

**DIRECTIONS:** Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the **ONE** that is **BEST** in each case and blacken the appropriate space on the answer sheet.

- A ✓
1. Which of the following statements best describes what is meant by the term homeostasis?
- (A) The maintenance of one's own internal environment
  - (B) The maintenance of the intracellular space
  - (C) The maintenance of one's own external environment
  - (D) The regulation of only water concentrations in the blood stream
  - (E) The regulation of the external environment
- ✓
2. Which of the following is NOT an example of a negative feedback system?
- (A) Your body temperature drops below the set point and effector organs are activated to generate heat.
  - (B) Your body temperature increases above the set point and mechanisms are activated to dissipate heat.
  - (C) Your body temperature drops below the set point and organs are activated to dissipate heat.
  - (D) After running a long race you are dehydrated and drink a glass of water.
  - (E) Both A and C are correct.
- C
- ✓
3. Which body compartment holds the largest amount of total body water?
- (A) Interstitial Fluid
  - (B) Extracellular Fluid
  - (C) Intracellular Fluid
  - (D) Plasma
  - (E) The blood
- C
- E
4. Which of the following molecules can diffuse through the phospholipid portion of the cell membrane using a protein pore, channel or carrier?
- (A) Small fat-soluble substances, ex. Oxygen
  - (B) Large water-soluble substances, ex. Glucose
  - (C) Small water-soluble substances, ex. Ions
  - (D) Very large proteins
  - (E) Both B and C are correct

5. Which of the following is the most abundant component of the cell membrane?

- B**
- (A) Carbohydrates
  - (B) Phospholipids**
  - (C) Enzymes
  - (D) Cholesterol
  - (E) Protein channels

\* 6. Which of the following statements regarding plasma is **INCORRECT**?

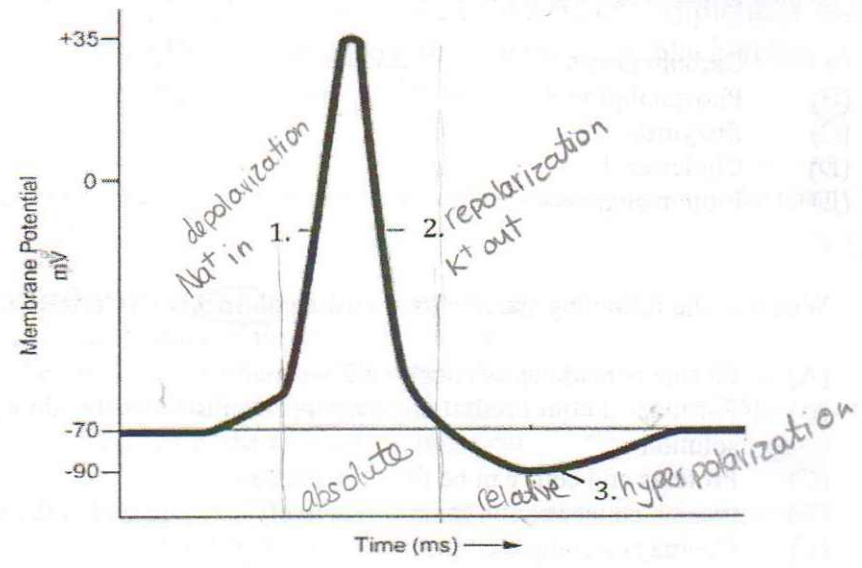
- C**
- (A) ✓ Plasma is made up of roughly 92% water
  - (B) ✓ Plasma is a liquid containing suspended substances that do not settle out of solution.
  - (C) Proteins and cells can be found in plasma.
  - (D) ✓ Plasma concentration remains relatively constant within the human body.
  - (E) ✓ Plasma is a component of the extracellular fluid.

7. Which of the following concerning osmosis is correct?

- A**
- (A) ✓ Water moves from areas of low solute concentration to high solute concentration
  - (B) ✗ Osmosis requires a membrane permeable to the solute but not the solvent
  - (C) ✗ The rate of movement of water during osmosis is dependent upon the size of the molecules in solution
  - (D) All the above are correct
  - (E) Both A and B are correct

8. A red blood cell (300 mOsm) will shrivel when placed in which of the following solutions? above 300

- D**
- (A) Pure water <sup>150</sup>
  - (B) 50 mM  $\text{CaCl}_2$  + 150 mM Glucose
  - (C) 300 mM Glucose <sup>300</sup>
  - (D) 50 mM  $\text{CaCl}_2$  <sup>150</sup> + 150 mM KCl <sup>300</sup>**
  - (E) None of the above



Answer the next 2 questions using the diagram above

9. Which of the follow is TRUE regarding the phases of an action potential shown above?
- (A) Line 1 is pointing to the repolarizing phase of an action potential
  - (B) Line 3 is pointing to the phase of the action potential caused by the movement of  $\text{Na}^+$  ions out of the cell
  - (C) The flow of  $\text{K}^+$  out of the cell results in line 1
  - (D) Line 2 is the part of the action potential that is caused by the closing of  $\text{K}^+$  voltage-gated channels
  - (E) Movement of  $\text{Na}^+$  ions causes the phase of action potential indicated by line 1
10. In the above diagram, which of the lines is/are pointing to the period of the action potential that is most closely related to the relative refractory period?
- (A) Line 1
  - (B) Line 2
  - (C) Line 3
  - (D) Line 1 and Line 2
  - (E) Line 2 and Line 3

E

C

11. Where does the action potential start on a typical neuron?

- C
- (A) The myelin sheath
  - (B) The dendrites
  - (C) Axon hillock
  - (D) Axon terminal
  - (E) Nodes of Ranvier

12. Which of the following channels is/are responsible for the absolute refractory period of an action potential? *Na<sup>+</sup> inactivation gates closing*

- A
- (A) Na<sup>+</sup> voltage gated channels
  - (B) K<sup>+</sup> voltage gated channels
  - (C) both Na<sup>+</sup> and K<sup>+</sup> voltage gated channels
  - (D) Ca<sup>++</sup> voltage gated channels
  - (E) both Ca<sup>++</sup> and Na<sup>+</sup> voltage gated channels

13. The speed of an action potential will travel faster

- C
- (A) if the action potential has a larger amplitude than normal
  - (B) if there are more action potentials per second (higher frequency) travelling down the nerve
  - (C) in myelinated axons compared to non-myelinated axons
  - (D) both A and C are correct
  - (E) All the above are correct

14. Which of the following statement(s) is/are **CORRECT**?

- E
- (A) ✓ Action potentials travel down the t-tubules
  - (B) Contractile proteins are located within the transverse (T) tubules
  - (C) ✓ T-tubules extend from the sarcolemma (cell membrane) down into the muscle cell
  - (D) The Ca<sup>2+</sup> is released from the sarcoplasmic reticulum (SR) and diffuses into the T-tubules during contraction
  - (E) Both A and C are correct statements

15. Which of the following molecules interact with each other to directly form the crossbridges?

- E
- (A) Tropomyosin and troponin
  - (B) Ca<sup>++</sup> and actin
  - (C) Actin and troponin
  - (D) Myosin and troponin
  - (E) Actin and myosin head

16.  $\text{Ca}^{2+}$  is very important for muscle contraction. An experimental drug is being tried out on UWO student volunteers. It **blocks** the release of **all**  $\text{Ca}^{2+}$  from the **sarcoplasmic reticulum**. Which of the following would you expect to see in these volunteers?

- C
- (A) ~~There will be a decrease in acetylcholine released from the motor neuron but a muscle contraction will still take place~~
- (B) ~~There will be a smaller endplate potential (EPP) but a muscle contraction will still take place~~
- (C)  There will be no sliding of actin over myosin
- (D) ~~The power stroke will take place but actin will be unable to release from myosin~~
- (E) ~~ATP will not be able to energize myosin~~

17. According to the sliding filament theory of a muscle contraction which of the following is occurring?

- D
- (A) ~~The thin myofilaments (actin) are getting shorter~~
- (B) ~~The thick myofilaments (myosin) are getting longer~~
- (C) ~~The Z lines get farther apart~~
- (D)  The sarcomeres shorten
- (E) ~~All the above occurs~~

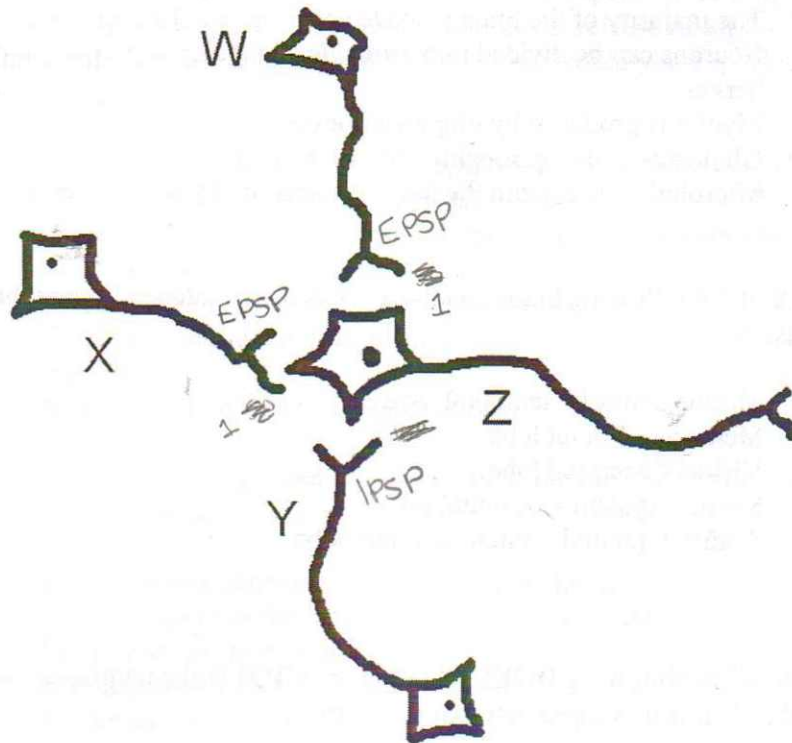
18. Arrange the following events in the correct order for excitation-coupling;

- ii) i) iv) v) iii
- i. the action potential spreads down the T-tubules
- ii. the action potential spreads over the muscle cell membrane
- iii. the power stroke occurs
- iv.  $\text{Ca}^{+2}$  channels on the sarcoplasmic reticulum open
- v. tropomyosin rolls off the myosin binding site found on actin

- E
- (A) i), ii), iv), v), iii)
- (B)  v), iii), ii), i), iv)
- (C) ii), i), v), iv), iii)
- (D) iii), i), ii), iv), v)
- (E)  ii), i) iv), v), iii)

19. Which of the following is correct concerning cells found in the brain?
- ~~(A)~~ The majority of the brain is made up of nerve cells (neurons)  
~~(B)~~ Neurons can be divided into astrocytes, unipolar nerves and multipolar nerves  
~~(C)~~ Myelin is produced by oligodendrocytes  
~~(D)~~ Glial cells make up roughly 10% of the brain  
~~(E)~~ Microglial cells contain the longest axons of any type of nerve cell (neuron)
20. Which of the following brain functions is correctly matched to the lobe it is located in?
- ~~(A)~~ Muscle control – temporal lobe  
~~(B)~~ Memory – frontal lobe  
~~(C)~~ Vision – occipital lobe  
~~(D)~~ Sensory system – occipital lobe  
~~(E)~~ Auditory (sound) system – frontal lobe
- \* 21. Which of the following **DOES NOT** occur at **BOTH** the neuromuscular junction and the chemical synapse between two nerves?
- ~~(A)~~ Entry of  $Ca^{++}$  into axon terminal causes the release of synaptic vesicles  
~~(B)~~ Neurotransmitter will attach to receptors opening special ion channels  
~~(C)~~ The neurotransmitter will either depolarize or hyperpolarize the muscle/postsynaptic nerve  
~~(D)~~ One action potential on the presynaptic nerve will always produce one action potential on the postsynaptic nerve and muscle cell  
~~(E)~~ Both C and D do not occur at both
22. Which of the following is/are the language of the nervous system?
- ~~(A)~~ Excitatory postsynaptic potentials (EPSPs)  
~~(B)~~ Inhibitory postsynaptic potentials (IPSPs)  
~~(C)~~ End plate potentials (EPPs)  
~~(D)~~ Action potentials  
~~(E)~~ All the above

23.



In the above diagram, a postsynaptic nerve (Z) receives 3 inputs W, X and Y. A single action potential at W and X will generate EPSPs on nerve Z, nerve Y will generate an IPSP on nerve Z. Which of the following situations is most likely to generate an action potential in nerve Z?

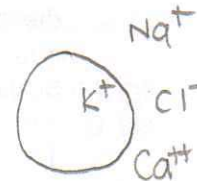
- E**
- (A) ~~x~~ one action potential from nerve W
  - (B) ~~x~~ 100 action potentials from W and Y simultaneously
  - (C) ~~x~~ 50 action potentials from W, 50 action potentials from X and 100 action potentials from Y simultaneously
  - (D) one action potential from W followed a second later by 1 action potential from X
  - (E) 50 action potentials from W and 50 action potentials from X simultaneously

**DIRECTIONS:** For each of the following statements below, ONE or MORE or the completions given is correct. Answer

- (A) if only 1,2 and 3 are correct  
 (B) if only 1 and 3 are correct  
 (C) if only 2 and 4 are correct  
 (D) if only 4 is correct  
 (E) if ALL are correct

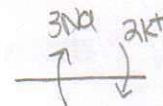
24. Which of the following best describes the concentration of ions in and around a typical cell at rest?

1. ✓ There is more  $\text{Cl}^-$  outside the cell than inside  
 2. ✗ There is less  $\text{Na}^+$  outside the cell than inside  
 3. ✓ There is more  $\text{K}^+$  inside the cell than outside  
 4. ✗ There is less  $\text{Ca}^{++}$  outside the cell than inside



25. Which of the following statements is/are TRUE regarding the  $\text{Na}^+/\text{K}^+$  ATPase?

1. ✓ It moves  $\text{Na}^+$  and  $\text{K}^+$  against their concentration gradients  
 2. ✓ It moves 3  $\text{Na}^+$  out of the cell for every 2  $\text{K}^+$  ions into the cell  
 3. ✓ It's a form of active transport  
 4. ✓ It contributes to the resting membrane potential



26. Which of the following methods of transport across a membrane always requires a protein carrier or pore?

1. ✓ Facilitated diffusion  
 2. ✓ Diffusion of an ion through the membrane  
 3. ✓ Active transport  
 4. Simple diffusion through the lipid bilayer

B

E

A

**DIRECTIONS:** For each of the following statements below, ONE or MORE or the completions given is correct. Answer

- (A)  if only 1, 2 and 3 are correct  
 (B)  if only 1 and 3 are correct  
 (C)  if only 2 and 4 are correct  
 (D)  if only 4 is correct  
 (E)  if ALL are correct

27. While lifting weights, you have a light dumbbell in your left hand and a heavy dumbbell in your right hand. You perform a biceps curl where you begin with both arms down at your side and slowly bend them to 90 degrees at the elbow. What will be the difference in the biceps nerve and muscle between the left and right arms?

1.  The frequency (number per second) of action potentials in the motor units of the right biceps muscle will be higher than the left biceps.  
 2.  There will be fewer motor units recruited in the right biceps compared to the left biceps.  
 3.  There will be more muscle cells contracting in the right biceps compared to the left biceps  
 4.  The speed (meters per second) of the action potential in the motor nerve of the left biceps will be faster than those in the right biceps.

28. During a muscle contraction and relaxation ATP is directly required for

1.  energizing the myosin molecule before crossbridge formation  
 2.  repolarization of the action potential  
 3.  releasing the crossbridge between the thin and thick myofilaments  
 4.  the release of  $Ca^{++}$  from the sarcoplasmic reticulum

29. Inhibitory postsynaptic potentials (IPSPs)

1.  are transmitted along myelinated axons by saltatory conduction  
 2.  can be summed/added together  
 3.  always result in a depolarization of the post-synaptic membrane  
 4.  may be caused by the action of a neurotransmitter

30. Which of the following is most likely to cause an excitatory postsynaptic potential (EPSP)?

1.   $Cl^-$  moving into the cell  
 2.   $K^+$  moving out of the cell  
 3.   $Ca^{++}$  moving out of the cell  
 4.   $Na^+$  moving into the cell

↓  
Na<sup>+</sup>

R heavy  
L light

B

B

C

D

E

A