



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY**

(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

MAIN EXAM

FOR THE DEGREE

OF

MASTER OF OPTOMETRY AND VISION SCIENCES

COURSE CODE: MOV 822

COURSE TITLE: ADVANCED OCULAR ANATOMY AND PHYSIOLOGY

DATE: 18/4/2023 TIME: 8.00-11.00 AM

INSTRUCTIONS TO CANDIDATES

- 1. Answer all questions**

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

SECTION A

1. A 35-year-old man was getting off the back of a truck when it started to move. Having placed his feet on the ground, he grabbed a rail on the truck with his right hand and held on. The truck continued along the road for one block before it stopped. In the meantime, the man had been dragged along the road as he held on to the truck. He was seen in the emergency room in a state of shock, with cuts and abrasions to his legs. On careful examination of his right arm, a number of muscles were found to be weak or paralyzed. In addition, it was noted that the pupil of the right eye was constricted and that there was drooping of the right upper eyelid. The right eyeball seemed to be less prominent than the left. The skin of the right cheek felt warmer and drier, and was redder in color, than the left cheek. Using your knowledge of anatomy, explain the clinical findings. What is the precise cause of this patient's ptosis of the right upper eyelid? (3 marks)
2. A 10-year-old girl who was walking to school passed a group of workmen digging a hole in the road. A sudden gust of wind carried some dirt particles into the air, and she suddenly experienced pain in her right eye. Although she wiped her eye and repeatedly blew her nose, the discomfort persisted. On being examined by an optometrist, she was found to have a small foreign body in her right conjunctival sac. Using your knowledge of anatomy, describe the different regions of the sac. What is the sensory nerve supply to the conjunctiva? Where do foreign bodies frequently lodge beneath the upper eyelid? In order to remove the foreign body from beneath the upper lid, the eyelid must be carefully everted. What structure within the upper lid preserves its shape and form and assists the Optometrist in keeping the lid everted? (2marks)
3. A 36-year-old man was diagnosed as having an aneurysm of the right internal carotid artery at the point where it passes through the cavernous sinus. It was noted that the patient had severe ptosis of the right eye and lateral strabismus. Using your knowledge of anatomy, explain the clinical findings. Why is the degree of ptosis in this condition more severe than that found in Horner's syndrome? Is the levator palpebrae superioris muscle attached to other anatomic structures in addition to the superior tarsal plate? (2 mark)
4. A 40-year-old woman complaining of a painless swelling of the upper lid of her left eye attended her physician. She said she had had the swelling for about 2 years and it was gradually increasing in size. On examination, a beadlike swelling measuring about 3 mm in diameter could be felt in the substance of the lid. On eversion of the lid, the area of conjunctiva related to the swelling was dark red. On closer questioning, the patient admitted that sometimes she experienced blurred vision in the left eye. What is the diagnosis? Which anatomic structure is involved? If the swelling were to become infected, as it sometimes does, toward which surface of the eyelid would the abscess point? Which surface of the eyelid would you incise for drainage? How do you account for the blurring of vision? (3 marks)
5. A 35-year-old woman visited her physician because of repeated attacks of muscular weakness. On questioning, she admitted that she felt weak all the time but the sensation grew worse with activity. Her husband had recently noticed that her right eyelid tended to droop toward the end of the day. About 3 weeks ago, after extensive walking in a shopping mall, she experienced double vision. Her visit to the doctor was precipitated by a change in her voice, which was gradually

becoming weak. On examination the patient was noted to have ptosis of the right eye. On being asked to look up to the ceiling for 2 or 3 minutes, the eyelid drooped even further. A period of rest restored the eyelid to its previous position. Following an intramuscular injection of neostigmine, the patient's eyelid returned to normal, and the strength of her voice improved. What is your diagnosis? Using your knowledge of anatomy, explain her ptosis of the right eye. What is the cause of the diplopia? (3 marks)

6. A 20-year-old medical student went to his physician and complained of an acute tender area on the middle of his left lower eyelid. Examination revealed a localized red, indurated area on the eyelid margin. Closer examination showed a yellowish spot in the centre of the swelling, indicating that the abscess was about to rupture. Gentle eversion of the lid showed no evidence of swelling on its posterior surface. What is the diagnosis? Which anatomic structure(s) is (are) involved in the inflammatory process? On which part of the margin of the lid does the abscess tend to point? (2 marks)
7. A 14-year-old boy was involved in a fight during school recess. Another much larger student hit him in the right eye with his fist. During the next hour both eyelids of the victim's right eye swelled up until he could barely see. Examination by the Optometrist revealed a bluish-red discoloration of both eyelids of his right eye with narrowing of the palpebral fissure. The discoloration extended to the forehead and the right cheek. Careful separation of the eyelids showed a localized hemorrhage of the inferolateral part of the bulbar conjunctiva. When the conjunctiva was gently moved with the tip of the examiner's little finger, the hemorrhage moved also. On asking the patient to look medially, the Optometrist could clearly see the posterior limit of the conjunctival hemorrhage. Does this patient have a simple "black eye," or is this a fracture of his anterior cranial fossa? What role does the orbital septum play in enabling one to distinguish between these lesions? Is the appearance of the conjunctival hemorrhage important in making a diagnosis? (3 marks)
8. A 75-year-old man complaining of a small nodule on the outer part of his right lower eyelid visited his physician. He said that he had noticed it about a year ago and was concerned about it now because it was gradually enlarging and had ulcerated. On examination, the nodule was about 4 mm in diameter and was ulcerated with pearly margins. It was noted that the base of the ulcer was tethered to deeper structures. Otherwise, the right eye was normal in all respects. The superficial parotid lymph nodes were not palpable. What is your diagnosis? To what deep structures was the ulcer likely to be fixed? Would you expect the superficial parotid nodes to be enlarged in this patient? (2 marks)
9. A 3-month-old boy was taken to a pediatrician because his mother had noticed that his left eye watered excessively when he cried. Recently she noted that when she gently wiped his eye with a tissue, a yellowish, sticky fluid exuded into the medial corner. The infant was referred to an optometrist, who confirmed the epiphora of the left eye and the emergence of pus into the lacus lacrimalis from the puncta when firm pressure was applied to the lacrimal sac. What is the diagnosis? What is the most likely cause in a child of this age? What are the anterior anatomic

relations of the lacrimal sac? Describe the anatomy of the drainage passages and give the direction and length of each of the tubes. (3 marks)

10. A 40-year-old black woman with sarcoidosis was seen by an optometrist because of bulging of both eyes and eyelids. She was unable to produce tears and she said that her eyes felt dry and itchy. Physical examination revealed bilateral proptosis and downward and medial displacement of the eyes. The lateral third of each eyelid was found to be swollen. Using your knowledge of anatomy, name the structure most likely affected by the sarcoidosis. (2 marks)

11. A 60-year-old woman visited her physician because she had noticed puffiness of her left lower eyelid. Her friends told her that it was getting worse, and that she should seek medical advice. She said that she had first seen the swelling 5 years earlier. On examination, the left lower eyelid looked normal, but at the junction with the cheek just above the orbital margin a soft tissue swelling could be detected on palpation. A diagnosis of orbital fat herniation was made. Using your knowledge of anatomy, explain how fat herniation can occur. (3 marks)

12. A 16-year-old boy was making a pipe bomb in his basement when it suddenly exploded. On examination in the emergency room, it was found that his right eye had been severely damaged, with perforation and prolapse of intraocular tissue. Because of the extensive prolapse of the retina and the poor prognosis for recovery of vision in that eye, the Optometrist decided to enucleate the eye. What anatomic structure in the orbit is preserved to form a socket for the prosthesis? Following the operation, will the globe be able to move naturally by the extraocular muscles? What is meant by the terms suspensory ligaments and check ligaments? (2 marks)

13. Discussing the operations to correct strabismus with a fourth-year medical student, an Optometrist was asked whether the superior and inferior recti or the oblique muscles are ever operated on for the condition. The optometrist replied that, although the medial and lateral recti are the commonest muscles to be shortened or lengthened in this condition, sometimes it may be necessary to operate on the other muscles. However, the fascial relationships for the inferior rectus and the inferior oblique muscles make the operation difficult. What is the name of the fascia that is closely related to the inferior rectus and the inferior oblique muscles? In reattachment of the tendons of the recti to the eyeball in operations for the correction of strabismus, is the sclera thick or thin in this situation? (3 marks)

14. A 47-year-old woman was admitted to the hospital complaining of severe pain of the left forehead and right eye. The pain had started 3 weeks previously and had progressively increased since then. One week ago she started to have double vision, and this morning her husband had noticed that her left eye was turning out laterally. The physician in charge made a careful neurologic work-up on this patient and found a lateral deviation of the left eye, dilatation of the left pupil with loss of direct and consensual light reflexes, paralysis of accommodation of the left eye, and paralysis of all left -sided ocular movement except laterally. He advised the patient to have a left -sided carotid arteriogram. The film showed an aneurysm of the internal carotid artery on the left side.

Explain this patient's signs and symptoms, and relate the signs and symptoms to the aneurysm. (2 marks)

15. After examining a 33-year-old man, the Optometrist turned to a fourth-year medical student and said, "This patient has a definite weakness in supraduction and incyclocloduction of the right eye." What is meant by these terms? Which muscles are used to produce levocycloverision? (2 Marks)
16. A 42-year-old man with pyemia secondary to a large carbuncle on the back of his neck suddenly developed a marked fever, chills, and sweating. During the next 48 hours he developed exophthalmos and immobility of his right eye. A CT scan of his orbits showed the presence of a space-occupying lesion behind his right eyeball. Given the history, explain the lesion of the right eye. (2 marks)
17. A 25-year-old student was involved in a head-on collision in his automobile. He was admitted to hospital with severe facial bruising, and an ophthalmology resident was called to examine his eyes. During the examination the resident tested the actions of the extraocular muscles. How would you test the actions of the superior rectus and the superior oblique muscles? (2 marks)
18. A senior ophthalmic surgeon was discussing the surgical treatment of strabismus with his resident. He stated that it was possible to perform a larger recession on the lateral rectus than on the medial rectus muscles without altering the ability of the lateral rectus to rotate the eye. Explain anatomically why this is so. 11 Explain the action of the extraocular muscles used in "rotating the eye upward" or "elevating the eye." 1 2 Where do the sensory nerve fibers originate in the extraocular muscles? Explain the significance of Hering's law and Sherrington's law of reciprocal innervation relative to the actions of the reciprocal innervation relative to the actions of the extraocular muscles. (2 marks)
19. 2 A 38-year-old man visited his physician because he had noticed that his upper eyelid drooped, especially when he was tired or emotionally upset. He had first observed this 8 months earlier. Three months before, he had started to have double vision, which was very slight to begin with and lasted only a few hours. During the past week the double vision had returned, was more severe, and lasted several hours. He commented that his friends have remarked that he does not seem to smile as much as he used to. On questioning he admitted that talking tires him and that his throat feels particularly tired after eating a large meal. On physical examination the patient had slight ptosis (drooping of the upper lid) of the left eye. The eye movements appeared to be normal, but the man's face appeared to be unnaturally immobile. In his attempts to smile the expression was more of a snarl than a happy expression. It was also noted that the patient responded to questions in a rather feeble voice with a nasal quality. When asked to hold his arms outstretched in front of him, the patient became quickly fatigued. What is the diagnosis? What causes this condition? (2 marks)

20. A 50-year-old-woman was seen as an outpatient because she had suddenly developed double vision. She was watching her favourite television program the day before, when double vision suddenly occurred. She had no other symptoms. A complete physical examination revealed that her left eye, when at rest, was turned medially and she was unable to turn it laterally. A moderate amount of glucose was found in her urine, and she had an abnormally elevated blood glucose level. When closely questioned, she admitted that recently she had noticed having to pass water more frequently, especially at night. She also said she often felt thirsty. Without making any efforts to reduce weight, she had lost 30 pounds during the past 3 years. Using your knowledge of neuroanatomy, explain the problem in her left eye. Do you think there is any connection between her glucosuria, high blood glucose, polyuria, polydipsia, and weight loss and her eye condition? (2 marks)
21. A 46-year-old woman complaining of pain over the left cheek visited her physician. She had first noticed the pain 3 weeks previously, and it had become progressively worse. The pain was constant in nature. Initially, the pain was relieved by taking aspirin, but later aspirin produced little or no effect; the pain prevented the patient from sleeping at night. In desperation, the patient had consulted her dentist, thinking that she might have a tooth problem, but the dentist could find nothing abnormal. A careful neurologic work-up detected a slight impairment of touch sensation over her left cheek. Both eyes looked and moved normally. An anteroposterior and lateral radiograph of her skull showed a lesion occupying most of the left maxillary air sinus. Superiorly, the roof of the sinus showed invasion by tumor growth. What is the diagnosis? Why did the patient complain of pain over her left cheek and have slight impairment of skin sensation over that area? (2 marks)
22. Intoxicated with alcohol, a 17-year-old boy crashed his sports car into a bridge abutment. Three days later, when he recovered consciousness in the intensive care unit, the neurologist noted that, in addition to extensive skin lacerations of his face, he had an obvious left-sided medial strabismus. All other movements of both eyes were normal. Which cranial nerve to the orbit had been damaged? Where in its intracranial course is this nerve most commonly damaged following head trauma? Why is this nerve the most common orbital nerve to be damaged in head injuries? (2 marks)
23. Prior to cataract surgery on the right eye, a patient was given a retrobulbar injection of 2% lidocaine solution mixed with 1: 100,000 epinephrine. Twenty minutes later the patient was examined and was unable to move his right eye in any direction except for slight movement downward and laterally. His eyeball was completely numb but his eyelids and brow had normal sensation. The patient complained that he was totally blind in his right eye. Which nerves has the local anaesthetic affected and which has it spared? (2 marks)
24. Optic nerve tumours confined to the orbital cavity are treated by operating directly on the orbital portion of the optic nerve. Surgeons approach the optic nerve either via the lateral wall or the medial wall of the orbit. The incidence of postoperative pupillary dilatation is much higher after

the lateral approach is used. Using your knowledge of anatomy, account for this difference. (2 marks)

25. A 65-year-old man with hypertension was admitted to the hospital with a diagnosis of cerebrovascular haemorrhage. On examination he was found to have paralysis on the right side of the levator palpebrae superioris, superior rectus, medial rectus, inferior rectus, and inferior oblique muscles. Furthermore, his right pupil was dilated and failed to constrict on exposure to light or on accommodation. The left eye was normal in every respect. It was also noted that the lower left part of his face was drooping; the upper part of his face was normal. Examination of his limbs showed that he had a left-sided hemiplegia. What is the diagnosis? Which area of the brain is involved? How would you explain the signs? (2 marks)
26. A 33-year-old man entered the Neurology Clinic with a history of eye problems and muscular weakness. Six months previously the patient had complained of a sudden onset of pain with extraocular movements in the right eye associated with a loss of vision in that eye. Examination by an optometrist at that time revealed a central scotoma of the right eye with a loss of color vision; the peripheral fields of vision were normal. Eye examination of the right eye showed a normal optic disc. The left eye was also normal. Eight weeks later the patient noted a marked recovery of function. Re-examination by the Optometrist showed a residual central scotoma of the right eye, a persistent loss of color vision, and impaired visual acuity. The right optic disc appeared paler than normal, especially on the temporal side. An extensive neurologic examination during this second visit to the clinic revealed that the patient's right arm and leg were weaker than normal, the weakness being worse in the extensors of the arm and the flexors of the leg. The deep tendon reflexes were hyperactive on the right side and the patient had a positive Babinski sign on that side. There was no evidence of weakness on the left side of his body. The patient experienced no numbness or paraesthesia. What is your diagnosis? Why is the right central scotoma associated with color blindness? Why did the right optic disc show indistinct margins and then later paleness on the temporal side?(2 marks)
27. 2 A 45-year-old woman was admitted to the neurosurgery unit with a tumor of the occipital lobe of the right cerebral hemisphere. On examination it was found that her sight in both eyes was normal. However, when asked to follow a slowly moving object with both eyes, she experienced great difficulty in doing so to the right. When she was asked to look at a fixed object in a particular location, she had pursuit difficulty only to the ipsilateral side. Using your knowledge of neuroanatomy, explain this phenomenon. (2 marks)
28. A 45-year-old man presented with the classic signs of acromegaly-enlarged, broad, spade-like hands, large feet, and protruding jaws. The patient complained of bitemporal headache that was associated with boring pain behind the eyes. Three days previously, he had noticed an impairment in vision. On attempting to cross the road he was nearly knocked down by a cyclist. A CT scan revealed a large tumor occupying the sella turcica and extending superiorly toward the third

ventricle. Explain the boring pain behind his eyes. What might be responsible for his impairment in vision and the near accident involving the cyclist? (2 marks)

29. A 58-year-old man who had suffered from chronic sinusitis for many years was seen by an otolaryngologist. After an extensive workup it was decided to operate on his sphenoidal air sinuses to improve the drainage. After the operation, the patient complained that he could not see with his right eye. Using your knowledge of anatomy, explain how this serious complication could occur. (2 marks)
30. Following a bicycle accident, an 18-year-old girl was diagnosed as having a blow out fracture of her right maxilla, resulting in diplopia and right-sided enophthalmos. During the surgical procedure to restore the bony fragments of the floor of the right orbit, the facial and ophthalmic surgeons discussed the boundaries of the maxillary sinus. Using your knowledge of anatomy, describe the bones that form the walls of the maxillary sinus. (2 marks)
31. A 27-year-old man was punched in the right eye and sustained a bruise in the medial portion of the right lower lid and the nose, as well as a bloody nose. Two days later, after blowing his nose, he noticed that the right lower and upper eyelids swelled up and his eye bulged forward. Frightened by the experience, he sought the assistance of his Optometrist. Using your knowledge of the anatomy of the region, explain the mechanism of his injury and findings. (2 marks)