NATIONAL UNIVERISTY OF LESOTHO

FACULTY OF HEALTH SCIENCES

DEPARTMENT OF PHARMACY

HUMAN ANATOMY AND PHYSIOLOGY (FHS 2300)

FINAL EXAMINATION

TIME: 3 HOURS JANUARY 2024 100 MARKS

INSTRUCTIONS:

Answer all questions by giving a letter corresponding to a correct answer

MUSCLE TISSUE

1. Which of the following is characteristic of fast oxidative fibers?
   A. High contraction speed
   B. Low myoglobin
   C. White colour
   D. Low fatigue rate

2. Which of the following is not a function of ATP in muscle contraction?
   A. Energizing the myosin heads so that they bind to actin
   B. Detaches myosin from actin
   C. Powers the pumps that transport Ca^{2+} back into the sarcoplasmic reticulum
   D. Activates acetylcholine receptors

3. Which of the following is characteristic of slow oxidative fibers?
   A. Low contraction speed
   B. Low myoglobin
   C. White colour
   D. Low fatigue rate

4. All the following occurs during muscle contraction except which one?
   A. I band and H zones disappear
   B. Lengths of thick and thin filaments stay the same
   C. Z lines move closer to one another
   D. M lines disappear completely

5. Which is the most rapid method to re-synthesize ATP during muscle contraction?
   A. Glycolysis
   B. Phosphagen system
   C. Tricarboxylic acid cycle (Krebs' cycle)
   D. Gluconeogenesis

6. Which are the two principal contractile proteins found in skeletal muscle?
   A. Actin and troponin
   B. Actin and myosin
   C. Troponin and tropomyosin
   D. Myosin and tropomyosin

7. Which of the following is the role of the sarcoplasmic reticulum in muscle cells?
   A. Store digestive enzymes
   B. Store sodium ions
   C. Store lipids
   D. Store calcium ions

8. Which of the following is characteristic of fast glycolytic fibers?
   A. Low fatigue rate
   B. Low myoglobin
   C. White colour
   D. High number of mitochondria

9. Which of the following bisects the functional unit of a muscle (sarcomere)?
    A. M lines
    B. Z lines
    C. I bands
    D. All the above

10. Type I muscle fibres have which of the following characteristics?
    A. Low ATPase activity, resistant to fatigue, low glycolytic capacity, high oxidative capacity
    B. High ATPase activity, fatigue easily, high glycolytic capacity, low oxidative capacity
    C. High ATPase activity, fatigue easily, high glycolytic capacity, high oxidative capacity
    D. Low ATPase activity, resistant to fatigue, low glycolytic capacity low oxidative capacity

11. Which of the following are sources of ATP for muscle contraction?
    A. Glycolysis
    B. Creatine phosphate
    C. Acetylcholine
    D. Both A and B are correct

12. Which of the following types of contraction produces a decrease in the length of a muscle?
    A. Isometric contraction
    B. Isotonic contraction
    C. Eccentric contraction
    D. Concentric contraction

13. Which of the following is a voltage sensor in the transverse tubules?
    A. Ryanodine receptor
    B. Dihydropyridine receptor
    C. Sarcoplasmic reticulum
    D. There is no voltage sensor in the transverse tubule

14. Which of the following structures borders the sarcomere?
    A. M lines
    B. Z lines
    C. I bands
    D. All the above

15. What is the role of troponin in muscle contraction?
    A. Binds calcium
    B. Shields the tropomyosin
    C. Prevents ATP binding to myosin head
    D. Troponin has no role in muscle contraction

16. Which of the following is not true foe Type I muscle fibres?
    A. Highly anaerobic
    B. High mitochondria and lot of capillaries
    C. High myoglobin
    D. Slow contraction

BIOLOGICAL MEMBRANES

17. What is the rate of diffusion of a substance across the cell membrane inversely proportional to?
    A. Concentration gradient for the solute
    B. Diffusion coefficient
    C. Surface area available for diffusion
    D. Thickness of the membrane

18. How do lipid soluble chemical messengers produce their effects on target cells?
    A. Binding to membrane receptors
    B. Binding to intracellular receptors
    C. Stimulating hydrolysis of cell membrane lipids
    D. Activating channels on the plasma membrane

19. Which of the following is true for biological membranes?
    A. They are made up of mainly phospholipids molecules and a few protein molecules
    B. They are impermeable to fat-soluble substances
    C. They are freely permeable to all molecules
    D. All the answers are correct

20. Which is the function of transmembrane channel proteins in the biological membrane?
    A. Allow passage of specific ions/molecules
    B. Catalyzing cellular reactions
    C. Allows recognition of specific molecules
    D. Allows binding of one cell to another and provides stability and shape to the cell

21. Which junction allows cells to communicate rapidly with one another?
    A. Desmosome
    B. Gap junction
    C. Tight junction
    D. Hemidesmosome

22. What is the primary force moving water from the blood plasma to the interstitial fluid?
    A. Active transport
    B. Cotransport with H^+
    C. Facilitated diffusion
    D. Hydrostatic pressure difference

23. How do water soluble chemical messengers produce their effects on target cells?
    A. Binding to membrane receptors
    B. Binding to intracellular receptors
    C. Stimulating hydrolysis of cell membrane lipids
    D. Activating channels on the plasma membrane

24. Which intercellular junctions directly allow the passage of small molecules and ions between the cytosol of one cell and its neighbor without movement into interstitial fluid?
    A. Gap junctions
    B. Focal adhesions
    C. Tight junctions
    D. Desmosomes

25. Which of the following is NOT a component of the cell membrane?
    A. Cholesterol
    B. Proteins
    C. Microfilament
    D. Phospholipids

26. Which of the following is a function of cholesterol in the plasma membrane?
    A. Stop transport of substances across the membrane
    B. Prevents formation of the lipid bilayer
    C. Maintaining the structural integrity and regulating the fluidity of cell membranes
    D. There is no cholesterol in the membrane

27. Which one of the following is NOT a serous membrane?
    A. Pleura
    B. Peritoneum
    C. Pericardium
    D. Mucosa
28. What is the name of the membrane that surrounds the lungs?
    A. Visceral pleura
    B. Dura mater
    C. Parietal peritoneum
    D. Visceral peritoneum

29. Solution A and B are separated by a membrane that is permeable to urea. Solution A is 10 mM urea, and solution B is 5 mM urea. If the concentration of urea in solution A is doubled, what happens to the flux of urea across the membrane?
    A. It doubles
    B. It decreases by one-half
    C. It remains unchanged
    D. It triples

30. Transport of D- and L- glucose proceeds at the same rate down an electrochemical gradient by which of the following processes?
    A. Cotransport
    B. Simple diffusion
    C. Primary active transport
    D. Facilitated diffusion

31. Which of the following will double the permeability of a solute in a lipid bilayer?
    A. Doubling the oil/water partition coefficient of the solute
    B. Doubling the molecular radius of the solute
    C. Doubling the concentration difference of the solute across the bilayer
    D. Doubling the thickness of the bilayer

TRANSPORT ACROSS MEMBRANES

32. Which of the following would occur because of the inhibition of Na^+/K^+- ATPase?
    A. Decreased intracellular Na^+ concentration
    B. Increased intracellular Ca^{2+} concentration
    C. Increased Na^+-glucose cotransport
    D. Increased intracellular K^+ concentration

33. Which transport processes involved in transport of glucose from the intestinal lumen into a small intestinal cell is inhibited by abolishing the usual Na^+ gradient across the cell membrane?
    A. Simple diffusion
    B. Primary active transport
    C. Secondary active transport
    D. Facilitated diffusion

34. Which of the following is not true for the Na^+/K^+ pump?
    A. It directly links Na^+ efflux with K^+ influx
    B. It requires ATP for its functioning
    C. It exchanges intracellular Na^+ for extracellular K^+
    D. It is an ion channel

35. Which of the following is the most abundant cation in ICF?
    A. Sodium
    B. Potassium
    C. Magnesium
    D. Calcium

36. Which one of the following is not normally found in ECF?
    A. Cyanide
    B. Chloride
    C. Phosphate
    D. Protein anion

BODY PLANES AND CAVITIES

37. Which major organ lies deep to the right hypochondriac regions?
    A. The duodenum
    B. The spleen
    C. The stomach
    D. The liver

38. Which plane of the body divides it into dorsal and ventral regions?
    A. Transverse
    B. Axial
    C. Coronal
    D. Sagittal

39. The directional term 'superior' in anatomy means which of the following?
    A. Cranial
    B. Ventral
    C. Caudal
    D. Dorsal

40. The 'anatomic position' could be described as which of the following?
    A. Lying down prone
    B. Lying down supine
    C. Standing displaying the ventral surface of the body
    D. Standing with arms and legs abducted

41. Which of the following is/are the contents of the ventral cavity?
    A. Heart and lungs
    B. Brain and spinal cord
    C. Viscera
    D. Gut, kidneys, liver, pancreas, spleen, bladder, internal reproductiveorgan

42. Which choice best describes the location of most of the musculo-skeletal system?
    A. It is in the dorsal cavity
    B. It is in the ventral cavity
    C. It is in the abdomino-pelvic cavity
    D. It is not located in a body cavity

43. Which of the stated relationship is correct?
    A. The heart is inferior to the clavicle
    B. The shoulder is distal to the carpals
    C. The phalanges are proximal to the metacarpals
    D. The eye is medial to the eyebrows

44. Complete the sentence correctly: 'Cervical vertebrae are...
    A. Superior to the rib cage
    B. Inferior to the thoracic vertebrae
    C. Located between the thoracic and sacral vertebrae
    D. Fused into a single bone called the sacrum

45. To what does the term 'hypochondriac' refer?
    A. A condition of having too few chondria
    B. The region of abdomen inferior to the rib.
    C. A person who often complains of an ailment
    D. Having insufficient cartilage in the knees

46. When a medicine is delivered via a patch attached to the skin, it is said to be delivered:
    A. Transdermally
    B. Subcutaneously
    C. Topically
    D. Intramuscularly

47. Which is the function of membrane proteins located in the interior side of the biological membrane?
    A. Allow passage of specific ions/molecules
    B. Catalysing cellular reactions
    C. Allows recognition of specific molecules
    D. Allows binding of one cell to another and provides stability and shape to the cell

48. Which chemical messengers acts on the cell that produces it?
    A. Paracrine messenger
    B. Autocrine messenger
    C. Hormone
    D. Neurotransmitter

HOMEOSTASIS

49. Which one of the following is not a component of homeostatic control systems?
    A. Integrating centre
    B. Receptor
    C. Effector
    D. Enzyme

50. Which of the following is the best definition of homeostasis?
    A. The microscopic study of tissues and cell
    B. The study of how the body works
    C. All the chemical processes that take place in the organelles of the body's cells
    D. The body's automatic tendency to maintain a relatively constant internal environment

51. Midway through a 5-mile workout a runner begins to sweat profusely. The sweat glands producing the sweat would be considered which part of a feedback loop?
    A. Controlled condition
    B. Receptors
    C. Stimulus
    D. Effectors

52. What happens if the core body temperature is too high?
    A. The capillaries dilate
    B. The blood vessels supplying the capillaries dilate
    C. The capillaries constrict
    D. The capillaries move closer to the surface of the skin

53. Which statement about homeostasis is incorrect?
    A. Because of this, the fluctuations of the internal environment are of extremely narrow range as compared to that of the external environment
    B. There is a definite control system regulating the homeostatic activities
    C. Homeostatic mechanisms keep the internal environment fixed despite wide changes in the external environment
    D. all the above

54. Which of the following is a specialized evaporative cooling in the respiratory tract in dogs?
    A. Woofing
    B. Licking
    C. Panting
    D. Sleeping

55. Which of the following strategies would not help restore a high body temperature to normal?
    A. Non-Shivering thermogenesis
    B. Sweating
    C. Flattening of skin hair
    D. Redistribution of blood flow to the periphery

56. What would NOT happen if the core body temperature was too low?
    A. There would be a reduced blood flow through the skin capillaries
    B. Shivering would release energy by muscle contraction
    C. Sweat would cool the body as it evaporated
    D. Hair erector muscles would contract

57. Where are the temperature sensitive receptors located?
    A. The skin
    B. The thermoregulatory centre
    C. The blood
    D. The kidney

58. What is the difference between negative and positive feedback?
    A. In positive feedback, the output of the control system turns on a stimulus that had been switched off and negative feedback keeps a stimulus that has been turned on by positive feedback on
    B. In positive feedback, the output of the control system reduces the original output stimulus and in negative feedback it increases the output stimulus
    C. In negative feedback, the output of the control system reduces the original output stimulus and in positive feedback it shuts off the feedback temporarily
    D. In negative feedback, the output of the control system reduces the original output stimulus and in positive feedback it increases the output stimulus

59. What is the term for a cycle of events in which the status of a body condition is continuously monitored, evaluated, changed and re-monitored?
    A. Feedforward control
    B. Feedback control
    C. Positive feedback
    D. Homeostasis

60. What is an example of a negative feedback loop with regards to blood pressure?
    A. Antidiuretic hormone (ADH) is released when blood pressure is low and when blood pressure increases, ADH levels drop
    B. Antidiuretic hormone (ADH) is released when blood pressure is high and when blood pressure decreases, ADH levels drop
    C. Adenosine is released when blood pressure is low and when blood pressure increases, adenosine levels drop
    D. Atrial natriuretic peptide (ANP) is released when blood pressure is low and when blood pressure increases, ANP levels drop

61. What 3 components are needed for homeostatic control system?
    A. Sensor, control centre and effector
    B. Sensor and effector
    C. Sensor, control centre and feedback centre
    D. Control centre, feedback centre and effector

62. What is the result of a failure in homeostasis?
    A. Disease
    B. Adaptation to the environment
    C. Evolution
    D. There is no deviation from homeostasis because the body will always adjust

63. Which of the following is true for positive feedback mechanisms?
    A. The response is in the opposite direction to the initial disturbance
    B. There is no response to any disturbance
    C. The response exacerbates the disturbance
    D. Both b. and c. are correct

NERVOUS SYSTEM

64. Which equation can be used to calculate the equilibrium potential for a single ion?
    A. Goldman equation
    B. Henderson-Hasselbalch equation
    C. Nernst equation
    D. The equilibrium potential cannot be calculated

65. Which of the following is the excitatory neurotransmitter in the CNS?
    A. Acetylcholine
    B. Glutamate
    C. Serotonin
    D. Dopamine

66. Which of the following amino acids act as neurotransmitters?
    A. Glycine
    B. Aspartate
    C. Tryptophan
    D. Phenylalanine

67. Which of the following describes temporal summation in a postsynaptic neuron?
    A. Non-arrival of signals at the postsynaptic neuron
    B. Arrival of signals at different times postsynaptic neuron
    C. Arrival of signals at different locations on the postsynaptic neuron
    D. Inhibition of transmission at a presynaptic neuron

68. Which of the following is/are characteristic of graded potentials?
    A. It is an all or none event
    B. Conducted decrementally
    C. Cannot be summed
    D. Depolarizing only

69. Which of the following equations is used to calculate the resting membrane potential?
    A. Goldman-Getz equation
    B. Henderson-Hasselbalch equation
    C. Nernst equation
    D. None of the above

70. Which of the following describes spatial summation in a postsynaptic neuron?
    A. Non-arrival of signals at the postsynaptic neuron
    B. Arrival of signals at different times postsynaptic neuron
    C. Arrival of signals at different locations on the postsynaptic neuron
    D. Inhibition of transmission at a presynaptic neuron

71. Which of the following describes temporal summation in a postsynaptic neuron?

A. Non-arrival of signals at the postsynaptic neuron
B. Arrival of signals at different times postsynaptic neuron
C. Arrival of signals at different locations on the postsynaptic neuron
D. Inhibition of transmission at a presynaptic neuron

72. Which of the following neurotransmitters is commonly affected or lost in Alzheimer's disease?

A. Dopamine
B. Gamma-aminobutyric acid (GABA)
C. Acetylcholine
D. Serotonin

73. Cerebrospinal fluid (CSF) is a clear fluid that occupies interconnected cavities within the brain (ventricular system) and the central canal of the spinal cord. Identify the statement which is incorrect:

A. CSF cushions and protects the cortex by providing buoyancy and mechanical protection for the brain within the skull (cranium)
B. CSF is formed by microglial cells in the brainstem
C. CSF serves a vital function in the regulation of blood flow to the cerebrum and thus contributes to stability in the volume and pressure within the cranial vault.
D. Researchers have suggested that levels of different biochemical markers in CSF may be helpful for assisting diagnosis of neurodegenerative disorders including dementia.

74. Neuroscientists have demonstrated that normal function of the brain depends on which one of the following?

A. The ability of neurons to communicate with each other
B. Electrical properties of neurons
C. Interactions between neurons at synapses
D. All of these

75. Which of the following are classic changes in brain tissue that are associated with Alzheimer's disease?

A. Neurofibrillary tangles and senile plaques
B. Dendritic spines
C. Microglia and synapses
D. Neurofibrillary tangles and microtubules

76. Which is the most distinctive and largest part of the human brain?

A. The cerebellum
B. The cerebrum
C. The temporal lobe
D. The hypothalamus

77. What part of a neuron is sometimes myelinated?

A. Dendrite
B. Axon
C. Soma
D. Axon hillock

78. A membrane potential is the difference in electrical charge between
    A. Potassium and sodium ions
    B. The inside and outside of the cell
    C. Phosphoric acid and glycolipid layers
    D. Resting and action potentials

79. During which period is there no chance of generating an action potential?
    A. Relative refractory period
    B. Absolute refractory period
    C. During intense stimulation
    D. An action potential will always be generated

80. Under which circumstances does a postsynaptic neuron fire?
    A. When the excitatory postsynaptic potential (EPSP) exceeds threshold
    B. When hyperpolarization occurs at the axon hillock
    C. When neurotransmitters dock onto receptor proteins
    D. When depolarization at the axon hillock exceeds the threshold for excitation

81. When does the end of the rising phase of an action potential occur?
    A. When potassium channels close
    B. When sodium channels close
    C. When potassium channels open
    D. When chloride channels open

82. Where are neurotransmitters often stored?
    A. Synaptic buttons
    B. Microtubules
    C. Synaptic Vesicles
    D. Endoplasmic reticulum

83. What effect does myelination have on axons?
    A. It protects them from damage
    B. It slows the propagation of signals along them
    C. It prevents cross talk between adjacent axons
    D. It allows them to conduct signals significantly faster

84. Through which process are neurotransmitters released?
    A. Excitation
    B. Exocytosis
    C. Pinocytosis
    D. Synthesis

85. During which period is there a chance of generating an action potential before the end of another action potential?
    A. Relative refractory period
    B. Absolute refractory period
    C. During intense stimulation
    D. An action potential will always be generated

86. How do neurotransmitter molecules produce signals in postsynaptic neurons?
    A. Entering the postsynaptic neuron
    B. Attaching to vesicles
    C. Binding to presynaptic receptors
    D. Binding to postsynaptic receptors

87. Which of these is a disease of the myelin sheath?
    A. Polio
    B. Leprosy
    C. Multiple sclerosis
    D. Alzheimer

88. Where does a nerve impulse jump from one to another during saltatory conduction?
    A. Synapse
    B. Axon
    C. Node of Ranvier
    D. Myelin sheath

89. Which are the neurons that carry impulses away from the central nervous system?
    A. Efferent nerves
    B. Afferent nerves
    C. Extensors
    D. Sensory nerves

90. Which of these has the highest permeability in a resting nerve cell?
    A. Cl-
    B. Na+
    C. K+
    D. I-

91. Which pair has inhibitory and excitatory neurotransmitters?
    A. GABA; glutamate
    B. Glutamate; GABA
    C. Serotonin; dopamine
    D. None of these

92. Which of the following neurotransmitters is commonly affected or lost in Parkinson's disease?
    A. Dopamine
    B. Gamma-aminobutyric acid (GABA)
    C. Acetylcholine
    D. Serotonin

SKELETON AND BONE

93. How many bones are there in the average person's body?
    A. 106
    B. 206
    C. 306
    D. 406

94. What is the skeletal system is made up of?
   A. Bones, joints, cartilages and tendons
   B. Ribs, heart and lungs
   C. Muscles and bones
   D. Bones, heart and lungs

95. Which of the following statements is incorrect?
   A. Bone protects and supports the body and its organs
   B. Bone is where most blood cells are made
   C. Bone is a dry and non-living supporting structure
   D. Bone serves as a storehouse for various minerals

96. Which bone protects the brain?
   A. Cranium
   B. Calcium
   C. Cerebrum
   D. Cerebellum

97. What is the function of the rib cage?
   A. Protects the spinal cord
   B. Provides attachment for the lungs
   C. Protects the heart and lungs
   D. Protects the stomach

98. What strengthens bone tissue?
   A. Bone marrow
   B. Cartilage
   C. Silica
   D. Calcium and phosphorus

99. The axial skeleton is comprised of how many bones?
   A. 90
   B. 126
   C. 60
   D. 80

100. The appendicular skeleton is comprised of how many bones?
   A. 126
   B. 100
   C. 80
   D. 110