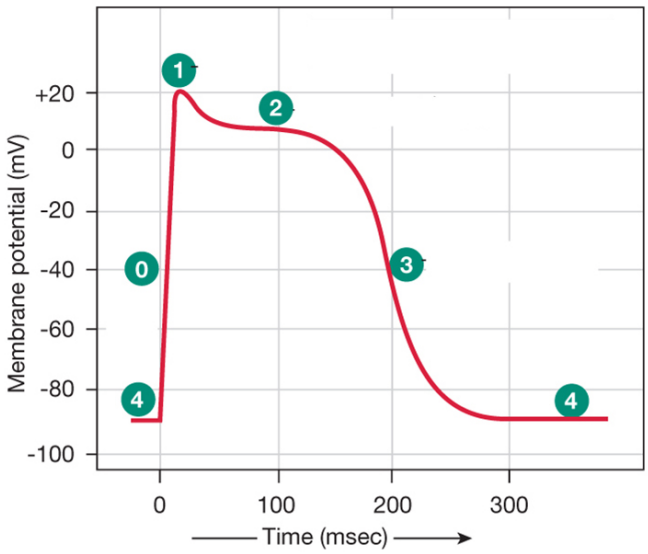
PBIO 376 First Midterm **Friday, Jan 28th, 2022**

1. Which of the following arteries has the lowest pressure during systole?
    a. aorta
    b. pulmonary artery
    c. coronary artery
    d. brachial artery
    e. external iliac artery

2. Which of the following most directly prevents prolapse of the mitral valve, and thus prevents mitral insufficiency? (The mitral valve is the left AV valve.)
    a. contraction of the left atrium
    b. blood flow in the coronary sinus
    c. closing of the aortic and pulmonary valves
    d. increased central venous pressure
    e. contraction of the papillary muscles

3. Which of the following causes a myocardial infarction?
    a. bleeding into the pericardium
    b. blockage of blood flow in a pulmonary artery
    c. insufficient cardiac output
    d. blockage of blood flow in a coronary artery
    e. drop in blood pressure associated with hemorrhage

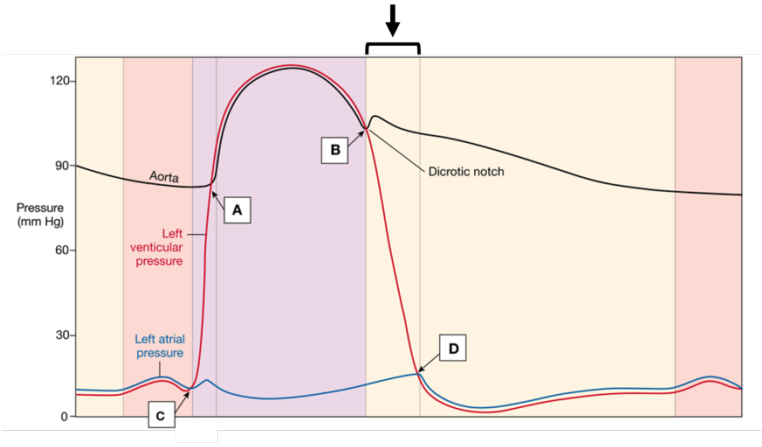
4. Refer to the figure at right, showing a cardiac action potential in a contractile cell. What type of ion channel is opening during phase 3?
    a. K^+ channel
    b. Na^+ channel
    c. I_f channels ("funny" channel)
    d. Ca^{++} channel
    e. Cl^- channel



5. Which of the following is TRUE about a cell in the SA node that is NOT TRUE about a contractile cell?
    a. has voltage-gated Ca^{++} channels that open to cause membrane depolarization
    b. has intercalated discs
    c. does not have a resting membrane potential
    d. is electrically coupled to other cells
    e. has voltage-gated K^{+} channels that open to cause membrane repolarization

6. The refractory period is
    a. the time when all the valves are closed.
    b. the time following a cardiac action potential during which a stimulus cannot trigger a second action potential.
    c. the steady depolarization that occurs in a pacemaker cell before it fires an action potential.
    d. the time it takes for a cardiac muscle cell to reach peak tension when it contracts.
    e. the time it takes for a cardiac muscle cell to relax after it has reached peak tension.

7. Refer to the figure at right. Which letter (A, B, C, D) indicates the time when the aortic valve opens after being closed?
    a. A
    b. B
    c. C
    d. D



8. Refer to the figure above at right. Which of the following is true about the phase of the cardiac cycle indicated by the arrow?
    a. all of the valves are open
    b. the pressure in the ventricles isn't changing
    c. the volume in the ventricles isn't changing
    d. the atria are contracting
    e. the ventricles are contracting

9. Pulmonary edema can be caused when blood backs up in the pulmonary circulation. This would occur as a result of
    a. increased preload
    b. sympathetic nervous system activation
    c. othostatic hypotension
    d. atrial fibrillation
    e. left ventricular heart failure

10. What parts of the cardiovascular system are innervated by the parasympathetic nervous system?
    a. most arterioles
    b. contractile cells in ventricles
    c. SA node
    d. SA node and most arterioles
    e. contractile cells in ventricles and most arterioles

11. The preload refers to factors that influence stroke volume by influencing the end-diastolic volume (in other words, the filling of the heart). All of the following directly affect the preload EXCEPT
    a. central venous pressure
    b. contraction of the atria during diastole
    c. contraction of smooth muscle surrounding the veins
    d. contraction of the ventricles during systole
    e. upright posture (effect of gravity on blood in veins)

12. Which of the following causes vasodilation?
    a. angiotensin II
    b. norepinephrine
    c. vasopressin
    d. activation of alpha-adrenergic receptors on vascular smooth muscle
    e. local increase of CO_2 in tissue surrounding blood vessels

13. Which of the following is a reflex response that occurs when baroreceptors sense a decrease in the mean arterial pressure (MAP)?
    a. vasoconstriction of arterioles to increase peripheral resistance
    b. less norepinephrine release by sympathetic nerves
    c. more acetylcholine release by parasympathetic nerves
    d. veins dilating so that blood shifts from arteries to veins
    e. kidneys increase Na^+ excretion to decrease extracellular fluid volume

14. Which of the following occurs in heart failure?
    a. edema
    b. reduced cardiac output
    c. increased levels of angiotensin II
    d. increased extracellular fluid volume
    e. ALL of the above occur in heart failure

15. Which of the following is NOT used in the treatment of hypertension?
    a. ACE inhibitor
    b. beta-2 adrenergic agonist
    c. angiotensin II receptor blocker
    d. Ca^{++} channel blocker
    e. diuretic

16. The genetic defect in cystic fibrosis causes
    a. a mutation in a ciliary protein causing an inability to clear mucus from the lungs.
    b. excess production of connective tissue in the lungs.
    c. excessive secretion by submucosal glands in the airways.
    d. abnormal Cl^- transport and deficient fluid secretion by epithelia.
    e. a mutation in a mucus protein that increases its viscosity.

17. Which of the following promotes <u>constriction of airways</u>?
    a. parasympathetic neural input
    b. epinephrine
    c. albuterol (inhaled medication for asthma treatment)
    d. montelukast (leukotriene antagonist)
    e. local increase in CO_2

18. Type II alveolar cells
    a. produce the connective tissue framework of the lungs.
    b. form the gas exchange barrier.
    c. secrete surfactant.
    d. phagocytize pathogens in the lung.
    e. secrete mucus.

19. Contraction of the abdominal muscles
    a. plays no role in ventilation.
    b. is involved in inspiration/inhalation during quiet breathing.
    c. is involved in inspiration/inhalation during active breathing.
    d. is involved in expiration/exhalation during quiet breathing.
    e. is involved in expiration/exhalation during active breathing.

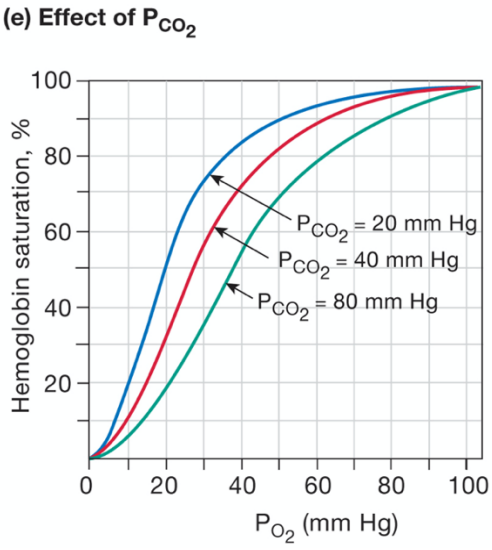
20. Which of the following is TRUE about surfactant?
    a. excess surfactant causes restrictive lung disease
    b. surfactant causes the pleural membranes to stick together
    c. surfactant contains amphipathic molecules that collect at the air/water interface
    d. surfactant decreases the compliance of the lungs
    e. surfactant is secreted by alveolar macrophages

21. Which of the following is a disorder in which the compliance of the lungs is <u>too low</u>?
    a. emphysema
    b. asthma
    c. infant respiratory distress syndrome (also called newborn respiratory distress syndrome)
    d. respiratory acidosis
    e. chronic obstructive pulmonary disease (COPD)

22. Which of the following is <u>most</u> affected in someone breathing air at high altitude?
    a. gas diffusion barrier
    b. partial pressure of O_2 (PO_2) in inhaled air
    c. forced vital capacity (FVC)
    d. compliance of the lungs
    e. forced expiratory volume in one second (FEV_1)

23. Sepsis, COVID-19 and other inflammatory disorders can cause acute respiratory distress syndrome (ARDS). Which of the following best describes how ARDS affects the respiratory system?
    a. increases the FEV_1
    b. causes a deficiency in surfactant secretion
    c. respiratory muscles become paralyzed
    d. alveoli fill with fluid, increasing the gas diffusion distance
    e. insufficient fluid secretion leads to destruction of alveoli

24. The figure shows that higher PCO_2 shifts the hemoglobin saturation curve to the right. This means that hemoglobin has a _____ affinity for O_2 in metabolically active tissues.
    a. higher
    b. lower



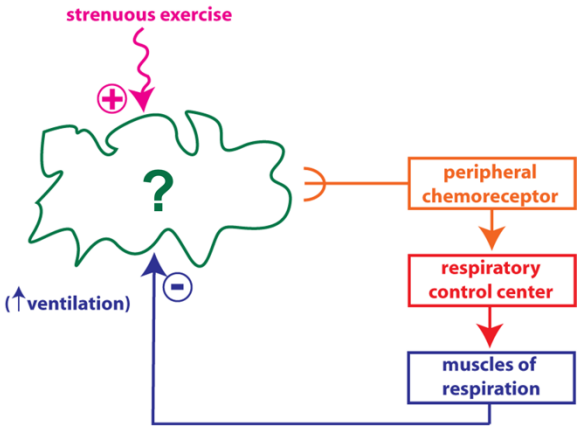
25. At the peak of exercise, if the alveolar PO_2 is 100 mm Hg, what is the systemic arterial PO_2?
    a. 100 mm Hg
    b. 75 mm Hg
    c. 60 mm Hg
    d. 46 mm Hg
    e. 40 mm Hg

26. Which of the following is the most important driver of ventilation in a healthy young adult breathing air at sea level (i.e. not at altitude)?
    a. venous partial pressure of O_2
    b. $[HCO_3^-]$ in the plasma
    c. hemoglobin saturation
    d. arterial partial pressure of CO_2 (PCO_2)
    e. arterial partial pressure of O_2 (PO_2)

27. Hyperventilation is the respiratory response to
    a. metabolic alkalosis
    b. metabolic acidosis
    c. decreased PCO_2
    d. increased hemoglobin saturation
    e. a full belly

28. Which of the following is an example of <u>feedforward regulation</u> involved in the adaptation to exercise?
    a. the abrupt increase in ventilation that occurs right at the start of exercise
    b. the steady increase in heart rate due to sympathetic activation
    c. the decrease in PCO_2 that occurs above the anaerobic threshold
    d. the change in distribution of blood flow to the tissues
    e. the increased ventilation that continues after exercise ends

29. Refer to the figure and fill in the blank. In someone who is engaged in <u>strenuous exercise</u>, _____ is increased, and this is sensed by peripheral chemoreceptors to cause increased ventilation.
    a. arterial PCO_2
    b. arterial PO_2
    c. pH of the blood plasma
    d. lactate in the blood plasma
    e. $[H^+]$ in the blood plasma



30. At the peak of exercise, mean arterial pressure increases. This is mainly due to
    a. increased peripheral resistance.
    b. increased heart rate and stroke volume.
    c. active hyperemia.
    d. decreased activation of peripheral chemoreceptors.
    e. decreased constriction of vascular smooth muscle.