14 test bank - Cardiovascular Physiology MCQ test bank with answers

Human Body Systems (University of Saskatchewan)

Human Physiology: An Integrated Approach, 7e, **(Silverthorn)**
Chapter 14 Cardiovascular Physiology

1) In the 16th century, William Harvey discovered evidence that
A) the cardiovascular system transports blood and air.
B) the cardiovascular system is an open system.
C) arteries and veins are linked by capillaries.
D) blood is recirculated instead of consumed.
E) the liver manufactures blood.
Answer: D
Section: Overview of the Cardiovascular System
Learning Outcome: 14.1
Bloom's Taxonomy: Knowledge

2) Capillaries are best described as
A) microscopic vessels in which blood exchanges material with the interstitial fluid.
B) thick walled vessels that convey blood away from the heart.
C) thin walled vessels that convey blood toward the heart.
D) thick walled vessels that carry blood rich in oxygen.
E) thin walled vessels that carry blood deficient in oxygen.
Answer: A
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

3) The most accurate definition of *artery* is a vessel that
A) carries highly oxygenated blood.
B) contains smooth muscle in its wall.
C) transports blood away from the heart.
D) transports blood toward the heart.
E) contains internal valves.
Answer: C
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

4) The purpose of having valves in the cardiovascular system is to
A) provide sounds so that heart health can be monitored.
B) ensure that blood flows in one direction.
C) prevent blood from flowing too quickly.
D) regulate blood pressure.
E) provide the force for circulation.
Answer: B
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

5) Which organ is NOT known to include a special portal system for blood?
A) heart
B) kidney
C) liver
D) brain
E) All of these organs have portal systems.
Answer: A
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

6) Which artery/arteries branch(es) is/are most proximal to the beginning of the aorta at the heart?
A) hepatic
B) renal
C) coronary
D) carotid
E) pulmonary
Answer: C
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

7) The hepatic portal vein carries blood away from the
A) digestive tract.
B) liver.
C) kidneys.
D) spleen.
E) pancreas.
Answer: A
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

8) The driving force for blood flow is a(n) _____ gradient.
A) osmotic
B) volume
C) pressure
D) gravity
Answer: C
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Knowledge

9) Which of the following statements about hydrostatic pressure is NOT true?
A) If a fluid is not moving, the pressure that it exerts is called hydrostatic pressure.
B) Force is not equal in all directions.
C) The lateral pressure component of moving fluid represents the hydrostatic pressure.
D) Hydrostatic pressure does not include the dynamic component of a moving fluid.
E) All of the statements are true.
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Comprehension

10) Each of the following changes will result in increased blood flow to a tissue EXCEPT one. Identify the exception.
A) increased blood volume
B) decreased vessel diameter
C) increased blood pressure
D) decreased peripheral resistance
E) relaxation of precapillary sphincters
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Comprehension

11) Which parameters are associated with increased resistance?
A) reduced flow
B) reduced friction
C) increased blood vessel diameter
D) decreased viscosity
E) decreased length
Answer: A
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Knowledge

12) As blood vessel length increases,
A) resistance increases only.
B) flow decreases only.
C) friction decreases only.
D) resistance increases and flow decreases.
E) both resistance and flow increase.
Answer: D
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Knowledge

13) Which of the following will increase flow in a vessel the most?
A) decrease length by 1 unit
B) increase radius by 1 unit
C) decrease viscosity by 1 unit
D) All have the same effect on flow.
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Comprehension

14) When a quantity is expressed as "4 cm/sec," what is being described is the
A) flow rate.
B) velocity of flow.
C) pressure.
D) pressure gradient.
E) volume.
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Knowledge

15) The sac around the heart is the
A) peritoneum.
B) pleural sac.
C) pericardium.
D) myocardium.
E) epicardium.
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

16) The function of the pericardial fluid is to
A) provide oxygen to the heart.
B) reduce friction between the heart and the pericardium.
C) provide fuel to the heart.
D) remove waste products from the heart.
E) store calcium for the heart.
Answer: B
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

17) At an intercalated disc,
A) the cell membranes of two cardiac muscle fibers are completely separated by a synapse.
B) the myofibrils are loosely attached to the membrane of the disc.
C) two cardiac muscle cells are connected by gap junctions.
D) t-tubules unite the membranes of the adjoining cells.
E) All of the answers are correct.
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.5
Bloom's Taxonomy: Knowledge

18) In the heart, valves are located
A) just between the atria and the ventricles.
B) just between the ventricles and the arteries.
C) just between the great veins and the atria.
D) between atria and ventricles and between ventricles and arteries.
E) just between the right and left ventricles.
Answer: D
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

19) Which valves have chordae tendineae?
A) aortic and pulmonary valves
B) bicuspid (mitral) and tricuspid valves
C) valves in veins
D) semilunar valves
E) coronary valves
Answer: B
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

20) The term *myogenic* indicates that the heart muscle is the source of
A) the contractile force for pumping.
B) a hormone that indirectly regulates blood volume.
C) the electrical signal that triggers heart contraction.
D) receptors that trigger blood pressure reflexes.
E) stem cells that repair damaged heart tissue.
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Knowledge

21) The action potential in a cardiac contractile cell causes
A) opening of L-type calcium channels.
B) opening of ryanodine receptor calcium channels.
C) activation of sodium-potassium ATPase.
D) activation of NCX transporters.
E) opening of HCN channels.
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Knowledge

22) Stretching a myocardial cell
A) only decreases the force of a contraction.
B) only allows more Ca^{2+} to enter.
C) only increases the force of contraction.
D) decreases the force of a contraction and allows more Ca^{2+} to enter.
E) allows more Ca^{2+} to enter and increases the force of a contraction.
Answer: E
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

23) The rapid depolarization phase of the action potentials of myocardial contractile cells is due to which ion(s)?
A) Ca^{2+} only
B) K^{+} only
C) Na^{+} only
D) both $Ca2^{+}$ and K^{+}
E) both Na^{+} and K^{+}
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Knowledge

24) During the plateau phase of the action potentials of myocardial contractile cells, which ion(s) is/are crossing the membrane?
A) Ca^{2+} only
B) K^{+} only
C) Na^{+} only
D) both $Ca2^{+}$ and K^{+}
E) both Na^{+} and K^{+}
Answer: D
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Knowledge

25) The flattening of the action potentials of myocardial contractile cells, called the plateau phase, is due to a combination of _____ K^+ permeability and _____ Ca^{2+} permeability.
A) increasing, increasing
B) decreasing, decreasing
C) increasing, decreasing
D) decreasing, increasing
Answer: D
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Knowledge

26) The action potentials of myocardial autorhythmic cells, are due to a combination of increasing Na^{2+} _____ and decreasing K^+ _____.
A) influx, efflux
B) efflux, influx
C) influx, influx
D) efflux, efflux
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Knowledge

27) The end of the plateau phase is due to the _____ of Ca^{2+} channels and _____ of K^+ channels.
A) opening, opening
B) closing, closing
C) opening, closing
D) closing, opening
Answer: D
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Knowledge

28) A typical action potential of a myocardial contractile cell lasts _____ millisecond(s).
A) less than 1
B) 1-5
C) 50-100
D) at least 200
E) at least 500
Answer: D
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Knowledge

29) The importance of the plateau phase of the action potential of myocardial cells is in
A) preventing overstretching of the cells.
B) enhancing the efficiency of oxygen use by the cells.
C) preventing tetanus.
D) preventing fibrillation.
E) regulating Ca^{2+} availability to the cells.
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

30) Myocardial cells can generate action potentials spontaneously because they have
A) unstable ion channels.
B) permanently open channels for Na^+ and K^+.
C) a net influx of Na^+.
D) L-type Ca^{2+} channels.
E) prolonged Ca^{2+} influx.
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Knowledge

31) I_f channels are permeable to
A) Na^+ only.
B) K^+ only.
C) Ca^{2+} only.
D) Na^+ and K^+.
E) Ca^{2+} and K^+.
Answer: D
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Knowledge

32) Autorhythmic cells
A) are also called pacemakers because they set the rate of the heartbeat.
B) are the same size as myocardial contractile cells.
C) have organized sarcomeres.
D) contribute to the force of contraction.
E) None of the answers are correct.
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.5
Bloom's Taxonomy: Knowledge

33) The depolarization of the pacemaker action potential spreads to adjacent cells through
A) gap junctions.
B) tight junctions.
C) chemical synapses.
D) desmosomes.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.5
Bloom's Taxonomy: Knowledge

34) The fibrous skeleton of the heart is important because it
A) forces electrical activity to be conducted through the atrioventricular node.
B) transmits electrical activity from the atria to the ventricles.
C) helps guide the blood into the proper chambers in sequence.
D) directs the flow of blood into the arteries.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Knowledge

35) The AV node is important because it
A) directs electrical impulses from the ventricles to the atria.
B) delays the transmission of the electrical impulses to the ventricles in order for the atria to finish contracting.
C) serves as the pacemaker in a normal heart.
D) electrically opens the AV valves.
E) None of these answers are correct.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Comprehension

36) The medical term for heart attack is
A) heart failure.
B) myocardial infarction.
C) heart murmur.
D) fibrillation.
E) heart block.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Knowledge

37) In the condition known as complete heart block, what happens?
A) Coronary arteries are blocked by plaques, preventing blood and oxygen from reaching the myocardial contractile cells.
B) Electrical signals from the SA node never reach the ventricles, so the contraction of the atria is not coordinated with the contraction of the ventricles.
C) The fibrous skeleton of the heart breaks down, interfering with the passage of blood from the atria to the ventricles.
D) The mitral valve leaflets calcify and close, preventing blood from being pumped efficiently by the left side of the heart.
E) Blood flow through the foramen ovale is blocked.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Comprehension

38) When the heart is in fibrillation,
A) the myocardial cells may become damaged from contracting too fast.
B) the myocardial cells deplete their oxygen supply because they are contracting too fast, and the lactic acid produced damages the myocardial cells.
C) effective pumping of the ventricles ceases because the myocardial cells fail to work as a team, and the brain cannot get adequate oxygen.
D) the myocardial cells are contracting together as they should; fibrillation indicates a normal sinus rhythm of 75 beats per minute.
E) there is no contraction of the myocardium.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Comprehension

39) Electrical shock to the heart is usually used to treat
A) ventricular fibrillation.
B) atrial fibrillation.
C) heart block.
D) heart murmur.
E) myocardial infarction.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Knowledge

40) ECGs
A) provide direct information about the heart function.
B) are most useful in diagnosing heart murmurs.
C) show the summed electrical potentials generated by all cells of the heart.
D) have two major components: waves and nodes.
E) measure the mechanical activity of the heart.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Comprehension

41) The P wave of an ECG corresponds to
A) the depolarization of the atria.
B) the progressive wave of ventricular depolarization.
C) the repolarization of the ventricles.
D) atrial repolarization.
E) None of the answers are correct.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

42) The QRS complex of an ECG corresponds to
A) the depolarization of the atria.
B) the progressive wave of ventricular depolarization.
C) the repolarization of the ventricles.
D) atrial repolarization.
E) None of the answers are correct.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

43) A heart rate of 125 beats per minute could be correctly termed
A) bradycardia.
B) tachycardia.
C) an arrhythmia.
D) fibrillation.
E) a normal resting heart rate.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

44) Ventricular contraction
A) begins during the first part of the P wave.
B) begins just after the T wave.
C) begins just after the Q wave.
D) begins during the latter part of the P wave.
E) None of the answers are correct.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

45) Atrial contraction
A) begins during the first part of the P wave.
B) begins just after the T wave.
C) begins just after the Q wave.
D) begins during the latter part of the P wave.
E) None of the answers are correct.
Answer: D
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

46) In electrocardiography, a lead is a(n)
A) electrode.
B) pair of electrodes.
C) cable that attaches between the ECG machine and the body.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

47) Which event happens at the start of a cardiac cycle?
A) Blood is ejected from the atrium.
B) The SA node fires.
C) The P wave develops.
D) Ventricular systole occurs.
E) Atrial systole occurs.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Comprehension

48) In order for blood to enter the heart,
A) the atria must be in diastole.
B) the pressure in the atria must be lower than in the veins.
C) the AV valves must be open.
D) the atria must not only be at rest but the atrial pressure must be lower than the veins.
E) All of the answers are correct.
Answer: D
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

49) Which of the following events result in the first heart sound?
A) The AV valves open.
B) The AV valves close.
C) The semilunar valves close.
D) The semilunar valves open.
E) The atria contract.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

50) During the isovolumic phase of ventricular systole,
A) the atria contract.
B) the atrioventricular valves and semilunar valves are closed.
C) blood is ejected into the great vessels.
D) the ventricles are relaxing.
E) the ventricles are filling with blood.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Comprehension

51) During the cardiac cycle,
A) the P wave of the ECG occurs between the first and second heart sounds.
B) the QRS complex of the ECG precedes the increase in ventricular pressure.
C) the third heart sound occurs during atrial systole.
D) the second heart sound coincides with the QRS complex of the ECG.
E) the greatest increase in ventricular pressure occurs during the ejection phase.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Comprehension

52) During ventricular systole,
A) the atria are contracting.
B) blood is entering the ventricles.
C) the AV valves are closed.
D) the pressure in the ventricles declines.
E) the ventricles are relaxed.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Comprehension

53) During ventricular ejection,
A) the ventricles are in systole.
B) the QRS complex is just starting.
C) the semilunar valves are closed.
D) the AV valves are open.
E) blood is forced into veins.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

54) The term used to describe the amount of blood in the ventricle available to be pumped out of the heart during the next contraction is
A) cardiac output (CO).
B) heart rate (HR).
C) end-diastolic volume (EDV).
D) stroke volume (SV).
E) end-systolic volume (ESV).
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Knowledge

55) The volume of blood ejected from each ventricle during a contraction is called the
A) end-diastolic volume.
B) end-systolic volume.
C) stroke volume.
D) cardiac output.
E) cardiac reserve.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Knowledge

56) The cardiac output is equal to
A) the difference between the end-diastolic volume and the end-systolic volume.
B) the product of heart rate and stroke volume.
C) the difference between the stroke volume at rest and the stroke volume during exercise.
D) the stroke volume less the end-systolic volume.
E) the product of heart rate and blood pressure.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Knowledge

57) The term that describes the volume of blood circulated by the heart in one minute is
A) cardiac output (CO).
B) heart rate (HR).
C) end-diastolic volume (EDV).
D) stroke volume (SV).
E) end-systolic volume (ESV).
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Knowledge

58) Epinephrine and norepinephrine increase ion flow through _____ channels.
A) Na^+ only
B) K^+ only
C) Ca^{2+} only
D) I_f only
E) I_f and Ca^{2+}
Answer: E
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Knowledge

59) According to Starling's law of the heart, the cardiac output is directly related to the
A) size of the ventricle.
B) heart rate.
C) venous return.
D) thickness of the myocardium.
E) end-systolic volume.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.13
Bloom's Taxonomy: Comprehension

60) Which of these will increase the heart rate?
A) only sympathetic stimulation to the SA node
B) only the application of epinephrine to the SA node
C) only the application of acetylcholine to the SA node
D) both sympathetic stimulation and application of epinephrine to the SA node
E) both sympathetic stimulation and application of acetylcholine to the SA node
Answer: D
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

61) Stimulation of the beta receptors on heart muscle results in
A) the formation of cAMP.
B) decreased rate of contraction.
C) decreased force of cardiac contraction.
D) increased sensitivity to acetylcholine.
E) All of the answers are correct.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Knowledge

62) Drugs known as beta blockers will
A) increase heart rate.
B) decrease heart rate.
C) increase stroke volume.
D) increase cardiac output.
E) decrease the end-systolic volume.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Knowledge

Match the following terms to the correct answer:

A. tricuspid valve
B. bicuspid valve
C. aortic valve
D. pulmonary valve

63) an AV valve that has three flaps
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

64) a semilunar valve that has the right ventricle on one side
Answer: D
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

65) also called the mitral valve
Answer: B
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

66) has three cuplike leaflets and has the aorta on one side
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

Match the name of the wave with the correlated event.

A. P wave
B. QRS complex
C. T wave
D. PR segment
E. ST segment

67) immediately followed by ventricular contraction
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

68) atrial contraction
Answer: D
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

69) ventricular repolarization
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

70) ventricular depolarization
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

71) atrial depolarization
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

Match each term with its definition.

A. cardiac output (CO)
B. heart rate (HR)
C. end-diastolic volume (EDV)
D. stroke volume (SV)
E. end-systolic volume (ESV)

72) the amount of blood pumped out of the heart during one contraction
Answer: D
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

73) the amount of blood in the ventricle available to be pumped out of the heart during one contraction
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

74) the volume of blood circulated by the heart in one minute
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

75) the amount of blood left in the ventricle after it contracts
Answer: E
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

76) The chambers of the heart that pump blood into the arteries are the _____.
Answer: ventricles
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

77) The chambers of the heart that receive blood from the veins are the _____.
Answer: atria
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

78) The primary function of the cardiovascular system is _____.
Answer: to transport material to and from all parts of the body
Section: Overview of the Cardiovascular System
Learning Outcome: 14.1
Bloom's Taxonomy: Knowledge

79) _____ are blood vessels that carry blood away from the heart.
Answer: Arteries
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

80) _____ are blood vessels that carry blood toward the heart.
Answer: Veins
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

81) The cardiovascular system is made up of _____, _____, and _____.
Answer: the heart, blood vessels, blood (Answers can be in any order.)
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

82) The most proximal arteries to branch from the aorta are the _____.
Answer: coronary arteries
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

83) Name the three portal systems in the body.
Answer:
1. hepatic portal system
2. renal portal system
3. hypothalamic-hypophyseal portal system
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

84) The _____ circuit carries blood to and from the alveoli of the lungs.
Answer: pulmonary
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

85) The _____ circuit carries blood to and from all parts of the body except the alveoli of the lungs.
Answer: systemic
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Knowledge

86) The pressure created in the ventricles is called the _____ pressure because _____.
Answer: driving, it is the force that drives blood through the blood vessels
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Knowledge

87) The term for reduced blood flow to the cardiac muscle is _____.
Answer: coronary ischemia
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

88) The _____ directs blood from the _____ of the heart to the lungs. Backflow of blood to the heart is prevented by _____. Blood from the lungs returns to the heart via _____.
Answer: pulmonary trunk, right ventricle, pulmonary valves, pulmonary veins
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.2
Bloom's Taxonomy: Comprehension

89) The heart is enclosed in the _____.
Answer: pericardial membrane
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

90) The superior portion of the heart where the major blood vessels enter and exit is the _____.
Answer: base
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

91) The inferior point of the heart is called the _____.
Answer: apex
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

92) The _____ is a wall that separates the two sides of the heart.
Answer: septum
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

93) The muscle layer of the heart wall is the _____.
Answer: myocardium
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

94) The heart is encased in a tough membranous sac called the _____. The heart is composed mostly of _____ muscle tissue, called the _____.
Answer: pericardium, cardiac, myocardium
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

95) The opening between each atrium and its ventricle is guarded by the _____, which connects the ventricular side to collagenous tendons, called _____. _____ muscles provide stability for these tendons.
Answer: atrioventricular valve, chordae tendineae, Papillary
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Knowledge

96) Cell junctions in contractile cells are called _____, which consist of two components: _____ and _____.
Answer: intercalated disks, desmosomes, gap junctions
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.5
Bloom's Taxonomy: Knowledge

97) The _____ are calcium channels in cardiac contractile cells. Opening them causes _____.
Answer: ryanodine receptors, calcium-induced calcium release
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Knowledge

98) The AV node delays the transmission of action potentials slightly to allow _____.
Answer: the atria to complete their contraction before ventricular contraction begins
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Comprehension

99) The cells responsible for establishing the rate of a cardiac contraction are the _____.
Answer: nodal cells
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Knowledge

100) A heart with cells contracting rapidly in a disorganized manner, with no effective pumping action, is said to be in _____.
Answer: fibrillation
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

101) A tracing of the electrical activity of the heart, monitored by electrodes placed on the skin, is called a(n) _____.
Answer: electrocardiogram
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

102) The period of time from the beginning of one heartbeat to the beginning of the next is termed the _____.
Answer: cardiac cycle
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

103) Abnormal patterns of cardiac activity are known as _____.
Answer: arrhythmias
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

104) A resting heart rate of less than 60 beats per minute is identified as _____.
Answer: bradycardia
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

105) A resting heart rate above 100 beats per minute is identified as _____.
Answer: tachycardia
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Knowledge

106) An increase in blood vessel diameter is known as _____.
Answer: vasodilation
Section: The Heart as a Pump
Learning Outcome: 14.3
Bloom's Taxonomy: Knowledge

107) The contraction phase of the cardiac cycle is termed _____.
Answer: systole
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

108) The period when blood is pushed into the arteries is called _____.
Answer: ventricular ejection
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

109) Listening to the heart through the chest wall is called _____.
Answer: auscultation
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

110) Narrowing of the opening of a heart valve is referred to as _____.
Answer: stenosis
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Knowledge

111) The _____ is the amount of blood in a ventricle at the beginning of systole.
Answer: end-diastolic volume
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Knowledge

112) The _____ is the amount of blood in a ventricle after it has contracted and before it begins to refill.
Answer: end-systolic volume
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Knowledge

113) The rule that states "Within limits, the heart pumps all of the blood that returns to it" is known as the _____.
Answer: Frank-Starling Law of the Heart
Section: The Heart as a Pump
Learning Outcome: 14.13
Bloom's Taxonomy: Knowledge

114) The amount of blood returning to the heart is the _____.
Answer: venous return
Section: The Heart as a Pump
Learning Outcome: 14.3
Bloom's Taxonomy: Knowledge

115) Place these structures in the order that blood returning to the heart from the body would pass through them.
1. right ventricle
2. left atrium
3. right atrium
4. pulmonary artery
5. left ventricle
6. pulmonary vein
A) 4, 2, 5, 6, 3, 1
B) 2, 5, 6, 4, 3, 1
C) 3, 1, 4, 6, 2, 5
D) 1, 3, 6, 4, 5, 2
E) 3, 2, 4, 6, 1, 5
Answer: C
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Application

116) If blood pressure doubled at the same time that the peripheral resistance doubled, the blood flow through a vessel would be
A) doubled.
B) halved.
C) 16 times greater.
D) 1/16 as much.
E) unchanged.
Answer: E
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Application

117) Which of the following conditions would have the greatest effect on peripheral resistance?
A) doubling the length of a vessel
B) doubling the diameter of a vessel
C) doubling the viscosity of the blood
D) doubling the turbulence of the blood
E) doubling the number of white cells in the blood
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Comprehension

118) Which statement is NOT true regarding cardiac muscle?
A) Cardiac muscle cells must obey the all-or-none law of contraction.
B) Cardiac muscle cells rely on a sarcoplasmic reticulum for storage of Ca^{2+} ions.
C) Calcium-induced calcium release is the process by which extracellular Ca^{2+} triggers the release of stored Ca^{2+} from the sarcoplasmic reticulum.
D) Intercalated disks contain both desmosomes for firm attachment and gap junctions to allow communication.
E) The oxygen demand of cardiac muscle cells is high because they have many mitochondria.
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

119) If the membranes of the cardiac muscle cells in the SA node become more permeable to potassium ions,
A) the heart rate will increase.
B) the heart rate will decrease.
C) the membrane will depolarize.
D) the stroke volume will increase.
E) the intracellular concentration of calcium ion will increase.
Answer: B
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

120) As a result of the long refractory period, cardiac muscle cannot exhibit
A) tonus.
B) treppe.
C) tetany.
D) recruitment.
E) fatigue.
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

121) Ivabrandine selectively blocks I_f channels in the heart. Which statement would be true concerning a patient who is taking this drug?
A) The drug would slow down this individual's heart rate.
B) This patient must have been suffering from bradycardia.
C) This drug would decrease contractility of the patient's heart.
D) This drug would raise the blood pressure of the patient.
E) The amount of calcium entering the patient's heart cells would increase.
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

122) Put these autorhythmic cells into the correct order for conveying electrical signals through a normal heart.
1. bundle of His
2. internodal pathway
3. Purkinje fibers
4. atrioventricular node
5. sinoatrial nodes
6. left and right bundle branches
A) 5, 2, 1, 6, 4, 3
B) 5, 2, 4, 1, 6, 3
C) 4, 2, 5, 1, 6, 3
D) 3, 6, 1, 4, 2, 5
E) 5, 4, 1, 6, 2, 3
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Application

123) The ECG of a person suffering from complete heart block would show
A) an increased PR interval.
B) an inverted P wave.
C) no visible T wave.
D) a smaller QRS complex.
E) more P waves than QRS complexes per minute.
Answer: E
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Comprehension

124) If the connection between the AV node and bundle of His becomes blocked,
A) the ventricles will beat faster.
B) the ventricles will beat more slowly.
C) the ventricular rate of contraction will not be affected.
D) the stroke volume will increase.
E) tachycardia will occur.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Comprehension

125) If a myocardial infarction results in the formation of scar tissue along the pathway of the left bundle branch,
A) cardiac arrhythmias may occur.
B) blood flow to the lungs will decrease.
C) the ventricle will contract more forcefully.
D) conduction through the left ventricle would remain normal.
E) the right ventricle will fail to contract.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Application

126) Abnormally slow conduction through the ventricles would change the _____ in an ECG tracing.
A) P wave
B) T wave
C) QRS complex
D) PR interval
E) RT interval
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Comprehension

127) If there is a blockage between the AV node and the AV bundle, how will this affect the appearance of the electrocardiogram?
A) The PR interval will be smaller.
B) The QRS interval will be longer.
C) There will be more P waves than QRS complexes.
D) There will be more QRS complexes than P waves.
E) The T wave will disappear.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Application

128) Put these phases of the cardiac cycle in the correct order.
1. opening of the semilunar valves
2. isovolumic contraction
3. beginning of atrial systole
4. closure of the AV valves
5. completion of ventricular filling
6. beginning of ventricular systole
7. ventricular relaxation
8. ventricular ejection
A) 4, 5, 1, 2, 7, 8, 3, 6
B) 3, 2, 6, 1, 4, 5, 8, 7
C) 3, 5, 6, 4, 2, 1, 8, 7
D) 3, 5, 6, 1, 8, 4, 2, 7
E) 3, 2, 6, 4, 5, 8, 7, 1
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Application

129) Left ventricular pressure is higher than pressure in the aorta during
A) atrial systole only.
B) ventricular diastole only.
C) ventricular systole only.
D) atrial systole and ventricular systole.
E) All of the answers are correct.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Comprehension

130) In which of the following situations would the end-systolic volume (ESV) be the greatest?
A) when sympathetic stimulation of the heart is increased
B) when parasympathetic stimulation of the heart is increased
C) when the force of myocardial contraction is increased
D) when the intracellular stores of calcium are increased
E) when stroke volume is increased
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Application

131) If the EDV is 140 mL, which other values are most likely to occur in a healthy, normal person?
A) The ESV could be 70 mL and the SV could be 90 mL.
B) The ESV could be 90 mL and the SV could be 50 mL.
C) The ESV could be 50 mL and the SV could be 90 mL.
D) The cardiac output could be 90 mL.
E) Diastolic pressure would be equal to EDV.
Answer: C
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Application

132) A certain drug decreases heart rate by producing hyperpolarization in the pacemaker cells of the heart. This drug probably binds to
A) nicotinic receptors.
B) muscarinic receptors.
C) alpha adrenergic receptors.
D) beta receptors.
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

133) Under which set of circumstances would the diameter of peripheral blood vessels be the greatest?
A) increased sympathetic stimulation
B) decreased sympathetic stimulation
C) increased parasympathetic stimulation
D) decreased parasympathetic stimulation
E) both increased parasympathetic and increased sympathetic stimulation
Answer: B
Section: The Heart as a Pump
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

134) Acetylcholine slows the heart rate by
A) just increasing ion influx, thus increasing the rate of depolarization.
B) just increasing the permeability to Ca^{2+}.
C) just increasing the permeability to K^{+}.
D) just decreasing the permeability to Ca^{2+}.
E) increasing the permeability to K^{+} and decreasing the permeability to Ca^{2+}.
Answer: E
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

135) Sympathetic stimulation increases the heart rate by
A) just increasing ion influx, thus increasing the rate of depolarization.
B) just increasing the permeability to Ca^{2+}.
C) just increasing the permeability to K^{+}.
D) just decreasing the permeability to Ca^{2+}.
E) increasing the permeability to K^{+} and decreasing the permeability to Ca^{2+}.
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

136) In which situation would the stroke volume be the greatest?
A) when venous return is increased
B) when venous return is decreased
C) when the force of contraction is decreased
D) when the difference between the end-diastolic volume and the end-systolic volume is small
E) when calcium channel blockers are present
Answer: A
Section: The Heart as a Pump
Learning Outcome: 14.13
Bloom's Taxonomy: Application

137) Manganese ions block the calcium channels in the cardiac muscle membrane. How would the presence of manganese in the extracellular fluid affect the contraction of the heart muscle?
A) The plateau phase of contraction would be longer.
B) The refractory period would be shorter.
C) The heart would beat less forcefully.
D) The heart rate would increase.
E) The contraction phase would be prolonged.
Answer: C
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Application

138) Drugs known as calcium channel blockers can be used to
A) decrease the force of cardiac contraction.
B) increase blood pressure.
C) constrict the coronary arteries.
D) increase sympathetic stimulation of the myocardium.
E) increase stroke volume.
Answer: A
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Application

Match the change with the cardiovascular event described.

A. increased
B. decreased
C. unchanged
D. stopped

139) The blood pressure in a vessel is 10 units at point A and 10 units at point B. Flow between those points is _____.
Answer: D
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

140) The blood pressure in a vessel is 20 units at point A and 10 units at point B. One minute later, the pressure is 15 units at point A and five units at point B. Flow between those points is _____.
Answer: C
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

141) Joey develops a medical condition that decreases his blood viscosity. Assuming no other change (e.g., no compensatory reflex), what happens to his blood pressure?
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

142) When a blood vessel dilates, resistance through that vessel is _____.
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

143) When a blood vessel dilates, blood viscosity is _____.
Answer: C
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

144) You suck milk through a 6-inch straw and through a 10-inch straw; the diameters are identical. Resistance is _____ in the 10-inch straw compared to the 6-inch straw.
Answer: A
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

145) When a blood vessel dilates, velocity of blood is _____.
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

146) Blood pressure decreases during sleep. How does this affect velocity?
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

147) During fasting, some capillary beds in the digestive tract are closed and therefore have no blood flow. Others are open to meet the minimal need of the tract for blood flow. During eating and as long as food is present in the tract, all capillary beds open to flow. What happens to total cross-sectional area of vessels in the digestive tract?
Answer: A
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

148) If total cross-sectional area of blood vessels in an organ increases, what happens to velocity of blood through that organ?
Answer: B
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

149) If total cross-sectional area of vessels in an organ remains the same but blood flow to that organ increases, what happens to velocity of blood?
Answer: A
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

150) In the autorhythmic cells, the _____ channels open when the cell membrane potential is -60 mV. These channels are permeable to _____ and _____.
Answer: I_f, K^+, Na^+
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

151) The resting membrane potential is _____ for skeletal muscle and _____ for contractile myocardium. It is _____ for autorhythmic myocardium.
Answer: -70 mV, - 90 mV, an unstable pacemaker potential (usually starts at -60 mV)
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

152) The rising phase of the action potential is a result of _____ for skeletal muscle, _____ for contractile myocardium, and _____ for autorhythmic myocardium.
Answer: Na^+ entry, Na^+ entry, calcium entry
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

153) The duration of the action potential is _____ in contractile myocardium, _____ in autorhythmic contractile, and _____ in skeletal muscle.
Answer: extended: 200+ msec, variable: generally 150+ msec, short: 1-2 msec
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

154) Sympathetic stimulation to the pacemaker cells _____ heart rate by _____ ion flow through _____ and _____ channels.
Answer: increases, increasing, I_f, calcium
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

155) List and explain the three types of substances transported by the blood. What is the source of each type?
Answer: Nutrients, water, and gases from the external environment, substances moving from cell to cell, and waste products to be eliminated from the body. Nutrients and water are absorbed from the digestive tract, gases are absorbed from the lungs, cells secrete substances such as hormones to communicate with other cells, and cells produce waste products as a consequence of metabolism.
Section: Overview of the Cardiovascular System
Learning Outcome: 14.1
Bloom's Taxonomy: Comprehension

156) What are the primary components of a cardiovascular system? What diffusion-related problem is solved by having a cardiovascular system?
Answer: Primary components are the heart (a pump), the blood, and the vessels, which include arteries, capillaries, and veins. The cardiovascular system solves the problem of inefficient diffusion over large distances by providing a force for the blood and a system of vessels leading to capillaries, which are distributed at a high density throughout all the organs. No living cell is more than a short distance from a capillary.
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Comprehension

157) Explain what a portal system is and give an example. How is a portal system different from the typical arrangement of vessels?
Answer: A portal system is a special circulation in which a capillary bed connects to another capillary bed before returning to the general circulation. An example is the hepatic portal system, in which capillaries of the digestive tract are connected to capillaries of the liver by way of the hepatic portal vein. Typically blood in a capillary bed flows through the venous system and back to the heart.
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Comprehension

158) Veins are said to carry deoxygenated blood. Does this mean that there is no oxygen in venous blood? Explain your answer. Are there veins that carry highly oxygenated blood? Again, explain your answer. What color is most venous blood compared to most arterial blood?
Answer: Venous blood has some oxygen, but usually less that arterial blood, so it is only relatively deoxygenated. Pulmonary veins are an example of veins carrying highly oxygenated blood. Venous blood is usually dark red, arterial blood is usually bright red.
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Comprehension

159) Distinguish between blood flow rate and blood flow velocity. When an expert in the field uses the term *blood flow,* does that term usually mean rate or velocity?
Answer: Flow rate is the volume of blood passing by a point per unit time. Velocity is how quickly a given amount of blood passes a point per unit time. Flow rate is usually what the expert is discussing.
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Comprehension

160) Discuss the attachments between adjacent cardiac muscle cells. What features are important anatomically and physiologically? Is there a disadvantage to this arrangement?
Answer: Cardiac muscle cells are joined by structures called intercalated disks. Abutting cells both have desmosomes, to tightly hold the cells together to withstand the physical force of contraction, and gap junctions, which act as tiny tunnels for ions to cross between cells. In this way, action potentials flow across cardiac muscle cells without disruption, as if the cells were one. One disadvantage of gap junctions is that they can be shut down, promoting fibrillation, which occurs when the cardiac muscle cells contract independently. Rather than producing useful pumping, the heart is only quivering as the teamwork of these millions of cells ceases.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Comprehension

161) What are ryanodine receptors? What type of tissue are they present in? Are all ryanodine receptors regulated in the same way? Explain your answer.
Answer: Ryanodine receptors are calcium channels, present in cardiac and skeletal muscle tissue. In cardiac muscle they are regulated by calcium, resulting in calcium-induced calcium release from the SR. In skeletal muscle, they are regulated by mechanical linkage to voltage-sensing receptors in SR, thus they are indirectly voltage-regulated.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

162) Explain how Ca^{2+} levels inside myocardial cells are altered.
Answer: Calcium enters the cell through voltage-gated calcium channels in the cell membrane. Calcium ions then open ryanodine receptor channels in the sarcoplasmic reticulum, resulting in calcium-induced calcium release. Calcium ions are transported back into the SR by a calcium ATPase, or removed from the cell by a sodium-calcium antiport protein.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

163) Draw a diagram of the excitation-contraction coupling and relaxation in cardiac muscles.
Answer: See Figure 14.9 in the chapter.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

164) Explain why a heart can keep beating after it has been removed from a living body.
Answer: Heart tissue is autorhythmic; thus it does not require stimulation by nerves.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.5
Bloom's Taxonomy: Comprehension

165) Compare and contrast the appearance of cardiac muscle cells and skeletal muscle cells under the microscope. Continue with an explanation of their similarities and differences in the initiation of their excitation-contraction coupling mechanisms. Finally, end your discussion by comparing their metabolic needs.
Answer: See Table 14.3 in the chapter.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

166) Compare and contrast cardiac muscle and skeletal muscle.
Answer: See the "Cardiac Muscle and the Heart" section and Table 14.3 in the chapter.
Section: Cardiac Muscle and the Heart
Bloom's Taxonomy: Comprehension

167) Compare and contrast the action potentials in the skeletal muscle, contractile myocardium, and autorhythmic myocardium.
Answer: See Table 14.3 in the chapter.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.7
Bloom's Taxonomy: Comprehension

168) Why is it necessary to direct the electrical signals in the heart through the AV node instead of allowing them to spread directly from the atria to the ventricles?
Answer: If electrical signals from the atria were conducted directly into the ventricles, the ventricles would start contraction at the top. The blood would be squeezed downward and would be trapped in the bottom of the ventricles.
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Comprehension

169) List the four types of autorhythmic cells that drive the heartbeat. Draw a sketch of the heart and indicate the location of each type of cell.
Answer: The four areas for the autorhythmic cells are SA node, internodal pathway, AV node, and Purkinje Fibers. See Figure 14.14 in the chapter.
Section: The Heart as a Pump
Learning Outcome: 14.8
Bloom's Taxonomy: Comprehension

170) Name four questions related to heart function that you could answer by examining an ECG and one abnormal condition that may be indicated by each function.
Answer:
1. What is the heart rate? Abnormal values could indicate tachycardia or bradycardia.
2. Is the rhythm of the heartbeat regular or irregular? Abnormal rhythm could indicate fibrillation.
3. Are all normal waves present in recognizable form? Electrical disorders in atria or ventricles could be indicated.
4. Does a QRS complex follow each P wave, and is the PR segment constant in length? Heart block may be indicated.
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Comprehension

171) Acetylcholine is excitatory at the neuromuscular junction, but inhibitory at the SA node. Explain why this is true.
Answer: Acetylcholine receptors in heart muscle are muscarinic, whereas they are nicotinic in skeletal muscle. These receptors are linked to different types of ion channels. At the nicotinic receptor, the response is excitatory due to a sodium influx. At the muscarinic receptor, the response is inhibitory due to a potassium efflux.
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

172) Compare and contrast the effects of cholinergic and adrenergic fibers on the heart. Include a comparison of the various types of receptors they interact with, and their location on the heart.
Answer: See Figure 14.19 in the chapter.
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

173) Explain what is meant by the contractility of the heart. How is contractility controlled?
Answer: Contractility is the intrinsic ability of a cardiac muscle fiber to contract at any given fiber length. Contractile force increases with ventricular end diastolic volume, which is determined by venous return. Both the endocrine and nervous systems regulate contractility.
Section: The Heart as a Pump
Learning Outcome: 14.13
Bloom's Taxonomy: Comprehension

174) Explain what is meant by the terms *respiratory pump* and *skeletal muscle pump.* Why are these important to the cardiovascular system?
Answer: Both refer to pressure exerted on the blood in veins that assist in venous return. During the pressure changes in the thoracic cavity associated with normal breathing, pressure in the thoracic portion of the inferior vena cava fluctuates, resulting in blood being drawn upward in the vena cava during each inhalation. Contractile activity of normal skeletal muscle momentarily squeezes the veins within and near the muscles, also helping to propel the blood. These and other slight pressure changes are essential because the overall pressure gradient of the venous system is low.
Section: The Heart as a Pump
Learning Outcome: 14.13
Bloom's Taxonomy: Comprehension

175) A chronotropic agent is one that affects the heart rate. Compare and contrast this term with an inotropic agent. Give specific examples of each.
Answer: Inotropic agents affect contractility. Catecholamines (epinephrine, norepinephrine) and drugs such as digitalis are positive inotropic agents, meaning they increase contractility. Heart rate is increased by epinephrine (a positive chronotropic agent) and decreased by acetylcholine (a negative chronotropic agent); there is also a variety of drugs that affect heart rate.
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Comprehension

176) Explain how Ca^{2+} levels inside myocardial cells are important to cell function.
Answer: See Figs. 14.9 and 14.21 in the chapter.
Section: The Heart as a Pump
Learning Outcome: 14.6
Bloom's Taxonomy: Comprehension

177) Diagram at least seven different factors that affect the components of the equation that relates cardiac output to heart rate and stroke volume. Explain each factor involved.
Answer: See Figure 14.22 in the chapter.
Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Comprehension

178) Amy is a premed student with a summer job as an animal research technician. One of her duties is to withdraw blood by syringe from the anterior vena cava of pigs, to be analyzed for various hormones. During her training she noticed that most blood samples were very dark in color, but occasionally a sample was bright red. Propose an explanation.
Answer: Amy misdirected her needle to a nearby artery instead of withdrawing blood from the vena cava. Arterial blood is more oxygenated than venous blood, thus not as dark.
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Synthesis

179) Sonja is pregnant. Over the next 40 weeks, her uterus will enlarge as the placenta develops and the fetus grows, her abdomen will add skin to accommodate distension, her breasts will grow, her blood volume will increase, and many other changes will occur. Using what you have learned about basic cardiovascular physiology, predict how parameters such as blood pressure and cardiac output will change. (Note that the fetus has a separate cardiovascular system, which does not need to be considered.) Explain your answer.
Answer: (Note to the instructor: These predictions are logical, but not all actually happen.) The growth of maternal tissues will require addition of blood vessels, thus total vessel length will increase. This would increase total peripheral resistance. Blood pressure may increase with increasing blood volume, and also to overcome the greater resistance and return the blood to the heart. Stroke volume should increase; cardiac output may increase as a result, or may remain the same if heart rate decreases.
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3, 14.11
Bloom's Taxonomy: Synthesis

180) Sonja is pregnant during the year she is taking human physiology. At each check-up, she expects to be told that her blood pressure has increased. Yet into the final weeks of her pregnancy, her blood pressure is unchanged from its pre-pregnancy value. Why did she expect her blood pressure to increase? Propose some explanations for why it didn't. (Hint: Sometimes women adopt healthier habits during pregnancy, there are large blood-filled sinuses in the maternal portion of the placenta, and there are many hormonal effects that are unique to pregnancy.)
Answer: (Note to instructor: You may want to alter the hint, providing more or less help, depending on what you have covered in class.)
Sonja assumes that her pressure will elevate with the increased blood volume and increased peripheral resistance that accompany the tissue growth she experiences. It is possible that she has adopted healthier diet and exercise habits during her pregnancy, offsetting an increase in pressure. It is also possible that the changing hormonal environment includes regulation of blood pressure so that it remains normal. It is also the case that the placenta forms a low-resistance reservoir for the maternal blood, offsetting the expected increase in total peripheral resistance and blood pressure.
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Synthesis

181) You are constructing working models of the heart for extra credit. Your first attempt failed because the cells separated from each other during beating. What structures did you omit, and why did this allow the heart to fall apart? You omitted the gap junctions in your second attempt. How would a real heart fail to function normally without gap junctions?
Answer: Desmosomes were omitted. Without desmosomes, the contractile force of the heart would be large enough to separate the cells from each other. Without the gap junctions, the electrical currents that stimulate contraction would not be propagated from cell to cell, and the heart would fail to beat.
Section: Cardiac Muscle and the Heart
Learning Outcome: 14.4
Bloom's Taxonomy: Synthesis

182) Vern, suffering from cardiac arrhythmias, is brought into the emergency room of a hospital. He begins to exhibit tachycardia and as a result loses consciousness. His anxious wife asks you why he has lost consciousness. What would you tell her?
Answer: During tachycardia, the heart beats at an abnormally fast rate. The faster the heart beats, the less time there is between contractions for it to fill with blood again. As a result, over a period of time the heart fills with less and less blood and thus pumps less blood out. The stroke volume decreases, as does the cardiac output. When the cardiac output decreases to the point where not enough blood reaches the central nervous system, loss of consciousness occurs.
Section: The Heart as a Pump
Learning Outcome: 14.9
Bloom's Taxonomy: Synthesis

183) What is a normal heart rate for healthy adults at rest, and what neural inputs contribute to the achievement of that range? How is heart rate affected when all nervous system input to the heart is blocked, and why is this effect seen?
Answer: A typical adult heart rate is 70 beats per minute. This normal resting value results from the constant parasympathetic inhibition of the higher endogenous rate of the SA node. Without neural input, resting heart rate is higher, matching the intrinsic rate of the SA node, 90-100 beats per minute.
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Application

184) Atropine inhibits parasympathetic activity. Discuss the effects of atropine on the heart and describe common expected side effects.
Answer: Parasympathetic stimulation of the heart has an inhibitory effect, slowing the heart rate. This inhibition is constant under normal circumstances, and without it the heart beats at the rate set by the pacemaker cells, which is higher than normal. Thus atropine, by removing the inhibition, increases heart rate. Other organs affected by atropine include any with muscarinic receptors. For example, atropine would inhibit intestinal motility, resulting in constipation. Atropine also inhibits the pupillary reflex, resulting in dilated pupils.
Section: The Heart as a Pump
Learning Outcome: 14.12
Bloom's Taxonomy: Application

185) How many liters of blood are distributed between the pulmonary and systemic circuits in a "typical" person? Assume 20% of the blood is in the lungs at any moment. If the cardiac output is 5 L/min, how long will it take a drop of blood to flow from the right ventricle to the left ventricle?
Answer: There are about 5 liters of blood in a 70 kg man. If 20% of the blood is in the lungs, then $5 \times 0.2 = 1$ liter of blood in the lungs.
$1 \text{ L} \times 1 \text{ min}/5 \text{ L} \times 60 \text{ sec}/1 \text{ min} \times 1 \text{ min}/60 \text{ sec} = 12$ seconds.
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Application

186) Compare the flow rates (Q) of tubes one and two, assuming the following parameters: Tube one: $\Delta P = 30$, $r = 3$, $L = 20$. Tube two: $\Delta P = 60$, $r = 4$, $L = 10$.
Answer: $Q \propto \Delta P/(L/r^4) \cdot Q_1 \propto 30/(20/3^4) = 121$. $Q_2 \propto 60/(10/4^4) = 1535$.
Flow rate in the second tube is about 12 times higher than that in the first tube.
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Application

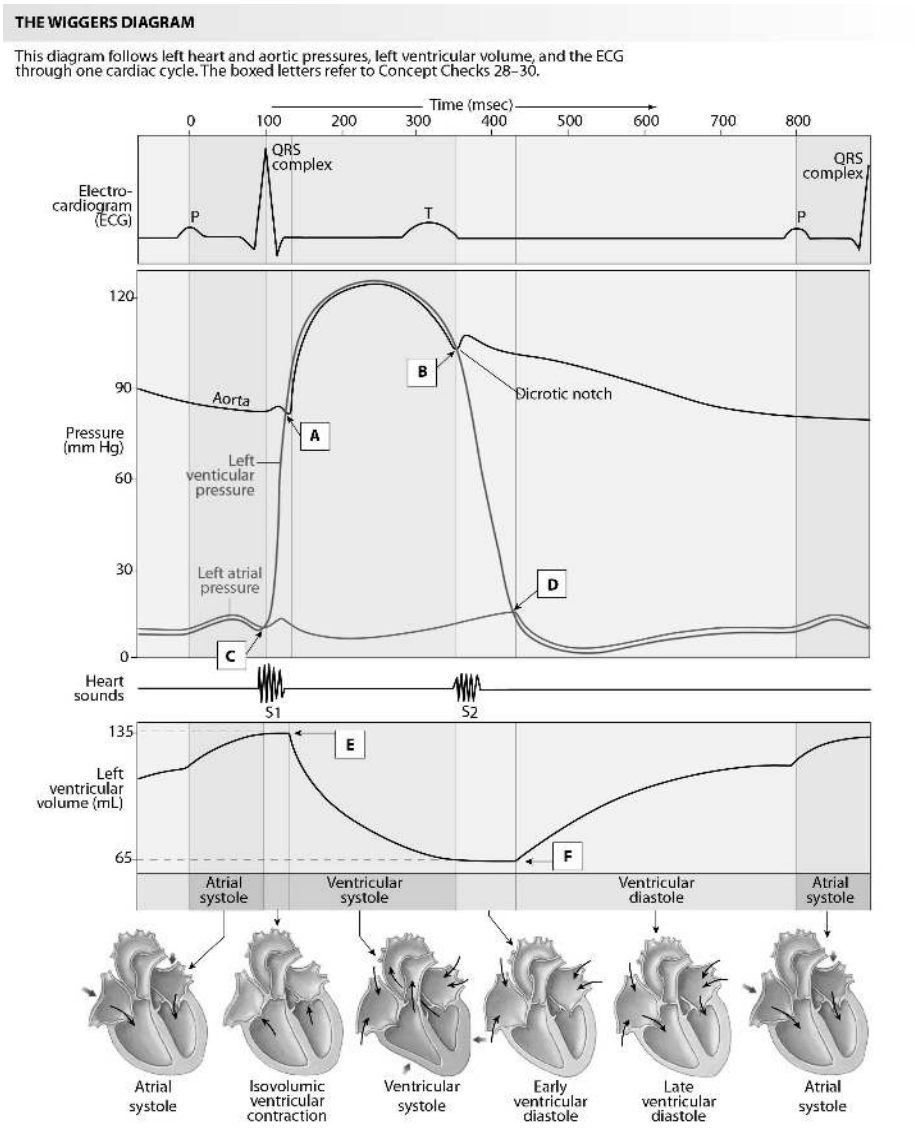
187) Using the appropriate equations, predict the effects in each scenario.
A. Vessels X and Y have the same diameter. X is 5 cm long and Y is 10 cm long. Which has the faster velocity of flow for the same fluid?
B. A blood vessel has a radius of 4 cm. Vasoconstriction reduces the radius to 1 cm. In order to maintain the same flow, by what factor must pressure increase?
C. The blood vessel in B above dilates from 1 cm to 4 cm. Does the flow rate increase or decrease?
D. A new subdivision is built between your house and the water storage tower. If the water company makes no adjustments, will the water pressure at your house change? If so, in which direction? Why?
Answer:
A. Assuming the same driving pressure, the velocity is the same.
Length is not a factor ($v = Q/A$).
B. 256.
$Q \propto \Delta P/R$, so $\Delta P \propto R$. As $R \propto 1/r^4$, $\Delta P \propto 1/r^4$.
As Q does not change, $\Delta P_1 \times r_1^4 = \Delta P_2 \times r_2^4$.
$r_1^4 = 4^4 = 256$.
C. increase
D. Your water pressure would decline, owing its diversion to the new subdivision houses.
Section: Pressure, Volume, Flow, and Resistance
Learning Outcome: 14.3
Bloom's Taxonomy: Application

188) A person has a total blood volume of 5 L. Of this total, 4 liters is contained in the systemic circulation and 1 L in the pulmonary circulation. If the person has a cardiac output of 5 L/min:
A. how long will it take for a drop of blood leaving the left ventricle to return to the heart?
B. how long will it take a drop of blood to go from the right ventricle to the left ventricle?
Answer:
A. SV = 5 L/min, volume = 4 L, which would be distributed in 4/5 min = 48 seconds.
B. Volume in the pulmonary circuit = 1 L, which would require 1/5 min, or 12 seconds to return to the left atrium from the right ventricle.
Section: Overview of the Cardiovascular System
Learning Outcome: 14.2
Bloom's Taxonomy: Application

189) If the stroke volume of the left ventricle is 65 mL/beat and the stroke volume of the right ventricle is 68 mL/beat, what will happen to the relative distribution of blood in the systemic and pulmonary circulation after 15 beats?
Answer: With each heartbeat, the left side will get "behind" by 3 mL, with this volume contributing to congestion in the pulmonary circuit; after 15 beats, the deficit will total 45 mL of extra fluid in the pulmonary circuit. This could be the beginning of congestion that sets the stage for congestive heart failure.
Section: The Heart as a Pump
Learning Outcome: 14.13
Bloom's Taxonomy: Synthesis

190) Miguel is a 25-year-old jogger with a target heart rate of 125 bpm. His resting pulse is 70 bpm. His blood volume is approximately 6.8 liters. At rest, his cardiac output is 6.3 liters/min.
A. What must his stroke volume be?
B. What might his EDV and ESV be?
C. During his workout, his heart rate increases to 125 bpm and his cardiac output to 12,500 mL/min. Do his SV, EDV, and ESV change with exercise?
Answer:
A. 90 mL CO = SV * HR; SV = CO/HR = 6.3 L/min/ 70 bpm.
B. Combination where EDV minus ESV = 90 mL
Average values are ESV = 44-60 mL, EDV = 134-150 mL.
C. Yes, the SV changes to 100 mL; EDV probably increases proportionately, to 149-167 mL. Thus, the ESV would be 49-67 mL. One would assume an increase in venous return would lead to atrial stretching and an increased EDV.
Section: The Heart as a Pump
Learning Outcome: 14.11
Bloom's Taxonomy: Application

191) Using the figure below (Fig. 14.18 from your text), calculate the following values:



A. Heart rate
B. Stroke volume
C. Cardiac output
D. Mean Arterial Pressure

Answer:

A. (1 cycle/800 msec) × (1000 msec/sec) × (60 sec/min)
   = 60,000 cycles/800 min
   = 75 cycles (or beats)/min
B. Stroke volume = EDV - ESV = 135 mL - 65 mL = 70 mL/beat
C. Cardiac output = HR × SV = 75 beats/min x 70 mL/beat = 5250 mL/min or 5.25 L/min
D. Mean Arterial Pressure = (DP + DP + SP)/3 = (85 + 85 + 120)/3 = 290/3 = 96.7 mm Hg or
   MAP = DP + 1/3 (SP-DP) = 85 + 1/3 (120-85) = 85 + 1/3 (35) = 85 + 11.7 = 96.7 mm Hg

Section: The Heart as a Pump
Learning Outcome: 14.10
Bloom's Taxonomy: Application