Identify the letter of the choice that best completes the statement or answers the question.

(1) Carrier-mediated transport (a) involves a specific membrane protein that serves as a carrier molecule. (b) always moves substances against a concentration gradient. (c) always requires energy expenditure. (d) Two of these answers. (e) All of these answers.

(2) Facilitated diffusion (a) involves a carrier molecule. (b) requires energy expenditure. (c) is how glucose enters the cells. (d) Both (a) and (c) above. (e) All of these answers.

(3) Which decreases the rate of diffusion for a substance through a membrane? (a) increasing the concentration gradient. (b) increasing the molecular weight of the substance. (c) increasing the permeability of the membrane. (d) increasing the surface area of the membrane. (e) opening the channels in the membrane.

(4) Which of the following substances is most likely to passively diffuse across the plasma membrane by dissolving in the membrane? (a) a cation (b) an anion (c) a nonpolar or nonionized molecule (d) a polar molecule (e) a molecule less than 0.8 nm in diameter

(5) By osmosis, water always moves to an area of higher (a) electrical intensity. (b) fluid pressure. (c) solute concentration. (d) water concentration. (e) simple diffusion.

(6) The electrical gradient for K^+ (a) favors its movement out of the cell at resting potential. (b) favors its movement into the cell at resting potential. (c) opposes the concentration gradient for K^+ at the equilibrium potential for K^+. (d) Both (a) and (c) above. (e) Both (b) and (c) above.

(7) The concentration gradient for Na^+ (a) favors its movement into the cell at resting potential. (b) favors its movement out of the cell at resting potential. (c) is maintained by the Na^+-K^+ pump. (d) Both (a) and (c) above. (e) Both (b) and (c) above.

(8) Which of the following statements concerning the Na^+-K^+ pump is incorrect? (a) the phosphorylated conformation of the Na^+-K^+ pump has high affinity for K^+ when exposed to the ICF. (b) the Na^+-K^+ pump has ATPase activity. (c) the Na^+-K^+ pump establishes Na^+ and K^+ concentration gradients across the plasma membrane; these gradients are critically important in the ability of nerve and muscle cells to generate electrical impulses essential to their functioning. (d) the Na^+-K^+ pump helps regulate cell volume by controlling the concentration of solutes inside the cell to minimize osmotic effects that would induce swelling or shrinking of the cell. (e) the ion concentration gradient established by the Na^+-K^+ pump drives cotransport carriers to move glucose against its concentration gradient across intestinal and kidney cells.

(9) Membrane potential (a) refers to a separation of charges across the membrane or to a difference in the relative number of + and - charges in the ECF and ICF. (b) is measured in units of millivolts with the sign alwaysdesignating the charge on the outside. (c) is less at the equilibrium potential for K^+ than at resting membrane potential. (d) cannot be measured easily. (e) All of these answers.

(10) The resting membrane potential is (a) much closer to the equilibrium potential for Na^+ than to the equilibrium potential for K^+. (b) much closer to the equilibrium potential for K^+ than to the equilibrium potential for Na^+. (c) the same as the equilibrium potential for Cl^-. (d) Both (a) and (c) above. (e) Both (b) and (c) above.

(11) At resting membrane potential (a) the membrane is more permeable to K^+ than to Na^+. (b) the membrane is more permeable to Na^+ than to K^+. (c) Cl^- is at its equilibrium potential. (d) Both (a) and (c) above. (e) Both (b) and (c) above.

(12) Graded potentials (a) are local changes in membrane potential that occur in varying degrees of magnitude. (b) serve as short-distance signals. (c) serve as long-distance signals. (d) Both (a) and (b). (e) Both (a) and (c).

(13) A threshold potential is (a) the potential achieved when two opposing forces acting upon an ion (concentration and electrical gradients) achieve a state of equilibrium. (b) the peak potential achieved during an action potential. (c) the point at which there is an explosive increase in Na^+ permeability. (d) the potential at which P K^+ increases. (e) always a positive potential.

(14) During the rising phase of the action potential, (a) P K^+ is much greater than P Na^+. (b) P Na^+ is much greater than P K^+. (c) P K^+ is the same as PNa^+. (d) Na^+ efflux occurs. (e) Two of these answers.

(15) The falling phase of the action potential is due to (a) calcium equilibrium. (b) potassium efflux. (c) potassium influx. (d) sodium efflux. (e) sodium influx.

(16) When an excitatory neurotransmitter binds to a nicotinic receptor (a) voltage-gated Na^+ channels open. (b) voltage-gated K^+ channels open. (c) chemically-gated Na^+ channels open. (d) voltage-gated Cl- channels open. (e) None of these answers.

(17) Which statement regarding graded potentials is false? (a) they are decremental. (b) they travel only short distances. (c) they are self-propagating. (d) they may contribute to the development of an action potential. (e) they travel in both directions along the membrane.

(18) Because of the presence of both activation and inactivation gates, voltage-gated Na+ channels can (a) be closed but capable of opening. (b) activated. (c) closed and not capable of opening. (d) All of these answers. (e) None of these answers.

(19) The refractory period (a) prevents action potentials from spreading forward and backward. (b) refers to the time period during which a portion of the membrane that has just undergone an action potential cannot undergo another action potential in response to normal triggering events because the channels opened during the action potential have not been restored to their "closed but capable of opening" conformation. (c) places an upper limit on the frequency with which a neuron can conduct action potentials. (d) Two of these answers. (e) All of these answers.

(20) Temporal summation takes place when (a) two EPSPs from the same presynaptic input occur so closely together in time that they add together or sum. (b) an EPSP and an IPSP occur simultaneously in time and cancel each other out. (c) two EPSPs that occur simultaneously from different presynaptic inputs add together or sum. (d) action potentials occurring in two presynaptic inputs simultaneously converge upon the postsynaptic cell, initiating two different action potentials in the postsynaptic cell. (e) None of these answers.

(21) Spatial summation occurs in a postsynaptic neuron (a) when several EPSPs from a single presynaptic input sum to reach threshold. (b) when EPSPs from several presynaptic inputs sum to reach threshold. (c) upon simultaneous interaction of an EPSP and an IPSP. (d) when several IPSPs from a single presynaptic input sum to hyperpolarize the membrane. (e) None of these answers.

(22) An IPSP is (a) produced by increased Na^+ permeability and K^+ permeability. (b) produced by increased K^+ permeability or increased Cl- permeability. (c) a hyperpolarization of the postsynaptic cell. (d) Both (a) and (c). (e) Both (b) and (c).

(23) Of the step in excitation-contraction below, which occurs before the others? (a) exposed actin sites bind with myosin cross bridges. (b) sodium channels open in the fiber's membrane. (c) calcium is released from the sarcoplasmic reticulum. (d) tropnin binds calcium. (e) attachment od ATP allows for cross bridge detachment.

(24) During a cross-bridge cycle in skeletal muscle, the (a) cross bridge is energized as myosin ATPase activity hydrolyzes ATP. (b) myosin cross bridge is able to bind with an actin molecule when Ca^{2+} pulls the troponin-tropomyosin complex aside. (c) linkage between actin and the myosin cross bridge is broken at the end of the cross-bridge cycle as Mg^{2+} binds to the cross bridge. (d) Both (a) and (b) above. (e) All of these answers.

(25) Which of the following is involved in the process of muscle relaxation (a) acetylcholinesterase destroys acetylcholine to allow the muscle membrane to return to resting potential. (b) Ca^{2+} is actively taken up by the lateral sacs of the sarcoplasmic reticulum when there is no longer a local action potential. (c) the cross bridges from the thick filaments bind to the thin filaments and bend in such a way as to return the filaments to their original resting position. (d) Both (a) and (b) above. (e) All of these answers.

(26) A motor unit refers to (a) a single motor neuron plus all of the muscle fibers it innervates. (b) a single muscle fiber plus all of the motor neurons that innervate it. (c) all of the motor neurons supplying a single muscle. (d) a pair of antagonistic muscles. (e) a sheet of smooth muscle cells connected by gap junctions.

(27) In twitch summation, (a) the muscle fiber is stimulated again before the action potential has returned to resting potential. (b) the muscle fiber is stimulated again before the filaments have completely returned to their resting position. (c) stronger muscle contractions occur but stronger action potentials do not occur. (d) Both (b) and (c) above. (e) All of these answers.

(28) Muscle tension (a) is created during muscle contraction as the tension generated by the contractile elements is transmitted via the connective tissue and tendons to the bones. (b) is the force exerted on a muscle by the weight of an object. (c) is greater than the load during an isometric contraction. (d) More than one of these. (e) None of these answers.

(29) During an isotonic contraction of a muscle in the arm (a) filaments do not shorten in the muscle. (b) movement does not occur. (c) the muscle does not change length. (d) the tension in the muscle does not overcome a load. (e) the tension in the muscle remains constant.

(30) With eccentric muscle contractions, (a) the development of tension occurs at constant muscle length. (b) the muscle lengthens while contracting. (c) the muscle shortens while contracting. (d) muscle length and tension vary throughout a range of motion. (e) None of these answers.

Marking Schemme

1. A
2. D
3. B
4. C
5. C
6. D
7. D
8. A
9. A
10. B
11. D
12. A
13. C
14. B
15. B
16. C
17. C
18. E
19. B
20. A
21. B
22. E
23. B
24. D
25. B

26. A
27. D
28. A
29. E
30. A