

There are 25 questions in this Biology 3058 exam.

All questions are "A, B, C, D, E, F, G, H" questions worth one point each.

There is a total of 25 points in this exam. Fill in your answers on the separate answer sheet.

The format for this exam is:

Fill in A if A is the only correct answer.

Fill in B if B is the only correct answer.

Fill in C if C is the only correct answer.

Fill in D if both A and B are correct (and C is NOT correct).

Fill in E if both A and C are correct (and B is NOT correct).

Fill in F if both B and C are correct (and A is NOT correct).

Fill in G if A and B and C are all correct.

Fill in H if none of the above is correct (A is NOT correct, B is NOT correct, and C is NOT correct).

ONLY MARK ONE LETTER PER QUESTION.

You may keep the question sheets.

Use a dark (black or blue) pencil or dark (black or blue) pen to fill in the answers.

DO NOT USE A RED PEN; DO NOT USE A RED PENCIL.

1. Which of the following serves as a sensor, or as part of a sensor, that functions in a negative feedback system?
 - A. Plasma-membrane Calcium Receptors located in cells in the kidney.
 - B. Parathyroid Hormone Receptors (PTHrRs) located in the plasma membranes of Parathyroid Gland cells.
 - C. Oxytocin Receptors located in cells in the walls of the uterus of a pregnant female.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

2. Which of the following serves as an actuating signal, or as part of an actuating signal, in a negative feedback system?
 - A. Blood plasma levels of Parathyroid Hormone Receptors (PTHrRs).
 - B. Blood plasma levels of Oxytocin.
 - C. Blood plasma levels of Calcium.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

3. Which of the following serves as an effector, or part of an effector, that functions in a positive feedback system?
 - A. Blood plasma levels of Oxytocin.
 - B. Oxytocin Receptors located in cells in the walls of the uterus of a pregnant female.
 - C. Parathyroid Hormone Receptors (PTHrRs) located in bone cells.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

4. An increase in blood plasma levels of parathyroid hormone
- A. leads to a decrease in the amount of calcium stored in the bones.
 - B. occurs in response to an increase in the blood plasma levels of calcium ions.
 - C. leads to a decrease in calcium ion reabsorption in kidney.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
5. An increase in blood plasma levels of 1,25-dihydroxyvitamin D {1,25-(OH)₂ vitamin D} will lead to an increase in the
- A. net flux of calcium from the blood plasma into the contents of the intestine.
 - B. amount of 1,25-dihydroxyvitamin D that binds only to the extracellular binding sites of spanning proteins in the plasma membranes of cells in the intestine.
 - C. net flux of 1,25-dihydroxyvitamin D from the blood plasma into the intracellular spaces of cells of the intestine.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
6. In a properly functioning negative feedback system, the
- A. value of the controlled variable will always be very close to the threshold value when the system is in steady state.
 - B. sensor measures the current value of the actuating signal.
 - C. the current value of the actuating signal will always be very close to the value of the set point when the system is in steady state.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
7. In a properly functioning positive feedback system,
- A. when the value of threshold is greater than the value of the output variable, then the value of the output variable always increases to the value of the plateau.
 - B. a change in the value of the actuating signal will lead to a change in the output of the effector.
 - C. the sensor measures the current value of the actuating signal.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

8. During endocytosis,
- A. a small portion of the plasma membrane of the cell is removed.
 - B. there is release of the molecules in the inside of the vesicle into extracellular space.
 - C. the vesicle membrane fuses with the plasma membrane of the cell.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
9. At 1 AM, an impermeable membrane separates a 1 liter solution of 2M KCl in the left compartment from a 1 liter solution containing both 1M NaCl and 1M KCl in the right compartment. At 2 AM, the membrane became permeable to potassium ions. At 4 AM, the membrane once again became impermeable to potassium ions. At 6 AM, the membrane became permeable to chloride ions and, in addition, maintained potassium ion impermeability. At 8 AM, the membrane became permeable to potassium ions again and, in addition, maintained its permeability to chloride ions. The membrane stayed impermeable to sodium ions at all times.
- A. The amount of chloride ions in the right compartment at 9 AM will be greater than the amount of chloride ions in the right compartment at 7 AM.
 - B. The amount of chloride ions in the right compartment at 7 AM will be greater than the amount of chloride ions in the right compartment at 5 AM.
 - C. The amount of potassium ions in the right compartment at 9 AM will be greater than the amount of potassium ions in the right compartment at 7 AM.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
10. At 1 AM, an impermeable membrane separates a 1 liter solution of 1M NaCl in the left compartment from a 1 liter solution containing both 1M NaCl and 1M KCl in the right compartment. At 2 AM, the membrane became permeable to chloride ions. At 4 AM, the membrane once again became impermeable to chloride ions. At 6 AM, the membrane became permeable to sodium ions and, in addition, maintained chloride ion impermeability. At 8 AM, the membrane once again became impermeable to sodium ions. At 10 AM the membrane once again became permeable to chloride ions and, in addition, maintained sodium ion impermeability. The membrane maintained impermeability to potassium ions during the entire period.
- A. The amount of sodium ions in the left compartment at 11 AM will be equal to the amount of sodium ions in the right compartment at 11 AM.
 - B. The amount of sodium ions in the left compartment at 7 AM will be greater than the amount of sodium ions in the left compartment at 5 AM.
 - C. The amount of chloride ions in the right compartment at 11 AM will be less than the amount of chloride ions in the right compartment at 9 AM.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

11. Net flux of which of the following substances across the plasma membrane can occur via a secondary active transport co-transporter?
- A. Glucose.
 - B. Bicarbonate.
 - C. Sodium.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
12. For which of the following processes is the net flux of sodium ions from a region of high concentration of sodium to a region of low concentration of sodium? The movement of sodium ions via
- A. an open voltage-gated sodium channel in a neuron whose voltage is at the threshold for an action potential.
 - B. the spanning protein responsible for secondary active cotransport of sodium and glucose.
 - C. the sodium-potassium ATPase primary active transport pump.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
13. At 1:02 AM, cell X has GLUT4 transporters included in the vesicular membranes of all its intracellular vesicles. Between 1:03 AM and 1:04 AM, there is exocytosis of all these vesicles of cell X. No endocytosis of vesicles in cell X occurs between 1:00 AM and 1:06 AM.
- A. Between 1:03 AM and 1:04 AM, portions of the plasma membrane of cell X are removed.
 - B. Between 1:03 AM and 1:04 AM, GLUT4 transporters are released into extracellular space.
 - C. The glucose permeability of the plasma membrane of cell X at 1:05 AM will be greater than the glucose permeability of the plasma membrane of cell X at 1:02 AM.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
14. When an antagonist binds to the receptor site of a ligand-gated ion channel,
- A. it only activates a tyrosine kinase.
 - B. the molecular complex formed by the antagonist and the channel immediately enters the cell nucleus.
 - C. the ion channel opens and becomes selectively permeable to specific ions.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

15. Which of the following are G-protein-coupled receptors?
- A. Plasma-membrane Calcium Receptors.
 - B. Parathyroid Hormone Receptors (PTHrRs).
 - C. Insulin Receptors.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
16. Which of the following is true for a G-protein?
- A. When an agonist binds to the binding site of a G-protein-coupled receptor (GPCR), this leads to GDP displacing a GTP bound to the alpha subunit of the G-protein.
 - B. When an antagonist binds to the binding site of a G-protein-coupled receptor (GPCR), this leads to GTP displacing a GDP bound to the alpha subunit of the G-protein.
 - C. When ATP binds to an alpha subunit of the G-protein, this leads to the alpha subunit of the G-protein dissociating from the beta and gamma subunits of the G-protein.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
17. Which of the following is true for a motor cortex corticospinal interneuron that produces action potentials during movements of the big toe of the right foot?
- A. A portion of its axon is located in a nerve in the right leg.
 - B. Its dendrites are located in the motor cortex of the left cerebral cortex.
 - C. Its axon terminals are located in the right half of the spinal cord.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
18. Which of the following is true for a toe motor neuron that excites a toe muscle that moves the big toe in the right foot?
- A. The cell body of the toe motor neuron is located in the spinal cord.
 - B. All of the axon terminals of the toe motor neuron are located in the spinal cord.
 - C. All of the toe motor neuron's dendrites are located in the spinal cord.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

19. In a normal neuron at rest,
- A. the membrane voltage is greater than the threshold value for the action potential.
 - B. the membrane voltage is less than zero.
 - C. the membrane conductance to potassium ions is greater than the membrane conductance to sodium ions.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
20. At 1 AM, a healthy squid giant axon is placed in a bath of normal squid physiological extracellular saline and is internally perfused with normal squid intracellular saline. Its resting potential at 1:55 AM is -70 millivolts. For this question, ignore any possible effects due to the sodium-potassium pump. At 2 AM, there is a change in the
- A. intracellular perfusion fluid so that its concentration of potassium ion is increased. This will cause a decrease in the Nernst equilibrium potential for potassium ion.
 - B. extracellular saline so that its concentration of potassium ion is decreased. This will cause a decrease in the Nernst equilibrium potential for potassium ion.
 - C. intracellular perfusion fluid so that its concentration of potassium ion is increased. This will cause an increase in the resting membrane voltage.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
21. The value of the Nernst equilibrium potential for sodium at 20°C will be
- A. zero volts if extracellular sodium ion concentration is equal to intracellular sodium ion concentration.
 - B. +58 millivolts if extracellular sodium concentration is ten times that of intracellular sodium ion concentration.
 - C. less than zero volts if extracellular sodium ion concentration is less than intracellular sodium ion concentration.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
22. In a normal nerve axon,
- A. a membrane voltage increase will lead to an increase in sodium conductance.
 - B. an increase in sodium conductance will lead to an increase in membrane voltage.
 - C. the sodium equilibrium potential will be greater than zero.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.

23. For this question, the sodium-potassium pump has just been turned off just prior to the action potential. During an action potential in a normal neuron, there is a net flux of
- A. sodium ions from intracellular space to extracellular space.
 - B. potassium ions from extracellular space to intracellular space.
 - C. potassium ions from a region of high potassium ion concentration to a region of low potassium ion concentration.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
24. At 2 AM a healthy nerve cell is resting in a bath of normal physiological saline. At 2:05 AM the cell is depolarized just over threshold so that an action potential occurs. At 3 AM the nerve cell is placed in a bath of a modified saline solution that contains a sodium ion concentration that is one-half the concentration of normal physiological saline. Potassium ion concentration is not changed. The modified physiological saline also contains molecules that block the flux of ions via the sodium-potassium primary active transport pump. At 3:05 AM the cell is depolarized just over threshold so that an action potential is produced.
- A. Resting voltage at 3:04 AM is greater than resting voltage at 2:04 AM.
 - B. The peak of the action potential at 3:05 AM is greater than resting potential at 3:04 AM.
 - C. The peak of the action potential at 3:05 AM is less than the peak of the action potential at 2:05 AM.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.
25. A complete motor neuron is removed from a frog and placed in normal physiological saline at 1 AM. The neuron is healthy. At 2 AM, the physiological saline bathing the neuron is removed and replaced with a modified physiological saline. The composition of the modified physiological saline is as follows: its potassium concentration is the same as normal physiological saline; its sodium concentration is the same as the intracellular sodium concentration of the motor neuron; its total concentration of solutes (osmolarity) is the same as normal physiological saline. The modified physiological saline also contains molecules that block the flux of ions via the sodium-potassium primary active transport pump. At 2:05 AM, the resting membrane voltage of the neuron is -70 millivolts. At 2:06 AM,
- A. the value of the Nernst equilibrium potential for sodium ions for the neuron is less than +20 millivolts.
 - B. an increase in sodium conductance will lead to no change in the amount of intracellular sodium.
 - C. an increase in sodium conductance will lead to an increase in the membrane voltage.
 - D. A and B.
 - E. A and C.
 - F. B and C.
 - G. A, B, and C.
 - H. None of the above.