

Monday, December 11th, 2023

Following directions on the mark-sense form, write your **name, and student number** in the blanks and fill in the bubbles. In addition, write your **name** on this exam.

When finished with the test, turn in both the mark-sense form and the exam at the front of the room.

PLACE ALL ANSWERS ON THE MARK-SENSE FORM

MULTIPLE CHOICE: Always choose the BEST, most complete answer. (2 points each)

Correct answers are in **red bold face**.

1. In order to maintain the extracellular fluid volume within the ideal range, the kidneys change the reabsorption or excretion of
 - a. HCO_3^- (bicarbonate).
 - b. water.
 - c. K^+ .
 - d. H^+ .
 - e. **Na^+** .

2. The renal tubule is
 - a. lined throughout with uroepithelium.
 - b. the site in the nephron where filtration occurs.
 - c. **the site in the nephron where reabsorption and secretion occur.**
 - d. found only in the renal cortex.
 - e. found only in the renal medulla.

3. Which of the following is found mainly in the medulla of the kidney?
 - a. filtration membrane
 - b. **vasa recta**
 - c. proximal tubule
 - d. distal tubule
 - e. glomerulus

4. Which of the following would increase the glomerular filtration rate (GFR)?
 - a. dilation of the efferent arteriole
 - b. **constriction of the efferent arteriole**
 - c. stimulation of sympathetic nervous system input to the kidney
 - d. loss of blood causing mean arterial pressure to fall below 80 mm Hg
 - e. ALL of the above would increase the GFR.

5. Damage to the filtration membrane causes
 - a. renovascular hypertension.
 - b. polyuria.
 - c. a decreased filtered load.
 - d. protein in the urine.**
 - e. tubuloglomerular feedback.

6. What type of neuron directly stimulates renin secretion and constriction of the afferent arteriole, as part of the systemic response to blood loss?
 - a. sympathetic postganglionic neuron**
 - b. parasympathetic postganglionic neuron
 - c. somatic motor neuron
 - d. hypothalamic osmoreceptor
 - e. large neurosecretory cell found in the hypothalamus and posterior pituitary

7. Which of the following is a drug that is used to reduce proteinuria in diabetic nephropathy?
 - a. vasopressin agonist
 - b. angiotensin II agonist
 - c. ACE inhibitor**
 - d. JAK inhibitor
 - e. glucocorticoid

8. Drugs that inhibit the sodium glucose cotransporter of the proximal tubule (SGLT2 inhibitors) are approved to treat diabetes mellitus and
 - a. glomerulonephritis.
 - b. AVP-R (arginine vasopressin resistance, also called nephrogenic diabetes insipidus).
 - c. renovascular hypertension.
 - d. heart failure.**
 - e. preeclampsia.

9. Which of the following causes an increased urine volume?
 - a. decreased GFR
 - b. decreased filtered load of glucose
 - c. hypoglycemia
 - d. desmopressin, a drug that acts as a vasopressin agonist
 - e. hydrochlorothiazide, a drug that blocks the Na⁺/Cl⁻ cotransporter in the distal tubule**

10. In which part of the nephron does organic molecule reabsorption and secretion occur?
 - a. renal corpuscle
 - b. proximal tubule**
 - c. loop of Henle
 - d. distal tubule
 - e. cortical collecting duct

11. If a substance is reabsorbed but not secreted,
- the amount excreted is greater than the filtered load.
 - the filtered load is greater than the amount excreted.**
 - the filtered load is the same as the amount excreted.
12. If you drank your whole 1.5-liter water bottle during class, which of the following would occur as a consequence?
- your extracellular fluid volume would increase by 1.5 liters
 - your extracellular fluid osmolarity would increase
 - water reabsorption in the proximal tubule would decrease
 - water reabsorption in the collecting duct would decrease**
 - you would produce a low volume of concentrated urine
13. Which hormone has its secretion stimulated when there is increased action potential firing by hypothalamic osmoreceptors?
- vasopressin**
 - renin
 - angiotensin II
 - atrial natriuretic peptide
 - aldosterone
14. What part of the nephron is important for generating the vertical osmotic gradient that provides the driving force for water reabsorption?
- cortical collecting duct
 - proximal tubule
 - loop of Henle**
 - renal corpuscle
 - efferent arteriole
15. Fill in the blank. As part of the response to volume loss, angiotensin II stimulates secretion of _____ from the adrenal cortex.
- atrial natriuretic peptide
 - renin
 - aldosterone**
 - erythropoietin
 - vasopressin

16. What will increase as a consequence of the kidneys' response to reduced renal blood flow, as occurs in heart failure?
- diuresis
 - extracellular fluid osmolarity
 - extracellular fluid volume**
 - glomerular filtration rate
 - natriuresis
17. The renal response to alkalosis (an increase in the pH of the ECF) activates
- increased H^+ secretion in the collecting duct.
 - increased H^+ reabsorption in the collecting duct.**
 - increased HCO_3^- reabsorption in the collecting duct.
18. Which of the following best describes what occurs in someone who is vaccinated?
- The vaccine stimulates long-lasting changes in the innate immune response.
 - The person develops passive immunity due to antibodies injected in the vaccine.
 - An adaptive immune response to the vaccine produces memory cells that can initiate a more rapid secondary immune response.**
 - The vaccine activates cytotoxic T cells, allowing them to kill bacteria.
 - The vaccine inhibits the innate immune response, allowing an adaptive immune response to develop.
19. Which of the following cells is NOT a phagocyte?
- neutrophil
 - antigen-presenting cell
 - macrophage
 - dendritic cell
 - cytotoxic T cell**
20. Which of the following is most directly involved in the generation of the membrane attack complex (MAC)?
- complement**
 - NK cell
 - neutrophil
 - histamine
 - cytotoxic T cell
21. What typically binds to an MHC I molecule?
- peptide derived from an intracellular antigen**
 - opsonin
 - T cell receptor from a helper T cell
 - B cell receptor
 - acute phase protein

22. What do helper T cells secrete that promotes the development of an adaptive immune response?
- a. acute phase proteins
 - b. complement
 - c. antibodies
 - d. granzymes
 - e. cytokines**
23. Which of the following cells expresses MHC II on its surface?
- a. red blood cell
 - b. antigen-presenting cell**
 - c. helper T cell
 - d. liver cell
 - e. virally infected cell
24. What type of immune cell is most important in promoting tolerance to self antigens?
- a. B cell
 - b. regulatory T cell**
 - c. cytotoxic T cell
 - d. helper T cell
 - e. plasma cell
25. The activation of an immune response involving B cells occurs in secondary lymphoid tissues. Which of the following is an important step in this process?
- a. B cell receptor binds MHC I
 - b. somatic recombination in antibody variable regions
 - c. secretion of perforin and granzymes
 - d. antigen binding to antibody expressed on surface of B cell**
 - e. help from cytotoxic T cells
26. Which type of cell gives rise to a plasma cell?
- a. megakaryocyte
 - b. neutrophil
 - c. B cell**
 - d. T cell
 - e. dendritic cell

27. Which component of the immune system is most effective at causing apoptosis (programmed cell death) of virally infected cells?
- a. complement
 - b. plasma cell
 - c. neutrophil
 - d. cytotoxic T cell**
 - e. helper T cell
28. Which of the following is true about monoclonal antibody drugs?
- a. They inhibit an intracellular kinase involved in cytokine signaling.
 - b. They can bind to multiple different epitopes on a single antigen.
 - c. They are effective because they lack specificity and bind to multiple targets.
 - d. They are large polypeptides that must be administered by infusion or injection.**
 - e. They are administered prior to vaccination to boost the immune response.
29. The JAK inhibitor baricitinib (Olmiant) was approved in 2022 for the treatment of COVID-19. How does this drug help in treatment?
- a. It increases the activation of cytotoxic T cells.
 - b. It blocks cytokine signaling to limit the damaging effects of cytokine storm in severely ill patients.**
 - c. It prevents infection of cells by blocking the receptor for the virus.
 - d. It activates cytokine signaling to stimulate lymphocyte proliferation.
 - e. It increases barrier function in the respiratory tract to prevent infection.
30. The use of convalescent plasma to reduce hospitalizations in outpatients infected with COVID-19 is an example of
- a. passive immunity.**
 - b. active immunity.
 - c. autoimmunity.
 - d. vaccination.
 - e. secondary immune response.
31. Which of the following is an amphipathic molecule?
- a. triacylglycerol
 - b. CO₂
 - c. glucose
 - d. water
 - e. phospholipid**

32. Which of the following is the major determinant of the osmolarity of a solution?
- a. the number of solute molecules**
 - b. both the number and size of solute molecules
 - c. the size of solute molecules
 - d. the charge of solute molecules
 - e. both the size and charge of solute molecules
33. If you open Na⁺ channels in a neuron at a membrane potential of -70mV
- a. the membrane hyperpolarizes.
 - b. Na⁺ ions flow into the cell.**
 - c. Na⁺ ions flow out of the cell.
 - d. There is no net movement of Na⁺ ions into or out of the cell at -70mV.
34. Which of the following best describes the action of calmodulin?
- a. acts as a docking protein for synaptic vesicles
 - b. is a ligand-activated transcription factor that binds to DNA and changes gene expression
 - c. is an intracellular Ca⁺⁺ binding protein that activates other proteins**
 - d. opens a ligand-gated Ca⁺⁺ channel to release Ca⁺⁺ from intracellular stores
 - e. is a membrane receptor that acts as a ligand-gated Ca⁺⁺ channel
35. Fill in the blank. Parasympathetic postganglionic neurons release acetylcholine that binds to _____ on their target cells.
- a. NMDA receptors
 - b. nicotinic receptors
 - c. ligand-gated ion channels
 - d. G protein coupled receptors (GPCRs)**
 - e. AMPA receptors
36. Graded potentials
- a. vary in size according to the strength of the stimulus that produces them.**
 - b. occur primarily in the axons of neurons.
 - c. are all-or-nothing signals that conduct long distances.
 - d. have a refractory period.
 - e. are always depolarizing.
37. What is true about the voltage-gated Na⁺ channels involved in action potentials?
- a. Channel opening causes membrane repolarization.
 - b. They are evenly distributed along the membrane of myelinated axons.
 - c. They open with a delay in response to depolarization.
 - d. They are responsible for the falling phase of the action potential.
 - e. They rapidly inactivate after opening.**

38. Multiple sclerosis is a CNS demyelinating disorder that primarily affects
- the generation of receptor potentials in touch sensitive neurons.
 - synaptic plasticity.
 - action potential amplitude.
 - synaptic transmission at the neuromuscular junction.
 - action potential conduction.**
39. Myasthenia gravis is an autoimmune disease that causes weakness by reducing the
- rate of cross-bridge cycling in skeletal muscle.
 - activity of acetylcholinesterase.
 - number of functional acetylcholine receptors at the neuromuscular junction.**
 - firing rate of somatic motor neurons.
 - excitability of somatic motor neurons.
40. Which of the following is a key step in the induction of long-term potentiation (LTP) at synapses in the hippocampus?
- activation of a G protein coupled receptor in the presynaptic cell
 - GABA release from the postsynaptic cell
 - strong hyperpolarization that resets inactivated voltage-gated Na^+ channels
 - strong depolarization that allows Ca^{++} entry via NMDA channels in the postsynaptic cell**
 - acetylcholine release by the presynaptic cell
41. Which of the following is the best description of the neural code?
- Sensory information is transmitted to the brain in an all-or-none manner.
 - All sensory receptors utilize the same labelled line.
 - The intensity of a stimulus is encoded by the magnitude of the change in membrane potential it produces in the sensory receptor.**
 - The location of a stimulus is encoded by the number of action potentials generated by sensory receptors.
 - Neurons are always activated in order of increasing size.
42. How do phasic sensory receptors respond to sustained, long-lasting stimuli?
- Their responses decrease rapidly.**
 - Their responses increase over time.
 - Their responses decrease initially, and then increase over time.
 - Their responses oscillate over time.

43. Individual olfactory sensory neurons
- respond to salt, sweet, bitter, sour, and umami odors.
 - express only one type of odorant receptor protein in their membranes.**
 - respond to only one type of odorant molecule.
 - can detect thousands of different odors.
 - have more than 20 different types of odorant receptors in their membranes.
44. Which of the following structures is a key component in the transduction of sound waves into action potentials?
- cerebellum
 - utricle
 - thalamus
 - basilar membrane**
 - semicircular canals
45. Which of the following sense organs is involved in detecting head movements?
- sacculle**
 - organ of Corti
 - cochlea
 - basilar membrane
 - retina
46. Our capacity to perceive different colors is dependent on
- the vitreous humor.
 - visual accommodation.
 - different types of cone photoreceptors.**
 - densely packed rod photoreceptors.
 - the pigment epithelium of the retina.
47. The relaxation phase of muscle contraction occurs as
- the thick filaments begin to shorten.
 - the thin filaments unwind.
 - chloride ions are released from the sarcoplasm.
 - glutamate is released.
 - calcium ions are pumped back into the sarcoplasmic reticulum.**

48. In executing all types of movements, motor units are normally recruited
- a. in a random sequence.
 - b. in order of increasing force.**
 - c. in order of increasing resistance to fatigue.
 - d. in order of decreasing contraction speed.
 - e. only one muscle at a time.
49. The function role of the flexion reflex is to
- a. increase the conduction speed of neural impulses.
 - b. rapidly withdraw a limb from a noxious stimulus.**
 - c. counteract the vestibulo-ocular reflex.
 - d. stabilize the head during repetitive movements.
 - e. override the knee jerk reflex.
50. Fill in the blank. The capacity of primates, including humans, to manipulate the fingers independently depends on direct connections between neurons in the _____ and motoneurons that innervate hand muscles.
- a. primary motor cortex**
 - b. spinal cord
 - c. thalamus
 - d. primary somatosensory cortex
 - e. cerebellum

END OF TEST

Please turn in your mark-sense form and your question sheets at the front of the room.

Have a great break, you deserve it.