

Friday, January 27<sup>th</sup>, 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.

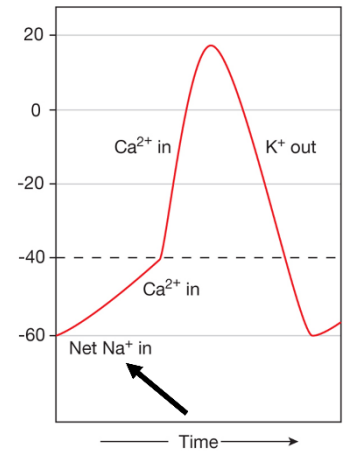
When finished with the test, turn in both the mark-sense form and the exam at the front of the room.

**PLACE ALL ANSWERS ON THE MARK-SENSE FORM**

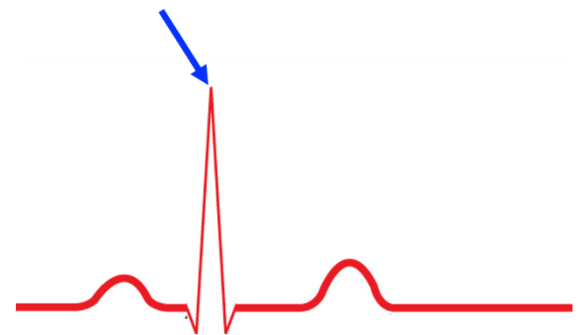
**MULTIPLE CHOICE: Always choose the BEST, most complete answer. (2 points each)**

1. Which of the following pressures is typically the lowest?
  - a) diastolic pressure in the aorta
  - b) diastolic pressure in the left coronary artery
  - c) systolic pressure in the aorta
  - d) systolic pressure in the pulmonary trunk
  - e) diastolic pressure in the right common carotid artery
  
2. The second heart sound
  - a) is caused by atrial contraction.
  - b) occurs at the time that pressure in the aorta becomes greater than pressure in the left ventricle.
  - c) occurs during systole.
  - d) is caused by turbulent flow through the semilunar valves.
  - e) is caused by the opening of the AV valves.
  
3. Which of the following is a technique that is used to create images of the working heart and the movement of its valves?
  - a) echocardiography
  - b) sphygmomanometry
  - c) auscultation
  - d) electrocardiography (ECG)
  - e) spirometry
  
4. What is a key difference between skeletal muscle cells and contractile cardiac muscle cells in the heart?
  - a) presence of striations
  - b) negative resting membrane potential
  - c) Ca<sup>++</sup> regulates contraction
  - d) length (time duration) of action potentials
  - e) presence of sarcoplasmic reticulum

5. The plateau phase of the cardiac action potential
- occurs in both contractile and pacemaker cells.
  - is due to the opening of voltage-gated  $\text{Na}^+$  channels.
  - is due to the opening of voltage-gated  $\text{K}^+$  channels.
  - is due to the opening of voltage-gated  $\text{Ca}^{++}$  channels.
  - shortens in response to acetylcholine.
6. The figure at right shows an action potential in a cell of the SA node. What factor normally triggers the opening of the channel that allows for net  $\text{Na}^+$  entry into the cell?
- increased intracellular  $\text{Ca}^{++}$
  - depolarization
  - acetylcholine released from parasympathetic postganglionic neurons
  - acetylcholine released from somatic motor neurons
  - hyperpolarization



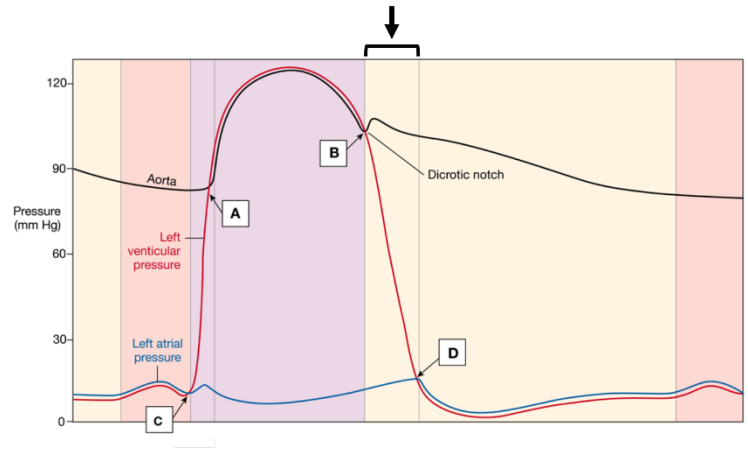
7. Which of the following helps ensure that the atria contract before the ventricles?
- long refractory period in cardiac contractile cells
  - rapid conduction of the action potential to the bottom of the ventricles
  - decreased parasympathetic input to the SA node
  - slowing of action potential conduction through the AV node
  - the atria are thin walled
8. Refer to the figure at right. What is occurring in the heart to cause the waveform indicated by the arrow?
- contraction of the atria
  - action potential traveling through the AV node
  - action potential traveling through the walls of the ventricles
  - closing of the AV valves
  - ventricular repolarization



9. Which of the following is rapidly fatal if not treated immediately (within the first few minutes)?
- atrial fibrillation
  - heart failure
  - angina
  - hypertension
  - ventricular fibrillation

10. Refer to the figure at right. What specific phase of the cardiac cycle is indicated by the bracket?

- a) ventricular systole
- b) isovolumetric relaxation
- c) ventricular diastole
- d) atrial contraction
- e) isovolumetric contraction



11. According to the Frank-Starling law of the heart, increasing the end-diastolic volume increases the

- a) afterload.
- b) peripheral resistance.
- c) heart rate.
- d) stroke volume.
- e) central venous pressure.

12. Which of the following works to increase the return of blood from veins in the legs?

- a) valves in veins
- b) contraction of skeletal muscle in the legs
- c) contraction of vascular smooth muscle in veins
- d) horizontal posture (lying down flat)
- e) ALL of the above work to increase venous return from the legs.

13. Which of the following is an effect of norepinephrine on the heart?

- a) hyperpolarizes contractile cells
- b) increases release of  $\text{Ca}^{++}$  from sarcoplasmic reticulum to increase contractility
- c) decreases the slope of the pacemaker potential
- d) increases  $\text{K}^+$  permeability in pacemaker cells
- e) decreases  $\text{Ca}^{++}$  permeability in pacemaker cells

14. Which of the following is the principal determinant of peripheral resistance?

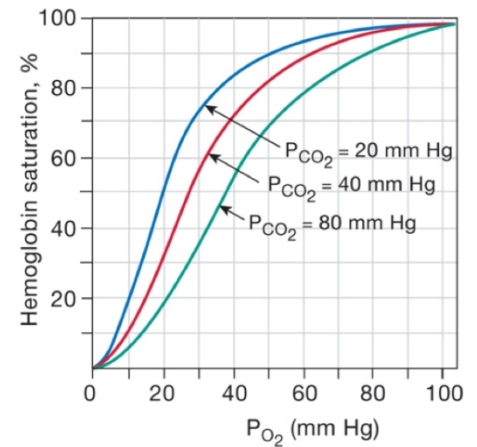
- a) heart rate
- b) central venous pressure
- c) constriction/dilation of arterioles
- d) number of capillaries
- e) end-diastolic volume

15. Which of the following is part of the *reflex response* to the Valsalva maneuver? The Valsalva maneuver is forced exhalation against a closed airway, raising pressure in the abdominal and thoracic cavities.
- a) increased action potential firing by carotid baroreceptors
  - b) increased heart rate
  - c) increased sympathetic output to the contractile cells of the ventricles
  - d) decreased vasodilation
  - e) decreased parasympathetic output to the SA node
16. All of the following drugs are used to treat hypertension EXCEPT
- a) thiazide diuretic
  - b) Ca<sup>++</sup> channel blocker
  - c) β-2 adrenergic agonist
  - d) ACE inhibitor
  - e) angiotensin II receptor blocker
17. A patient presents with dyspnea (shortness of breath) and edema (swelling caused by fluid accumulation in interstitial spaces). What is likely causing these symptoms?
- a) atrial fibrillation
  - b) postural hypotension (low blood pressure upon standing)
  - c) heart failure
  - d) ventricular fibrillation
  - e) increased parasympathetic output to the heart
18. Which of the following best describes what occurs in the genetic disorder cystic fibrosis?
- a) lack of fluid secretion by epithelial cells results in thick mucus that is difficult to clear and promotes bacterial infection
  - b) excessive mucus secretion causes increased resistance in large airways
  - c) lack of surfactant secretion causes restrictive lung disease
  - d) excessive activity by fibroblasts thickens the connective tissue framework of the lungs
  - e) breakdown in connective tissue framework of lungs leads to collapse of small airways
19. Which of the following relaxes airway smooth muscle?
- a) acetylcholine
  - b) leukotriene
  - c) histamine
  - d) inflammatory paracrine
  - e) epinephrine

20. Which of the following is NOT FOUND in an alveolus?
- a) endothelial cell
  - b) pseudostratified ciliated epithelium
  - c) macrophage
  - d) cell that secretes surfactant
  - e) elastic connective tissue
21. When the diaphragm contracts
- a) the volume of the abdominal cavity increases.
  - b) exhalation occurs.
  - c) the airways constrict.
  - d) the ribs and sternum are depressed.
  - e) the volume of the thoracic cavity increases.
22. According to Boyle's law, when volume increases
- a) flow decreases.
  - b) temperature increases.
  - c) the total pressure of a gas mixture is equal to the sum of the partial pressures.
  - d) pressure decreases.
  - e) resistance decreases.
23. In infant respiratory distress syndrome, a deficiency of surfactant causes
- a) decreased lung compliance.
  - b) thick mucus that clogs the airways.
  - c) decreased surface tension.
  - d) fibrosis.
  - e) increased airway resistance.
24. In what way does asthma reduce gas exchange at the pulmonary capillaries?
- a) increases diffusion distance
  - b) decreases alveolar ventilation
  - c) decreases the surface area available for gas exchange
  - d) reduces airway resistance
  - e) decreases dead space
25. Iron deficiency will cause
- a) decreased alveolar ventilation.
  - b) saturation of hemoglobin.
  - c) a decrease in the solubility of O<sub>2</sub> in plasma.
  - d) an increase in the affinity between O<sub>2</sub> and hemoglobin.
  - e) a decrease in the O<sub>2</sub> carrying capacity of blood.

26. Refer to the graph at right. Because metabolism produces  $\text{CO}_2$ , what the graph shows is that
- $\text{O}_2$  dissociates from hemoglobin more readily in metabolically active tissues.
  - $\text{CO}_2$  increases the affinity of hemoglobin for  $\text{O}_2$ .
  - $\text{PCO}_2$  decreases when hemoglobin is saturated.
  - pH increases when  $\text{PCO}_2$  increases.
  - pH increases in metabolically active tissues.

(e) Effect of  $\text{PCO}_2$



27.  $\text{CO}_2$  is primarily transported in the blood
- bound to hemoglobin.
  - in solution.
  - as  $\text{HCO}_3^-$  (bicarbonate).
28. What is the neurotransmitter released by neurons in the phrenic nerve that activates contraction of the muscles of the diaphragm?
- norepinephrine
  - acetylcholine
  - dopamine
  - epinephrine
  - serotonin
29. The central chemoreceptor is stimulated by
- increased  $[\text{H}^+]$  in the blood.
  - decreased pH in the blood.
  - increased  $\text{PCO}_2$  in the blood causing increased  $[\text{H}^+]$  in the cerebrospinal fluid.
  - increased  $\text{PO}_2$  in the blood.
  - decreased  $\text{PO}_2$  in the blood.
30. Strenuous exercise causes metabolic acidosis. What **decreases** as a consequence of the respiratory response to metabolic acidosis?
- ventilation
  - the rate of  $\text{CO}_2$  release at the lungs ( $\text{VCO}_2$ )
  - arterial  $\text{PO}_2$
  - pH of the blood
  - arterial  $\text{PCO}_2$

**END OF TEST**

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