

BMD 334
Practice Exam 2
Sample 1

Name _____

ID _____

1. **Which of the following are located in greater concentration inside the cell compared to outside?**
 - A) Proteins
 - B) Sodium ions
 - C) Potassium ions
 - D) A and B
 - E) A and C

2. **Assume calcium (Ca^{2+}) and sodium (Na^+) are both located across the plasma membrane such that the concentrations in the intracellular fluid for sodium and calcium are equal and the concentrations in the extracellular fluid for sodium and calcium are equal, and the concentration in the extracellular fluid is greater than that in the intracellular fluid. The membrane potential is -60 mV. Which of the following statements is true?**
 - A) The electrochemical driving force for both ions is to move into the cell.
 - B) The magnitude of the electrochemical driving force for calcium is greater than that for sodium.
 - C) Both A and B are true
 - D) Neither A nor B is true

3. **Which of the following would increase the rate of simple diffusion across the plasma membrane?**
 - A) An increase in the electrochemical gradient
 - B) An increase in the permeability
 - C) An increase in the surface area
 - D) A and C
 - E) All of the above

4. **Which of the following transport processes require energy?**
 - A) Diffusion of oxygen through the lipid bilayer
 - B) Facilitated diffusion of glucose across the plasma membrane
 - C) Movement of ions through open ion channels
 - D) Co-transport of glucose with sodium
 - E) All of the above

5. **Which of the following statements about the sodium/potassium pump is true?**
 - A) Three sodium are transported into the cell per ATP
 - B) One potassium is transported out of the cell per ATP
 - C) This is an example of primary active transport
 - D) A and C
 - E) All of the above

6. **For counter-transport of molecule A with sodium, which of the following is true?**
- A) Sodium moves into the cell
 - B) A moves into the cell
 - C) Energy is required
 - D) A and C
 - E) All of the above
7. **A cell is placed in a 200 mM solution of sodium chloride. What happens to the cell?**
- A) Nothing
 - B) The cell swells
 - C) The cell shrinks
8. **The plasma membrane facing the lumen of a hollow organ is called what?**
- A) Apical membrane
 - B) Basolateral membrane
 - C) Basement membrane
9. **If solute is actively transported from lumen to interstitial fluid and the epithelium is permeable to water, in what direction does water move?**
- A) Lumen to interstitial fluid
 - B) Interstitial fluid to lumen
 - C) Water does not move
10. **Which of the following chemical messengers travels to the target cell via the bloodstream?**
- A) Hormone
 - B) Neurotransmitter
 - C) Neurohormone
 - D) A and C
 - E) All of the above
11. **Receptors for lipophobic chemical messengers are generally located**
- A) on the plasma membrane.
 - B) inside the cell.
12. **Which of the following statements about tyrosine kinase is true?**
- A) Tyrosine kinase is a transmembrane protein.
 - B) Tyrosine kinase is a second messenger.
 - C) Tyrosine kinase catalyzes the phosphorylation of a protein.
 - D) A and C
 - E) All of the above

13. **Estrogens stimulate the production of progesterone receptors in the uterine lining, making the uterus sensitive to progesterone. This is an example of ____.**
- A) an additive effect
 - B) antagonism
 - C) synergism
 - D) permissiveness
 - E) independence
14. **Which of the following chemical classes of messengers is generally lipid soluble?**
- A) Steroids
 - B) Amines
 - C) Eicosanoids
 - D) A and C
 - E) All of the above
15. **If a cell produces norepinephrine as its final secretory product, then the cell must also have enzymes to synthesize which of the following chemical messengers?**
- A) Epinephrine
 - B) Serotonin
 - C) Dopamine
 - D) A and C
 - E) All of the above
16. **Which of the following will increase the response of a target cell to its messenger?**
- A) An increase in the concentration of messenger near the target cell
 - B) An increase in the affinity of the receptor for the messenger
 - C) An increase in the number of receptors on the target cell for the messenger
 - D) A and C
 - E) All of the above
17. **In primary hyposecretion of thyroid hormones,**
- A) levels of thyroid hormones in the blood decrease.
 - B) levels of TRH in the blood increase.
 - C) levels of TSH in the blood increase.
 - D) All of the above
18. **Which of the following is part of the EFFERENT branch of the nervous system?**
- A) Somatic
 - B) Parasympathetic
 - C) Sympathetic
 - D) B and C
 - E) All of the above

19. **Which type of glial cell forms myelin in the peripheral nervous system?**
- A) Astrocytes
 - B) Schwann cells
 - C) Ependymal cells
 - D) Microglia
 - E) Oligodendrocytes
20. **Which of the following statements about a neuron at rest is FALSE?**
- A) Permeability to potassium is greater than permeability to sodium.
 - B) The force of the electrochemical gradient for sodium movement is greater than the force of the electrochemical gradient for potassium movement.
 - C) There is a small leak of sodium ions into the cell.
 - D) There is a large leak of potassium ions out of the cell.
 - E) The Na/K pump is actively moving sodium ions out of the cell and potassium ions into the cell.
21. **Which of the following could produce a depolarization?**
- A) A stimulus acts to open channels for both sodium and potassium.
 - B) A stimulus acts to open channels for potassium only.
 - C) A stimulus acts to close channels for potassium.
 - D) A and B
 - E) A and C
22. **At which of the following sites would the concentration of voltage-gated sodium channels be greatest?**
- A) Excitatory synapse
 - B) Inhibitory synapse
 - C) Dendrites
 - D) Axon hillock
 - E) Axon terminal
23. **Which of the following axons would have the greatest rate of action potential conduction?**
- A) Myelinated, 5 micron diameter
 - B) Myelinated, 2 micron diameter
 - C) Unmyelinated, 5 micron diameter
 - D) Unmyelinated, 2 micron diameter
24. **During pre-synaptic facilitation,**
- A) an EPSP is produced in the post-synaptic cell.
 - B) neurotransmitter release from the post-synaptic cell is decreased.
 - C) neurotransmitter release from the post-synaptic cell is increased.
 - D) A and B
 - E) A and C

25. **An enzyme that catalyzes degradation of biogenic amine neurotransmitters is ____.**
- A) Choline acetyl transferase
 - B) Acetylcholinesterase
 - C) Monoamine oxidase
 - D) A and C
 - E) All of the above
26. **Which of the following amino acid neurotransmitters is excitatory?**
- A) Aspartate
 - B) Glycine
 - C) Glutamate
 - D) A and C
 - E) B and C
27. **During the absolute refractory period,**
- A) Sodium activation gates are primarily in the closed position.
 - B) Sodium inactivation gates are primarily in the closed position.
 - C) A second action potential cannot be elicited, regardless of stimulus strength.
 - D) A and C
 - E) B and C
28. **Depolarization of a neuron to threshold stimulates**
- A) rapid opening of voltage-gated sodium channels.
 - B) slow closing of voltage-gated sodium channels.
 - C) slow opening of voltage-gated potassium channels.
 - D) A and C
 - E) All of the above
29. **If a cation is equally distributed across the cell membrane (that is, its concentration inside the cell equals its concentration outside the cell), then which of the following statements is FALSE?**
- A) At -70 mV, the chemical force on the ion is zero.
 - B) At $+30$ mV, the chemical force on the ion is zero.
 - C) The equilibrium potential for the ion would be 0.
 - D) At -70 mV, the electrochemical force on the ion acts to move it out of the cell.
30. **At which of the following types of synapses are EPSPs or IPSPs likely to occur?**
- A) Axo-somatic
 - B) Axo-axonic
 - C) Axo-dendritic
 - D) A and C
 - E) All of the above

31. **When a neurotransmitter binds to a receptor and activates a G-protein that closes potassium channels, what type of membrane potential change occurs?**
- A) Fast EPSP
 - B) Fast IPSP
 - C) Slow EPSP
 - D) Slow IPSP
 - E) None, the membrane potential is stabilized
32. **At nicotinic cholinergic receptors, what type of ion channel gating occurs?**
- A) Sodium channels open
 - B) Potassium channels open
 - C) Channels for both sodium and potassium open
 - D) Sodium channels close
 - E) Potassium channels close
33. **When EPSPs are being produced on a post-synaptic cell at 2 DIFFERENT synapses. what is occurring on the post-synaptic cell?**
- A) Pre-synaptic inhibition
 - B) Pre-synaptic facilitation
 - C) Spatial summation
 - D) Temporal summation
 - E) Mass confusion
34. **Synaptic vesicles**
- A) store calcium.
 - B) release neurotransmitter by exocytosis.
 - C) degrade neurotransmitters.
 - D) form gap junctions.
35. **Which of the following statements about voltage-gated sodium channels is FALSE?**
- A) Sodium activation gates open in response to a depolarization.
 - B) Sodium inactivation gates open in response to a repolarization.
 - C) Voltage-gated sodium channels are found at excitatory synapses and when active, produce a fast EPSP.
 - D) Opening of sodium activation gates and closing of sodium inactivation gates BOTH contribute to the absolute refractory period.
 - E) The opening of voltage-gated sodium channels is part of a positive feedback loop.

SHORT ANSWER. PRINT ANSWERS DIRECTLY ON THE EXAM. The number of points available per question are as indicated.

36. (5 points) Describe the cAMP second messenger system. Include enough detail to understand how a messenger binding to a receptor leads to a response inside the cell. You may use numbered steps, a drawing (clearly labeled), or write it out in paragraph form.

37. (5 points) Match the hormones to the endocrine gland that secretes it. by placing the letter corresponding to the correct endocrine gland in the blank in front of the hormone. An endocrine gland may be the answer to none, one, or more than one of the hormones. If there are two possible answers, you only have to provide one correct answer per blank.

- | | | |
|--------------------|-----------------------|------------------------|
| A) Pancreas | B) Ovaries | C) Thyroid gland |
| D) Thymus | E) Parathyroid glands | F) Posterior pituitary |
| G) Adrenal medulla | H) Adrenal cortex | |

_____ Insulin

_____ Aldosterone

_____ Epinephrine

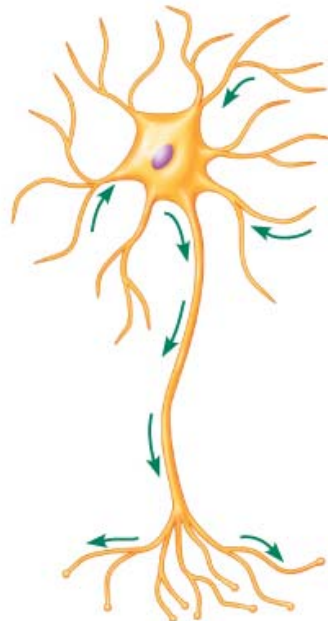
_____ Calcitonin

_____ Oxytocin

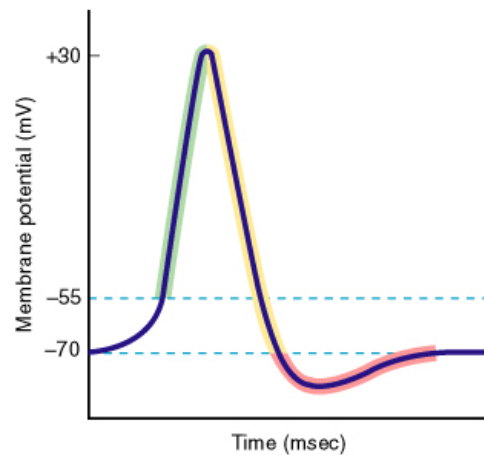
38. (5 points) Complete the following table of hypothalamic tropic hormones, anterior pituitary tropic hormones, and final endocrine gland and hormone. The first column is completed as an example. Hormone abbreviations are okay, but must be EXACT. If unsure, write it out (spelling does not count as long as you are close).

Hypothalamic Tropic Hormone	TRH		GHRH	
Anterior Pituitary Tropic Hormone	TSH		GH	LH and FSH
Target Endocrine Gland	Thyroid gland	Adrenal cortex		Gonads
Final Hormone	Thyroid hormones	Cortisol		Sex Hormones

39. (4 points) Label a dendrite, soma, axon hillock, and axon terminal on the picture of a neuron below. Make sure your label is clear.



40. (4 points) In the picture of an action potential below, identify the depolarization phase, repolarization phase, and after-hyperpolarization. For each of these phases, state whether permeability is greater for sodium or potassium.



42. (4 points) Match the enzyme with the appropriate description. There may be more than one answer per blank. An answer may be used more than once or not at all.

A) Adenylate cyclase	B) Protein kinase	C) Phospholipase C
D) Phosphodiesterase	E) Choline acetyl transferase	F) Monoamine oxidase

_____ Catalyzes the phosphorylation of a protein (consider direct effects only)

_____ Breaks down cAMP

_____ Catalyzes the synthesis of a second messenger

- 43. (3 points) Given that an anion ion has an equilibrium potential of -80 mV and the resting membrane potential is -70 mV, answer the following questions.**

At rest, what is the direction of the electrochemical force: into or out of the cell?

Is the anion in greater concentration inside or outside the cell?

At rest, what direction is the chemical force for the anion: into or out of the cell?