



# THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

**A. M. E. C. E. A**

**REGINA PACIS INSTITUTE OF HEALTH SCIENCES**

**MAIN EXAMINATION**

**AUGUST - DECEMBER 2016 TRIMESTER**

**FACULTY OF SCIENCES**

**DEPARTMENT OF NURSING**

**NUR 101: PHYSIOLOGY**

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**Duration: 3 Hours**

**INSTRUCTIONS: Answer ALL Questions**

## **SECTION A**

- Q1. Which of the following characteristics is shared by simple and facilitated diffusion of glucose?
- a) Occurs down an electrochemical gradient
  - b) Is saturable
  - c) Requires metabolic energy
  - d) Is inhibited by the presence of galactose
  - e) Requires a Na<sup>+</sup> gradient
- Q2. During the upstroke of the action potential
- a) There is net outward current and the cell interior becomes more negative
  - b) There is net outward current and the cell interior becomes less negative
  - c) There is net inward current and the cell interior becomes more negative
  - d) There is net inward current and the cell interior becomes less negative
- Q3. The correct temporal sequence for events at the neuromuscular junction is
- a) Action potential in the motor nerve; depolarization of the muscle end plate ; uptake of Ca<sup>2+</sup> into the presynaptic nerve terminal.
  - b) Uptake of Ca<sup>2+</sup> into the presynaptic terminal; release of acetylcholine (ACh); depolarization of the muscle end plate
  - c) Release of ACh; action potential in muscle
  - d) Uptake of Ca<sup>2+</sup> into motor end plate; action potential in the motor end plate; action potential in muscle
  - e) Release of ACh; action potential in muscle end plate; action potential in muscle

Q4. Which characteristic or component is shared by skeletal muscle and smooth muscle?

- a) Thick and thin filaments arranged in sarcomeres
- b) Troponin
- c) Elevation of intracellular  $[Ca^{2+}]$  for excitation – contraction coupling
- d) Spontaneous depolarization of the membrane potential
- e) High degree of electrical coupling between cells.

Q5. Repeated stimulation of a skeletal muscle fiber causes a sustained contraction (tetanus). Accumulation of which solute in intracellular fluid is responsible for the tetanus?

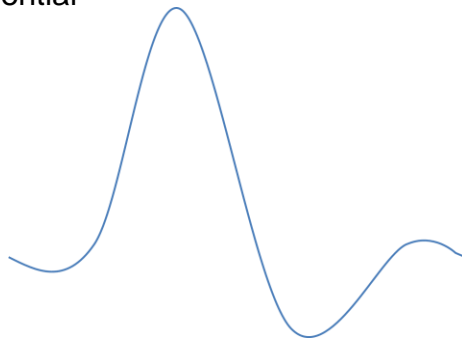
- a)  $Na^+$
- b)  $Ca^{2+}$
- c)  $Cl^-$
- d)  $Mg^{2+}$
- e)  $Ca^{2+}$
- f) Troponin
- g) Calmodulin
- h) Adenosine triphosphate (ATP)

Q6. In error, a patient is infused with large volumes of a solution that causes lysis of his red blood cells (RBCs). The solution was most likely

- a) Isotonic NaCl
- b) Isotonic Mannitol
- c) Hypertonic mannitol
- d) Hypotonic urea
- e) Hypertonic urea

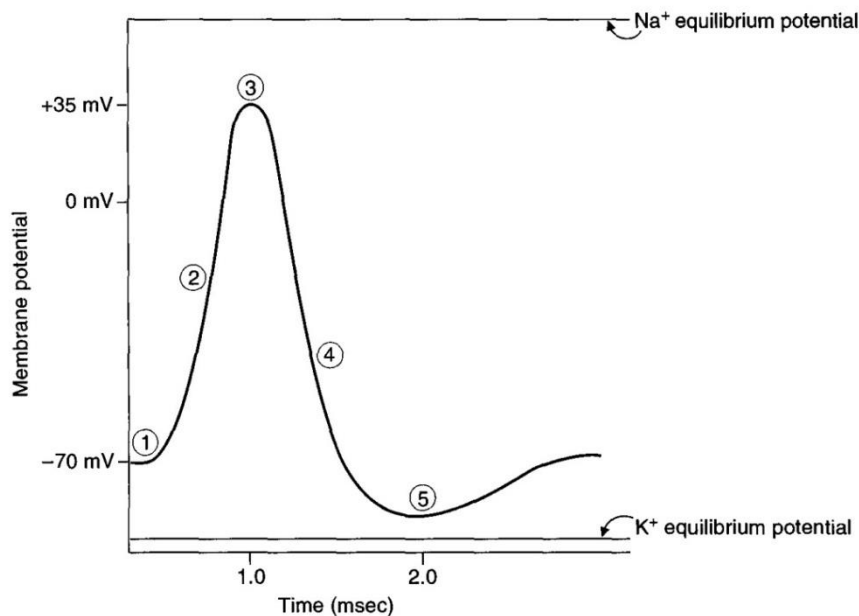
Q7. During a nerve action potential, a stimulus is derived as indicated by the arrow as shown in the following figure. In the response to the stimulus, a second action potential

stimulus



- a) Of smaller magnitude will occur
- b) Of normal magnitude will occur

- c) Of normal magnitude will occur, but will be delayed
- d) will occur, but will not have an overshoot
- e) will not occur



- Q8. At which point labeled point on the action potential is the  $K^+$  closest to electrochemical equilibrium?
- a) 1
  - b) 2
  - c) 3
  - d) 4
  - e) 5
- Q9. Which process is responsible for the change in membrane potential that occurs between point 3 and point 4
- a) Movement of  $Na^+$  into the cell
  - b) Movement of  $Na^+$  out of the cell
  - c) Movement of  $K^+$  into the cell
  - d) Movement of  $K^+$  out of the cell
  - e) Activation of the  $Na^+-K^+$  pump
  - f) Inhibition of the  $Na^+-K^+$  pump
- Q10. The rate of conduction of action potentials along a nerve will be increased by?
- a) Stimulating the  $Na^+-K^+$  pump
  - b) Inhibiting the  $Na^+-K^+$  pump
  - c) Decreasing the diameter of the nerve
  - d) Myelinating the nerve

- e) Lengthening the nerve fiber
- Q11. Transport of D- and L- glucose proceeds at the same rate down and electrochemical gradient by which of the following processes?
- a) Simple diffusion
  - b) Facilitated diffusion
  - c) Primary active transport
  - d) Contransport
  - e) Countertransport
- Q12. The permeability of a solute in a lipid bilayer will be increased by an increase in the
- a) Molecular radius of the solute
  - b) Oil/water partition coefficient of the solute
  - c) Thickness of the bilayer
  - d) Concentration difference of the solute across the bilayer.
- Q13. A drug completely blocks  $\text{Na}^+$  channels in nerves .which of the following effects on the action potential would it be expected to produce?
- a) Block the occurrence of action potentials
  - b) Increase the rate of rise of the upstroke of the action potential
  - c) Shorten the absolute refractory period
  - d) Abolish the hyperpolarizing after-potential
  - e) Increase the  $\text{Na}^+$  equilibrium potential
  - f) Decrease the  $\text{Na}^+$  equilibrium potential
- Q14. At the muscle end plate, acetylcholine (ACh) casues the opening of
- a)  $\text{Na}^+$  channels and depolarization toward the  $\text{Na}^+$  equilibrium potential
  - b)  $\text{K}^+$  channels and depolarization toward the  $\text{K}^+$  equilibrium potential
  - c)  $\text{Ca}^{2+}$  channels and depolarization toward the  $\text{Ca}^{2+}$  equilibrium potential
  - d)  $\text{Na}^+$  and  $\text{K}^+$  channels and depolarization to a value halfway between the  $\text{Na}^+$  and  $\text{K}^+$  equilibrium potential
  - e)  $\text{Na}^+$  and  $\text{K}^+$  channels and hyperpolarization to a value halfway between the  $\text{Na}^+$  and  $\text{K}^+$  equilibrium potential
- Q15. An inhibitory postsynaptic potential
- a) Depolarizes the postsynaptic membrane by opening  $\text{Na}^+$  channels
  - b) Depolarizes the postsynaptic membrane by opening  $\text{K}^+$  channels
  - c) Hyperpolarizes the postsynaptic membrane by opening  $\text{Ca}^{2+}$  channels
  - d) Hyperpolarizes the postsynaptic membrane by opening  $\text{Cl}^-$  channels

- Q16. Which of the following would occur as a result of the inhibitor of  $\text{Na}^+$ ,  $\text{K}^+$ -ATPase?
- Decreased intracellular  $\text{Na}^+$  concentration.
  - Increased intracellular  $\text{K}^+$  concentration.
  - Increased intracellular  $\text{Ca}^{2+}$  concentration.
  - Increased  $\text{Na}^+$  - glucose cotransport
  - Increased  $\text{Na}^+$ - $\text{Ca}^{2+}$  exchange
- Q17. Which of the following temporal sequences is correct for excitation-contraction coupling in skeletal muscle?
- Increased intracellular  $[\text{Ca}^{2+}]$ ; action potential in the muscle membrane; cross-bridge formation
  - action potential in the muscle membrane; depolarization of the T tubules; release of  $\text{Ca}^{2+}$  from the sarcoplasmic reticulum (SR)
  - action potential in the muscle membrane; splitting of adenosine triphosphate (ATP); binding of  $\text{Ca}^{2+}$  to troponin C
  - release of  $\text{Ca}^{2+}$  from the SR; depolarization of the T tubules; binding of  $\text{Ca}^{2+}$  to troponin C
- Q18. Which of the following transport processes is involved if transport of glucose from the intestinal lumen into a small intestinal cell is inhibited by abolishing the usual  $\text{Na}^+$  gradient across the cell membrane?
- Simple diffusion
  - Facilitated diffusion
  - Primary active transport
  - Cotransport
  - Countertransport
- Q19. Which of the following causes rigor in skeletal muscle?
- No action potentials in motoneurons
  - An increase in intracellular  $\text{Ca}^{2+}$  level.
  - A decrease in intracellular  $\text{Ca}^{2+}$  level.
  - An increase in adenosine triphosphate (ATP) Level
  - A decrease in adenosine triphosphate (ATP) Level
- Q20. Secretion of  $\text{H}^+$  by gastric parietal cells occurs by which of the following processes?
- Simple diffusion
  - Facilitated diffusion
  - Primary active transport
  - Cotransport

e) Counter transport

### **SECTION B**

- Q1. Describe the functional organization of the body **(6marks)**
- Q2. Name the types of proteins found on the cell membrane and list their function. **(6marks)**
- Q3. List the types of RNA found in the cell **(3marks)**
- Q4. With an aid of a diagram describe a cell membrane **(10marks)**
- Q5. Draw a well labeled structure of a neuron **(5marks)**
- Q6. In action potential differentiate the following **(10marks)**
- a) Action potential
  - b) Depolarization
  - c) Repolarization
  - d) Hyper- polarization
  - e) Threshold

### **SECTION C**

- Q1. Describe transport across a cell membrane. **(20marks)**
- Q2. Describe excitation –contraction coupling of smooth muscles **(20marks)**
- Q3. Write short notes on different types of muscle tissue. **(20marks)**

**\*END\***