



Physiology
OF THE CARDIOVASCULAR SYSTEM

Cardiac Electrical Activity

1- A person's electrocardiogram (ECG) has no P wave, but has a normal QRS complex and a normal T wave. Therefore, his pacemaker is located in the:

- A. Sinoatrial (SA) node.
- B. Atrioventricular (AV) node.
- C. Bundle of His.
- D. Purkinje system.
- E. Ventricular muscle.

2- In the sinoatrial (SA) node, phase 4 depolarization (pacemaker potential) is attributable to:

- A. An increase in K^+ conductance.
- B. An increase in Na^+ conductance.
- C. A decrease in Cl^- conductance.
- D. A decrease in Ca^{2+} conductance.
- E. Simultaneous increase in K^+ and Cl^- conductances.

3- The physiologic function of the relatively slow conduction through the atrioventricular (AV) node is to allow sufficient time for:

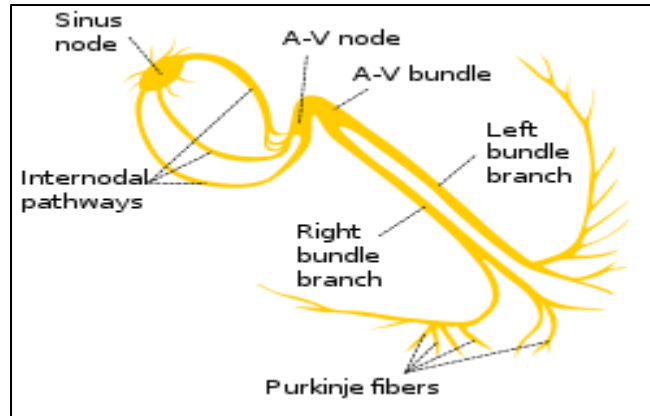
- A. Runoff of blood from the aorta to the arteries.
- B. Venous return to the atria.
- C. Filling of the ventricles
- D. Contraction of the ventricles.
- E. Repolarization of the ventricles.

4- Sinoatrial (SA) node is the pacemaker of the heart because of:

- A. Location in the right atrium.
- B. Neural control.
- C. Natural leakiness to Na^+
- D. Natural leakiness to K^+

5- Which of the following best explains how sympathetic stimulation affects the heart:

- A. Permeability of the S-A node to sodium decreases
- B. Permeability of the A-V node to sodium decreases
- C. Permeability of the S-A node to potassium increases
- D. There is an increased rate of upward drift of the resting membrane potential of the S-A node
- E. Permeability of the cardiac muscle to calcium decreases



Q's 6-9

6- Which of the following conducting systems has the slowest conducting velocity:

- A. (SA) node.
- B. Atrial muscle.
- C. Purkinje fibers.
- D. (AV) node.

7- Which of the following conducting systems has the highest conducting velocity:

- A. (SA) node.
- B. Atrial muscle.
- C. Purkinje fibers.
- D. (AV) node.

8- Which one of the structures in the image above its rate of rhythmic discharge is greater than any other part in the heart:

- A. (SA) node.
- B. Atrial muscle.
- C. Purkinje fibers.
- D. (AV) node.

9- Which one of the structures in the image above connects directly with surrounding atrial muscle fibers:

- A. (SA) node.
- B. Internodal pathways.
- C. Purkinje fibers.
- D. (AV) node.

10-What is the normal total delay of the cardiac impulse in the A-V node and the A-V bundle system:

- A. 0.03 sec.
- B. 0.06 sec.
- C. 0.09 sec.
- D. 0.13 sec.
- E. 0.17 sec.

11- If the S-A node discharges at 0.00 seconds, when will the action potential normally arrive at the AV bundle (bundle of His):

- A. 0.22 sec.
 - B. 0.18 sec.
 - C. 0.16 sec.
 - D. 0.12 sec.
 - E. 0.09 sec.
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Answers:

Q1 : B (The absent P wave indicates that the atrium is not depolarizing and, therefore, the pacemaker cannot be in the sinoatrial (SA) node. Because the QRS and T waves are normal, depolarization and repolarization of the ventricle must be proceeding in the normal sequence. This situation can occur if the pacemaker is located in the atrioventricular (AV) node. If the pacemaker were located in the bundle of His or in the Purkinje system, the ventricles would activate in an abnormal sequence (depending on the exact location of the pacemaker) and the QRS wave would have an abnormal configuration. Ventricular muscle does not have pacemaker properties)

Q2 : B (Phase 4 depolarization is responsible for the pacemaker property of sinoatrial (SA) nodal cells. It is caused by an increase in Na⁺ conductance and an inward Na⁺ current (I_f), which depolarizes the cell membrane)

Q3 : C (The atrioventricular (AV) delay (which corresponds to the PR interval) allows time for filling of the ventricles from the atria. If the ventricles contracted before they were filled, stroke volume would decrease)

Q4 : C

Q5 : D (During sympathetic stimulation, the permeabilities of the S-A node and the A-V node increase. Also, the permeability of cardiac muscle to calcium increases resulting in an increased contractile strength. In addition, there is an upward drift of the resting membrane potential of the S-A node)

Q6 : D conduction velocity is the lowest in AV node because there are less gap junctions.

Q7 : C

Q8 : A

Q9 : B

Q10 : D (The impulse coming from the S-A node to the A-V node arrives at 0.03 sec. Then there is a total delay of 0.13 sec in the A-V node and bundle system allowing the impulse to arrive at the ventricular septum at 0.16 sec)

Q11 : D (The action potential arrives at the A-V bundle at 0.12 sec. It arrives at the A-V node at 0.03 sec and is delayed 0.09 sec in the A-V node, which results in an arrival time at the bundle of His of 0.12 sec)