

TRUE/FALSE

1. Stimulation of beta-adrenergic receptor sites will result in peripheral vasoconstriction.

ANS: F

Beta receptor sites are divided into beta₁ and beta₂. Beta₁ receptors are found in the heart and kidneys. Stimulation of beta₁ receptor sites in the heart results in increased heart rate, contractility, and ultimately irritability of cardiac cells. Stimulation of beta₁ receptor sites in the kidneys results in the release of renin into the blood. Renin promotes the production of angiotensin, a powerful vasoconstrictor. Beta₂ receptor sites are found in the arterioles of the heart, lungs, and skeletal muscle. Stimulation results in dilation. Stimulation of beta₂ receptor sites in the smooth muscle of the bronchi results in dilation.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

2. Blood pressure is the result of cardiac output and peripheral vascular resistance.

ANS: T

Blood pressure is equal to cardiac output multiplied by peripheral vascular resistance. Blood pressure is the force exerted by the circulating blood volume on the walls of the arteries. Peripheral vascular resistance is the resistance to the flow of blood determined by blood vessel diameter and the tone of the vascular musculature.

OBJ: Identify and explain the components of blood pressure and cardiac output.

MULTIPLE CHOICE

1. The apex of the heart is formed by the _____.
a. tip of the left ventricle
b. tip of the right atrium
c. right atrium and right ventricle
d. left atrium and left ventricle

ANS: A

The heart's apex, or lower portion, is formed by the tip of the left ventricle. The apex lies just above the diaphragm, between the fifth and sixth ribs, in the midclavicular line.

OBJ: Identify the surfaces of the heart.

2. The left atrium receives blood from the _____.
a. pulmonary veins
b. aorta
c. pulmonary arteries
d. inferior vena cava

ANS: A

The left atrium receives freshly oxygenated blood from the lungs via the right and left pulmonary veins.

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

3. The anterior surface of the heart consists primarily of the _____.
a. left atrium
b. right atrium
c. left ventricle
d. right ventricle

ANS: D

The front (anterior) surface of the heart lies behind the sternum and costal cartilages. It is formed by portions of the right atrium and the left and right ventricles. However, because the heart is tilted slightly toward the left in the chest, the right ventricle is the area of the heart that lies most directly behind the sternum.

OBJ: Identify the surfaces of the heart.

4. Blood pressure is determined by _____ multiplied by _____.
a. stroke volume; heart rate
b. heart rate; cardiac output
c. cardiac output; peripheral vascular resistance
d. stroke volume; peripheral vascular resistance

ANS: C

Blood pressure is equal to cardiac output multiplied by peripheral vascular resistance.

OBJ: Identify and explain the components of blood pressure and cardiac output.

5. The right atrium receives venous blood from the head, neck, and thorax via the _____, from the remainder of the body via the _____, and from the heart via the _____.
- coronary sinus; superior vena cava; inferior vena cava
 - superior vena cava; coronary sinus; inferior vena cava
 - inferior vena cava; superior vena cava; coronary sinus
 - superior vena cava; inferior vena cava; coronary sinus

ANS: D

The right atrium receives blood low in oxygen from the superior vena cava, which carries blood from the head and upper extremities; the inferior vena cava, which carries blood from the lower body; and the coronary sinus, which is the largest vein that drains the heart.

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

6. The heart is divided into _____ chambers but functions as a _____-sided pump.
- two; four
 - three; two
 - four; two
 - four; three

ANS: C

The heart has four chambers: two atria and two ventricles. The right and left sides of the heart are separated by an internal wall of connective tissue called a *septum*. The interatrial septum separates the right and left atria. The interventricular septum separates the right and left ventricles. The septa separate the heart into two functional pumps. The right atrium and right ventricle make up one pump. The left atrium and left ventricle make up the other.

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

7. Stimulation of alpha-adrenergic receptors results in _____.
- increased heart rate
 - peripheral vasoconstriction
 - constriction of bronchial smooth muscle
 - increased force of myocardial contraction

ANS: B

Alpha₁ receptors are found in the eyes, blood vessels, bladder, and male reproductive organs. Stimulation of alpha₁ receptor sites results in constriction.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

8. Which side of the heart is a low-pressure system that pumps venous blood to the lungs?
- Left
 - Right

ANS: B

The job of the right side of the heart is to pump unoxygenated blood to and through the lungs to the left side of the heart. This is called the *pulmonary circulation*. The right side of the heart is a low-pressure system.

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

9. Which side of the heart is a high-pressure system that pumps arterial blood to the systemic circulation?
- Left
 - Right

ANS: A

The left side of the heart is a high-pressure pump. The job of the left heart is to receive oxygenated blood and pump it out to the rest of the body. This is called the *systemic circulation*. The left ventricle is a high-pressure chamber. Its wall is much thicker than the right ventricle (the right ventricle is 3 to 5 mm thick; the left ventricle is 13 to 15 mm thick). This is because the left ventricle must overcome a lot of pressure and resistance from the arteries and contract forcefully in order to pump blood out to the body.

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

10. The thick, muscular middle layer of the heart wall that contains the atrial and ventricular muscle fibers necessary for contraction is the _____.
- epicardium
 - pericardium
 - myocardium
 - endocardium

ANS: C

The myocardium (middle layer) is a thick, muscular layer that consists of cardiac muscle fibers (cells) responsible for the pumping action of the heart.

OBJ: Describe the structure and function of the coverings of the heart.

11. Blood flows from the right atrium through the _____ valve into the right ventricle.

- a. mitral
- b. aortic
- c. pulmonic
- d. tricuspid

ANS: D

Blood flows from the right atrium through the tricuspid valve into the right ventricle.

OBJ: Beginning with the right atrium, describe blood flow through the normal heart and lungs to the systemic circulation.

12. Rapid ejection of blood from the ventricular chambers of the heart occurs because the _____ and _____ valves open.

- a. pulmonic; aortic
- b. tricuspid; mitral
- c. pulmonic; mitral
- d. tricuspid; aortic

ANS: A

When the ventricles contract, the pulmonic and aortic valves open, allowing blood to flow out of the ventricles.

OBJ: Name and identify the location of the atrioventricular (AV) and semilunar (SL) valves.

13. The base of the heart is found at approximately the level of the _____ rib(s).

- a. first
- b. second
- c. fourth
- d. fifth and sixth

ANS: B

The base of the heart is its upper portion and is formed mainly by the left atrium, with a small amount of right atrium. It lies at approximately the level of the second rib, immediately in front of the esophagus and descending aorta.

OBJ: Identify the surfaces of the heart.

14. Which of the following are semilunar valves?

- a. Aortic and pulmonic
- b. Aortic and tricuspid
- c. Pulmonic and mitral
- d. Tricuspid and mitral

ANS: A

The pulmonic and aortic valves are semilunar (SL) valves. The semilunar valves prevent backflow of blood from the aorta and pulmonary arteries into the ventricles.

OBJ: Name and identify the location of the atrioventricular (AV) and semilunar (SL) valves.

15. Blood leaves the left ventricle through the _____ valve to the aorta and its branches and is distributed throughout the body.

- a. mitral
- b. aortic
- c. pulmonic
- d. tricuspid

ANS: B

When the left ventricle contracts, freshly oxygenated blood flows through the aortic valve into the aorta and out to the body.

OBJ: Beginning with the right atrium, describe blood flow through the normal heart and lungs to the systemic circulation.

16. Blood flows from the left atrium through the _____ valve into the left ventricle.

- a. mitral
- b. aortic
- c. pulmonic
- d. tricuspid

ANS: A

Blood flows from the left atrium through the mitral (bicuspid) valve into the left ventricle.

OBJ: Beginning with the right atrium, describe blood flow through the normal heart and lungs to the systemic circulation.

17. The right ventricle expels blood through the _____ valve into the pulmonary trunk.

- a. mitral
- b. aortic
- c. pulmonic
- d. tricuspid

ANS: C

The right ventricle expels the blood through the pulmonic valve into the pulmonary trunk. The pulmonary trunk divides into a right and left pulmonary artery, each of which carries blood to one lung (pulmonary circuit).

OBJ: Beginning with the right atrium, describe blood flow through the normal heart and lungs to the systemic circulation.

18. The primary neurotransmitters of the sympathetic division of the autonomic nervous system are _____.
a. dopamine and acetylcholine
b. muscarine and norepinephrine
c. acetylcholine and epinephrine
d. norepinephrine and epinephrine

ANS: D

When sympathetic nerves are stimulated, the neurotransmitters norepinephrine and epinephrine are released.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

19. Complete occlusion of the _____ coronary artery, also referred to as the *widow maker*, usually results in sudden death.
a. right
b. left main
c. circumflex
d. left anterior descending

ANS: B

Complete occlusion of the left main coronary artery, also referred to as the *widow maker*, usually results in sudden death.

OBJ: Name the primary branches and areas of the heart supplied by the right and left coronary arteries.

20. Stimulation of beta₂ receptor sites results in _____.
a. increased heart rate
b. peripheral vasoconstriction
c. constriction of renal blood vessels
d. relaxation of bronchial smooth muscle

ANS: D

Beta₂ receptor sites are found in the arterioles of the heart, lungs, and skeletal muscle. Stimulation results in dilation. Stimulation of beta₂ receptor sites in the smooth muscle of the bronchi results in dilation.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

21. *Chronotropy* refers to an effect on _____.
a. heart rate
b. force of contraction
c. bronchial smooth muscle
d. speed of conduction through the atrioventricular node

ANS: A

Chrono refers to rate. *Chronotropic effect* refers to a change in heart rate. *Positive chronotropic effect* refers to an increase in heart rate. *Negative chronotropic effect* refers to a decrease in heart rate.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

22. The left main coronary artery divides into the _____ branches.
a. marginal and circumflex
b. marginal and anterior descending
c. anterior and posterior descending
d. anterior descending and circumflex

ANS: D

The left main coronary artery supplies oxygenated blood to its two primary branches: the left anterior descending (LAD)(also called the *anterior interventricular*) artery and the circumflex artery (CX).

OBJ: Name the primary branches and areas of the heart supplied by the right and left coronary arteries.

23. The primary neurotransmitter of the parasympathetic division of the autonomic nervous system is _____.
a. dopamine
b. muscarine
c. acetylcholine
d. norepinephrine

ANS: C

Acetylcholine (Ach) is a chemical messenger (neurotransmitter) released when parasympathetic nerves are stimulated. Ach binds to parasympathetic receptors.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

24. The _____ artery supplies the right atrium and ventricle with blood.
a. right coronary
b. left main coronary
c. left circumflex
d. left anterior descending

ANS: A

The right coronary artery supplies the right atrium and ventricle with blood.

OBJ: Name the primary branches and areas of the heart supplied by the right and left coronary arteries.

25. The tricuspid valve is _____.
a. a semilunar valve
b. located between the left ventricle and aorta
c. located between the right atrium and right ventricle
d. located between the right ventricle and pulmonary artery

ANS: C

The tricuspid valve is located between the right atrium and right ventricle.

OBJ: Identify and describe the location of the atrioventricular (AV) and semilunar (SL) valves.

26. When the left ventricle contracts, freshly oxygenated blood flows through the _____ valve into the _____.
a. aortic; aorta
b. mitral; right atrium
c. tricuspid; right ventricle
d. pulmonic; pulmonary arteries

ANS: A

When the ventricles contract, the semilunar valves open, allowing blood to flow out of the ventricles. When the right ventricle contracts, blood that is low in oxygen flows through the pulmonic valve into the right and left pulmonary arteries. When the left ventricle contracts, freshly oxygenated blood flows through the aortic valve into the aorta and out to the body.

OBJ: Identify and describe the location of the atrioventricular (AV) and semilunar (SL) valves.

27. Thin strands of fibrous connective tissue extend from the atrioventricular (AV) valves to the papillary muscles and prevent the AV valves from bulging back into the atria during ventricular systole. These strands are called _____.
a. cardiac cilia
b. Purkinje fibers
c. papillary muscles
d. chordae tendineae

ANS: D

Chordae tendineae are thin strands of connective tissue. On one end, they are attached to the underside of the AV valves. On the other end, they are attached to small mounds of myocardium called papillary muscles. Papillary muscles project inward from the lower portion of the ventricular walls. When the ventricles contract and relax, so do the papillary muscles. The papillary muscles adjust their tension on the chordae tendineae, preventing them from bulging too far into the atria.

OBJ: Identify and describe the location of the atrioventricular (AV) and semilunar (SL) valves.

COMPLETION

1. _____ is the period during which a heart chamber is contracting and blood is being ejected.

ANS: Systole

OBJ: Identify and discuss each phase of the cardiac cycle.

2. The thick, muscular middle layer of the heart wall that contains the atrial and ventricular muscle fibers necessary for contraction is the _____.

ANS: myocardium

OBJ: Identify the three cardiac muscle layers.

3. The _____ are the heart chambers that receive blood.

ANS: atria

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

4. The inferior surface of the heart is also called the _____ surface.

ANS: diaphragmatic

OBJ: Describe the location of the heart.

5. The _____ are the heart chambers that pump blood.

ANS: ventricles

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

6. _____ is the period of relaxation during which a heart chamber is filling.

ANS: Diastole

OBJ: Identify and discuss each phase of the cardiac cycle.

7. The right atrium receives deoxygenated blood from the _____ (which carries blood from the head and upper extremities), the _____ (which carries blood from the lower body), and the _____ (which receives blood from the intracardiac circulation).

ANS: superior vena cava; inferior vena cava; coronary sinus

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

MATCHING

- a. _____ in myocardial cells function as electrical connections and allow the cells to conduct electrical impulses very rapidly.
- b. Typically results when the heart's demand for oxygen exceeds its supply from the coronary circulation
- c. Specialized nerve tissue located in the internal carotid arteries and the aortic arch that detect changes in blood pressure
- d. The _____ septum separates the right and left atria.
- e. Electrolyte very important in cardiac muscle contraction.
- f. A negative _____ effect refers to a decrease in heart rate.
- g. Space between the lungs that contains the heart, great vessels, trachea, and esophagus, among other structures
- h. Pulmonary arteries and veins, aorta, superior and inferior vena cavae
- i. Term used to refer to distinct conditions caused by a similar sequence of pathologic events—a temporary or permanent blockage of a coronary artery
- j. Amount of blood flowing into the right atrium each minute from the systemic circulation
- k. Sensors in the internal carotid arteries and aortic arch that detect changes in the concentration of hydrogen ions (pH), oxygen, and carbon dioxide in the blood
- l. A buildup of excess blood or fluid in the pericardial space can cause cardiac _____.

1. Acute coronary syndromes
2. Chronotropic
3. Tamponade
4. Great vessels
5. Gap junctions
6. Chemoreceptors
7. Interatrial
8. Mediastinum
9. Myocardial ischemia
10. Venous return
11. Baroreceptors
12. Calcium

1. ANS: I
2. ANS: F
3. ANS: L
4. ANS: H
5. ANS: A
6. ANS: K
7. ANS: D
8. ANS: G
9. ANS: B
10. ANS: J
11. ANS: C
12. ANS: E

SHORT ANSWER

1. List two factors that may affect the heart's efficiency as a pump.

ANS:

Abnormalities of cardiac muscle, the valves, or the conduction system.

OBJ: Identify and explain the components of blood pressure and cardiac output.

2. Name the valve that separates the right ventricle from the right atrium.

ANS:

Tricuspid valve

OBJ: Name and identify the location of the atrioventricular (AV) and semilunar (SL) valves.

3. Define *systole*.

ANS:

Contraction or the ejection of blood from a chamber of the heart

OBJ: Identify and discuss each phase of the cardiac cycle.

4. What is meant by the term *ejection fraction*?

ANS:

Ejection fraction is the percentage of blood pumped out of a heart chamber with each contraction. Each ventricle holds about 150 mL when it is full; they normally eject only about half this volume (70 to 80 mL) with each contraction.

OBJ: Identify and explain the components of blood pressure and cardiac output.

5. Explain the Frank-Starling law of the heart.

ANS:

According to the Frank-Starling law of the heart, to a point, the greater the volume of blood in the heart during diastole, the more forceful the cardiac contraction, and the more blood the ventricle will pump (stroke volume). This is important so that the heart can adjust its pumping capacity in response to changes in venous return, such as during exercise. If, however, the ventricle is stretched beyond its physiologic limit, cardiac output may fall because of volume overload and overstretching of the muscle fibers

OBJ: Identify and explain the components of blood pressure and cardiac output.

6. A patient has a heart rate of 80 beats/min. His stroke volume is 70 mL/beat. Is his cardiac output normal, decreased, or increased?

ANS:

Output is normal.

Stroke volume = 70 mL/beat

Heart rate = 80 beats/minute

$SV \times HR = CO$

$70 \text{ mL/beat} \times 80 \text{ beats/min} = 5600 \text{ mL/min} = 5.6 \text{ L/min}$

Cardiac output = normal (normal is between 4 and 8 L/min)

OBJ: Identify and explain the components of blood pressure and cardiac output.

7. Briefly describe parasympathetic innervation of the heart.

ANS:

Parasympathetic (inhibitory) nerve fibers supply the sinoatrial node, atrial muscle, and the atrioventricular junction of the heart by the vagus nerves.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

8. The right atrium receives blood low in oxygen from three vessels. Name them.

ANS:

Superior vena cava, inferior vena cava, and coronary sinus

OBJ: Beginning with the right atrium, describe blood flow through the normal heart and lungs to the systemic circulation.

9. List three types of sympathetic (adrenergic) receptor sites.

ANS:

There are five main types of sympathetic (adrenergic) receptors: α_1 , α_2 , β_1 , β_2 , and dopamine (or dopaminergic).

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

10. What factors affect afterload?

ANS:

Afterload is the pressure or resistance against which the ventricles must pump to eject blood. Afterload is influenced by the following: arterial blood pressure, the ability of the arteries to become stretched (arterial distensibility), and arterial resistance.

OBJ: Identify and explain the components of blood pressure and cardiac output.

11. Define *atrial kick*.

ANS:

At the end of ventricular diastole, both atria simultaneously contract to eject 10% to 30% more blood into the ventricles.

OBJ: Explain atrial kick.

12. What effects can be expected from sympathetic stimulation of the heart?

ANS:

Sympathetic stimulation of the heart results in increased heart rate, force of contraction, conduction velocity, blood pressure, and cardiac output.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

13. Describe the function of the right atrium of the heart.

ANS:

The right atrium receives deoxygenated blood from the superior vena cava (which carries blood from the head and upper extremities), the inferior vena cava (which carries blood from the lower body), and the coronary sinus (which receives blood from the intracardiac circulation). Blood passes through the tricuspid valve to the right ventricle.

OBJ: Identify and describe the chambers of the heart and the vessels that enter or leave each.

14. List six of the signs and symptoms of decreased cardiac output.

ANS:

Acute changes in blood pressure; acute changes in mental status; cold, clammy skin; color changes in the skin and mucous membranes; crackles (rales); dyspnea; dysrhythmias; fatigue; orthopnea; restlessness

OBJ: Identify and explain the components of blood pressure and cardiac output.

15. What effects can be expected from parasympathetic stimulation of the heart?

ANS:

Parasympathetic stimulation has the following actions: it slows the rate of discharge of the SA node, slows conduction through the AV node, decreases the strength of atrial contraction, and can cause a small decrease in the force of ventricular contraction.

OBJ: Compare and contrast the effects of sympathetic and parasympathetic stimulation of the heart.

16. What factors affect stroke volume?

ANS:

Stroke volume is determined by the degree of ventricular filling when the heart is relaxed (preload), the pressure against which the ventricle must pump (afterload), and the myocardium's contractile state (contracting or relaxing).

OBJ: Identify and explain the components of blood pressure and cardiac output.

17. Your patient is a 62-year-old woman complaining of a "racing heart." Your examination of the patient reveals a pulse rate of 192 beats/min. Briefly explain why recognition of a rapid heart rate is important when providing patient care.

ANS:

Increases in heart rate shorten all phases of the cardiac cycle. The most important is that the time the heart spends relaxing is less. If the length of time for ventricular relaxation is shortened, there is less time for them to fill adequately with blood. If the ventricles do not have time to fill, the following occur: the amount of blood sent to the coronary arteries is reduced, the amount of blood pumped out of the ventricles will decrease (cardiac output), and signs of myocardial ischemia may be seen.

OBJ: Identify and explain the components of blood pressure and cardiac output.

18. Name the two main branches of the left coronary artery.

ANS:

The left main coronary artery supplies oxygenated blood to its two primary branches: the left anterior descending (LAD; also called the *anterior interventricular*) artery and the circumflex artery (CX).

OBJ: Name the primary branches and areas of the heart supplied by the right and left coronary arteries.