

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)

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?
- acute phase proteins
 - complement
 - antibodies
 - granzymes
 - cytokines
23. Which of the following cells expresses MHC II on its surface?
- red blood cell
 - antigen-presenting cell
 - helper T cell
 - liver cell
 - virally infected cell
24. What type of immune cell is most important in promoting tolerance to self antigens?
- B cell
 - regulatory T cell
 - cytotoxic T cell
 - helper T cell
 - 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?
- B cell receptor binds MHC I
 - somatic recombination in antibody variable regions
 - secretion of perforin and granzymes
 - antigen binding to antibody expressed on surface of B cell
 - help from cytotoxic T cells
26. Which type of cell gives rise to a plasma cell?
- megakaryocyte
 - neutrophil
 - B cell
 - T cell
 - dendritic cell

27. Which component of the immune system is most effective at causing apoptosis (programmed cell death) of virally infected cells?
- complement
 - plasma cell
 - neutrophil
 - cytotoxic T cell
 - helper T cell
28. Which of the following is true about monoclonal antibody drugs?
- They inhibit an intracellular kinase involved in cytokine signaling.
 - They can bind to multiple different epitopes on a single antigen.
 - They are effective because they lack specificity and bind to multiple targets.
 - They are large polypeptides that must be administered by infusion or injection.
 - 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?
- It increases the activation of cytotoxic T cells.
 - It blocks cytokine signaling to limit the damaging effects of cytokine storm in severely ill patients.
 - It prevents infection of cells by blocking the receptor for the virus.
 - It activates cytokine signaling to stimulate lymphocyte proliferation.
 - 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
- passive immunity.
 - active immunity.
 - autoimmunity.
 - vaccination.
 - secondary immune response.
31. Which of the following is an amphipathic molecule?
- triacylglycerol
 - CO₂
 - glucose
 - water
 - phospholipid

32. Which of the following is the major determinant of the osmolarity of a solution?
- the number of solute molecules
 - both the number and size of solute molecules
 - the size of solute molecules
 - the charge of solute molecules
 - both the size and charge of solute molecules
33. If you open Na^+ channels in a neuron at a membrane potential of -70mV
- the membrane hyperpolarizes.
 - Na^+ ions flow into the cell.
 - Na^+ ions flow out of the cell.
 - 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?
- acts as a docking protein for synaptic vesicles
 - is a ligand-activated transcription factor that binds to DNA and changes gene expression
 - is an intracellular Ca^{++} binding protein that activates other proteins
 - opens a ligand-gated Ca^{++} channel to release Ca^{++} from intracellular stores
 - 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.
- NMDA receptors
 - nicotinic receptors
 - ligand-gated ion channels
 - G protein coupled receptors (GPCRs)
 - AMPA receptors
36. Graded potentials
- vary in size according to the strength of the stimulus that produces them.
 - occur primarily in the axons of neurons.
 - are all-or-nothing signals that conduct long distances.
 - have a refractory period.
 - are always depolarizing.
37. What is true about the voltage-gated Na^+ channels involved in action potentials?
- Channel opening causes membrane repolarization.
 - They are evenly distributed along the membrane of myelinated axons.
 - They open with a delay in response to depolarization.
 - They are responsible for the falling phase of the action potential.
 - 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
- in a random sequence.
 - in order of increasing force.
 - in order of increasing resistance to fatigue.
 - in order of decreasing contraction speed.
 - only one muscle at a time.
49. The function role of the flexion reflex is to
- increase the conduction speed of neural impulses.
 - rapidly withdraw a limb from a noxious stimulus.
 - counteract the vestibulo-ocular reflex.
 - stabilize the head during repetitive movements.
 - 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.
- primary motor cortex
 - spinal cord
 - thalamus
 - primary somatosensory cortex
 - 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.