

1. Which of the following has the lowest pressure?
 - a. the aorta at the end of systole
 - b. the aorta at the end of diastole
 - c. a coronary artery at any time during the cardiac cycle
 - d. the pulmonary trunk at the end of systole
 - e. the pulmonary trunk at the end of diastole

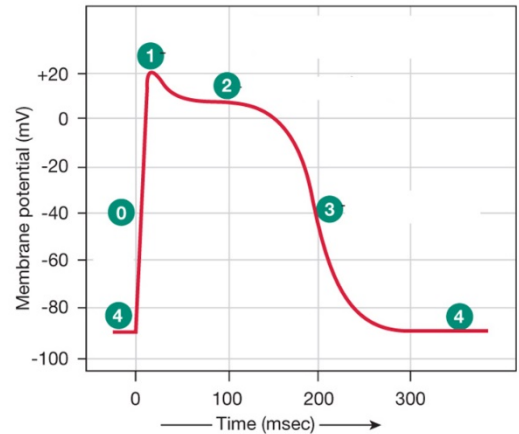
2. Which of the following is TRUE about papillary muscles?
 - a. are the last part of the heart to contract during systole
 - b. are located in the atria
 - c. their contraction prevents stenosis of the semilunar valves
 - d. their contraction prevents prolapse of the AV valves
 - e. their contraction causes the AV valves to close

3. Which of the following causes the second heart sound at the beginning of diastole?
 - a. turbulent blood flow through the AV valves
 - b. opening of the AV valves
 - c. closing of the AV valves
 - d. closing of the pulmonary and aortic valves
 - e. turbulent blood flow through the pulmonary and aortic valves

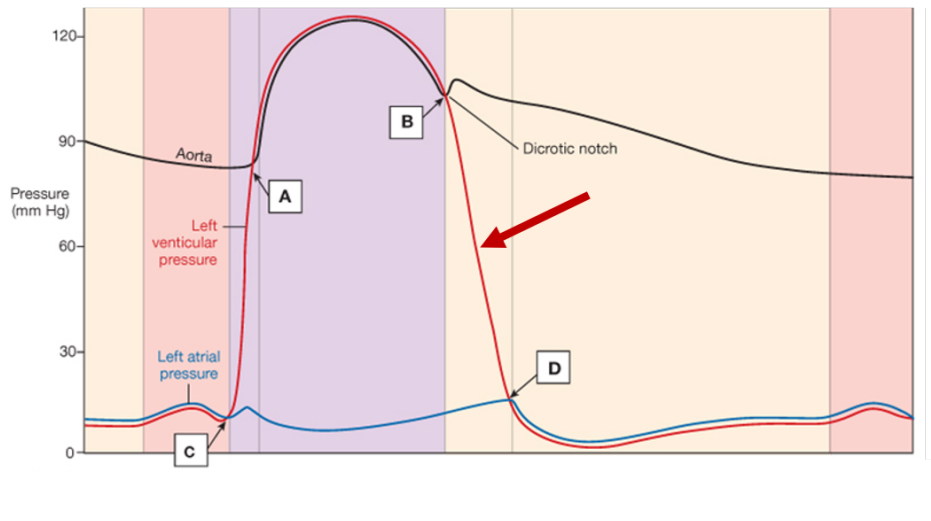
4. In the SA node, what type of ion channel is responsible for repolarization (returning to a negative membrane potential)?
 - a. “funny” channel that opens in response to hyperpolarization
 - b. voltage-gated K⁺ channel
 - c. voltage-gated Na⁺ channel
 - d. voltage-gated Ca⁺⁺ channel
 - e. ligand-gated K⁺ channel

5. What prevents contractile cells from firing action potentials in rapid succession, allowing the heart time to relax between contractions so that it can pump?
 - a. inhibition by parasympathetic nerve fibers
 - b. long refractory period
 - c. intercalated discs
 - d. fibrous connective tissue of the cardiac skeleton

6. Refer to the figure at right, showing the action potential in a cardiac muscle cell. Which phase corresponds to the time when voltage-gated Ca^{++} channels are open?
- phase 0
 - phase 1
 - phase 2
 - phase 3
 - phase 4



7. Refer to the figure at right. Which letter indicates the time when the left AV (mitral valve) closes after being open?
- A
 - B
 - C
 - D



8. Refer to the figure above. Which of the following best explains the rapid change in pressure indicated by the arrow?
- all the valves are closed
 - all the valves are open
 - the ventricles are contracting
 - the atria are contracting
 - heart muscle is being activated by the sympathetic nervous system
9. Heart failure
- is a term that is used to mean cardiac arrest.
 - can occur when the ventricles don't fill properly.
 - usually leads to decreased extracellular fluid volume.
 - can result from an abnormally high cardiac output.
 - is associated with decreased peripheral resistance

10. What is the effect of norepinephrine at the SA node?
- increases K^+ permeability
 - causes a longer opening time for I_f ("funny") channels to speed depolarization
 - makes the pacemaker potential take longer to get to threshold
 - hyperpolarizes pacemaker cells
 - decreases contractility
11. Fill in the blank. According to the Frank-Starling law of the heart, stroke volume is increased by increasing the _____.
- afterload
 - peripheral resistance
 - heart rate
 - end-systolic volume
 - end-diastolic volume
12. Which of the following causes constriction of the veins to preserve blood pressure following a hemorrhage?
- increased activity of the sympathetic nervous system
 - decreased activity of the parasympathetic nervous system
 - nitric oxide
 - acetylcholine
 - increased compliance of the veins
13. Which of the following is responsible for short term regulation of the mean arterial pressure?
- Frank-Starling law of the heart
 - baroreceptor reflex
 - kidney regulation of ECF osmolarity
 - increased ventilation
14. Heart failure causes decreased blood flow to the kidneys, resulting in which of the following pathological changes?
- low ECF osmolarity
 - dilation of arterioles and decrease in peripheral resistance
 - edema (fluid accumulation in the tissues)
 - decreased formation of angiotensin II
 - orthostatic hypotension

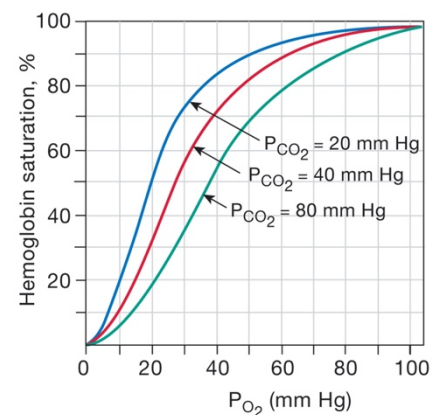
15. Which of the following is a treatment for hypertension?
- angiotensin II agonist
 - drug that increases urine volume by inhibiting Na^+ reabsorption
 - muscarinic agonist
 - muscarinic antagonist
 - beta adrenergic agonist
16. What type of protein is defective in cystic fibrosis?
- chloride channel
 - glucose transporter
 - mucus protein
 - neurotransmitter receptor
 - cilia protein
17. Which of the following is a role of the Type II alveolar cells?
- form the delicate gas exchange barrier
 - produce the connective tissue framework of the lungs
 - secrete mucus in the airways
 - protect against pathogens
 - secrete surfactant
18. What is the key problem in asthma?
- increased compliance of the lung
 - increased connective tissue surrounding the alveoli
 - hyperresponsiveness of airways causing increased airway resistance
 - deficient secretion by submucosal glands
 - fluid accumulation in the alveoli
19. Which of the following is responsible for inhalation during quiet breathing?
- internal intercostals
 - abdominal muscles
 - diaphragm
 - elastic recoil of the lungs
 - relaxation of airway smooth muscle

20. Which of the following is a characteristic seen in chronic obstructive pulmonary disease (COPD)?
- compliance of the lungs is too high
 - reduced FEV_1/FVC ratio in spirometry testing
 - decreased alveolar ventilation
 - destruction of alveoli so that there is decreased surface area available for gas exchange
 - ALL of the above are characteristics seen in COPD.
21. Which of the following is TRUE about surfactant?
- Surfactant contains amphipathic molecules that collect at the air-water interface.
 - Surfactant increases surface tension in the fluid lining the alveoli.
 - Excess surfactant causes restrictive lung disease.
 - Surfactant is the substance that causes the pleural membranes to stick together.
 - Surfactant decreases the compliance of the lungs.
22. Efficient amounts of oxygen are transported in the blood because
- oxygen has a high solubility in plasma.
 - oxygen reacts with water to form bicarbonate.
 - oxygen binds to plasma proteins.
 - oxygen binds to hemoglobin.
23. Which of the following reduces the partial pressure of oxygen in alveoli?
- breathing air at high altitude
 - hyperventilation
 - iron deficiency
 - anemia
 - metabolic acidosis

24. **Refer to the graph.** Given that CO_2 is produced by metabolism, the effect of PCO_2 depicted means that

- pH increases in metabolically active tissues.
- there is increased dissociation of O_2 from hemoglobin in metabolically active tissues.
- there is increased binding of O_2 to hemoglobin in metabolically active tissues.
- PCO_2 decreases when hemoglobin is saturated.
- PCO_2 increases when hemoglobin is saturated.

(e) Effect of P_{CO_2}



25. What is the neurotransmitter released by neurons that stimulate contraction of respiratory muscles?
- dopamine
 - GABA
 - norepinephrine
 - acetylcholine
 - glutamate
26. Which of the following is monitored by central chemoreceptors?
- arterial PCO_2
 - arterial PO_2
 - arterial pH
27. Which of the following is most likely to double the rate of ventilation?
- arterial PCO_2 decreases from 40 to 35 mm Hg
 - arterial PO_2 increases from 90 to 100 mm Hg
 - arterial PO_2 decreases from 100 to 90 mm Hg
 - pH increases from 7.42 to 7.44
 - arterial PCO_2 increases from 40 to 45 mm Hg
28. Which of the following factors most directly stimulates hyperventilation during strenuous exercise?
- decrease in arterial PO_2
 - decrease in arterial PCO_2
 - increased lactate in the circulation
 - increased $[\text{H}^+]$ in the circulation
 - increased $[\text{HCO}_3^-]$ in the circulation
29. During strenuous exercise
- increased ventilation leads to metabolic acidosis.
 - increased anaerobic metabolism leads to metabolic acidosis.
 - increased ventilation leads to respiratory acidosis.
30. Active hyperemia is responsible for
- increasing ventilation to keep pace with the body's needs during moderate exercise.
 - stimulating hyperventilation during strenuous exercise.
 - increasing peripheral resistance during exercise.
 - increasing blood flow to skeletal muscles during exercise.
 - increasing contractility in the heart.