



**AMREF INTERNATIONAL UNIVERSITY
SCHOOL OF MEDICAL SCIENCE
DEPARTMENT OF REHABILITATION MEDICINE
BACHELOR OF SCIENCE IN PHYSIOTHERAPY
END OF JANUARY-APRIL 2026 TRIMESTER EXAMINATIONS**

UNIT CODE: PHT 224

UNIT NAME: NEUROSCIENCE MAIN EXAM

DATE: 9th April 2026

TIME: TWO HOURS

START: 6pm

STOP : 8pm

INSTRUCTIONS (physical exams)

- 1. Do not write on this question paper**

(Marks and questions distribution as per program curriculum.)

INSTRUCTIONS (Online examinations)

1. This exam is marked out of 70 marks
2. This Examination comprises 3 Sections
3. This online exam shall take 2 Hours
4. Late submission of the answers will not be accepted
5. Ensure your web-camera is on at all times during the examination period
6. No movement is allowed during the examination
7. Idling of your machine for 5 min or more will lead to lock out from the exam
8. The Learning Management System (LMS) has inbuilt integrity checks to detect cheating
9. Any aspect of cheating detected during and or after the exam administration will lead to nullification of your exam
10. In case you have any questions call the invigilator for this exam on Tel. 0705833434 and or the Head of Department on Tel 0720491032
11. For adverse incidences please write an email to: amiu.examinations@amref.ac.ke

**SECTION A: MULTIPLE CHOICE QUESTIONS. SELECT THE BEST RESPONSE.
EACH CORRECT ANSWER IS ONE MARK (30 MARKS)**

- 1) Which part of the nervous system is the focus of sobriety tests?
- A. Occipital lobe
 - B. ANS
 - C. Hypothalamus
 - D. Cerebellum
- 2) The cerebral aqueduct is a canal connecting 3rd and 4th ventricles. What brain structure would likely contain it?
- A. thalamus
 - B. hypothalamus
 - C. pons
 - D. midbrain
 - E. medulla
- 3) Using anatomical points of reference, the cerebellum is _____ to the cerebrum and _____ to the pons.
- A. anterior / dorsal
 - B. posterior / ventral
 - C. rostral / ventral
 - D. caudal / dorsal
- 4) Hemorrhage of the main blood vessel which supplies the basal ganglia (e.g. caudate, putamen, and globus pallidus) is likely to involve which other nearby structure:
- A. hippocampus
 - B. substantia nigra
 - C. red nucleus
 - D. mammillary body

E. internal capsule

5) What are the first cells in the auditory system to fire action potential?

A. inner hair cells

B. outer hair cells

C. spiral ganglion neurons

D. medial geniculate nucleus neurons

6) Fill in the blanks: in the vestibular system, otolith organs detect _____ and semicircular canals are sensitive to _____

A. head rotation to the left / head rotation to the right

B. head rotation to the left / tilts of the head

C. head rotations / force of gravity

D. force of gravity / rotations of the head

7) Merkel's disks

A. are rapidly adapting

B. are sensitive to cold

C. are protopathic receptors

D. are epicritic receptors

8) While taking a 9.01 exam, a student impales himself in the belly in despair. After which, he notices that, from the belly down, he can only feel pain on the right side of his body. Conversely, he can only experience tactile sensations on the left side of his body from the belly down. Where did he lesion himself?

A. the right dorsal column at the cervical level

B. the right dorsal column at the lumbar level

C. the left dorsal column at the cervical level

9) the left dorsal column at the lumbar level Which pair of neurons is most similar in terms of their temporal firing patterns?

A. M-type ganglion cells and Merkel's disks

B. P-type ganglion cells and Meissner's corpuscles

C. M-type ganglion cells and Pacinian corpuscles

10) M-type ganglion cells and Ruffini endings
Agnosias are the inability to recognize objects even when the ability to recognize their components (simple sensory skills) are intact. Damage to which component of the nervous system is likely to cause an agnosia?

A. Peripheral sensory neurons

B. Ventral posterior nucleus of the thalamus

C. primary somatosensory cortex

D. secondary somatosensory cortex

E. posterior parietal cortex

11) A foot fetish of a sexual nature might be explained by which of the following:

A. Sensory neurons that innervate the genitals enter the spinal cord at the same segment as sensory neurons that innervate the toes

B. Sensory neurons that innervate the genitals use the same neurotransmitter as sensory neurons that innervate the toes

C. The toes and genitals are adjacent in the somatotopic map of the body surface onto primary motor cortex

D. The toes and genitals are adjacent in the somatotopic map of the body surface onto primary somatosensory cortex

12) The primary sensory cortex is supplied with blood from _____.

A) the anterior cerebral artery

B) the middle cerebral artery

C) the anterior cerebral artery and the posterior cerebral artery

D) the anterior cerebral artery and the middle cerebral artery

E) the posterior cerebral artery

13) This brain structure has no major role in pain perception or pain modulation _____

- A. Superior colliculus.
- B. Ventral posteromedial nucleus of the thalamus (VPM).
- C. Periaqueductal gray (PAG).
- D. Amygdala.
- E. Substantia gelatinosa.

14) The pyramidal tract _____

- A. originates in the reticular formation
- B. contains both ascending and descending axons
- C. can end monosynaptically on a motoneurons
- D. is part of the "limbic system"
- E. is located in the anterior crus (limb) of capsula interna

15) The cerebellum is _____

- A. Physically attached to the pons by the middle cerebral peduncle
- B. Connected to the spinal cord neurons through axons in the Inferior cerebellar peduncle
- C. Innervated by climbing fibers
- D. Is not directly connected to the motor cortex

16) The membrane potential of a neuron depolarizes when _____

- A. AMPA receptors are activated
- B. The extracellular K^+ concentration increases
- C. K^+ channels close.
- D. GABAA receptors are activated in the presence of very high intracellular Cl^- concentration

17) All of the following are true regarding Lower motor neurons (LMN) except:

- A. Alpha LMNs synapse with skeletal muscle fibers
- B. LMN syndrome is characterized by weakness, atrophy, and hyperactive deep

tendon reflexes

- C. LMN groups are organized topographically in the spinal cord
- D. The cell bodies of the LMNs are located in the brainstem and spinal cord

18) Which type of fiber could be considered the longest?

- A. preganglionic parasympathetic
- B. preganglionic sympathetic
- C. postganglionic parasympathetic
- D. postganglionic sympathetic

19) Which of these cranial nerves contains preganglionic parasympathetic fibers?

- A. optic, CN II
- B. facial, CN VII
- C. trigeminal, CN V
- D. hypoglossal, CN XII

20) What region of the limbic lobe is responsible for generating stress responses via the hypothalamus?

- A. hippocampus
- B. amygdala
- C. mammillary bodies
- D. prefrontal cortex

21) When a cup starts to slip from one's hand it makes quick vibrations, which are felt through the hand. Which receptor, that is important in perceiving vibration, is being triggered?

- A. The Ruffini cylinder, a slow-adapting (SA II) mechanoreceptor that fires to continuous pressure.
- B. The Meissner corpuscle, a fast-adapting (FA I) mechanoreceptor that fires to 'on' and 'off' stimulus.
- C. The Merkel receptor, a slow-adapting (SAI) mechanoreceptor that fires to continuous pressure.

- D. The Pacinian corpuscle, a fast adapting (FA II) mechanoreceptor that fires to 'on' and 'off' stimulus.

22). Jade and her parents moved to Australia from Vietnam when Jade was an infant. Now that she is an adult, Jade speaks English fluently whereas her parents still struggle to speak English. Why might this be?

- A. Jade's parents were too old for their brains to form any new neurological pathways when they moved to Australia.
- B. Adult brains display less plasticity for language acquisition than a young child's brain.
- C. Adult brains display more plasticity for language acquisition than a young child's brain.
- D. The development of brain plasticity means that it is impossible to learn a new language after childhood.

23) Which statement is true about developmental plasticity?

- A. It is a typical feature of childhood.
- B. It is evident in both a child's brain and an adult's brain.
- C. It occurs only in people recovering from serious brain injuries.
- D. It is more evident in some areas of the brain than in other areas of the brain.

24). A 43-year-old man sustains a wound to the lateral neck. This results in weakness of elevation and retraction of the shoulder on the ipsilateral side and difficulty turning the head up and toward the contralateral side. No sensory changes are present. Which of the following nerves most likely has been injured?

- A. Axillary
- B. Lateral cord of the brachial plexus
- C. Phrenic
- D. Spinal accessory
- E. Suprascapular

25). A 65-year-old man has loss of pain and temperature sensation on the right side of the face and from the neck down on the left. Examination shows partial paralysis of the soft

palate, larynx, and pharynx, and ataxia, all on the right. The most likely cause of these findings is thrombosis to which of the following arteries?

- A. Basilar
- B. Right posterior inferior cerebellar
- C. Left posterior inferior cerebellar
- D. Right superior cerebellar
- E. Left superior cerebellar

26). A 4-month-old boy is brought to the physician by his mother for a well-child examination. He is at the 98th percentile for head circumference. Physical examination shows dilation of the scalp veins and spasticity of the lower extremities. The physician suspects excessive cerebrospinal fluid accumulation in the ventricular system of the brain. The source of this fluid is most likely which of the following?

- A. Choroid plexus
- B. Dura mater
- C. Pia mater
- D. Roof of the third ventricle

27). A 68-year-old woman is brought to the physician by her husband because of strange behavior. The previous evening, she had gotten up suddenly from the dinner table and started to undress in front of guests. Further questioning discloses a 1- year history of a progressive change in behavior. She writes everything down on a notepad; otherwise, she forgets. She cannot remember the names of her four grandchildren or the date of her wedding anniversary. These symptoms are most likely associated with a deficit in which of the following?

- A. Acetylcholine
- B. Dopamine
- C. Glucose 6-phosphate dehydrogenase
- D. Insulin
- E. Serotonin

28). A 50-year-old man has had gradually progressive hand weakness. He has atrophy of the forearm muscles, fasciculations of the chest and arms, hyperreflexia of the lower extremities, and extensor plantar reflexes. Sensation is not impaired. Which of the following is the most likely diagnosis?

- A. Amyotrophic lateral sclerosis
- B. Dementia, Alzheimer type
- C. Guillain-Barré syndrome
- D. Multiple cerebral infarcts
- E. Multiple sclerosis

29). Mr. Stanilopolis recently fell. He told his therapist that he fell because he was not wearing his glasses. However, his daughter reports to the therapist that her father commonly walks with a broad-based gait, uses furniture in the home to help him stabilize his balance while walking, and frequently loses his balance in dim light and unlevel surfaces. The daughter also states that her father commonly complains of dizziness (vertigo), ear ringing (tinnitus), and decreased hearing. Upon examination, the therapist finds an abnormal presence of nystagmus. She suspects impairment of which neurological system?

- A. visual system
- B. proprioceptive system
- C. vestibular system
- D. autonomic nervous system

30). Ann and Amanda are in a car traveling to school. Amanda is a passenger in the front seat while Ann drives. Amanda is using this commuting time to catch up on reading for her classes. Fifteen minutes into the drive, Amanda begins to sweat and feel nauseated. She first attributes her discomfort to a lack of breakfast. Amanda continues to read but feels increasingly dizzy, faint, and nauseous. She tells Ann, who recognizes Amanda's condition as motion sickness and advises her to stop reading and instead watch the oncoming traffic. Ann recognizes that motion sickness is often caused by:

- A. An incongruence between proprioceptive and vestibular system signals reaching the cortex
- B. Incongruent signals traveling to the cortex from the reticular activating and inhibiting systems
- C. Parasympathetic nervous system dominance (over sympathetic nervous system activity)
- D. An incongruence between visual and motion signals reaching the vestibular system

SECTION B: SHORT ANSWER QUESTIONS. ANSWER ALL QUESTIONS. EACH QUESTION IS 5 MARKS (20 MARKS)

1. Associate the stages of declarative memory with their respective brain areas (5 marks)
2. Discuss the neurological deficits resulting from infarction of the middle cerebral, anterior cerebral, posterior cerebral, and basilar arteries, with emphasis on somatosensory and motor function, special senses, autonomic regulation, and emotional and behavioral changes. (5 marks)
3. Compare peripheral and central vestibular disorders and give examples of each (5 marks)
4. Describe the locations and/or decussations of vertical pathways in the lower medulla (5 marks)

LONG QUESTIONS. ANSWER ALL QUESTIONS. EACH QUESTION IS 10 MARKS. (20 MARKS)

- 1) A doorman, 32 years old, was stabbed in the back. Two years after the injury, an examination revealed the following positive signs:
 - paralysis and pronounced atrophy of the small muscles on the right hand (myotomes C8-T1)
 - lack of all sensations over a strip of the ulnar side of the right arm (dermatomes C8-T1)
 - paralysis of the right leg with a hyperactive patellar reflex, Babinski's sign and minor atrophy of the
 - muscles
 - loss of sensibility to pain, heat, and cold from dermatome T3 and below on the left side

Questions: 1

- a) Discuss the causes of the motor's deficit in the hand and the leg (**4 MARKS**)
- b) Explain why there is a loss of sensibility to pain, heat and cold on the left side of the body (**3 MARKS**)
- c) Discuss what sensory signs would show if the injury involved the entire lateral half of segment C8- T1 in the spinal cord (**3 MARKS**)

Question 2

- a) Parkinson's disease is a disorder of the basal ganglia. Explain what neurons are

lost in the disease and the main result (regarding movement) of this loss with respect to neurotransmitter and activity in the basic circuitry of the basal ganglia (6 marks)

- b) Tremor is a symptom of Parkinson's disease but also occurs in patients with damage in another brain area. Which area is this? And what is different between the two tremors (4 marks)

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