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

(1) 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).

(2) The negative charge established along a nerve cell membrane is due to (a) movement of Na+ into the cell (b) movement of proteins out of the cell (c) higher permeability of K+ relative to Na+. (d) intracellular protein anions (e) Both (c) and (d).

(3) The cells of excitable and nonexcitable tissues share which of the following properties? (a) a threshold potential (b) a resting membrane potential (c) an ability to open the Na^+ gates (d) All of these answers (e) None of these answers.

(4) Which term below best describes an excitable when a resting membrane potential is present? (a) polarized (b) depolarized (c) hyperpolarized (d) repolarized (e) nonpolarized

(5) 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.

(6) A change in a membrane potential from -70 mV to -60mV is an example of (a) depolarization (b) hyperpolarization (c) polarization (d) repolarization (e) zero potential.

(7) A change in a membrane potential from +30 mV to -70 mV is an example of (a) depolarization (b) hyperpolarization (c) polarization (d) repolarization (e) zero potential.

(8) 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.

(9) At the peak of an action potential, (a) the electrical gradient for K^+ tends to move this ion outward (b) the concentration gradient for K^+ tends to move this ion outward (c) K^+ permeability greatly increases (d) All of these answers. (e) Two of these answers

(10) Which of the following is responsible for the falling phase of an action potential? (a) opening of Na^+ gates (b) Na^+-K^+ pump restoring the ions to their original locations (c) Greatly increased permeability to Na^+ (d) ATP-ase destroying the energy supply that was maintaining the action potential at its peak (e) None of these answers.

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

(12) 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.

(13) 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.

(14) When chemically-gated Na^+ channels open (a) the membrane hyperpolarizes (b) the membrane repolarizes (c) the membrane depolarizes (d) the membrane becomes more negative (e) the membrane is inhibited.

(15) When a membrane is stimulated due to opening of chemically-gated Na^+ channels (a) an impulse is propagated (b) a graded potential is established (c) an action potential is established (d) the voltage becomes more negative (e) the voltage stays the same.

(16) An action potential develops when: (a) threshold voltage is reached (b) voltage-gated Na^+ channels open and the membrane reaches about -60 millivolts (c) spatial and/or temporal summation of graded potentials occurs to a great enough extent (d) depolarization of the axon occurs (e) All of these answers.

(17) Myelinated axons conduct impulses much faster because: (a) the myelin insulates the axon (b) channels only have to open at the nodes (c) voltage is not lost through along myelinated areas (d) of saltatory conduction (e) All of these answers.

(18) Which of the following is not a graded potential? (a) end-plate potential (b) action potential (c) slow-wave potential (d) receptor potential (e) postsynaptic postential

(19) 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.

(20) 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.

(21) Which protein(s) is/are responsible for development of the resting membrane potential? (a) leak channels (b) gated channels (c) pumps (d) Both (a) and (b) above (e) Both (a) and (c) above.

(22) The membrane is more permeable to K^+ than to Na^+ (a) at resting potential (b) during the rising phase of an action potential (c) during the falling phase of an action potential (d) Both (a) and (b) (e) Both (a) and (c).

(23) A recording electrode is placed into a nerve cell to measure the membrane potential at a particular point. When the physiologist glances at the recording and sees that the membrane at that instant has a potential of +15 mV, she knows that the portion of the membrane being recorded is (a) in the normal resting state (b) in the reversal phase of an action potential when the inside of the cell becomes more positive than the outside (c) more permeable to Ca^{2+} than normal (d) in the after hyperpolarization phase of an action potential (e) Two of these answers.

(24) Conduction by local current flow (a) occurs in unmyelinated fibers (b) is faster than propagation of an action potential in myelinated fibers because myelin acts as an insulator to slow down the impulse (c) involves current flowing locally between the active and adjacent inactive areas, thereby bringing the inactive areas to threshold so that they too become active (i.e., have an action potential) (d) Both (a) and (c) above (e) All of these answers.

(25) Saltatory conduction (a) occurs in unmyelinated nerve fibers (b) is slower than conduction by local current flow because the myelin acts as an insulator to slow the impulse down (c) involves the impulse jumping from one node of Ranvier to the adjacent node (d) refers to the action potential spreading from one Schwann cell to the adjacent Schwann cell (e) More than one of these answers.

(26) Which of the following statements concerning propagation of action potentials is incorrect? (a) saltatory conduction occurs in myelinated nerve fibers (b) during conduction by local current flow, there is a flow of current between the active and adjacent inactive area of the cell membrane, thereby decreasing the potential in the inactive area to threshold (c) the action potential jumps from one Schwann cell to the adjacent Schwann cell in a myelinated fiber (d) saltatory conduction is faster than conduction by local current flow (e) conduction by local current flow is the method of propagation in unmyelinated fibers.

(27) Which of the following nerve fibers will have the highest conduction velocity? (a) an unmyelinated nerve fiber with conduction velocity = 0.35 m/sec (b) an unmyelinated nerve fiber smaller than nerve fiber a. (c) a myelinated nerve fiber the same size as nerve fiber a. (d) a myelinated fiber larger than nerve fiber a. (e) it is impossible to determine with the information provided.

(28) Select the incorrect statement about the action potential. (a) it has an all-or-none characteristic. (b) it has a refractory period. (c) it is triggered by depolarization to threshold. (d) it occurs along a plasma membrane (e) it speeds up transmission by summation.

(29) Permeability of which ion is affected by a positive feedback mechanism once threshold is reached? (a) sodium (b) potassium (c) calcium (d) chloride (e) protein.

(30) During the peak of the action potential which ion has the greatest permeability? (a) sodium (b) potassium (c) calcium (d) chloride (e) protein.