocochlear nerve

E. Midbrain
1. Level of inferior colliculus
2. Trochlear nerve
3. Level of superior colliculus
4. Oculomotor nerve
5. Level of pretectum (e.g., light reflex)

F. Diencephalon
1. Dorsal thalamus
2. Hypothalamus
3. Epithalamus
4. Subthalamus

G. Cerebrum
1. Gray matter (e.g., cytoarchitecture (layers), Brodmann cortical areas)
2. White matter (e.g., projections, internal capsule, optic radiations, commissural fibers, associational fibers)
3. Functions

H. Cerebellum

I. Blood supply
1. Surface arteries
2. Circle of Willis and its branches

ANATOMY (HISTOLOGY): Systemic Health

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

D. Neurohistology
1. Neural plate, neural fold, neural groove, neural tube, neural vesicles
2. Derivatives of neural crest (e.g., ganglia, adrenal medulla)
3. Layers of neural tube (e.g., ependymal, mantle, marginal)
4. Degeneration and regeneration in the nervous system

ANATOMY (DEVELOPMENTAL): Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit

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

ANATOMY (DEVELOPMENTAL): Conjunctiva / Cornea / Refractive Surgery

A. Conjunctiva

1. Ectodermal specialization forming conjunctiva and glands

B. 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

ANATOMY (DEVELOPMENTAL): Lens / Cataract / IOL / Pre-and Post-Operative Care

A. 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

ANATOMY (DEVELOPMENTAL): Episclera / Sclera / Anterior Uvea

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

B. 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 canal, scleral spur, trabecular meshwork
   5. Endothelial membrane

C. 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

D. Posterior chamber

E. 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

ANATOMY (DEVELOPMENTAL): Vitreous / Retina / Choroid

A. Choroid
   1. Tissue origin (paraxial mesoderm, neural crest cells)
   2. Development of choroidal vasculature (3 stages)
   3. Development of Bruch membrane

B. 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)

C. 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

ANATOMY (DEVELOPMENTAL): Optic Nerve / Neuro-Ophthalmic Pathways

A. 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

ANATOMY (DEVELOPMENTAL): Glaucoma

Developmental Anatomy of the eye as it relates to primary open-angle glaucoma, angle-closure glaucoma, and secondary glaucoma

A. 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 canal, scleral spur, trabecular meshwork
   5. Endothelial membrane

B. 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

C. 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

D. 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

E. 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

BIOCHEMISTRY: Systemic Health

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-Menten 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/eicosanoids
      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

PHYSIOLOGY: Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit

A. 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
5. Purposes and roles for vision

B. 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

C. 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

PHYSIOLOGY: Conjunctiva / Cornea / Refractive Surgery

A. 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

PHYSIOLOGY: Lens / Cataract / IOL / Pre- and Post-Operative Care

A. 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

PHYSIOLOGY: Episclera / Sclera / Anterior Uvea

A. Uvea
1. Functions of ciliary body
2. Functions of iris
3. Functions of choroid
4. Uveal blood flow: choroid, ciliary body, iris (unique characteristics of each, functions of each)

PHYSIOLOGY: Vitreous / Retina / Choroid

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

B. 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
11. Unique environment of the eye (high extravascular pressure)
12. Retinal blood flow (unique characteristics, dual supply, functions)

PHYSIOLOGY: Optic Nerve / Neuro-Ophthalmic Pathways

A. 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
9. Plasticity

B. 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)

C. Pupillary pathways
1. Sympathetic pathway to iris
2. Parasympathetic pathway to iris
3. Functional relationships between pupillary pathways and central nervous system

PHYSIOLOGY: Glaucoma

A. 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)

B. 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)

PHYSIOLOGY: Systemic Health

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)
8. Hemodynamic patterns (resistance, transmural pressure, flow rate, critical closing pressures)
9. Autoregulation
10. Autotomic nervous system control

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, T_3, T_4)
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

J. 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

IMMUNOLOGY: Systemic Health

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

MICROBIOLOGY: Systemic Health

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. Reckettsia
    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

PATHOLOGY: Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit

A. Orbit, Adnexa, Lacrimal System
1. Epidemiology, history and symptom inventory
2. Observation, inspection, recognition of signs, and techniques and skills
3. Diagnostic testing (applications and interpretations)
4. Pathophysiology and diagnosis

PATHOLOGY: Conjunctiva / Cornea / Refractive Surgery

A. Cornea/External Disease
1. Epidemiology, history and symptom inventory
2. Observation, inspection, recognition of signs, and techniques and skills
3. Diagnostic testing (applications and interpretations)
4. Pathophysiology and diagnosis
5. Contact lens selection and post-fitting complications

PATHOLOGY: Lens / Cataract / IOL / Pre- and Post-Operative Care

A. Lens/Cataract
1. Epidemiology, history and symptom inventory
2. Observation, inspection, recognition of signs, and techniques and skills
3. Diagnostic testing (applications and interpretations)
4. Pathophysiology and diagnosis

PATHOLOGY: Episclera / Sclera / Anterior Uvea

A. Uveitis, Sclera/Episclera
1. Epidemiology, history and symptom inventory

2. Observation, inspection, recognition of signs, and techniques and skills
3. Diagnostic testing (applications and interpretations)
4. Pathophysiology and diagnosis

PATHOLOGY: Vitreous / Retina / Choroid

A. Retina/Vitreous
1. Epidemiology, history and symptom inventory
2. Observation, inspection, recognition of signs, and techniques and skills
3. Diagnostic testing (applications and interpretations)
4. Pathophysiology and diagnosis

PATHOLOGY: Optic Nerve / Neuro-Ophthalmic Pathways

A. Neuro-Ophthalmic Disorders
1. Epidemiology, history and symptom inventory
2. Observation, inspection, recognition of signs, and techniques and skills
3. Diagnostic testing (applications and interpretations)
4. Pathophysiology and diagnosis

PATHOLOGY: Glaucoma

A. Glaucoma
1. Epidemiology, history and symptom inventory
2. Observation, inspection, recognition of signs, and techniques and skills
3. Diagnostic testing (applications and interpretations)
4. Pathophysiology and diagnosis

PATHOLOGY: Systemic Health

A. General Health
1. Epidemiology
2. Detailed history with regards to differential diagnosis of fatigue, weight loss, fever, headache, dizziness, and malaise
3. Presentations involving abnormal body habitus and demeanor
4. Physical developmental norms and standards for all ages
5. Common systemic side effects of medications
6. Principles of basic cardiac life support
7. Preventive medicine
8. Medical laboratory tests for screening
9. Diagnostic testing and imaging
10. Pathophysiology and diagnosis

B. 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

C. Immunologic System
1. Epidemiology
2. Symptoms and signs of immunologic conditions
    a. Hypersensitivity disorders (Type I, Type II, Type III, Type IV)
    b. Autoimmune diseases (e.g., systemic lupus erythematosus, sarcoidosis, reactive arthritis)
    c. Immunodeficiency diseases (e.g., AIDS)
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

D. 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

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

F. Musculoskeletal System
1. Epidemiology
2. Symptoms and signs of the various arthritic syndromes (e.g., JRA, RA, ankylosing spondylitis)
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

G. Integumentary System
1. Epidemiology
2. Skin manifestation of systemic disorders
3. Skin lesions in the phakomatoses
4. Common dermatoses including allergic manifestations
5. Benign, premalignant, and malignant skin lesions
6. Diagnostic testing and imaging
7. Pathophysiology and diagnosis

H. Head and Neck
1. Epidemiology
2. Symptoms and signs of diseases of the nasopharynx, sinuses, salivary glands, lymph nodes, carotid and temporal arteries, skin and temporomandibular joint
3. Auscultation of carotid arteries, skull and orbits for bruits and venous hum
4. Potential significance of dysarthria, dysphagia, dysphonia and hoarseness
5. Diagnostic testing and imaging
6. Pathophysiology and diagnosis

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

J. 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

K. Hematopoietic and Lymphoid System
1. Epidemiology
2. Symptoms and signs of common blood disorders
    a. Non-neoplastic disorders of blood cells
    b. Neoplastic disorders of blood cells
    c. Non-neoplastic disorders of lymph nodes
    d. Neoplastic disorders of lymph nodes
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

L. Respiratory System
1. Epidemiology
2. Symptoms and signs of respiratory disorders
    a. Chronic obstructive pulmonary disease (COPD), emphysema, asthma, etc.
    b. Infectious diseases of the lung
    c. Neoplastic diseases of the lung
    d. Interstitial diseases including pneumoconiosis
3. Significance of common respiratory symptoms (e.g., cough, hemoptysis, wheezing, shortness of breath)
4. Symptoms and signs of anaphylaxis
5. Diagnostic testing and imaging
6. Pathophysiology and diagnosis

M. Gastrointestinal System
1. Epidemiology
2. Symptoms and signs of common gastrointestinal disorders
    a. Diseases of the esophagus (e.g., reflux, motility, disorders)
    b. Disorders of the stomach (e.g., gastritis, ulcers)
    c. Disorders of the intestines and colon (e.g., enteritis, colitis)
    d. Neoplastic disorders of the gastrointestinal tract
    e. Diseases of the liver, biliary tract, and pancreas
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

N. Cardiovascular System
1. Epidemiology
2. Risk factors for atherosclerotic heart disease
3. Symptoms and signs of cardiovascular disease
    a. Congestion, edema
    b. Hemorrhage, shock
    c. Thromboembolism
    d. Systemic hypertension
    e. Atherosclerosis
    f. Aneurysms
    g. Vasculitis
    h. Coronary artery disease
    i. Hypertensive heart disease
    j. Bacterial infections and their nonsuppurative sequelae (e.g., rheumatic fever, glomerulonephritis, infective endocarditis)
    k. Cardiomyopathies

l. Congestive heart failure
4. Diagnostic testing and imaging
5. Pathophysiology and diagnosis

O. Endocrine/Metabolic System
1. Epidemiology
2. Symptoms and signs of endocrine disorders
a. Diabetes
b. Hyperthyroidism (e.g., Graves' disease)
c. Hypothyroidism
d. Goiters
e. Hyperparathyroidism
f. Hypoparathyroidism
g. Hyperpituitarism
h. Hypopituitarism
i. Hypercorticism (e.g., Cushing disease)
j. Hypocorticism (e.g., Addison disease)
k. Disorders of adrenal medulla (e.g., pheochromocytoma)
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

P. Nervous System and Neuromuscular Diseases
1. Epidemiology
2. Symptoms and signs associated with non-ocular neurological conditions
a. Cerebrovascular diseases
b. Headaches
c. Infectious diseases of the central nervous system
d. Nervous system neoplasms
e. Muscular atrophy, muscular dystrophy
f. Demyelinating diseases
g. Leukodystrophies, gangliosidoses
h. Neurodegenerative diseases (e.g., Alzheimer disease, Parkinson disease)
i. Trauma; closed head injuries
j. Autoimmune disorders (e.g., myasthenia gravis)
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

Q. Renal and Urogenital System
1. Epidemiology
2. Symptoms and signs of urogenital and renal disorders
a. Acute renal failure
b. Chronic renal failure
c. Glomerulonephritis
d. Pyelonephritis
e. Nephrotic syndrome
f. Diabetic nephropathy
g. Neoplasms of the urinary tract
h. Sexually transmitted diseases
i. Cystitis
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

R. Reproductive System
1. Epidemiology
2. Pregnancy

a. Normal physiological changes
b. Pathological changes
3. Complications of pregnancy (e.g., pre-eclampsia, eclampsia)
4. Implication of breast feeding
5. Diagnostic testing and imaging
6. Diseases/Disorders
a. Neoplasms (including breast cancer)
b. Disorders of the menstrual cycle
c. Disorders of the prostate
d. Erectile dysfunction

S. Nutrition
1. Epidemiology
2. Symptoms and signs of nutritional abnormalities
a. Malabsorption
b. Alcoholism
c. Vitamin deficiencies and toxicities
d. Trace minerals
e. Eating disorders
3. Diagnostic testing and imaging
4. Pathophysiology and diagnosis

T. Liver and Biliary Tract
1. Epidemiology
2. Symptoms and signs of liver disorders (e.g., cirrhosis, hepatitis, liver failure)
3. Biliary tract disorders
4. Diagnostic testing and imaging
5. Pathophysiology and diagnosis

U. Mental Illness and Behavioral Disorders
1. Epidemiology
2. Symptoms and signs of mental illness (e.g., depression, suicide, anxiety, schizophrenia, bipolar disorder)
3. Symptoms and signs of behavioral disorders (e.g., substance abuse; child, spouse and elder abuse)
4. Psychological tests
5. Pathophysiology and diagnosis

V. Congenital/Hereditary Conditions
1. Epidemiology
2. Symptoms and signs of common genetic disorders (e.g., Down syndrome, cystic fibrosis, congenital anomalies)
3. Symptoms and signs of common congenital disorder (e.g., fetal alcohol syndrome, rubella, syphilis, toxoplasmosis)
4. Diagnostic testing and imaging
5. Pathophysiology and diagnosis

W. Anomalies of Child Development
1. Clinical characteristics of children who deviate from normal patterns of development, and epidemiology of developmental disorders

X. Anomalies of the Aging Adult
1. Clinical characteristics of changes in perceptual function (non-visual) associated with aging
a. Hearing
b. Coordination
c. Cognition
d. Psycho-social status

OPTICS (GEOMETRICAL): Ametropia

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. Ophthalmic and optical instruments

OPTICS (GEOMETRICAL): Ophthalmic Optics / Spectacles

A. Ophthalmic and optical instruments

OPTICS (GEOMETRICAL): Contact Lenses

A. Ophthalmic and optical instruments

OPTICS (PHYSICAL): Ametropia

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

OPTICS (PHYSICAL): Ophthalmic Optics / Spectacles

A. 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)

OPTICS (OPHTHALMIC): Ophthalmic Optics / Spectacles

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. Reflection
   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

C. 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
8. Spectacle magnification
   a. Shape and power factors
   b. Iseikonic lens design
9. Methods of remedying reflections and ghost images

D. 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. Dissimilar segments
   c. Prism segments
   d. Multiple corrections
   e. Contact lenses
   f. Fresnel prisms
   g. Fresnel Adds

E. 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

F. Physical characteristics and biological compatibility of frame materials

G. Fitting, adjustment, specification, and nomenclature of frames

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

I. 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

J. 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

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

OPTICS (OPHTHALMIC): Contact Lenses

A. 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
7. Lens types and materials
8. Optics of contact lenses: curves, zones, widths, and tear lens effects, sagittal depth; center and edge thickness; flex; asphericity and toric designs

OPTICS (OPHTHALMIC): Low Vision

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

OPTICS (PHYSIOLOGICAL): Ametropia

A. Refractive states: emmetropia, myopia, hyperopia, astigmatism, presbyopia, anisometropia
1. Epidemiology, history and symptom inventory
2. Observation and recognition of clinical signs, and techniques and skills including determination of:
a. Interpupillary distance
b. Visual acuity
c. Corneal curvature and thickness
d. Objective static and dynamic refractive status, including automatic refractive devices
e. Standard subjective refraction procedures, including astigmatic dials, crossed cylinders, stenopaic slit, fogging methods, bichrome, and accommodation balance (equalization) techniques
f. Binocular subjective refraction procedures, including Turville Infinity Balance and vectographic (Polaroid) techniques
g. Cycloplegic subjective and objective techniques
h. Amplitude of accommodation
i. Trial lenses
j. PRA/NRA
k. Add powers
l. Refractive correction applications (e.g., LASIK)

B. Anomalies of Refraction: Aphakia, Pseudophakia, and Aniseikonia
1. Epidemiology, history and symptom inventory
2. Observation and recognition of clinical signs and phenomena associated with aphakia and pseudophakia:
a. Magnification

b. Field of view
c. Spatial distortion
d. Convergence demands
e. Sensitivity to glare
f. 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

3. Observation and recognition of clinical signs, and techniques and skills associated with aniseikonia including:
1. Detection of aniseikonia
2. Measurement of aniseikonia

C. Schematic eye models
1. Dioptric 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

D. 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

E. Image quality
1. Aberrations (spherical, chromatic, coma, curvature, oblique astigmatism, distortion, wavefront sensing aberrometry)
2. Diffraction
3. Stray light
4. Point and line spread functions
5. Resolving power
6. Modulation transfer function (Fourier optics)

F. 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 illuminance
5. Effects of incoherent radiation (e.g., infrared, visible, ultraviolet) on tissue
a. Mechanisms of damage
b. Wavelength, energy levels, thresholds for reactions
c. 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

OPTICS (PHYSIOLOGICAL): Contact Lenses

A. Basic theories and methods of fitting, and contact lens selection and designs

B. Patient selection and post-fitting complications

OPTICS (PHYSIOLOGICAL): Low Vision

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

OPTICS (PHYSIOLOGICAL): Accommodation / Vergence / Oculomotor Function

A. Eye movements
1. Purpose and roles for vision
2. Dynamics and kinematics
3. Specification of direction of gaze and ocular orientation (torsion)
4. Reflex movements, including compensatory movements (e.g., vestibulo-ocular reflex, optokinetic nystagmus)
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)

B. Anomalies of eye movements
1. Epidemiology, history and symptom inventory
2. Observation and recognition of clinical signs, and techniques and skills to test:
    a. Comitance
    b. Deviations and measurements thereof
    c. Diplopia
    d. Motor fusion
    e. Paralytic syndromes
    f. Fixation disparity
    g. Nystagmus

C. Accommodation and Accommodative Vergence
1. Epidemiology, history and symptom inventory
2. Observation and recognition of clinical signs, and techniques and skills to test:
    a. Amplitude range, facility of accommodation
    b. Analysis of accommodation and vergence relationships
3. Biomechanics of accommodative reflexes

D. Pupils
1. Purposes and roles for vision
2. Dynamics of muscle action
3. Biomechanics of pupillary reflexes

4. Interrelationships between pupillary changes, accommodation, and convergence (the near reflex)
5. Factors affecting pupil size

OPTICS (PHYSIOLOGICAL): Amblyopia / Strabismus

A. Sensory Anomalies of Binocular Vision/Strabismus
   1. Epidemiology, history and symptom inventory
   2. Observation and recognition of clinical signs, and techniques and skills to test:
      a. Monocular fixation patterns
      b. Amblyopia
      c. Sensory fusion and stereopsis
      d. Anomalous correspondence
      e. Suppression

OPTICS (PHYSIOLOGICAL): Perceptual Function / Color Vision

A. Anomalies Secondary to Acquired Neurological Impairment
   1. 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
      a. Noncomitancy
      b. Field loss and neglect
      c. Loss of accommodation
      d. Loss of fusion
      e. Vision perception-motor deficiencies
   2. Modification of optometric management for the patient with acquired neurological impairment

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. Disturbances of perceived direction and distance (aniseikonia and amblyopia)
   4. 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

G. Entoptic phenomena
1. Characteristics and origin of various phenomena (involving the cornea, lens, and vitreous)
2. Vascular and circulatory phenomena (Purkinje tree, capillary circulation)
3. Phenomena associated with central vision (Maxwell spot, Haidinger brushes)
4. Phenomena associated with retinal distention or other forms of retinal activity (Moore lightning streaks, blue arcs of the retina, phosphenes)

H. 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
7. Inherited anomalies of color vision
    a. Classification
    b. Inheritance patterns
    c. Color vision tests (e.g., pseudoisochromatic tests, arrangement tests, anomaloscope)
8. Acquired anomalies of color vision
    a. Classification
    b. Etiology
    c. Color vision tests
9. Conditions for color vision testing
10. Societal implications of color vision anomalies
    a. School
    b. Vocational requirements
    c. Patient interest
11. Patient management strategies
    a. Counseling
    b. Special aids

I. 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)

J. Psychophysical Scaling Methods and Theory

K. Signal Detection Methods and Theory

OPTICS (PHYSIOLOGICAL): Visual and Human Development

A. 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. 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

C. 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

D. Visual perceptual-motor skills

E. Anomalies of Child Development
1. Epidemiology; history and signs/symptoms manifest by patients in the age ranges noted below in (2)
2. 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
3. Vision problems which may be associated with deviations from normal patterns of development
4. Tests used by optometrists to determine a child's level of visual-perceptual development, such as:
    a. Visual attention and discrimination
    b. Visual-motor integration
    c. Intersensory integration
    d. Bilateral integration and laterality

PHARMACOLOGY: Contact Lenses

A. Preparations used with contact lenses

PHARMACOLOGY: Accommodation / Vergence / Oculomotor Function

A. 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

PHARMACOLOGY: Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit

A. General Principles
1. Factors affecting drug bioavailability
2. Routes of administration
3. Mechanisms of action
4. Preservatives

B. Anti-infective agents

C. Anti-inflammatory agents
1. Steroids
2. Non-steroidals

D. Indications/contraindications/side effects/drug interactions

PHARMACOLOGY: Conjunctiva / Cornea / Refractive Surgery

A. General Principles
1. Factors affecting drug bioavailability
2. Routes of administration
3. Mechanisms of action
4. Preservatives

B. Ocular anesthetics

C. Antihistamines

D. Anti-inflammatory agents
1. Steroids
2. Non-steroidals

E. Lubricants and tear substitutes

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

G. Hyperosmotic agents

H. Mast cell stabilizers

I. Vasoconstrictors

J. Immune modulators

K. Anti-infective agents

L. Nutritional supplements

M. Indications/contraindications/side effects/drug interactions

PHARMACOLOGY: Lens / Cataract / IOL / Pre- and Post-Operative Care

A. General Principles
   1. Factors affecting drug bioavailability
   2. Routes of administration
   3. Mechanisms of action
   4. Preservatives

B. Anti-inflammatory agents
   1. Steroids
   2. Non-steroidals

C. Lubricants and tear substitutes

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

E. Indications/contraindications/side effects/drug interactions

PHARMACOLOGY: Episclera / Sclera / Anterior Uvea

A. General Principles
   1. Factors affecting drug bioavailability
   2. Routes of administration
   3. Mechanisms of action
   4. Preservatives

B. Mydriatics and cycloplegics

C. Anti-inflammatory agents
   1. Steroids
   2. Non-steroidals

D. Lubricants and tear substitutes

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

F. Vasoconstrictors

G. Indications/contraindications/side effects/drug interactions

PHARMACOLOGY: Vitreous / Retina / Choroid

A. General Principles
   1. Factors affecting drug bioavailability
   2. Routes of administration
   3. Mechanisms of action
   4. Preservatives

B. Anti-inflammatory agents
   1. Steroids
   2. Non-steroidals

C. Anti-infective agents

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

E. Nutritional supplements

F. Indications/contraindications/side effects/drug interactions

PHARMACOLOGY: Optic Nerve / Neuro-Ophthalmic Pathways

A. General Principles
   1. Factors affecting drug bioavailability
   2. Routes of administration
   3. Mechanisms of action
   4. Preservatives

B. Mydriatics and cycloplegics

C. Miotics

D. Anti-inflammatory agents
   1. Steroids
   2. Non-steroidals

E. Indications/contraindications/side effects/drug interactions

PHARMACOLOGY: Glaucoma

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

3. Mechanisms of action
4. Preservatives

B. Antiglaucoma agents

C. Hyperosmotic agents

D. Mydriatics and cycloplegics

E. Indications/contraindications/side effects/drug interactions

PHARMACOLOGY: Systemic Health

A. General principles
1. Pharmacodynamics
a. Concept of receptors
b. Dose-response relationships
c. Routes of drug administration
2. Pharmacokinetics
a. Absorption, distribution, metabolism and excretion of drugs
b. Quantitative aspects
c. Influencing factors (e.g., age, gender, pathology, genetics, diet)
3. Mechanisms of action
4. Preservatives

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., intropic 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. Nutritional supplements

O. Indications/contraindications/side effects/drug interactions

P. Drug use and metabolism in pregnancy and breast feeding

Last revised: 09/29/2016

PART I
Applied Basic Science
Items: 350*
Sessions: 2

Click Here to View and Print the entire Content Outline sorted by Discipline. **

Click Here to View and Print the entire Content Outline sorted by Condition.**

Click Here to View and Print all of the Sample Applied Basic Science Items. **

		A. ANATOMY (Gross, Neuroanatomy, Histology, and Development)	B. BIOCHEMISTRY / PHYSIOLOGY	C. IMMUNOLOGY / MICROBIOLOGY / PATHOLOGY	D. OPTICS (Geometrical, Physical, Ophthalmic, and Physiological)	E. PHARMACOLOGY
		12% - 18% Items: 42 - 62	10% - 14% Items: 35 - 49	22% - 30% Items: 77 - 105	31% - 35% Items: 108 - 122	11% - 17% Items: 40 - 60
Conditions related to:						
REFRACTIVE STATUS / SENSORY PROCESSES / OCULOMOTOR PROCESSES	Items: 122					
Ametropia	Items: 29 - 39				VIEW	
Ophthalmic Optics / Spectacles	Items: 17 - 25				VIEW	
Contact Lenses	Items: 8 - 14				VIEW	VIEW
Low Vision	Items: 5 - 9				VIEW	
Accommodation / Vergence / Oculomotor Function	Items: 10 - 18				VIEW	VIEW
Amblyopia / Strabismus	Items: 9 - 17				VIEW	
Perceptual Function / Color Vision	Items: 10 - 18				VIEW	
Visual and Human Development	Items: 6 - 10				VIEW	
NORMAL HEALTH / DISEASE / TRAUMA	Items: 228					
Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit	Items: 20 - 28	VIEW	VIEW	VIEW		VIEW

Conjunctiva / Cornea / Refractive Surgery	Items: 34 - 50	VIEW	VIEW	VIEW		VIEW
Lens / Cataract / IOL / Pre- and Post-Operative Care	Items: 7 - 13	VIEW	VIEW	VIEW		VIEW
Episclera / Sclera / Anterior Uvea	Items: 16 - 24	VIEW	VIEW	VIEW		VIEW
Retina / Choroid / Vitreous	Items: 17 - 25	VIEW	VIEW	VIEW		VIEW
Optic Nerve / Neuro-Ophthalmic Pathways	Items: 14 - 22	VIEW	VIEW	VIEW		VIEW
Glaucoma	Items: 13 - 21	VIEW	VIEW	VIEW		VIEW
Emergencies / Trauma	Items: 8 - 14	VIEW	VIEW	VIEW		VIEW
Systemic Health	Items: 55 - 75	VIEW	VIEW	VIEW		VIEW

* Note that the Part I ABS® Exam will contain a total of 370 items: 350 items will be scored; 20 items are designated as pre-test items.

(Last Updated: 09/29/2016)

** NBEO® periodically will be updating the Exam Content Matrix, related Conditions - Disciplines Content Outline, and Sample Items.

RELATED LINKS

:: Part II (PAM®)
:: TMOD® Exam
:: PAM®/TMOD® Tutorial
:: Exam Content Outline
:: Sample Test Items
:: Exam Content Matrix
:: Test Center Locations
:: ADA & Non-ADA-Type
:: Candidate Instructions

NEWS and NOTES

:: October 15, 2018
Registration for the June 2019 ACMO® examination is now available.
- Register Now

:: October 5, 2018
Scores for the August 2018 Part III CSE® and ISE examinations have been posted online.
- View Now

:: September 28, 2018
Scores for the August 2018 Part I ABS® examination have been posted online.
- View Now

:: September 28, 2018
Scores for the September 2018 CPDO® examination have been posted online.
- View Now

:: September 28, 2018
Registration for the March 2019 CPDO® examination is now available.
- Register Now

:: September 7, 2018
Scores for the July 2018 Part III CSE® and ISE examinations have been posted online.
- View Now

:: August 20, 2018
Registration for the March 2019 Part I ABS® examination is now available.
- Register Now

:: August 8, 2018

PAM® - Patient Assessment & Management

Exam Administration

The Part II PAM® examination is administered in a computer-based testing (CBT) format. The NBEO® has contracted with Pearson VUE for computerized testing services. Pearson VUE's extensive network of more than 200 test centers provides relatively easy access for all candidates to sit for the exam. An interactive tutorial, designed to familiarize candidates with the features of the CBT format, can be downloaded here.

The PAM® examination is administered in a single day. The December administration of PAM® will be offered on two dates, but each candidate will take the exam on a single day. Different versions of the PAM® exam will be given on each of the two days, but they will be equivalent in content and difficulty level. The April administration will continue to be offered on a single day.

The PAM® exam is comprised of two sessions on a single day. Each session consists of approximately 175 items. The PAM® exam is composed of Full Cases, Solo Items, and Minicases. Candidates are given 3 1/2 hours to complete each session. The morning session includes an additional 15 minutes (for a total time of 3 3/4hours) which is devoted to a tutorial (similar to the tutorial posted on this website) and the reading and signing of a non-disclosure agreement (NDA). There is an optional break of up to 45 minutes between the morning and afternoon sessions.

Eligibility

The earliest date for a student candidate to take the Part II examination is the December administration during the candidate's academic year of graduation at an accredited institution*, thereby allowing two opportunities to sit for the examination prior to graduation.

** Accredited by the Accreditation Council on Optometric Education (ACOE) of the American Optometric Association. Accredited Academic institutions include the 19 schools and colleges of optometry in the continental United States, the School of Optometry at Inter American University of Puerto Rico, and the two schools of optometry in Canada.*

Registration and Scheduling

Candidates wishing to take the PAM® or TMOD® examinations must register and pay the exam fee using the NBEO's online registration system. Upon completion of the NBEO® online registration, candidates will receive 2 automatic emails.

1. Email from NBEO® Confirming Registration

(Subject Line: "NBEO® Exam Confirmation")

> Your registration was successfully received. After your registration is processed, you will be sent a second email providing the Pearson VUE instructions for selecting a test center. If you have questions, please contact our Registrar at 704-332-9565.

2. Email from NBEO® with Instructions for Site Selection

(Subject Line: "Contact Pearson VUE ***Site Selection***")

> Once your registration is processed, you will receive a second email with instructions for contacting Pearson VUE to select your site. Candidates will select a single day to take the exam (the PAM® exam is offered on two different days in December, but candidates will select one of the two days). Click here for a list of Pearson VUE test center locations. Candidates may schedule the exam for any time slot that is available at their chosen site. PAM® candidates will be scheduled for an 8-hour time slot.

If at any point you are unable to review your registration through the NBEO® website, please visit http://www.pearsonvue.com/nbeo/ to confirm your registration and seat selection.

Be sure to check your spam/junk mail folders in case the emails are indirectly routed.

If you have questions, please contact our Registrar at 704-332-9565. If you need assistance with a site

Exam Content

The PAM® examination will consist of 45-55 full cases, 15-20 solo items, and 15-25 minicases. The distribution of items by content area is indicated in the tables below.

Disease/Trauma (60 - 70% of items)	Item Count
Lids / lashes / lacrimal system / ocular adnexa / orbit	11 - 22
Conjunctiva / cornea / refractive surgery	33 - 44
Lens / cataract / IOL / pre- and post-operative care	17 - 28
Episclera / sclera / uvea	11 - 22
Vitreous / retina	33 - 44
Optic nerve / neuro-ophthalmic pathways	28 - 38
Glaucoma	16 - 27
Emergencies	11 - 22
Systemic health	11 - 22

Refractive/Sensory/Oculomotor (30 - 40%)	Item Count
Ametropia	11 - 22
Ophthalmic optics	6 - 17
Contact lenses	17 - 28
Low Vision	6 - 17
Accommodative / vergence / oculomotor anomalies	20 - 25
Amblyopia / strabismus	6 - 17
Perceptual function / color vision	6 - 17
Visual and human development	0 - 6**

** Items pertaining to visual and human development may appear in cases in other categories.

The Examination Content Matrix, which contains the subject areas and their relative emphases, can be viewed by clicking here.

Items on the PAM® examination are targeted to assess entry-level competence. Therefore, patient cases generally focus on either typical presentations of relatively high frequency conditions or conditions with low frequency but high criticality. When low frequency, high criticality cases are presented, they will be portrayed in a pathognomonic manner.

FULL PATIENT CASES begin with a scenario in which the patient history and clinical data are presented. These data usually include at least one visual (e.g., color ophthalmic photographs; contact lens fluorescein pattern; spectacle frame fitting problem; visual field plots; other instrumentation printouts). The scenarios are followed by 4-7 related multiple-choice items.

SOLO ITEMS are relatively straight forward, knowledge-centric, independent entities. They include a question and 3 - 7 answer options.

MINICASES are an abbreviated version of a full patient case. They consist of a shortened scenario with 2 - 4 related questions. Most minicases will also include one or more associated images.

See the Sample Test Items page for more information about MR items.

The table below describes the types of items that will appear on the PAM® examination.

Type of Test Item	Content
Diagnosis	most appropriate diagnosis
Related to Diagnosis	indicate data supporting or correlating with diagnosis; correlation of possible additional data; or,indicate additional data or next test needed
Treatment / Management	most appropriate treatment / management
Related to Treatment / Management	treatment mechanism; additional data needed to treat effectively; additional next test needed; additional data or next test needed; patient education; follow-up; or, prognosis
Clinical Correlation of Basic Science Principles	pathophysiology / etiology, anatomy, biochemistry, physiology, immunology / microbiology / pathology,

Legal Issues / Ethics	licensure and governmental regulation of optometry, standards of professional ethics, doctor-patient relationship, professional liability
Public Health	epidemiology, biostatistics and measurement, environmental vision, health care policy and administration

Description of PAM® Item Types

Patient Cases are the most clinically sophisticated item type within the PAM® exam. They include a lengthy, comprehensive scenario of simulated patient data, multiple supportive photos, and 4-7 items per case, each with 3-10 answer options. Click here to view 4 sample PAM® patient cases.

- There are 45-55 patient cases on the exam.
- The patient case section of the Pearson VUE PAM® exam appears on a standard white background.
- The scenario is found on the left side of the Pearson VUE computer screen. The case images appear at the bottom of the left side of the screen, beneath the scenario. The 4-7 items are presented one at a time, on the right side of the screen. Candidates are able to view the scenario/images on the left side of the screen at the same time that they work with a case item on the right side.
- Patient case images typically provide a considerable amount of essential patient information. Photos may supply normal or abnormal case details; candidates are expected to correctly interpret the visually presented findings. Images may include, but are not limited to, color photographs and such testing results as VFs, FAs, OCTs, ultrasonography, radiologic imaging, etc.
- Case items may be multiple-choice, with a single correct answer, or they may be multiple-response, with up to 4 correct answers. It is necessary to select all of the correct answers, and only the correct answers, in a multiple-response question to receive credit.

Solo items are relatively straightforward, knowledge-centric, independent entities. They include a question and 3-7 answer options. Click here to view 3 sample PAM® solo items.

- The PAM® exam contains 15-20 solo items.
- The solo item section of the Pearson VUE PAM® exam appears on a pale blue background to help distinguish this section from the patient case and mini case sections.
- Solo items may be multiple choice, with a single correct answer, or they may be multiple response, with up to 4 correct answers. It is necessary to select all of the correct answers, and only the correct answers, in a multiple-response question to receive credit.
- The 15-20 solo items are presented on the Pearson VUE test center computer screens one at a time.

Minicases are more complex than solo items, but not as detailed as patient cases. They each consist of an abbreviated scenario and 2-4 related questions. Click here to view 2 sample PAM® mini cases.

- The PAM® exam contains 15-25 mini cases.
- The mini case section of the Pearson VUE PAM® exam appears on a pale orange background to help distinguish this section from the patient case and solo item sections.
- On the left side of the Pearson VUE mini case computer screen, the abbreviated scenario is presented while on the right side of the screen; one of the 2-4 associated items is shown one at a time.
- Mini case items may be multiple-choice, with a single correct answer, or they may be multiple-response, with up to 4 correct answers. It is necessary to select all of the correct answers, and only the correct answers, in a multiple-response question to receive credit.

Multiple-response Items

The question portion (stem) of each multiple-response item indicates to the candidate how many of the options should be selected. For example, when an item stem asks, "Which 3 of the following ...," the stem concludes with the phrase (Select 3) to make it unmistakable to examinees that this is a multiple response item that requires 3 correct responses.

Embedded TMOD® Examination

Approximately 100 - 120 of the 350 items in the PAM® examination are categorized as TMOD® (Treatment and Management of Ocular Disease) items. A TMOD® breakout score and pass-fail decision will be determined based on these items, and reported for state boards requirements. In order to be classified as a TMOD® item, the content of the item must pertain to one or more of the following:

- Formulation of most appropriate disease diagnosis which will be treated and/or managed
- Clinical correlation of basic science principles related to disease diagnosis and treatment
- Selection of treatment/management, including systemic considerations
- Dose, form, schedule, and duration of treatment
- Contraindications and side effects of medication, including systemic considerations

posted online.
- View Now

:: September 29, 2017
Scores for the August 2017 Part I ABS® examination have been posted online.
- View Now

:: September 8, 2017
Scores for the July 2017 Part III CSE® and ISE examinations have been posted online.
- View Now

:: June 30, 2017
2017-2018 Candidate Evaluation Forms and Guide are now available online.
- View Now

:: June 30 , 2017
CSE® and ISE Orientation Videos for 2017-2018 have been posted online.
- view CSE® video
- view ISE video

:: June 15, 2017
The 2018 Exam Calendar is now available to view online.
- View Now

> More News

- Follow-up and prognosis, including reassessment of diagnosis after initiating treatment
- Treatment and management of ocular emergencies and urgencies

Additional Information

Two blank PAM® Patient Scenario Templates, one for Disease/Trauma cases and one for Refraction/Sensory/Oculomotor Conditions cases, are available as exam preparation resources. These templates should be viewed as examples, since some patient cases may include additional clinical findings or in the instance of minicases, fewer clinical findings.

In multiple cases on the exam, "BVA" data are included in the patient scenarios. The abbreviation "BVA" refers to "best visual acuity" or "best-corrected visual acuity" measurement, which may be accomplished by refraction, pinhole testing, etc. Thus, all BVA entries refer to the best achievable visual acuity by the patient depicted in the scenario. If the BVA is reduced (e.g., worse than 20/20), no pinhole entry will be included in the BVA clinical data since it is implied via the BVA terminology that this has already been done.

Candidates should assume that VA at near was tested at 16 inches unless otherwise noted.

"Review of systems" entries are current symptoms reported by the patient. The patient's current medical conditions and diagnoses are recorded as "Patient medical history" entries.

All patients with diabetes mellitus will have an HgbA1c value as part of the medical history. Interpretation of HgbA1c values is considered an entry level skill; therefore additional interpretation and/or normal ranges will not be given.

Some patient cases in the PAM® exam may include normal clinical photos and/or visuals. It is anticipated that candidates will review and appropriately interpret the visuals included in the patient cases.

When visual field images are displayed side-by-side, with the right visual field on the right and the left visual field on the left, the image numbers will appear to be out of sequence (see Sample Case 4 as an example). This occurs because images are numbered sequentially as referenced in the case scenario, and the OD is always referenced before the OS in the clinical findings section. In some instances, it is necessary to display the visual fields vertically; in these instances the right visual field will be on top followed by the left visual field below.

Candidates should assume that all items in the case refer specifically to the patient depicted in the scenario. If the item is not referencing the depicted patient, it will be stated clearly in the item stem. For example: "Which of the following is the mostly likely cause of this condition in the general population?" or "In the majority of patients complaining of these symptoms ..."

To reduce the verbiage within cases and test items, individual drugs included on PAM® are referenced by generic or trade name, but not both. During the exam, candidates have access to a searchable drug list. You may search for a drug by it's trade name or generic name. These lists may be accessed from any page of the exam by clicking on the Exhibits button at the top of the screen. Candidates should note that the list will include drugs used on other National Board exams; therefore, significantly more drugs will appear on the list than actually appear on the PAM® exam.

In addition, commonly utilized abbreviations included in the PAM® patient cases can be found on the abbreviations list. A copy of the PAM® Examination Abbreviations List may be accessed from any page of the exam by clicking on the Exhibits button at the top of the screen.

Additional Iformation:

- View a sample PAM® drug list here.
- View a sample PAM® abbreviation list here.
- There are 4 sample PAM® patient cases available on the web site.

Revised 04/2014

PART II
Patient Assessment and Management
Format: Case-based, Image Intensive
Items: 350
Sessions: 2

Click Here to View and Print all of the Sample Patient Assessment and Management Cases.

		F. CLINICAL PRESENTATION (History, Signs, Symptoms)	G. CLINICAL CORRELATION OF BASIC SCIENCE PRINCIPLES	H. DIAGNOSIS	I. TREATMENT / MANAGEMENT	J. LEGAL ISSUES / ETHICS / PUBLIC HEALTH
		*See Below	11% - 17% ** Items: 40 - 60	26% - 34% ** Items: 90 - 120	40% - 57% ** Items: 140 - 200	4% - 10% Items: 15 - 35
Conditions related to:						
REFRACTIVE / SENSORY PROCESSES / OCULOMOTOR PROCESSES	30% - 40%					
Ametropia	Items: 11-22					
Ophthalmic Optics / Spectacles	Items: 6-17	Click here to view the Sample Case.				
Contact Lenses	Items: 17-28	Click here to view the Sample Case.				
Low Vision	Items: 6-17					
Accommodative / Vergence / Oculomotor Anomalies	Items: 20-25					
Amblyopia / Strabismus	Items: 6-17					
Perceptual Function / Color Vision	Items: 6-17					
Visual and Human Development	Items: 0-6+					
NORMAL HEALTH / DISEASE / TRAUMA	60% - 70%					
Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit	Items: 11-22					
Conjunctiva / Cornea / Refractive Surgery	Items: 33-44					
Lens / Cataract / IOL / Pre- and Post-Operative Care	Items: 17-28					
Episclera / Sclera / Anterior / Uvea	Items: 11-22	Click here to view the Sample Case.				
Retina / Choroid / Vitreous	Items: 33-44	Click here to view the Sample Case.				

Optic Nerve / Neuro-Ophthalmic Pathways	**Items: 28-38**					
Glaucoma	**Items: 16-27**					
Emergencies / Trauma	**Items: 11-22**					
Systemic Health	**Items: 11-22**					

*** Candidates are assessed on Clinical Presentation by virtue of the interpretation and application of history, signs, and symptoms included in each Case Scenario.**

**** Embedded Treatment and Management of Ocular Disease (TMOD®) examination items (100-120 items).**

+ Items pertaining to visual and human development will appear in cases in other categories.

NATIONAL BOARD OF EXAMINERS IN OPTOMETRY

National Center of Clinical Testing in Optometry®

Clinical Skills Exam

CANDIDATE GUIDE

Part III – Clinical Skills Examination

August 2018 - July 2019

(*ISE*® candidates please refer to the *ISE*® candidate guide)

The Part III – Clinical Skills Examination (*CSE*®) is a practical examination comprised of 19 clinical skills, assessed during a 3.75-hour session and involving actual patients. Described in this document are the clinical assessments that are to be performed at each of the 4 Stations. The Candidate Instructions included at the end of this document will be posted in the appropriate examination rooms for review during the examination.

The Evaluation Forms, Candidate Guides, Equipment Lists and other helpful resources are available on the NBEO's website at: www.optometry.org/nccto

Candidates are expected to thoroughly review this manual in preparation for the Part III Exam. This manual contains all relative information a Candidate would need to adequately prepare for the clinical skills exam.

Candidates should be aware that the majority of the information in this manual will not be reviewed again during the Candidate Orientation process.

August 22, 2018

OVERVIEW OF TERMS

- **NBEO:** National Board of Examiners in Optometry
- **NCCTO:** National Center of Clinical Testing in Optometry
- **Candidate:** an individual taking the Clinical Skills Exam
- **NCCTO Staff:** the (full-time) personnel responsible for executing the exam and serving as a Candidate advocate and liaison to the NBEO. Referred to as "Staff" throughout this guide.
- **In-House Examiner (IHE):** the on-site Examiner responsible for both scoring the Candidate's performance in Station 2 and also for ensuring Standardized Patient safety
- **Remote Examiner (RE):** the individual responsible for scoring the Candidate's performance remotely
- **Standardized Patient (SP):** the individuals trained to serve as a patient and interact in a neutral manner with the Candidate during the examination process. Referred to as "SP" throughout this guide.
- **Proctor:** the individual who will confirm views in Station 4.
- **Session:** a complete 4-Station, 19-skill exam; each day may be comprised of several sessions
- **Station:** an exam room that contains required skills to be assessed during a delineated time period; *CSE*® has 4 Stations.
- **Examination Cycle:** Stations 1, 2, and 3 have a 30-minute time allocation and Station 4 has a 15-minute time allocation.
- **Observation Time:** the time between cycles where Candidates can familiarize themselves with the Stations
- **Skill:** 1 of the 19 tests performed in *CSE*®
- **Procedure:** Each skill is considered one procedure except Skills 5 and 16 which are segmented into multiple procedures.
- **Item:** a numbered procedural element within each skill
- **Evaluation Form:** the yes-no checklist an Examiner uses to evaluate the Candidate
- **Candidate Performance:** when the Candidate is actually performing the procedures/skills
- **STOP:** When a Candidate's performance is stopped for either safety purposes or because they have used all available attempts to complete a Skill. See Stopped Skills information in guide.
- **Repeat:** When a Candidate wishes to repeat a Skill or Item. See Repeat Information in guide.
- **Finished:** When a Candidate has completed their performance and will no longer be scored on any exam items. See Candidate completion of a Station information in guide.

PART III OVERVIEW

The Part III examination is composed of 19 clinical skills which Candidates will demonstrate across 4 Stations. The clinical skills to be assessed are the same for all test sessions and utilize the same scoring criteria.

All 4 Stations will be audio and video recorded for review during the scoring process by either an In-House or Remote Examiner. Four Examiners and four SPs contribute to each Candidate's Clinical Skills Examination score.

The *CSE*® evaluation forms contain the criteria Examiners and SPs use to assess Candidate performance. The exam criteria are in the form of yes-no checklists and items must be completed **in their entirety** to receive credit.

The following are the required Skills to be completed, broken down by Station.

Station 1 (30 minutes examination time):

1. Case History / Patient Communication
2. Patient Education
3. Binocular Extraocular Muscle Motility and Gross Horizontal Saccadic Eye Movement Evaluation
4. Static Peripheral Confrontation Visual Fields
5. Near Cover Test and Near Point of Convergence
6. Pupil Testing
7. Blood Pressure Measurement
8. Ophthalmic Lens Evaluation

Station 2 (30 minutes examination time):

9. Biomicroscopy
10. Goldmann Applanation Tonometry
11. 3-Mirror Gonioscopy
12. Collagen Implant Insertion and Removal
13. Soft and GP Contact Lens Insertion, Evaluation, and Removal

Station 3 (30 minutes examination time):

14. Retinoscopy
15. Distance Subjective Refraction
16. Heterophoria and Vergence Testing at Distance
17. Accommodation Testing

Station 4 (15 minutes examination time):

18. Binocular Indirect Ophthalmoscopy
19. Dilated Biomicroscopy and Non-Contact Fundus Lens Evaluation

EXAM PREPARATION

PREPARATION:

- In addition to reviewing this Candidate Guide, the following information should be reviewed by Candidates in preparing for their exam:
  - Evaluation Forms
  - Candidate Orientation Video
  - NCCTO Site Information and Equipment List
  - Information regarding traveling to Charlotte, hotels, etc.

  These resources can be found at: **www.optometry.org/nccto**

EQUIPMENT:

- All necessary equipment used during the exam will be provided by the NCCTO.
- **Candidates may only bring their own retinoscope** to use in lieu of the one provided.
  - Only retinoscopes and extra handles are allowed in the examination room.

ATTIRE:

- Candidates are expected to wear professional attire.
  - The NBEO interprets professional attire as attire that **EXCLUDES** jeans, shorts, t-shirts, scrubs, garments that could be viewed to be immodest (e.g. tank tops, sheer clothing), tennis shoes, sneakers, and/or flip flops.
- Candidates must bring and wear white lab coats throughout the exam.
- Candidates reporting to the test center in attire deemed to be inappropriate will be addressed by NCCTO Staff **and may not be permitted to take the exam.**

NBEO ACCOUNT INFORMATION:

- Candidates must know their OE Tracker # and NBEO Password, which will be used to complete a required Incident Report and optional Survey at the end of your exam. This is the same Password the Candidate created and used to register for NBEO exams and/or view scores on the NBEO website.

ARRIVAL TO TEST CENTER

REPORTING LOCATION:

- The reporting location is: 200 S. College St, Suite 2020 (20th floor of the BB+T Building), Charlotte, NC 28202

REPORTING TIME:

- **Candidates must report to the test center on the date and at the time for which they registered online.**
  - The Registration process begins at the time reflected on the registration. You can review your registration here: check registration time.
- This time includes the registration, orientation, exam process and check-out.
  - Candidates reporting for the **8:30 AM time slot** should arrive no earlier than 8:20 AM and should be finished by 12:30 PM. We recommend scheduling flights after 2:30 PM
  - Candidates reporting for the **12:00 PM time slot** should arrive no earlier than 11:50 AM and should be finished by 4:00 PM. We recommend scheduling flights after 6:00 PM.
- In the event a Candidate finds they have arrived to the BB&T center before the times listed above, the 3rd floor of the building contains an indoor mall with restaurants, shops and cafes. **Candidates are welcome to spend time on the 3rd floor while waiting for their registration time.**
- Candidates who are late for registration may be disqualified from the examination session.
- Space and time constraints may prevent a Candidate from being rescheduled to a later session, and, in that event, the Candidate then forfeits his/her right to being tested (and his/her examination fee) for that date's administration of *CSE*®.

ON-SITE EXAM DAY REGISTRATION

PHOTO IDENTIFICATION:

- To be admitted to the test center, you must present one acceptable form of photo identification that includes **both an embedded photograph and signature**.

- The **only** acceptable forms of identification are:
  - A valid driver's license or an official photo ID issued by the government of the state or province where you reside.
  - A valid passport.
  - A valid student identification card from an accredited school or college of optometry is acceptable, provided this ID card includes **both a photograph and signature embedded in the card**.
  - In order to be considered valid, **the ID must:**
    - Match the name listed on your NBEO Profile (https://www.optometry.org/profile/)
      - If the name does not match, a Candidate may be denied access to the exam.
      - To submit a name change, click here: https://www.optometry.org/pdf/namechange.pdf. Your online profile will be updated once the NBEO records are updated internally.
    - Be current and not expired (if the ID is expired, a Candidate may be denied access to the exam).

ARM BANDS / CANDIDATE IDENTIFICATION / ROTATION

- All Candidates will be provided with two arm bands. These arm bands should be worn at all times during the exam, with the number displayed on the side of your arm.
- The front of the Arm Bands will have your Candidate # and your rotation, which is randomly assigned.
- Candidates will be assigned a specific Station order and will rotate as appropriate through the Stations. This means that not all Candidates will start the examination at Station 1. Candidates may start at any Station and will rotate through the remaining Stations as appropriate.

  The rotation sequences through the Stations are:
  - 1 → 2 → 3 → 4
  - 2 → 3 → 4 → 1
  - 3 → 4 → 1 → 2
  - 4 → 1 → 2 → 3

- On the back of the **right** arm badge will be each respective Candidate's name and OE Tracker number. These are provided for verification purposes. Throughout the exam, Examiners and SPs may ask you for your OE Tracker number.

PHOTOGRAPH

- A staff member will be taking a picture of each Candidate during the registration process to assist in ensuring the correct Candidate is being evaluated in the correct Station.
- For identification purposes, you should appear in the photo as you will during the exam. For instance, if you plan to wear glasses during the exam, you should have your glasses on during the photo; if you plan on having your hair pulled up in a ponytail, you should do so in your photo.

PERSONAL ITEMS & LOCKER USE

- Personal belongings including cell phones, watches, wallets, purses, etc. are not allowed in the testing area. Non-compliance with any aspect of this policy is an irregularity, which will be reported to the NBEO, and may be subject to the consequences associated with cheating.
- Lockers will be provided for Candidates to store all personal items.
- Candidates are welcome to leave items outside of a locker but should be aware that the area is accessible by others, and, while it is under video surveillance, it is not locked or secured.
  - Candidates can store oversized luggage in the lobby.
  - The NBEO will not be responsible for items that are lost and/or damaged.
  - We ask that Candidates be respectful of the area as this is an office space.
  - Please use the provided restrooms to change clothing if needed.

ORIENTATION

- Following registration, the candidates will be seated in the Candidate Orientation room in which a slideshow presentation will be shown. This presentation is only intended to provide a brief overview of the expectations of the exam, as well as to remind Candidates about the highlights of the exam process.
- Following Orientation, Staff will be available to address any questions Candidates may have.
- Candidates can view the Orientation video online at www.optometry.org/nccto

EQUIPMENT OVERVIEW IN ORIENTATION ROOM

- Following Candidate Orientation, Candidates will be provided ample time to view all of the individual Station equipment and supplies.
- During this time, Candidates are encouraged to become familiar with the equipment.
- Candidates are requested to treat the equipment with care and to inform an NCCTO Staff Member if there are any issues with equipment or supplies.
- Candidates should also take time to become familiar with the BIO Headset and Slit Lamp.
- Information regarding specific equipment and supplies should be reviewed online in the NCCTO Site Information and Equipment Guide at www.optometry.org/nccto

PERSONAL NOTES, EVALUATION FORMS, ETC.

- Candidates may keep personal notes during the Orientation time only.
- **No notes or other written materials may be taken into any examination room at any time.**
- All notes and written materials must be left in the Candidate locker or the lobby area.
- Any notes and written materials discovered during the exam will be subject to confiscation.
- All notes taken during the exam on NCCTO provided materials must remain in the exam room.
- **Violation of these policies may be cause for disqualification from, dismissal from, and/or failure of the examination.**

DURING THE EXAM

REASONABLE ITEMS:

- Candidates are allowed to take "reasonable" items through the exam.
- All items must be provided to Staff for inspection and approval.
- Example of reasonable items are:
    - Bottles of water/Gatorade/etc (any labels must be removed, must contain a lid)
    - Tissues
    - Cough Drops, Mints, Gum
    - Granola Bar, Other individually wrapped snack item
    - Chap Stick, Hair Ties/Hair Clips, Sanitary items, etc.
    - Eye Patch
- Pens and Pencils will be provided in each Station for Candidate use.

CANDIDATE IDENTIFICATION & INTRODUCTION

- During the exam, do not refer to yourself by name, but by your OE Tracker # (or at least the last 3 of your OE Tracker #).
- For instance, if your OE Tracker # is 700000 you may introduce yourself as: "**I am Candidate 700000**" or "**I am Dr. 000**"

CLOCKS & TIME KEEPING

- Candidates are responsible for monitoring their time.
- There is a synchronized wall clock in each exam room, to the right of the Exam Chair.
- Additionally, an on-line countdown clock will be available on the exam room computer for Candidates to use. Use of the countdown clock is optional. **It is not the official timer for the exam; announcements are the official timers.** Since the clocks use the internet if there is a problem with the internet a countdown will not be available for use and the candidate will not be provided any additional time.
- Candidates may practice the use of the countdown clock here: http://www.online-stopwatch.com/countdown/ Additional information about the countdown clock can be found in the NCCTO Site Information and Equipment Guide.
- Examiners, Proctors, and/or SPs will not remind Candidates of the remaining time at a Station.
- If time expires before a Candidate completes the Station, the items not performed will be scored as "no". Because of this, Candidates are urged to carefully monitor their time.

ANNOUNCEMENTS

There are four announcements that play throughout an exam session:

#1: The first announcement **"Patients and Examiners, please report to your designated exam rooms"** signals the test center personnel to prepare for the exam to start. *This announcement is not relative to Candidates.*

#2: Once Candidates are in the hallway, the second announcement **"Candidates please enter the exam room"** signals Candidates to enter their Station and begin their observation time.

#3: The third announcement **"The exam cycle has begun"** signals the official start of the first 30-minute exam cycle, **please note Candidates will only have 15 minutes of exam time in Station 4**.

- Candidates should close the exam room door.
- Station 2 In-House Examiners and Station 4 Proctors will enter the room at this point.

#4: The fourth announcement **"The Exam cycle has ended, please proceed to your next exam room"** will indicate the official end of each examination cycle, at which point the Candidate will exit the exam room. Station 4 will have an announcement that will play at the 15-minute mark to signal the end of that station's exam time but the candidate will remain in the room until the announcement instructing them to move to the next exam room plays.

As mentioned above, these announcements are the "official" timers for the exam.

EXAM STRUCTURE

- Following Orientation and Equipment Review, Candidates will be escorted to the test center and will stand outside of their assigned Station.
- Once Announcement #2 plays, Candidates may enter the exam room and begin their observation time.

CANDIDATE OBSERVATION TIME:

- Candidates are provided with 4-5 minutes observation time in the Station before each exam cycle begins.
- Staff will be monitoring time and if it is determined that an SP took longer to prepare the Station and a Candidate's observation time was significantly impacted, that Candidate may be compensated with additional observation time.

- Exam room computers are only for viewing the Station Instructions and using the countdown timer, Candidates are prohibited from using these computers for anything else.
  - Any items performed before the exam begins (washing hands, focusing the slit lamp) will not be scored and must be repeated once the exam begins.
  - During the Observation Time, Candidates are encouraged to**:**
    - Become familiar with the layout of the Station
    - Practice with equipment (remember items will not be scored during this time)
    - Set-out supplies that will be used (do not open packages)
    - Practice adjusting the lighting
    - Review Station Instructions
    - Review the Repeat Policy (posted on back of the exam room door)
    - Try on the BIO Headset in Station 4
  - During the Observation Time, **Candidates cannot:**
    - Perform anything on an SP (this includes asking the SP to move into the slit lamp)
    - Take blood pressure
    - Write on any pieces of paper
    - Open any sealed packages

CANDIDATE COMPLETION OF A STATION

- The Candidate's performance ends at each Station with Announcement #4, or by the Candidate stating they are finished, whichever occurs first.
- Candidates who finish a Station before the Station ending announcement plays and wish to end the scoring portion of the Station may make the following statement to the SP: "I am finished with this **Station**". At this time the Candidate **will not be scored on any additional skills/items** and the SP will start preparing the room for the next Candidate. It is up to the Candidate whether or not to make this statement.
- If the Candidate makes a confusing statement or begins any casual conversation, the SP or Proctor will remind the Candidate that it is the Candidates' responsibility to let them know if they are finished with the station.

THROUGHOUT THE EXAM SESSION

- Candidates are expected to remain in the exam room until announcement #4 plays, except for the last cycle.
- Once the cycle ends, Candidates should proceed to their next exam room (there is an arrow on the back of the door you exit which indicates the direction of the next Station).
- The Candidates will wait outside their next Station until the door opens. **Candidates should not open the exam room door.**
- Once the door has been opened, Candidates may enter and will again have observation time to familiarize themselves with the Station equipment and supplies.
- Announcement #3 will again indicate the start of the next 30-minute cycle for Stations 1, 2 and 3 and 15-minute cycle for Station 4.
- This process will continue until all 4 examination cycles have been completed.

FINAL CYCLE / END OF EXAM

- For the **final cycle**, after the Candidate states they are finished or announcement #4 plays, whichever comes first, the Candidate will exit the room and sit at the computer desk to the left of the exam room where they will fill out an Incident Report and complete an optional Survey.
- Candidates should remain at the workstation until dismissed by Staff.

PERFORMANCE OF SKILLS/ITEMS

- Items are sequenced in the order in which they should be optimally conducted.
- Candidates may alter the sequencing of certain items performed within a skill**, as long as the Candidate's sequence makes practical sense**.

- **Candidates may also alter the sequence of Skills within a Station, the only exception to this policy is in Station 3 - Retinoscopy must be the first skill performed (see Station 3 overview for additional information).**

REPEATING ITEMS / SKILLS

All repeat information is posted in each Exam Room for Candidate review during the exam.

Repeating ITEMS

- Candidates can repeat item(s) as long as they are within the Skill.

Repeating PROCEDURES and SKILLS

- Candidates can repeat any Procedure or Skill in the Station but must state their intention to repeat.
- Once a Candidate makes the repeat statement, all scores recorded by the Examiner are erased, and the Candidate will be scored as if performing the entire Procedure or Skill for the first time.
- In the event a Candidate is stopped during a Procedure or Skill, they cannot repeat the Procedure or Skill.

REPEAT CAUTIONS

- While repeating can be a positive option, Candidates are strongly encouraged to ensure they can repeat the Skill within the time limitation and that they are confident they can repeat all of the items within the Skill. It has been noted that Candidates who have not monitored their time sufficiently and try to repeat an entire Skill for one missed item, often run out of time.
- Additionally, it has often been noted that Candidates repeating a Skill tend to focus so much on the missed items, that they ultimately miss other items overall, resulting in a lower score than initially obtained.

NOTE-TAKING

- Once the exam cycle begins, Candidates will be provided with a ½ sheet of blank green paper.
- If for some reason you do not receive a piece of green paper, simply ask the SP in the Station and they will provide it to you.
- Nothing written on this green paper will be scored and must be left in the exam room.

EXAMINERS/PROCTORS

- Examiners/Proctors are present in Station 2 and Station 4 only.
- Only the SP will be in Stations 1 and 3.
- In Station 2, Examiners will indicate which eye to perform procedures **when asked by the Candidate**. In Station 4, the SP will indicate which eye to perform the skills on.
- Examiners/Proctors will be confirming the presence of a view **when asked** (see views for more information).

OBSERVERS

- Occasionally, additional personnel may be on-site observing the exam. Observers will not have any affect on a Candidate's score and should be ignored by the Candidate. These personnel have been instructed not to converse with Candidates, Examiners and/or SPs in the examination rooms.

CANDIDATE QUESTIONS DURING THE EXAM:

- Outside of regular exam questions (e.g., case history questions, inquiring about views, etc), during the exam, Examiners, Proctors and SPs will only answer "where" questions, such as where equipment switches are located, where the room lighting control is, or where supplies/clinical materials are located.
- Candidates may ask "where" questions at any time during the observation time and exam time; "how to" questions will not be answered.
- **No additional examination time will be provided for any time used to ask and answer Candidate questions.**

STATING FINDINGS

- Candidates are strongly encouraged to talk through their exam process.
- Candidates are encouraged to speak **clearly** and **audibly.**
- Candidates are required to state their findings in the same manner as they would be entered into a patient's medical record.
- When evaluating the ocular health in Stations 2 and 4, **appropriate clinical terminology** (structures being identified/assessed, etc.) should be used.

- Candidates should avoid stating their ocular health findings using terminology such as “OK,” “fine,” “WNL,” and/or “not bad.”
- Skill 8, Lensometry is the only Skill where Candidates are not required to verbalize their findings. Instead, Lensometry findings should be documented on the form provided to the Candidate in Station 1.

VIEWS:

- As part of the exam process, in Stations 2 and 4, the Slit Lamp and BIO headset are equipped with cameras that obtain live images as viewed by the Candidate.
- When examining any ocular structure, the views cannot be “**fleeting**”.

Location of Cameras:

- For the Slit Lamps, the camera is mounted on the LEFT ocular. Candidates should make sure that the image they are viewing is completely seen through the left ocular ONLY.
- For the BIO Headsets, the camera is mounted centrally, with images being recorded through each ocular.
- Extensive time has been spent ensuring all of the cameras, monitors, video feeds and recording systems are calibrated to the best of the NCCTO’s ability. As a result, as long as the view is not obstructed, Candidates should know the images will be recorded exactly as viewed by the Candidate.

Obtaining and Confirming Views:

- Candidates are responsible for ensuring the Examiners and Proctors have a view on the monitor.
- Candidates may ask at any point if there is a view and they will be given a response of either “I have a view” or “I do not have a view.”
- Examiners and Proctors will only comment on views while they are being performed. In the event a Candidate asks at the end of a Skill if the Examiner/Proctor had views during the Skill, they will be told “I can only comment on a view while it is being performed.”
- It should be noted that in the event an Examiner/Proctor confirms the presence of a view, it only means that something is visible on the monitor.
- Confirmation of a view does **not** indicate: quality of the view, whether the view meets the minimum criteria, whether the view is of the correct angle/structure or that the view is a “good view.”
- In the event an Examiner/Proctor says they do not have a view, Candidates are encouraged to troubleshoot and ensure nothing is obstructing the view through the left ocular of the slit lamp.
- Candidates are not allowed to view the monitors at any time. Monitors are calibrated and positioned in a certain manner for optimal views by Examiners/Proctors who are trained in how to view the monitors.
- **If a Candidate is determined to be attempting to view the monitor, this action may result in disqualification from, dismissal from, and/or failure of the exam.**

Candidate Concerns:

- Candidates who are amblyopic or monocular are advised to use the better eye for observing through the **left ocular** of the slit lamp.
- This may involve Candidates altering their position at the slit lamp so that they are able to look through the left ocular using their right eye or wearing a patch on their right eye.
- Candidates are encouraged to make a simple statement such as “I will be using my right eye to look through the left ocular” so the Examiner/Proctor is aware the Candidate is intentionally choosing to utilize the equipment in this manner.
- Candidates who believe that their amblyopic or monocular status warrants special accommodations other than what is described above should submit a written request to the NBEO as described on the NBEO website http://www.optometry.org/disability_part3.cfm. **Additionally, Candidates who may require special accommodations should not schedule their Part III Exam until there is a decision made on their request.**

SP SAFETY and PROCEDURE ATTEMPTS

Hand-Washing

- Candidates are expected to follow the CDC’s guideline for hand washing, which includes the specified timeframe of washing hands for at least 15 seconds.

Intervenes/Corrective Actions

- If there is an intervention a corrective action is expected on the part of the Candidate then you may proceed with the rest of Skill.

STOPS

- If after 4 attempts or for Patient safety, the candidate will be stopped.
- Keep in mind that a Remote Examiner may deem an action as grossly endangering an SP and will stop scoring a skill.
- If a Candidate is stopped, they will be scored "no" on any remaining items and are not allowed to repeat the skill.
- If the SP is concerned about their own safety, they have the ability to "Stop" a Candidate from continuing on with a skill.

STAFF INTERACTIONS:

Neutrality:

- Examiners, SPs and Staff may appear to be neutral or show little emotion during the exam. Candidates should not regard this as a personal dislike or an indication of performance quality.

Staff Interaction during Exam:

- During the Exam, Examiners and SPs are allowed to say very little other than what has been scripted.
- If a Candidate asks a question that cannot be answered, Examiners, SPs or Staff may respond with "I do not have that information," "I can't answer that," or "It is up to you." These comments are not indicators of a Candidate's performance or decisions, but simply an answer for a situation where the Examiner/SP/Staff do not have a standardized response.
- If asked, Examiners and SPs will not provide you guidance on how and/or what to perform and if you should repeat a skill. Candidates must use their best judgement in these situations.

SP INTERACTIONS:

SP TITLES:

- Candidates may refer to the SPs as "Mr. or Ms. Lee."
- "Lee" is the fictitious family name assigned to all SPs.

Repeating Candidate:

- In the event a Candidate is **re-taking *CSE*®**, Staff will ensure there are no conflicts with assigned SPs.
- Although the NCCTO Staff does its best to ensure a Repeating Candidate has not seen the same SP in the same station, in rare instances, this may occur if there is an unusual circumstance.

SP PERSONAL SPACE

Please be mindful of the SP's personal space, especially when using the slit lamp and the phoropter. In addition, be careful where you touch the patient (e.g., you should not touch the SP below the shoulder).

CASUAL CONVERSATION:

- Beyond a cordial hello, SPs will not initiate any casual conversation with Candidates.
- During the session SPs will remain in the room with the Candidates. Casual conversation may occur, **ONLY if the Candidate initiates the conversation**.
- Candidates should not ask about certain topics (see examples below).

Examples of inappropriate topics:

- Information regarding the NBEO/NCCTO
- Information regarding the overall Clinical Skills Exam
- Questions about the SP or their position (how long employed, what stations qualified for)
- SP experience or ocular information (if you've worn contacts, had any surgeries, have a prescription)
- Candidate's performance
- Optometry School the Candidate attends
- Other Candidate's information and/or performance

CANDIDATE WOUNDS / INJURIES / MEDICAL EMERGENCIES

- Any open wounds on a Candidate's finger or hand must be covered.
- If you have questions or concerns about whether a potential wound needs to be covered, you can show the wound to Staff during the registration process.

- Should a Candidate become injured during the exam a band-aid and glove will be provided.
    - If a Candidate believes they have injured themselves, they should notify personnel in the exam room.
    - When a Candidate experiences an injury in which the potential for blood borne pathogen exposure is possible candidates must use Universal Precautions. The CDC recommends **Universal Precautions** for the care of all patients, regardless of their diagnosis or presumed infection status.
- Out of concern for SP safety and to prevent contamination of exam equipment, **any bleeding must be stopped prior to continuing the exam.**
- No additional time will be given during the exam for injuries that occur as a result of Candidate error.
- In the event a medical emergency should occur during the exam, Candidates should remain calm and a Staff member will be there to assist and assess the situation.
- The process for injuries also applies if it occurs in the orientation room.

RESTROOM / DRINKING FOUNTAIN USE

- It is advisable for Candidates to use the restroom before the examination begins. No time allowance is given for restroom use during the examination sessions. In the event a Candidate needs to use the restroom during the exam, they should inform the SP who will escort them to the restroom.
- The same principles for restroom use apply to using the water fountain.

POST EXAM INFORMATION

CANDIDATE INCIDENT REPORTS & SURVEYS

At the conclusion of the exam, all Candidates will sit at the workstation to the left of their final exam room.

- At the workstation will be a computer that will be used by Candidates to submit an incident report and to complete the optional survey.
- Candidates will log into the Incident Report using their OE Tracker # and the same password (created by the Candidate) used to register for the exam or view scores on the NBEO website.
- Candidates are encouraged to think through their exam and use this opportunity to document any irregularity that may have occurred in each Station which a Candidate feels may have negatively impacted their performance. Incident Reports **will not be accepted** from Candidates once they have left the testing area.
- Candidates can document any concerns involving the equipment, Examiners, SPs, Proctors or the Candidate's individual performance.
- Once Candidates have completed the Incident Report, they will be offered the opportunity to complete an optional survey. The survey is a basic set of questions that allows you to review your experience at the test center.

Once all Incident Reports have been submitted, they will be reviewed by Staff. **Staff will be reviewing videos and interviewing the SP, Proctor or Examiner for more information regarding your Incident Report**. Additionally, staff will inspect any reported equipment malfunction. This process may take some time so completing the Candidate Survey will provide you with something to occupy your time

- During the Incident Reports Review, since videos are available to view any issues, Staff will only discuss incidents with Candidates if clarification or further information is needed. If Staff discusses an Incident Report with a Candidate in the exam room, the Candidate should assume the discussion is being recorded.
- Once all Incident Reports have been reviewed and it is determined there are no administrative issues or all issues have been resolved, Staff will dismiss Candidates from the exam hall.

RETEST POLICY

- The NBEO retest policy dictates that repeat tests are provided only due to administrative irregularities (e.g., equipment failure, loss of electrical power, or an unacceptable patient) who/which negatively affected the Candidate's performance.

ADDITIONAL EXAM INFORMATION

CANDIDATE TO CANDIDATE INTERACTION

- Candidates may engage in conversation during the registration and orientation process only.
- **Once Candidates are escorted to the test center hall, no communication should occur between Candidates at any time during the exam or post-exam process.**
    - "Communication" includes conversation, verbal statements, non-verbal cues/expressions (e.g., thumbs up/down, shaking head, high-fives, etc.), and passing notes, as examples.
    - **Violation of this policy will not be tolerated and may be cause for disqualification from, dismissal from, and/or failure of the examination.**

CODE OF CONDUCT

- All exams performed at the NCCTO are audio and video recorded. Candidates will be scored on what is seen on the recording. It is important to note that actions will be taken by the NBEO if it is determined that a Candidate has falsified or had prior knowledge data/findings during the examination or if a Candidate has abandoned a Patient during a skill.
- Below are excerpts from the Candidate Agreement/Ethics Policy all Candidates agreed to when registering for *CSE*®:

  A primary concern of the NBEO Ethics Policy is the confidentiality and security of exam items and materials. All NBEO exam items (such as questions, answers, case scenarios, images and Clinical Skills Examination (CSE®) patient data, scripts, or other materials) contained in past, current, or future exams are strictly confidential and are the copyrighted property of the NBEO.

  Any verbal discussion or written disclosure of any aspect of the copyrighted exam items, clinical cases, ***scripts, or standardized patient information*** *after the examination is strictly forbidden.*

  …the NBEO has the right and sole discretion, exercised in good faith, to determine the appropriate penalty or sanction for any Improper Conduct or violation of NBEO proprietary rights, including without limitation any one or more of the following:

  - *Disqualification from taking or continuing to sit for the current examination.*
  - *Disqualification from taking any future NBEO examinations; such disqualification can be for any period of time that the NBEO determines is appropriate in the circumstances, perhaps even for multiple years, or permanently.*
  - *Disqualification from reporting of examination scores.*
  - *Cancellation of examination scores.*
  - *Inclusion of a permanent score of "0F*" in a Candidate score report. This signifies a failing score of zero on the CSE®. The licensing board, school, or other third party to whom such score is reported may contact the NBEO for more information including a summary of the findings regarding the Improper Conduct.*

VIDEO APPEALS

- Once scores are released, if a Candidate believes their scores are not accurate, they may appeal their *CSE*® results.
- All video appeals should contain substantive issues to be considered and should be filed online at the NBEO website within 30 days from the date on which the *CSE*® scores are posted.
- The video appeals process takes approximately 6 to 8 weeks.
- If the initial appeal is denied, Candidates may appeal further to the Judicial Committee of the Board of Directors.
- Additional information regarding the appeals process can be found online.

SCORING PRACTICES

- The NBEO uses quantitative and qualitative data analysis to evaluate examination uniformity and fairness in order to identify potentially poor measurement. Candidates who achieve scores above the overall cut-off requirement receive a passing score. A *CSE*® score below the cut-off requirement will result in a failing score.
- Additional information regarding scoring practices, score breakdowns and reports is available online.

Station 1 Overview

At the start of Station 1, the SP will hand the Candidate a Patient Data Form (PDF) with the Ophthalmic Lens Evaluation Form on the back, click here for a sample. This form will include the name, age, race/ethnicity, and gender of the Patient being portrayed and indicates whether the **portrayed** Patient uses glasses and/or CLs. Candidates should be prepared to respond to the Patient being **portrayed** rather than on the SP's personal characteristics. For example, the SP may be a white female in her mid-40s not wearing glasses portraying an elderly black male who wears glasses. The PDF also contains information about the portrayed Patient's ocular and medical history and pertinent family history. Candidates should assume that the portrayed Patient filled out the PDF prior to entering the examination room. Information on the PDF can be used to conduct the Case History.

If a Candidate asks a question during Case History / Patient Communication for which the answer is not provided to the SP on their script, the SP will respond "I do not know," or provide a similar response.

Skill 1 requires that the Candidate obtain at least 4 HPI elements; however, it may be necessary for the Candidate to gather additional information in order to determine the best tentative diagnosis.

At the conclusion of the case history skill, Candidates are to verbally STATE their best tentative diagnosis for the Chief Complaint and two Case History findings which support the tentative diagnosis. There may be more than one correct response to the tentative diagnosis question that would receive full credit, and one or more answers that are partially correct that receive partial credit. However, you are to indicate what you believe is the *one best* diagnosis. If more than one diagnosis is given, Candidates must clearly state which one is their best tentative diagnosis.

After Case History, for the remainder of the examination skills in Station 1, Candidates must ignore the information provided on the PDF and the information obtained from the SP during Skill 1 and examine the actual SP sitting for the Station. Candidates should not consider **any** of the Case History / Patient Communication information to be relevant to the other skills performed at Station 1, to include prescriptions, eye wear, or diagnosis.

As with all skills, the Candidate is also responsible for initiating Skill 2. After completion of Case History, the Candidate would proceed to Skill 2, Item 1. **When asked**, the SP will respond with a scripted question about a condition. The condition in Skill 2 is not relevant to Skill 1. When providing facts/details for Skill 2, the Candidate must provide the minimum number of facts/details requested and all facts/details stated must be correct.

Skill 5, Near Cover Test and Near Point of Convergence is segmented into two Procedures.

For Pupil Testing, the Candidates' findings are compared to premeasured findings in which the pupil size was rounded to the nearest 0.5 mm. Additionally, you should clearly state that you are checking for a Consensual response.

All Blood Pressure measurements should be taken on the Life/Form Blood Pressure Measurement Arm. This simulated arm is made out of latex, so if a Candidate is allergic to latex, they should request latex-free gloves from the Standardized Patient before handling the arm. Candidates are required to make sure the equipment is **turned on** in order to obtain a measurement. There will be a label covering the display, Candidates should make sure they do **not** remove this label. A corner of the display should have been left uncovered so Candidates can ensure the box is turned on and functioning. Verbally state your BP findings before or after removing the cuff but **NOT** during removal as this will ensure the BP findings will be audible. If you wish to repeat the skill, you should inform the SP who will reset the equipment.

The glasses for the ophthalmic lens evaluation do not belong to the SP. At the start of the Station, the SP will provide separate single vision and progressive spectacles intended for the Lensometry Skill (Ophthalmic Lens Evaluation Form). It is the Candidate's responsibility to focus and zero the lensmeter.

Station 2 Overview

The Candidate can assume all ophthalmic instruments (tonometer probe, gonioscopy lens, forceps) are disinfected and ready for use. The surfaces of the slit lamp biomicroscope that come into contact with the SP's face must be properly disinfected.

For Biomicroscopy, Goldmann Applanation Tonometry, 3-Mirror Gonioscopy, and Soft and GP contact lens insertion, evaluation and removal, you should ask the Examiners which of the patient's eyes (OD or OS) to perform the skills. In addition, the Examiners will only state "I have a view" when asked by the Candidate.

It is important to note that, when an Examiner reports having a view, he/she is simply indicating that the view is unobstructed; it does not imply anything about the quality of the view. The Examiner is <u>not</u> permitted to comment on the quality of the view as that would be providing feedback on the Candidate's performance.

Candidates should assume the SP has less than 3 diopters of cyl and if they have it, it is at 180.

When examining any ocular structure, the views cannot be "fleeting". Additionally, when the item requires viewing an entire structure, it means 360˚.

Four attempts are allowed to complete each skill. Upon unsuccessfully performing the fourth attempt, you will be stopped by the Examiner and instructed to move on to the next skill. You may also be stopped prior to the fourth attempt if the Examiner or SP believes you are placing the SP at harm. (See SP safety and procedure attempts)

For tonometry and gonioscopy, anesthetic must be used in the tested eye only. To promote patient comfort during gonioscopy, Celluvisc™ should be used. Regarding gonioscopy views, Candidates must state the correct quadrant.

During Punctual Plugs, Candidates should properly **insert half of the implant** into the punctum. In most cases, the Candidate may choose which eye to perform this skill. For certain SPs, the Examiner may direct you to perform Punctal Plugs on one eye or the other. This is because with certain SPs, one punctum may be more open than the other. **Do not rest the forceps on the SP's eye lid**. Additionally, time starts when the implant is in the punctum and for SP safety please do not keep the plug in longer than 2 seconds (i.e., do not ask or state something while the implant is in and then start counting; if you must count, start counting immediately). Anesthetic is not allowed for punctual plugs. You can assume the collagen implants in an open package are sterile. If you contaminate an implant, you should retrieve another implant.

If at anytime your hands or equipment come in direct contact with the RGP cleaner, you must completely wash the solution off (if it is on your hands then you must use soap and water; if it is on an instrument, then rinse with saline solution) prior to coming in contact with the SP.

Skill 13 combines gas permeable contact lens (GPCL) and soft contact lens (SCL) insertion, evaluation and removal. These procedures have been combined into a single skill for purposes of efficiency. When asked, the Examiner will instruct the Candidate to insert a GPCL on one of the Patient's eyes (OD or OS) and a SCL on the other eye. The SCL is a toric lens with markings at 3 and 9 o'clock. Candidates should report the rotation from the doctor's perspective. For the GPCL, Candidates can assume the lens is clean for insertion. Once removed it should be stored in the case from which it was removed.

If the Candidate is unable to safely and effectively remove the lens from the SP's eyes and is stopped by the Examiner, the Examiner will remove the lens. Candidates will not receive any additional time for the Examiner to remove the lens. Also, the Candidate will not be able to perform any further items for that portion (SCL or GPCL) of the Contact Lens Skill in which they had the difficulty but may continue with the other lens if it hasn't been removed yet. Additionally, for SP comfort, Examiners will remove the GPCL with a suction cup.

At any point, if a Candidate does not remember which eye the Examiner directed them to use for a Skill, they may ask the Examiner to clarify.

Station 3 Overview

In Station 3, results from one skill are used in the performance of a subsequent skill. This design simulates clinical reality and facilitates a smooth flow in the Station. Although it is inevitable that some errors may affect the results in performing a subsequent skill, **steps have been taken to minimize the impact of this linkage by emphasizing the *process* of *how* the Candidate examines the SP, rather than the findings.**

The SP's **actual age** will be displayed on the Patient name badge. If the badge is not visible, Candidates may ask the SP for their actual age.

For camera lighting purposes, at minimum, keep the computer monitor on at all times

Skill 14: Retinoscopy
Candidates will perform a "3-eyed" Retinoscopy:

1. Retinoscopy on OD
2. Retinoscopy on OS
3. Quick repeat of sphere component OD

Performing "3-eyed" Retinoscopy prevents the need to do a careful fogging prior to starting Retinoscopy. Either eye can be done first; however, it will usually be OD. You must verbally state your findings. Do not forget to state your working distance.

It is important that you state your Retinoscopy findings before you start subjective refraction or before you take a visual acuity. If you decide to perform Retinoscopy after taking a visual acuity, it will NOT be used for scoring purposes. Any repeat of retinoscopy is done on your own accord and will not be scored by the Examiners. Additionally, if you take a visual acuity before completing Retinoscopy, you will be scored "no" for the entire Retinoscopy Skill.

During Refraction, while checking cylinder power and axis, you must use the JCC.

Skill 16-Heterophoria and Vergence Testing at Distance is segmented into 3 Procedures. You must state your findings verbally in the same manner as you would enter them into a patient record. The horizontal phoria findings must include the magnitude and direction of the phoria, e.g. 6 pd exo; 2 pd eso. For the vertical phoria, the eye must also be specified, e.g. 2 pd right hyper. The horizontal vergence findings must specify directionality, e.g. BI or negative relative vergence; BO or positive relative vergence. Findings should include blur, break, and recovery for BI/BO. The vertical vergence findings must specify the eye and the directionality, e.g. or infra OD; or supra OS.

In measuring relative accommodation in Accommodation Testing, you must clearly state what you are using as your near base (distance subjective refraction or BCC). The NRA and PRA findings should be stated relative to the patient's near base you have chosen.

At the end of each of the Skills 15, 16, and 17, the Candidate must briefly educate the SP on their findings using layman's terms.

Station 4 Overview

In addition to the SP, Station 4 will have an additional person in the room called a Proctor. For Skills 18-19, when asked, the SP will direct the Candidates on which eye (OD **or** OS) to perform the skills. At any point, if a Candidate does not remember which eye the Proctor directed them to use for a procedure, they may ask the SP to clarify.

For BIO, the SP will set the light at the appropriate mark; if it is not set, just ask the SP to set the light for you. The aperture (largest) and filter (no filter) options will already be set, do not adjust these or your views will be compromised. Additionally, the optimal working distance is between 10-25 inches. The image you view through the oculars is the same image being recorded.

For Skill 19, the view is through the left ocular.

When examining any ocular structure, the views cannot be a “fleeting” view.

For retroillumination only, your light source must be on maximum illumination, and you must move the light source to obtain the necessary red/orange image.

Regarding views, the Proctor will only state “I have a view” or “I do not have a view” as appropriate, when asked by the Candidate.

It is important to note that, when a Proctor reports having a view, he/she is simply indicating that the view is unobstructed; it does not imply anything about the quality of the view. The proctor is <u>not</u> permitted to comment on the quality of the view as that would be providing feedback on the Candidate’s performance. (see views for more information)

At the conclusion of Skill 19, you should ask the proctor for a **<u>hypothetical</u>** finding observed during a dilated fundus exam

AUGUST 2018-JULY 2019 CANDIDATE INSTRUCTIONS FOR STATION 1
(posted on the exam room computer)

Surfaces of the ophthalmic equipment that come into contact with the SP's face should be cleaned prior to use by wiping with an alcohol swab.

Skill 1: Case History / Patient Communication
You are to obtain a complete case history from the SP, who will **portray** a Patient presenting to your office for the first time. You will be presented a Patient Data Form (PDF) which will include the portrayed patient's general information, personal and family history as well as review of systems. You may use the Patient Data Form to take notes.

When you are finished gathering the case history data, **you must STATE the best tentative diagnosis** for the Patient's Chief Complaint and support your diagnosis.

REMINDER: The Case History script information and tentative diagnosis, prescriptions, eye wear, etc., *are not related to any other skills in this Station* and must be disregarded for the rest of the skills.

Skill 2: Patient Education
You are to educate the SP regarding the requested ocular condition by describing the condition and how it affects the eyes/vision, preventative, diagnostic and/or treatment options, and prognosis, interval, and/or follow up. Your explanation (facts/details) to the Patient of the ocular condition must be accurate, clear, and in non-technical terms to promote Patient understanding.

Skill 3: Binocular Extraocular Muscle Motility and Gross Horizontal Saccadic Eye Movement Evaluation
You are to assess and describe the SP's binocular extraocular muscle motility in 6 cardinal positions of gaze (up right, right, down right, up left, left, and down left), using a penlight or transilluminator and assessing eye alignment in a physiological H pattern. You must also evaluate Gross Horizontal Saccadic Eye Movements using the silver/gold wands. You must state your findings verbally in the same manner as you would enter them into a patient record.

Skill 4: Static Peripheral Confrontation Visual Fields
You are to assess and describe the peripheral confrontation visual fields responses of the SP using the finger counting method. You must state your findings verbally in the same manner as you would enter them into a patient record.

Skill 5: Near Cover Test and Near Point of Convergence
You are to perform a Near Cover Test on the SP and objectively measure any oculomotor deviation by neutralizing any observed motion with prism, or confirming orthophoria using 2-4Δ BI and BO. You must also perform Near Point of Convergence. You must state your findings verbally in the same manner, as you would enter them into a patient record (e.g., for NCT include phoria vs. tropia).

Skill 6: Pupil Testing
You are to assess and describe the pupils and pupillary responses of the SP. You must state your findings verbally in the same manner as you would enter them into a patient record.

Skill 7: Blood Pressure Measurement
You are to obtain a blood pressure measurement on the Simulated Arm. You should assume that the procedure is being done as part of a comprehensive examination and that the sphygmomanometer provided in the room is the appropriate size for the patient. You must state your findings verbally in the same manner as you would enter them into a patient record.

Skill 8: Ophthalmic Lens Evaluation
You are to evaluate two pairs of ophthalmic spectacles glasses, one progressive and the other single vision. These spectacles do not belong to the Patient at the Station. You should record, on the Ophthalmic Lens Evaluation Form provided, all of the data required for these spectacle lenses.

THIS IS A 30-MINUTE STATION

Candidates are encouraged to review the Station 1 Evaluation Forms for detailed information on the items required to be completed during the examination.

AUGUST 2018- JULY 2019 CANDIDATE INSTRUCTIONS FOR STATION 2
(posted on the exam room computer)

The surfaces of the slit lamp biomicroscope that come into contact with the Patient's face should be cleaned prior to use. Candidate should assume the tonometer probe, gonioscopy lens, and forceps are already cleaned and ready for use.

Skill 9: Biomicroscopy
You are to perform a comprehensive slit lamp examination on *one* eye of the SP, as indicated by the Examiner. You may use a cotton-tipped applicator to assist in eversion of the upper eyelid if needed. You must verbally state your findings to the Examiner in the same manner as you would enter them into a patient record.

Skill 10: Goldmann Applanation Tonometry
You are to perform Goldmann applanation tonometry on *one* eye of the SP, as indicated by the Examiner. You must state your findings to the Examiner verbally in the same manner as you would enter them into a patient record.

Skill 11: 3-Mirror Gonioscopy
You are to perform gonioscopy on *one* eye of the SP, as indicated by the Examiner. During the skill, you are expected to obtain and maintain a clear gonioscopic view of the anterior chamber angle and perform a systematic examination of all 4 anterior chamber angle quadrants using the appropriate mirror. You must state your findings to the Examiner verbally in the same manner as you would enter them into a patient record.

Skill 12: Collagen Implant Insertion and Removal
You are to prepare and then insert half of the collagen implant into the inferior punctum on one lid of the SP. The plug is *not* to be moved into the horizontal canaliculus but should be held in place in the vertical canaliculus for a maximum of 2 seconds, and then MUST be removed. Upon removal, the collagen implant should be discarded. **After** removing the implant, you must accurately describe to the Examiner how the collagen implant should be moved into the horizontal canaliculus. Topical anesthetic should **not** be instilled prior to performing this Skill.

Skill 13: Soft and Gas Permeable Contact Lens Insertion, Evaluation, and Removal
You are to properly prepare and insert a toric soft contact lens (SCL) on one eye of the SP and a gas permeable contact lens (GPCL) on the other eye, as indicated by the Examiner. Topical anesthetic should **not** be instilled prior to inserting the lenses. You should assume that the GPCL provided has been cleaned and disinfected and, since a disposable SCL is used, there is no need to clean or disinfect it. Using the slit lamp biomicroscope, you are expected to evaluate the lenses on the SP's eyes and based on the fit. Fluorescein should be instilled only in the eye with the GPCL. After evaluation, you should remove both contact lenses from the SP's eyes. The SCL should be discarded; the GPCL should be stored in the appropriate case. Suction cups and other mechanical removers are *not* permitted. You must state your findings to the Examiner verbally in the same manner as you would enter them into a patient record.

THIS IS A 30-MINUTE STATION

Candidates are encouraged to review the Station 2 Evaluation Forms for detailed information on the items required to be completed during the examination.

AUGUST 2018- JULY 2019 CANDIDATE INSTRUCTIONS FOR STATION 3
(posted on the exam room computer)

Surfaces of the phoropter that come into contact with the SP's face should be cleaned prior to use by wiping with an alcohol swab.

Skill 14: Retinoscopy
You are to perform static distance retinoscopy on *both* eyes of an SP. You must verbally state your findings in the same manner as you would enter them into a patient record prior to any subjective response by the SP. This must be done prior to starting your subjective refraction or taking a visual acuity.

Any repeat of retinoscopy will not be scored.

Turn on overhead room lights when stating Retinoscopy and Refraction findings for scoring purposes.

Skill 15: Distance Subjective Refraction
Based on the static distance retinoscopy and PD finding previously obtained, you are to perform a distance subjective refraction on *both* eyes of the SP, including a prism dissociated balance. You must state your findings verbally in the same manner as you would enter them into a patient record.

Skill 16: Heterophoria and Vergence Testing at Distance
You should assume that the SP is non-strabismic and use the findings from your distance subjective refraction for this skill.

You are to conduct a von Graefe measurement of the SP's horizontal and vertical heterophorias at *distance* only. You may perform the "pursuit" technique or the "flash" technique. You must state your findings verbally in the same manner as you would enter them into a patient record. For the horizontal phoria the findings must include the magnitude and direction of the phoria, e.g. 6 pd exo or 2 pd eso. For the vertical phoria, the eye must also be specified, e.g. 2 pd hyper, OD.

You are to measure the SP's horizontal and vertical vergences at *distance* only. The horizontal vergence findings must specify directionality, e.g. BI or negative relative vergence; BO or positive relative vergence. The vertical vergence findings must specify the eye and the directionality, e.g. infra OD; or supra OS.

Skill 17: Accommodation Testing
You will determine the SP's binocular (fused) crossed-cylinder dioptric value relative to the distance subjective refraction. You must determine and state the near base prior to performing NRA and PRA. You must state the NRA and PRA values relative to the SP's near base (distance subjective refraction or BCC). If the PRA is greater than -3 diopters, stop and state, "The patient's PRA is greater than -3 diopters."

You must verbally state your findings in the same manner as you would enter them into a patient record.

THIS IS A 30-MINUTE STATION

Candidates are encouraged to review the Station 3 Evaluation Forms for detailed information on the items required to be completed during the examination.

AUGUST 2018- JULY 2019 CANDIDATE INSTRUCTIONS FOR STATION 4
(posted on the exam room computer)

Surfaces of the slit lamp biomicroscope that come into contact with the Patient's face should be cleaned prior to use by wiping with an alcohol swab.

Skill 18: Binocular Indirect Ophthalmoscopy

You are to perform binocular indirect ophthalmoscopy (BIO) on *one* eye of an SP as indicated by the SP. You have the choice of performing BIO with the SP seated or reclined.

You must state your findings verbally in the same manner as you would enter them into a patient record. The findings must be accurate for credit.

Skill 19: Dilated Biomicroscopy and Non-Contact Fundus Lens Evaluation

You are to properly examine the crystalline lens (with direct and retroillumination) and the retrolental area/anterior vitreous using the biomicroscope **without** the non-contact fundus lens. You are to examine the posterior vitreous, optic nerve, 4 vasculature arcades, fovea and macula using the biomicroscope **with** the non-contact fundus lens. All items will be performed on *one* eye of an SP. You must state structures when viewing and also state your findings verbally in the same manner as you would enter them into a patient record.

After examining the Patient, educate the patient regarding a given **hypothetical** finding.

THIS IS A 15-MINUTE STATION

Candidates are encouraged to review the Station 4 Evaluation Forms for detailed information on the items required to be completed during the examination

PART III
Clinical Skills
Format: Performance Test
Items: ≥ 414
Skills: 20

Click Here to View and Print all of the Clinical Skills Examination Forms.

Conditions related to:		K. COMMUNICATION SKILLS	L. AFFECTIVE SKILLS	M. PSYCHOMOTOR SKILLS	N. CLINICAL OBSERVATION & REPORTING SKILLS
		18.2% Points: 182.04	6.8% Points: 68.41	48.1% Points: 480.93	26.9% Points: 268.62
REFRACTIVE / SENSORY PROCESSES / OCULOMOTOR PROCESSES	**37.7% Points: 376.92**				
Ametropia					
Ophthalmic Optics / Spectacles					
Contact Lenses					
Low Vision					
Accommodative / Vergence / Oculomotor Anomalies					
Amblyopia / Strabismus					
Perceptual Function / Color Vision					
Visual and Human Development					
NORMAL HEALTH / DISEASE / TRAUMA	**62.3% Points: 623.08**				
Lids / Lashes / Lacrimal System / Ocular Adnexa / Orbit					
Conjunctiva / Cornea / Refractive Surgery					
Lens / Cataract / IOL / Pre- and Post-Operative Care					
Episclera / Sclera / Anterior / Uvea					
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