UNIVERSITY OF BAMENDA

FACULTY OF HEALTH SCIENCE

FIRST SEMESTER CONTINUOUS ASSESSMENT FOR 2011/2012 SESSION

DEPARTMENT: Biomedical Sciences
COURSE CODE: MED 205
DATE: 25/05/2012
DURATION: 4:00-5:00

COURSE INSTRUCTORS: Salah
COURSE TITLE: Human Physiology
TIME ALLOWED: 1 Hour

INSTRUCTIONS: ***Answer all the Thirty Questions by Selecting the letters that answers the question***

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(1). A red blood cell initially contains 200 mOsm of impermeant solute. It is dropped into a large bath containing 200 mOsm of permeant solute and 100 mOsm of impermeant solute. The steady-state cell volume will: (a) remain constant. (b) increase by 3/2. (c) decrease by 2/3. (d) increase by 2. (e) decrease by ½.

(2). A toxin attacks a cell by inserting a nonselective channel in the membrane, causing the cell's voltage to depolarize to near 0 mV. As a result, what will happen to cell volume? (a) remain constant (b) increase (c) decrease (d) decrease then increase (e) cannot be determined.

(3). Which of the following is not a source of energy used by cells? (a) glucose (b) the H^+ gradient across mitochondrial membranes (c) ATP (d) The Na^+ gradient across the plasma membrane (e) The osmotic gradient across the plasma membrane.

(4). Which of the following is not true about the way Na^+ crosses cell membranes? (a) by diffusion through lipid (b) by active transport through a protein (c) by diffusion through protein channels (d) by exchange for Ca^{2+} via a protein (e) by exchange for H^+ via a protein.

(5). A Nernst or equilibrium potential: (a) is always negative to the resting voltage (b) is due to diffusion (c) is equal to the resting voltage (d) is always positive to the resting voltage (e) depends on the membrane capacitance.

(6). Which of the following would not change the K^+ current crossing a cell membrane? (a) a change in intracellular voltage (b) a change in extracellular K^+ concentration (c) a change in the open probability of the membrane's K^+ channels (d) a change in the number of the membrane's K^+ channels (e) a change in the membrane's capacitance.

(7). Assume the membrane is permeable only to Na^+, K^+, and Cl^-. Given that $g_K = 2$ mS/cm^2, $g_{Na} = 1$ mS/cm^2, and $g_{Cl} = 1$ mS/cm^2, what is the resting potential? (Assume the coefficient in the Nernst equation is 60 mV.) (a) +60 mV (b) –120 mV (c) –60 mV (d) 0 mV (e) –90 mV

(8). The rapid depolarization and overshoot of the axonal action potential is due to: (a) a rapid increase in K^+ conductance (b) a rapid increase in Ca^{2+} conductance (c) a rapid reduction in inactivation of Na^+ conductance (d) a rapid inactivation of Na^+ conductance (e) a rapid activation of Na^+ conductance.

(9). The relative refractory period is mostly due to: (a) an elevated K^+ conductance (b) an elevated Na^+ conductance (c) an inactivated K^+ conductance (d) an increase in membrane capacitance (e) an influx of Ca^{2+}

(10). Given the peak voltage of a membrane action potential is +50 mV; the Na^+ equilibrium potential, E_{Na}, is +70 mV; and at the time of the peak voltage, the K^+ current, i_K, is 20 □A/cm^2, what is the Na^+ conductance, g_{Na} (S/cm^2), at the time of the peak voltage? (a) 10^{-6} S/cm^2 (b) 10^{-3} S/cm^2 (c) 1 S/cm^2 (d) 10^3 S/cm^2 (e) 10^6 S/cm^2

(11). The cardiac ventricular action potential: (a) is of shorter duration than the skeletal muscle action potential (b) does not involve TTX sensitive, voltage dependent Na^+ channels (c) involves both T- and L-type Ca^{2+} channels (d) is generated by the same channels as the nerve action potential (e) is of shorter duration than the smooth muscle action potential.

(12). Evolution has produced myelinated axons in order to help us: (a) think more rapidly (b) speak more clearly (c) hear more acutely (d) move more rapidly (e) see a wider spectrum of light.

(13). A patient has a genetic defect in their axonal Na^+ channels such that there is a negative shift in the voltage dependence of their m- and h-gates. Which of the following could not be a direct consequence? (a) the h-gates close more rapidly than m-gates open (b) increased resting inactivation of Na^+-channels (c) paralysis (d) a change in threshold voltage (e) weakness.

(14). A reduction in ACh esterase at the NMJ will cause: (a) a higher frequency of MEPPS (b) a lower frequency of MEPPS (c) a block in transmission of action potentials (d) exceptionally large MEPPS with near normal time courses (e) exceptionally long MEPPS with near normal amplitudes.

(15). Which of the following is <u>not</u> a property of the Acetylcholine Receptor, ACh-R? (a) it resides in the postsynaptic muscle membrane (b) it is selective for monovalent cations (c) it will gate open and closed after binding 2 ACh (d) it catalyzes the breakdown of ACh to choline and acetate (e) it is the target of the disease myasthenia gravis.

(16). A presynaptic nerve terminal releases a neurotransmitter that activates a K^+ conductance in the postsynaptic membrane. If the postsynaptic cell body had an initial voltage of –70 mV and E_{Na} = +70 mV, E_{Cl} = -70 mV and E_K = -90 mV, the new postsynaptic voltage will be: (a) between –70 mV and +70 mV (b) a train of action potentials (c) between –70 mV and –90 mV (d) more negative than –90 mV (e) –70 mV.

(17). Smooth muscle, in contrast to skeletal and cardiac muscle, force generation requires: (a) an increase in myosin kinase activity (b) cross bridge binding to actin (c) an increase in intracellular Ca^{2+} (d) an action potential (e) an increase in myosin ATPase activity.

(18). In malignant hyperthermia, inhalation of an anesthetic causes a rapid and sustained increase in body temperature due to heat production from asynchronous contractions of skeletal muscle fibers. This is due to: (a) increased Ca^{2+} ATPase activity in the SR (b) inactivation of troponin (c) spontaneous Ca^{2+} release by the Ryanodine receptors (d) inhibition of the ACh receptor channels at the endplate (e) removal of inhibition of the myosin ATPase.

(19). A kidney cell receives a signal (ADH) to insert more aquaporins into its plasma membrane. The apical side of the cell faces a solution containing 145 mM NaCl, 4 mM KCl and 2 mM $CaCl_2$ (we can assume the osmotic coefficients are unity). The intracellular solution has an osmolarity of 300 mOsm. Immediately following insertion of the aquaporin, water flow across the apical membrane will: (a) increase into the cell. (b) decrease into the cell. (c) not change. (d) increase out of the cell. (e) decrease out of the cell.

(20). In all animal cells the energy stored in ATP is directly used to: (a) transport Na^+ out. (b) transport K^+ out. (c) transport Ca^{2+} in. (d) transport H^+ in. (e) transport glucose in.

(21). The membrane conductance does not directly depend on: (a) the open probability of membrane channels. (b) the Nernst potential for each ion. (c) the number of channels in the membrane. (d) random gating of membrane channels. (e) the single channel conductance of each contributing channel.

(22). Given intracellular Na^+ is 10 mM; extracellular Na^+ is 100 mM; intracellular K^+ is 100 mM; extracellular K^+ is 10 mM; $g_{Na} = 0.01$ mS/cm^2; $g_K = 0.11$ mS/cm^2; and Cl^- is in equilibrium, what is the Cl^- Nernst potential? (a) $E_{Cl} = -50$ mV (b) $E_{Cl} = -60$ mV (c) $E_{Cl} = +60$ mV (d) $E_{Cl} = 0$ mV (e) E_{Cl} cannot be determined.

(23). An action potential is recorded and found to have a duration of 300 mS. The recording was most likely made from: (a) a nerve axon. (b) a motor neuron. (c) a skeletal muscle fiber. (d) a cardiac muscle fiber. (e) a smooth muscle cell.

(24). A genetically altered squid has no voltage dependent K^+ channels in its nerves. The effect on action potentials is to: (a) There is no effect. (b) decrease propagation velocity. (c) increase (more positive) threshold. (d) increase the relative refractory period. (e) decrease the relative refractory period.

(25). Which of the following gating processes has the most rapid kinetics? (a) Na^+ channel inactivation (b) Na^+ channel activation (c) K^+ channel activation (d) Ca^{2+} Channel activation (e) Ca^{2+} channel inactivation.

(26). Which of the following would result from a demyelinating disease? (a) Increased propagation velocity (b) Decreased conductance per length of axon (c) Decreased capacitance per length of axon (d) Decreased safety factor (e) Increased frequency of action potentials.

(27). Which of the following would decrease propagation velocity of a nerve action potential? (a) Myelination of the axon (b) Increased diameter of the axon (c) Increased capacitance per length of axon (d) Decreased capacitance per length of axon (e) Increased length constant of the axon.

(28). Small ions do <u>not</u> enter cells by: (a) pinocytosis (b) membrane channels. (c) primary active transport. (d) secondary active transport. (e) diffusion through the lipid barrier.

(29). One action potential in a motor neuron causes a train of action potentials in the skeletal muscle fibers of its motor unit. The defect could be: (a) too little ACh per quanta. (b) too few quanta released per nerve action potential. (c) too few ACh receptors. (d) too little ACh esterase. (e) too few Ca^{2+} channels in the presynaptic terminal.

(30). At the neuromuscular junction, the miniature end plate potential (MEPP) is due to: (a) the release of one molecule of ACh. (b) the activation of one ACh receptor. (c) one presynaptic action potential. (d) the release of one quanta of ACh. (e) one muscle action potential.

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Grand Total : 30 Marks

Good Luck