



International Examinations

Visual Sciences

Instructions for Candidates

The International Council of Ophthalmology
Examinations for Ophthalmologists





Introduction

The International Council of Ophthalmology is the executive body of the International Federation of Ophthalmological Societies. One of the objectives of the Council is to advance ophthalmic education. The International Visual Sciences Examination is part of that initiative.

Objectives of the International Visual Science Examination

The members of the International Council of Ophthalmology are of the opinion that every ophthalmologist, wherever they are working, are required to have a good knowledge of basic science in order to understand the principles underlying their clinical practice.

Testing Knowledge:

The primary objective of the Examination is to discover whether a candidate has acquired the breadth and depth of knowledge necessary to understand the scientific basis of ophthalmology. The aim is to achieve a uniformly high standard throughout the world.

Effect on Training Programmes:

The existence of an international examination provides the possibility for eye departments with residents in training, or for the candidates themselves, to assess their performance in relation to a universal standard.

Effect on Promotion:

Heads of eye departments throughout the world have great difficulty in deciding on the level of competence and knowledge of a particular candidate applying for training in ophthalmology, or in promotion from one post to another. The acquisition of this qualification will indicate the level of theoretical knowledge of the candidate in relationship to an international standard. This can be of particular importance if a candidate is moving from one country to another to undertake further training.

Relationships to other Diplomas:

The International Visual Sciences Examination is intended to complement but not to replace existing examinations in basic science. However, certain countries and examining bodies have accepted this Examination as equivalent to the basic science part of their examinations. Candidates should check with their own ophthalmological society or examining body to ascertain the status of the Examination in their own country.

Structure of the Examination

The Visual Sciences Examination is aimed at doctors in training who wish to become ophthalmologists. The Examination will be directed by the Examiners appointed by the Examination Committee of the International Council of Ophthalmology. At present the offices of this Committee are in London, England.

- a) The Examination shall be held annually in April. At present it is conducted in Chinese, English, French, Portuguese and Spanish. Other languages will be considered if there are sufficient numbers of candidates to justify the additional translation of the questions. The Examination will normally be held in the candidate's own country.
- b) The Visual Sciences Examination will consist of 120 multiple-choice questions (MCQ) over a 3 hour period. Examples of the method used for these questions and the instructions can be found on pages 15–16.
- c) The candidates will enter their answers on the "Answer Paper" which will be computer marked. A positive mark will be awarded for each correct answer. No mark is given to those questions marked incorrectly or left blank. The computerised results are then analysed by the Examiners.
- d) Questions will be asked from all or some of the following:

Visual Sciences subjects related to Ophthalmology

Part 1

- i) Anatomy of the Eye, the Orbit and related structures
- ii) Embryology
- iii) Vision
- iv) Neuro Anatomy
- v) Ocular Physiology, Biochemistry and Cell Biology
- vi) Pharmacology
- vii) Epidemiology and Statistics
- viii) Genetics
- ix) Pathology
- x) Microbiology

A syllabus will be found on pages 5–14 of this booklet.

The MCQ papers are not available to candidates after the examination.

- e) **Visual Sciences:** the candidates will be informed if they have failed, passed, passed with merit or, exceptionally, passed with distinction. The marks for each section will be given to each candidate to enable them to assess their strengths and weaknesses.
- f) To aid the Examiners and to ensure the quality of the questions, the answers to each part of each question are also analysed. This information is used to identify the core knowledge questions and those which can compare different groups of candidates in different years. This information is used to determine the pass mark, which ensures that the results of the Examination are comparable from year to year.
- g) Visual Acuities will be given in LogMAR with, in brackets, the metric Snellen, the imperial Snellen and the decimal notations. For example, "Visual acuity LogMAR 0.5 (6/6, 20/60, 0.33)".
- h) Answering all the questions accurately is the best way of obtaining a pass grade but because accuracy of answers is very important and takes time **it is still possible to pass the examination without completing all the questions.**
- i) The question bank is large and only a small percentage of questions are repeated from year to year. Candidates are warned that, although good for practice, using books of questions and answers may be misleading.

Certificates

A candidate will be given a signed certificate indicating whether she/he has

- a) passed the Visual Sciences
 - passed with distinction
 - passed with merit

Unless candidates have passed the complete Visual Sciences Examination (or been granted exemption from it) they cannot normally proceed to the Clinical Ophthalmology Examination. In order not to delay their training, candidates may re-take the Visual Sciences and/or Optics, Refraction and Instruments at the same time as taking the Clinical Ophthalmology Examination. However under these circumstances certificates will only be issued if all sections are passed.

Examination regulations

1. The structure of the examination is described on pages 1 and 2.
2. The certificate will be presented to those who have achieved the appropriate level in the Examination and who have complied with the regulations.
3. The fees and dates of the Examination are obtainable from the:

Examination Office,
International Council of Ophthalmology,
Unit 2, Forest Industrial Park, Redbridge, London IG6 3HL
E-mail: assess@icoph.org

to whom all enquiries should be addressed.
4. Application forms must reach the Examination Office before the closing date – 24th January.
Applications received after the closing date will not be processed.
5. The appropriate fee must be paid and cleared before the closing date.
6. Applications for admission to the Examination must be accompanied by a photocopy of the candidate's medical qualification and certificate of registration, together with a small passport-size photograph. (No certificates are required for 2nd and subsequent entries.)
7. Candidates wishing to withdraw their applications must do so *in writing*. For withdrawals received before 24th January a refund will be given, but there will be a 30% deduction to cover administrative charges. No fee refund will be given to candidates wishing to withdraw after the closing date for applications 24th January.
8. A candidate withdrawing an application on or after the closing date for applications - as shown in the Examination Calendar - or who fails to appear for the Examination for which his entry fee has been accepted, *will not be entitled to any refund or transfer of the fee.*
9. A candidate who may desire to make representations with regard to the conduct of their Examination must address them to the Examination Executive and not, in any circumstance, to an Examiner.

10. The Examination Committee may refuse to admit to an Examination, or to proceed with the Examination of any candidate who infringes any of the regulations, or who is considered by the Examiners to be guilty of behaviour prejudicial to the proper management and conduct of the Examination.
11. Candidates may be admitted to the International Visual Sciences Examination for Ophthalmologists provided they possess a medical qualification acceptable in the country in which the Examination is taken.
12. The above conditions may be modified at the discretion of the Examination Committee.
13. If a candidate is determined by the Examinations Committee to have cheated in the examination, he or she will not have their answer sheet marked and they will be determined as having failed the examination. She/he will not be allowed to re-sit the examination for a period of 1 to 5 years and they may be reported to their local Ophthalmological Society and/or Ministry of Health.

*On the day of the Examinations candidates must provide their own HB pencils, a sharpener and erasers. The answer papers cannot be marked with a pen or biro. **Only HB pencils may be used.***

Guide to Candidates

CURRICULUM

The ICO Curriculum is published in *Klinische Monatsblätter für Augenheilkunde* November 2006, pages S1–S48. It was drawn up by a task force under the leadership of Professors M.F.Goldberg, A.G.Lee and M.O.M.Tso

SYLLABUS

for the Visual Sciences Examination

A syllabus is indicative of the areas of knowledge expected of candidates. The syllabus is, however, not intended to be exhaustive or to exclude other items of knowledge which are of similar relevance. Questions will be based on the main sections below.

VISUAL SCIENCES EXAMINATION

Anatomy of the Eye, Orbit and related structures

- A Orbit and cranial cavity
 - 1. Sinuses
 - 2. Bones comprising the orbital walls
 - 3. Orbital foramina, ducts, canals, and fissures
 - 4. Orbital Contents
 - a. periorbita
 - b. fibroadipose tissue
 - c. blood vessels, nerves and muscles of the orbit
 - 5. Cranial cavity
 - a. cranial fossae and foraminae
 - b. meninges
 - c. blood supply and venous drainage
 - d. Base of skull
 - e. facial bones

- B Structure of the globe
 - 1. Shape, size and position
 - 2. Changes with age

- C Eyelids
 - 1. Anatomy, histology, innervation and vascular supply
 - a. Skin
 - b. Orbicularis muscle
 - c. Orbital septum
 - d. Levator muscle, Müller's muscle
 - e. Tarsal plate and meibomian glands

- D Lacrimal Apparatus
1. Lacrimal Glands
 - a. Anatomy and histology
 - b. Function
 - c. Innervation
 - d. Vascular supply
 - e. Accessory glands
 2. Lacrimal excretory system – anatomy and histology
- E Conjunctiva and Tenon’s Capsule
1. Histology
 2. Zones
 3. Vascular supply
 4. Plica semilunaris and caruncle
- F Tear Film
1. Structure
 2. Function
 3. Composition
- G Cornea and Sclera
1. Shape
 2. Structure
 3. Nerve supply
- H Anterior Chamber
1. Angle structures and limbus
 2. Aqueous pathway
 3. Outflow structures
 4. Clinical anatomy - gonioscopy
- J Lens and Zonules
1. Size, position and shape and changes with age
 2. Structure
- K Extraocular Muscles
1. Origin
 2. Insertion
 3. Blood supply
 4. Two types of muscle fibres
 5. Nerve supply
 6. Actions
 7. Motor end plates
- L Uvea
1. Attachments to the sclera
 2. Iris
 - a. Structure
 - b. Vascular supply
 - c. Innervation

3. Ciliary body
 - a. Structure
 - b. Function
 - c. Blood supply
4. Choroid
 - a. Structure
 - b. Blood supply
 - c. Ultrastructure of the vascular system
 - d. Ultrastructure of the Bruch's membrane
 - e. Function

- M Retina
1. Retinal pigment epithelium
 - a. Ultrastructure
 - b. Function
 2. Extracellular matrix
 3. Neurosensory retina
 - a. Ultrastructure and function of different cell types
 - b. Regional differences
 - c. Vascular supply
 - d. Macula
 - e. Ora serrata

- N Vitreous
1. Structure
 2. Composition
 3. Attachments

Embryology

- A Ocular Development
1. Chronological sequence of events in the formation of the eye
 2. Neuro-ectoderm - differentiation
 3. Surface ectoderm - differentiation
 - a. Lids
 - b. Lens
 4. Neural crest cells - differentiation
 - a. Uvea
 - b. Cornea
 - c. Chamber angle
 5. Vascular system

Neuro Anatomy

- A Optic Nerve including the Nerve Head
1. Anatomy
 2. Blood Supply
 3. Arrangement of Nerve fibres and their connections
 4. Pia, Dura and Arachnoid sheaths

- B Optic chiasm
 - 1. Anatomy and relationships
 - 2. Arrangement of fibers
 - 3. Blood supply
- C Optic Tracts
 - 1. Anatomy
- D Lateral Geniculate Body
 - 1. Anatomy and connections
- E Optic Radiations
 - 1. Anatomy and connections
- F Optic Cerebral Cortex
 - 1. Anatomy, vascular supply and connections / projections
- G Cranial Nerves
 - 1. Olfactory nerve
 - 2. Optic nerve
 - a. Central and peripheral course
 - b. Blood supply of different topographical areas
 - c. Meningeal sheaths
 - 3. Oculomotor nerve
 - a. Nuclear anatomy
 - b. Anatomical central and peripheral anatomical course
 - c. Function
 - 4. Trochlear nerve
 - a. Anatomical central and peripheral course
 - b. Function
 - 5. Trigeminal nerve
 - a. Nuclear complex
 - b. Anatomical central and peripheral course
 - c. Function
 - 6. Abducens nerve
 - a. Anatomical central and peripheral course
 - b. Function
 - 7. Facial nerve
 - a. Anatomy and peripheral course
 - b. Function
 - 8. Auditory nerve
- H Autonomic system
 - 1. Parasympathetic system including ganglia
 - a. Pathways
 - b. Synapses
 - c. Function
 - 2. Sympathetic
 - a. Pathways
 - b. Function

- I Pathways involved with eye movements
 - 1. Mid brain
 - 2. Cerebellum
 - 3. Frontal cortex

- J Blood supply of Brain and Venous Drainage
 - 1. Blood supply of Brain and venous system
 - 2. Ventricles and flow of CSF

Physiology of Vision and the Visual System

- A Vision
 - 1. Summation
 - 2. Light and Dark adaptation
 - 3. Form and Depth perception
 - 4. Motion detection
 - 4. Flicker detection
 - 5. Contrast sensitivity
 - 6. Visual fields
 - a. single
 - b. binocular
 - c. 'Hill of vision'

- B Colour vision
 - 1. Colour discrimination
 - 2. Luminosity
 - 3. Spectral sensitivity
 - 4. Colour detection
 - 5. Basis of colour blindness

- C Retinal cell function
 - 1. Photoinduction
 - 2. Single cell potential
 - 3. Retinal connections
 - 4. Neurotransmitters
 - 5. Receptors and Synapses

- D Electrophysiology
 - 1. Electroretinogram
 - 2. Electroculogram
 - 3. Visually evoked potential
 - 4. Receptive fields
 - 5. Receptor/neural cell responses
 - 6. Ganglion cell responses

- E Binocular vision
 - 1. Stereopsis and Depth perception
 - 2. The horopter
 - 3. Image disparity
 - 4. Retinal rivalry

- F Visual System
 1. Magnocellular pathways
 2. Parvocellular pathways
 3. Pre Striate and Striate cortical pathways and processing
- G Control of Ocular Movements
 1. Mid brain control
 2. Cerebellar function
 3. Cortical control
 4. Fixation reflex
 5. Oculovestibular and oculocervical reflexes
 6. Vergence
- H
 1. Pupil responses and control
 2. Accommodation and control

Ocular Physiology, Biochemistry and Cell Biology

- A General
 1. Oxidative metabolism and ATP production
 2. Glucose metabolism and tissue Glycation
 3. Oxidation and reduction
 4. Free radical production
 5. Lipid metabolism
 6. Collagen structure and synthesis
- B Tear film
 1. Constitution
 2. Production
 3. Control
- C Eye Lids and Conjunctiva
 1. Functions
- D Cornea and sclera
 1. Corneal transparency
 2. Metabolism
 3. Wound healing
 4. Fluid transport
- E Uveal Tract
 1. Blood supply
 2. Function of the iris, ciliary body, choroid and its components
 3. Blood aqueous barrier
 4. Metabolism including eicosanoids, detoxification and antioxidation
 5. The outflow system and control of intraocular pressure
 6. Control of aqueous secretion
- F Lens
 1. Lens transparency

2. Transmission and structural properties
 3. Transport of nutrients
 4. Lens metabolism
 5. Age changes and free radical damage
- G Vitreous
1. Architectural properties
 2. Physico chemical properties
 3. Diffusion
- H Retina
1. Glucose metabolism
 2. Protein metabolism
 3. Lipid metabolism
 4. Photochemical reactions
 5. Synaptic connections
 6. Dopamine reactions
 7. Blood flow
 8. Blood-retinal barrier
 9. Metabolism, restoration and renewal
 10. Rhodopsin
 11. Photoreceptor proteins
 12. Mechanisms of damage
 13. Functions of different cell types
- I Retinal Pigment Epithelium
1. Functions of the RPE
 2. Transport in the RPE

Pharmacology

- A Basic Principles
1. Pharmacokinetics
 2. Pharmacodynamics
 3. Drug receptor interactions
- B Ocular Pharmacology
1. Drug handling by the tissues of the eye
 2. Delivery methods of ocular medication
 3. Ocular toxicity from systemic drugs
- C Tear film
1. Tear replacements
- D Autonomic nervous system
1. Cholinergic agents
 - a. Muscarinic agents
 - b. Nicotinic agents
 2. Adrenergic agents

- a. Alpha-adrenergic
 - b. Beta-adrenergic
 - (1) Agonists
 - (2) Antagonists
- E Control of intraocular pressure
1. Prostaglandins
 2. Adrenergic agonists and antagonists
 3. Carbonic anhydrase inhibitors
 4. Osmotic agents
 5. Neuro-protective agents
- F Anti-inflammatory agents
1. Antihistamines
 2. Glucocorticoids
 3. Non-steroidal anti-inflammatory agents
- G Immuno suppressive agents
1. Corticosteroids
 2. Cyclosporin
 3. Tacrolimus
 4. Methotrexate
 5. Cellcept
 6. Biologics
- H Anaesthetics
1. Local anaesthetics
- I Antimicrobials
1. Antibacterials
 2. Antifungals
 3. Antivirals
 4. Therapy for endophthalmitis

Principles of Ophthalmic Epidemiology

- A Epidemiology
1. Prevalence, Incidence and Distribution of Visual Impairment and Blindness
 2. Patterns of sight-threatening eye disease
 3. Epidemiological methodology
 4. Cross-sectional, case control and cohort studies
 5. Visual impairment and blindness in children
 6. Prevention strategies
 7. Recommendations of Vision 2020 and World Health Organisation
- B Basic Statistics
1. Arithmetic mean
 2. Median

3. Mode
4. Bimodal distribution
5. Standard deviation
6. Confidence intervals
7. P- values and Significant P-values
8. Analysis of variance, Student's t test
9. Chi-squared (χ^2 test)
10. Mann-Whitney test
11. Relative risk
12. Risk reduction
13. Odds ratio
14. Correlation coefficient
15. Linear Regression
16. Survival analysis
17. Hazard ratio
18. Sensitivity, specificity, predictive value
19. Incidence
20. Prevalence

Genetics

A Chromosomes and cell division

B Molecular Genetics

1. DNA and RNA
 - a. base pairs
2. Genes
 - a. Codons
 - b. Transcription and translation
 - c. Allele, homozygote and heterozygote
3. Chromosome defects
4. Gene mutations
5. Human Genome

C Clinical Genetics

1. Autosomal inheritance
 - a. Dominant
 - i expressivity
 - ii penetrance
 - b. Recessive
 - i homozygotes
 - c. x-linked
 - i Lyonisation
2. Mitochondrial inheritance
3. Multifactorial inheritance
4. Population genetics
 - a. gene frequency
 - b. genetic linkage
5. Principles of Cloning

6. Polymerase Chain reaction
7. Gene probes
8. Principles of Gene therapy

General Principles of Pathology and Microbiology

- A Inflammation
1. Types of inflammatory cells
 - a. Cytologic features
 - b. Function
 2. Patterns of inflammation
 - a. Acute
 - b. Chronic
 - (1) Granulomatous
 - (2) Nongranulomatous
 - (3) Vasculitis
 3. Causes of inflammation
 - a. Infectious agents
 - (1) Staining properties, morphology
 - (2) Reaction pattern - (acute, chronic, etc.)
 - b. Noninfectious
 - (1) Trauma
 - (2) Systemic conditions
 - (3) Immune mediated
 - (4) Vascular disease
 4. Sequelae of inflammation - repair
- B Cell Growth
1. Hyperplasia
 2. Metaplasia
 3. Dysplasia
 4. Neoplasia
 - (1) Carcinogenesis
 - (2) Gene control
 - (3) Oncogenes
 - (4) Radiation
 - (5) Cytotoxic agents
 5. Apoptosis
- C Immunology
1. Cells and tissues of the immune system
 2. Innate immune response
 3. Antigen recognition
 4. Major histocompatibility system
 5. T-cell activation
 6. B-cell activation
 7. Immunological tolerance and autoimmunity
 8. Allergy and hypersensitivity
 9. Transplant immunology

- D Microbiology
 - 1. General microbiology
 - a. Host defence mechanisms
 - b. Bacterial pathogenicity
 - 2. Bacteria
 - 3. Chlamidia
 - 4. Viruses
 - 5. Fungi
 - 6. Intracellular –parasites
 - 7. Helminths
 - 8. Sterilization and disinfectants

Guidance on Multiple Choice Questions

1 Documents

On your desk you will find the following:

- (a) An ANSWER PAPER (response sheet)
- (b) A QUESTION BOOK

2 DO NOT USE PEN OR BIRO - USE ONLY AN HB PENCIL

Use a *high quality* eraser which *does not smudge* and bring 2 HB pencils, and a pencil sharpener to the examination.

Do not fold or crease the Answer Paper.

3 Identification

Please check that the *Name* and *Centre* on your Answer Paper are correct before answering the questions.

Please fill in the stage of training on the Answer Paper.

Please check your name and number on the front cover of the question book.

4 Method of answering

There are 120 Multiple Choice Questions. The answer paper is numbered 1–120.

All 120 questions are of the four options multiple-choice type with only one correct answer. Each question has four statements. Stems a, b, c, and d.

On the ANSWER PAPER there are corresponding boxes for each statement.

IT IS ESSENTIAL THAT YOU MARK EACH ANSWER CLEARLY.

Specimen Question

Regarding the embryology of ocular tissues, which one of the following structures is derived from ectoderm?

- a) Corneal endothelium. ()
- b) Eyelashes. (←)
- c) Levator palpebrae. ()
- d) Tarsal plate. ()

IMPORTANT

It is vital to use only a horizontal, clear line. If any line is other than horizontal, the whole question will not be marked and will not score.

You are advised *initially* to mark your answers in the QUESTION BOOK. When you are satisfied with your answers, you **MUST** transfer them to the Answer Paper. The transfer of the answers **MUST** be made within the period allotted for the examination. Disqualification will occur if the candidate does not stop writing when instructed by the invigilator.

If you decide to change a response, careful rubbing out is essential before entering the new mark as smudge marks may be misread as a response.

Should your ANSWER PAPER be spoilt a spare paper can be obtained from the invigilator.

- 5 **Marking** *each item* is as follows:
- | | |
|------------------------------|---------|
| CORRECT: | +1 Mark |
| NO ANSWER / INCORRECT ANSWER | 0 Mark |

- 6 **Confidentiality**
THE QUESTION BOOK MUST NOT BE REMOVED NOR MAY ANY PARTS OF
IT COPIED. IT WILL BE COLLECTED FROM YOU BY THE INVIGILATORS,
TOGETHER WITH THE ANSWER PAPER.

The International Council of Ophthalmology
Examinations for Ophthalmologists

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