Chapter 9 a--Cardiac Physiology

1. The systemic circulation

   A. receives more blood than the pulmonary circulation does
   B. receives blood from the left ventricle
   C. is a low pressure system compared to the pulmonary circulation
   D. receives blood from the right ventricle and is a high pressure system compared to the pulmonary circulation
   E. receives more blood than the pulmonary circulation does, and receives blood from the left ventricle.

2. Which valve(s) prevent regurgitation of blood from a right ventricle to the atrium?

   A. tricuspid
   B. mitral
   C. pulmonary
   D. tricuspid and pulmonary
   E. all of these

3. Semilunar valves

   A. prevent backflow of blood from the ventricles to the atria
   B. prevent backflow of blood from the atria to the ventricles
   C. prevent backflow of blood from the ventricles to the arterial trunks
   D. prevent backflow of blood from the arterial trunks to the ventricles
   E. none of these

4. The wall of the left ventricle is thicker than the wall of the right ventricle because the

   A. left ventricle must pump much more blood than the right ventricle so it must have stronger walls
   B. right ventricle must pump much more blood than the left ventricle so it has a larger chamber to accommodate the blood and a correspondingly thinner wall
   C. left ventricle must pump the same amount of blood into a higher-resistance, higher-pressure system
   D. right ventricle must create higher tension within its walls
   E. left ventricle must pump oxygenated blood, which requires more energy than pumping deoxygenated blood

5. Adjacent cardiac muscle cells are joined together end-to-end in the ventricles by

   A. intercalated discs
   B. sarcomeres
   C. Purkinje fibers
   D. sinoatrial nodes
   E. atrioventricular nodes

6. The primary function of the pericardial sac is to

   A. prevent excessive expansion of the heart as it fills with blood
   B. secrete a fluid that reduces friction as the heart beats
   C. serve as a reservoir for blood to be used during strenuous exercise
   D. provide oxygen and nutrients to the heart muscle
   E. catch and kill any bacteria in the blood flowing through the heart chambers

7. The chordae tendineae

   A. keep the AV valves from everting during ventricular systole
   B. hold the AV valves open during diastole
   C. hold the right and left ventricles together
   D. transmit the electrical impulse from the atria to the ventricles
   E. contract when the ventricles contract

8. The heart chamber that has the greatest work load is

   A. the right ventricle
   B. the left ventricle
   C. the left atrium
   D. the right atrium
   E. both atria

9. A lumen that contains blood with a comparatively higher concentration of oxygen is in the

   A. right ventricle
   B. inferior vena cava
   C. pulmonary artery
   D. pulmonary vein
   E. coronary veins

10. The aortic valve

    A. prevents the backflow of blood into the aorta during ventricular diastole
    B. prevents the backflow of blood into the left ventricle during ventricular diastole
    C. prevents the backflow of blood into the right ventricle during ventricular diastole
    D. closes when the first heart sound is heard
    E. none of these

11. The right half of the heart pumps blood through the ____ circuit and the left half pumps blood through the ____ circuit.

    A. systolic; diastolic
    B. coronary; pulmonary
    C. systemic; pulmonary
    D. pulmonary; systemic
    E. systemic; coronary

12. Blood returning from the lungs

    A. enters the right atrium
    B. enters the left atrium
    C. is poorly oxygenated
    D. enters the right atrium and is poorly oxygenated
    E. enters the left atrium and is poorly oxygenated

13. Choose a correct sequence of blood flow during one pass through the heart and lungs (some steps may have been omitted):

    A. right atrium®bicuspid valve®pulmonary vein
    B. aortic valve®right ventricle®lung
    C. lung®pulmonary artery®left atrium
    D. right ventricle®bicuspid valve®aortic valve
    E. none of these

14. The low-resistance pathway that permits electrical activity to pass from cell-to-cell in myocardial tissue is the

    A. desmosome
    B. septum
    C. gap junction
    D. T-tubule
    E. sarcoplasmic reticulum

15. What component of the cardiac conduction system distributes electrical signals through the papillary muscles directly?

    A. AV nodes
    B. AV bundle
    C. bundle of His
    D. Purkinje fibers
    E. SA node

16. The plateau of the cardiac action potential results from the opening of voltage-gated slow ____ channels in the plasma membrane of the ____ cell.

    A. sodium; contractile
    B. potassium; autorhythmic
    C. calcium; contractile
    D. chloride; pacemaker
    E. potassium; contractile

17. Which of the following statements about action potentials in the heart is correct?

A. The rising phase of the action potential in autorhythmic cells is due to a rapid Ca^{2+} influx.
B. The rising phase of the action potential in contractile cells is due to a rapid Na^{+} influx.
C. The plateau phase of the action potential in contractile cells is due to a slow Ca^{2+} influx.
D. The rising phase of the action potential in autorhythmic cells is due to a rapid Ca^{2+} influx, and the rising phase of the action potential in contractile cells is due to a rapid Na^{+} influx
E. all of these

18. On a normal ECG, a wave for repolarization of the atria is not recorded. Why?

A. The leads are not placed in a position to pick it up.
B. No repolarization of the atria occurs normally.
C. It occurs simultaneously with ventricular depolarization and is masked by the QRS complex.
D. It does not travel through body fluids.
E. It is too small to be picked up by external recording electrodes.

19. Which of the following criteria must be met for the heart to function efficiently?

A. Excitation and contraction of the cardiac muscle fibers of each heart chamber should be coordinated to ensure efficient pumping.
B. The atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete.
C. The right side of the heart should contract first to ensure that oxygenated blood is delivered to the heart before the left side contracts.
D. Excitation and contraction of the cardiac muscle fibers of each heart chamber should be coordinated to ensure efficient pumping, and the atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete.
E. The atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete, and the right side of the heart should contract first to ensure that oxygenated blood is delivered to the heart before the left side contracts.

20. The AV nodal delay ensures that:

A. The atria contract and empty their contents into the ventricles prior to ventricular systole.
B. The ventricles contract prior to atrial systole.
C. Tetanic contractions of cardiac muscle are impossible.
D. Ventricular diastole occurs before systole.
E. Atrial diastole occurs before atrial systole.

21. The normal pacemaker of the heart is the

A. SA node
B. AV node
C. bundle of His
D. Purkinje system
E. ventricular myocardium

22. The function of the atrioventricular node is to

    A. excite the left and right atrium
    B. control the heart rate
    C. prevent the atria and ventricles from contracting simultaneously
    D. repolarize the heart after systole
    E. none of these

23. The direction of the impulse through the conduction system of the heart is normally:

    A. AV node¾SA node¾bundle of His¾Purkinje fibers
    B. AV node¾bundle of His¾SA node-¾Purkinje fibers
    C. bundle of His¾AV node¾Purkinje fibers¾SA node
    D. SA node¾AV node¾bundle of His¾Purkinje fibers
    E. SA node¾bundle of His¾Purkinje fibers¾AV node

24. The QRS complex represents

    A. depolarization of the atria
    B. depolarization of the ventricles
    C. the AV nodal delay
    D. repolarization of the ventricles
    E. the time during which the heart is contracting

25. The fastest rate of autorhythmicity is normally carried out by the

    A. AV bundle
    B. AV node
    C. bundle of His
    D. Purkinje fibers
    E. SA node

26. Depolarization occurs at the AV node

    A. during the P wave
    B. between the P wave and QRS complex
    C. during the QRS complex
    D. between the QRS complex and T wave
    E. during the T wave

27. Which of the following ECG waves represents ventricular repolarization?

    A. P wave
    B. QRS complex
    C. T wave
    D. PR segment
    E. Ventricular repolarization occurs simultaneously with atrial depolarization and consequently cannot be recorded.

28. Which is the normal sequence of the spread of cardiac excitation?

1. AV node
2. SA node
3. atria
4. Purkinje fibers
5. bundle of His
6. ventricular myocardium

A. 2¾3¾1¾5¾4¾6
B. 3¾2¾1¾4¾5¾6
C. 2¾3¾1¾4¾5¾6
D. 1¾2¾3¾4¾5¾6
E. none of these

29. Extrasystole of the heart means that it

A. beats too slowly
B. fills with too much blood
C. has a complete block
D. loses blood
E. produces a premature beat

30. The SA is the heart's normal pacemaker because

A. It has the fastest rate of autorhythmicity.
B. It has both sympathetic and parasympathetic innervation.
C. It lies in the right atrium.
D. Activation of K^+ channels occurs more rapidly in this region than elsewhere in the heart.
E. None of these.

31. Fibrillation is the

A. backflow of blood throughout the heart
B. coordinated function of nodal cells
C. failure of the heart valves to function
D. flow of blood through the heart's fibrous skeleton
E. uncoordinated excitation and contraction of cardiac cells

32. The AV node

A. is the normal pacemaker of the heart
B. is the only electrical connection between the atria and the ventricles
C. rapidly conducts the impulse from the atria to the ventricles so that they contract simultaneously
D. is not innervated by the vagus nerve
E. has the slowest rate of depolarization in the heart

33. The electrocardiogram is most useful in determining which component of cardiac output?

A. stroke volume
B. heart rate
C. ejection fraction
D. end-diastolic volume
E. murmurs

34. An ectopic focus is the place where

A. An abnormally excitable area of the heart initiates a premature action potential.
B. All of the electrical impulses of the heart terminate normally.
C. An ECG lead is attached on the outside of the chest.
D. A heart valve is attached.
E. The chordae tendineae attach to a valve.

35. The function of the ventricular conduction system of the heart is to

A. spread the action potential throughout the ventricle to ensure a single, coordinated contraction of the both ventricles
B. spread the action potential in the absence of sympathetic stimulation
C. spread the action potential throughout the atria and ventricles
D. slow down the original action potential so it has time to spread through the ventricles evenly
E. spread the action potential throughout the ventricle to ensure a single, coordinated contraction of the both ventricles, and slow down the original action potential so it has time to spread through the ventricles evenly

36. The refractory period of cardiac muscle

A. lasts almost as long as the contraction period
B. is much longer than the refractory period in skeletal muscle
C. prevents tetanic contraction of the heart to occur to ensure smooth, coordinated ejection of blood from the ventricles
D. all of these
E. lasts almost as long as the contraction period and is much longer than the refractory period in skeletal muscle

37. The membrane potential of cardiac muscle cells at rest is about ____ mV.

A. -110
B. -90
C. -70
D. -50
E. -30

38. Why can't tetanus occur in the heart?

A. There are no distinct motor units in the heart.
B. There is inadequate oxygen supply via the coronary circulation to metabolically support a sustained contraction.
C. The refractory period in cardiac muscle lasts almost as long as the contraction.
D. The heart contracts with maximal force every beat so it is impossible to increase the strength of its contraction.
E. Vagal stimulation slows down the heart rate to prevent summation of contractions.

39. During isovolumetric phases of the cardiac cycle,

A. The atria are contracting.
B. All heart valves are closed.
C. Blood is being ejected into the aorta.
D. The ventricles can only be relaxing.
E. The atria are contracting and all heart valves are closed.

40. 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

41. The cardiac output is equal to

A. (EDV - ESV) x HR
B. heart rate x EDV
C. the difference between the stroke volume at rest and the stroke volume during exercise
D. the stroke volume minus the ESV
E. heart rate x blood pressure

42. Which factor(s) would decrease cardiac output?

A. increased venous return
B. decreased vagal stimulation of the heart
C. increased preload
D. decreased preload
E. increased venous return and increased preload

43. If the connection between the SA node and AV node becomes blocked,

A. The QRS complex will be absent on an ECG.
B. The ventricles will beat more slowly.
C. The atria will beat slower.
D. Tachycardia will occur.
E. The QRS complex will be absent on an ECG and tachycardia will occur.

44. Which is true when your sympathetic nervous system is more active?

A. The SA node depolarizes more rapidly.
B. The myocardium repolarizes more rapidly.
C. More Ca^{2+} becomes available and causes more forceful heart contractions.
D. Norepinephrine is stimulating the heart.
E. All of these.

45. Which of the following decreases ESV?

A. acetylcholine
B. preload
C. afterload
D. parasympathetic activity
E. vagal activity

46. What percentage of ventricular filling is normally accomplished before atrial contraction begins?

A. 0%
B. 20%
C. 80%
D. 50%
E. 100%

47. Vagal influences on the heart result in

A. enhanced calcium permeability at the SA node
B. enhanced potassium permeability at the SA node
C. less frequent depolarization of the SA node
D. enhanced calcium permeability at the SA node and enhanced potassium permeability at the SA node
E. enhanced potassium permeability at the SA node and less frequent depolarization of the SA node

48. A condition in which the heart is contracting in an uncontrolled, rapid, and irregular manner:

A. is heart block
B. is fibrillation
C. can be treated with administration of an electrical current
D. is heart block and fibrillation
E. is fibrillation and can be treated with administration of an electrical current

49. The heart

A. is sympathetically innervated via cardiac nerve fibers
B. is parasympathetically innervated by vagus nerve fibers
C. is innervated by the phrenic nerve
D. is innervated by only the sympathetic division of the autonomic nervous system
E. is sympathetically innervated via cardiac nerve fibers and is parasympathetically innervated by vagus nerve fibers

50. When the heart is sympathetically stimulated,

A. ESV will increase.
B. It is responding to acetylcholine.
C. It is responding to norepinephrine.
D. Ca^{2+} channels are opening in greater numbers.
E. It is responding to norepinephrine, and Ca^{2+} channels are opening in greater numbers.

51. The second heart sound is produced by the

A. opening of the AV valves
B. closing of the AV valves
C. opening of the semilunar valves
D. closing of the semilunar valves
E. blood rushing through the AV valves during diastole, creating a turbulent flow

52. The first heart sound

A. occurs when the AV valves open
B. occurs when the semilunar valves close
C. signals the onset of ventricular diastole
D. occurs when the AV valves close, and signals the onset of ventricular systole
E. occurs when the semilunar valves close, and signals the onset of ventricular diastole

53. The aortic valve opens

A. when ventricular pressure exceeds aortic pressure
B. at the start of ventricular systole
C. just after the isovolumetric relaxation phase
D. just before the isovolumetric contraction phase
E. none of these

54. During isovolumetric contraction,

A. Rapid filling of the ventricles occurs.
B. No blood enters or leaves the ventricles.
C. The maximum volume of blood is ejected.
D. The maximum rate of ejection occurs.
E. *Both* the maximum volume of blood is ejected *and* the maximum rate of ejection occurs.

55. The period lasting from closure of the AV valve to opening of the aortic valve is known as

A. isovolumetric ventricular contraction
B. isovolumetric ventricular relaxation
C. the rapid ejection phase
D. the rapid filling phase
E. none of these

56. A heart valve opens and closes due to

A. being pulled by the heart muscle
B. pressure differences on the valve's two sides
C. Na^+ and K^+ fluxes during ventricular depolarization
D. turbulent flow in the atria and ventricles
E. none of these

57. Cardiac output

A. is the volume of blood pumped by each ventricle during each contraction or beat
B. is the volume of blood pumped by each ventricle per minute
C. equals heart rate x stroke volume
D. is the volume of blood pumped by each ventricle during each contraction or beat, and equals heart rate x stroke volume
E. is the volume of blood pumped by each ventricle per minute, and equals heart rate x stroke volume

58. The dicrotic notch on the aortic pressure curve is due to

A. a disturbance set up by the aortic valve closing
B. a disturbance set up when the AV valves close
C. elastic recoil of the aorta during ventricular diastole
D. turbulent flow through a stenotic valve
E. atherosclerosis in the aorta

59. An insufficient AV valve

A. fails to open completely
B. is not connected to chordae tendineae
C. produces a gurgling diastolic murmur
D. allows blood to backflow into a ventricle during diastole
E. none of these

60. Atrial flutter is characterized by a ____ rhythm, as impulses pass from the AV node to the ventricles.

A. 1:1
B. 2:1
C. 3:4
D. 5:2
E. 7:1

61. A whistling murmur heard between the second and first heart sound would be indicative of

A. a stenotic AV valve
B. an insufficient AV valve
C. a myocardial infarction
D. an insufficient semilunar valve
E. No conclusions can be reached based on the information provided.

62. At rapid heart rates

A. Systole and diastole shorten equally.
B. Systole stays almost constant, but diastole shortens.
C. Systole lengthens and diastole shortens
D. Diastole lengthens and systole shortens.
E. None of these.

63. Twelve complete ECG patterns are recorded over 10 seconds, which means the heart rate is ____ beats per minute.

A. 60
B. 72
C. 90
D. 108
E. 120

64. If stroke volume is 80 ml and the heart rate is 70 beats per minute, the cardiac output is

A. 150 ml/min
B. 560 ml/min
C. 5,600 ml/min
D. 8,700 ml/min
E. none of these

65. If the cardiac output is 4,800 ml/min and the heart rate is 60 beats per minute, the stroke volume averages ____ ml.

A. 60
B. 70
C. 80
D. 120
E. 140

66. According to the Frank-Starling law of the heart,

A. Shortening cardiac muscle fibers prior to contraction causes a more forceful contraction.
B. Increasing venous return increases EDV, which leads to an increased stroke volume.
C. As cardiac output decreases, blood pools in the vasculature and increases arterial blood pressure.
D. The left ventricle must pump more blood than the right ventricle since the left ventricle must pump blood to more regions of the body.
E. The greater the stroke volume, the smaller the subsequent ESV, because as more blood is squeezed out, the heart cannot fill as completely.

67. During heart failure,

A. The Frank-Starling curve is shifted to the left.
B. The heart pumps out a smaller stroke volume than normal for a given EDV.
C. A compensatory increase in sympathetic activity increases the contractility of the heart to normal in the early stages of the disease.
D. All of these.
E. The heart pumps out a smaller stroke volume than normal for a given EDV, and a compensatory increase in sympathetic activity increases the contractility of the heart to normal in the early stages of the disease.

68. The term *systole* means

A. closure
B. conduction
C. contraction
D. opening
E. relaxation

69. Parasympathetic innervation to the heart:

A. involves the vagus nerve
B. decreases the rate at which the pacemaker potential reaches threshold
C. decreases the strength of ventricular contraction
D. all of these
E. involves the vagus nerve and decreases the strength of ventricular contraction

70. Sympathetic stimulation of the heart

A. increases the heart rate
B. increases the heart's contractility
C. shifts the Frank-Starling curve to the left
D. involves the release of norepinephrine
E. all of these

71. Select the incorrect statement about rheumatic fever.

A. It causes a heart murmur.
B. It is an autoimmune disease.
C. It is triggered by a streptococcus bacterium.
D. The heart conduction system is disrupted.
E. The heart valves become inflamed and scarred.

72. Increased ____ permeability of nodal cells hyperpolarizes the SA node.

A. chloride
B. iodide
C. potassium
D. sodium
E. zinc

73. The parasympathetic nervous system has little effect on ____ activity.

A. atrial
B. AV node
C. heart rate
D. SA node
E. ventricular

74. If the EDV were held constant, increased cardiac output could be accomplished by

A. decreased sympathetic stimulation of the heart
B. decreased parasympathetic stimulation of the heart
C. decreased contractility
D. increased length of isovolumetric contraction
E. increased arterial blood pressure

75. Which of the following is not associated with an increase in stroke volume?

A. increased end-diastolic volume
B. increased contractility of the heart
C. increased end-systolic volume
D. increased preload
E. increased venous return

76. Vasodilation of coronary arteries is induced by

A. adenosine
B. nitroglycerin
C. nitric oxide
D. all of these
E. adenosine and nitroglycerin

77. The cardiac muscle

A. extracts oxygen and nutrients from the blood within its chambers
B. receives its blood supply primarily during ventricular systole when blood is forced into the vessels supplying the heart
C. receives its blood supply as all blood returning to the heart from the lung passes through the cardiac circulation before being pumped to the systemic circulation
D. receives most of its blood supply during ventricular diastole by means of the coronary circulation
E. none of these

78. A metabolic predictor of heart disease that is independent of one's cholesterol/lipid profile is

    A. HDL
    B. VLDL
    C. homocysteine
    D. methionine
    E. creatine

79. The pulmonary circulation carries oxygenated blood from the lungs through the coronary circulation and then into the aorta.

    True False

80. The right ventricle pumps deoxygenated blood through the tricuspid valve and into the pulmonary arteries.

    True False

81. The aortic valve prevents backflow of blood from entering the left ventricle during ventricular diastole.

    True False

82. The mitral valve prevents regurgitation of blood back into the left atrium from the left ventricle.

    True False

83. The function of the chordae tendineae and papillary muscles is to hold the AV valves open during diastole to ensure complete ventricular filling.

    True False

84. The AV valve controls the amount of blood entering the atrium from the venous system.

    True False

85. The SA node is the only part of the heart that can function as the heart's pacemaker.

    True False

86. The only point of electrical contact between the atria and the ventricles is the AV valve.

    True False

87. An action potential spreads through the atria by gap junctions, but there are no gap junctions present in the ventricles, so the impulse must be propagated throughout the ventricular myocardium by the bundle of His and Purkinje system.

    True False

88. An action potential impulse passes through the internodal pathways between the P wave and Q waves on an ECG.

True False

89. Ventricular systole is displayed as the QRS on the ECG, and ventricular diastole is displayed as the T wave.

True False

90. With 2:1 rhythm, the atrial rate is very rapid and the ventricular rate is normal or above normal, whereas with 2:1 block, the atrial rate is normal but the ventricular rate is below normal.

True False

91. The plateau phase of the action potential in a contractile cardiac muscle cell occurs as a result of activation of slow Ca^{2+} channels.

True False

92. Oxygenated blood flows through semilunar valves, whereas deoxygenated blood flows through AV valves.

True False

93. Diastole refers to the period of cardiac repolarization.

True False

94. Atrial systole is responsible for the first heart sound, whereas the ventricular systole is responsible for the second heart sound.

True False

95. Ventricular filling occurs more rapidly early in diastole than it does later in diastole.

True False

96. Atrial systole contributes most of a ventricle's EDV.

True False

97. Ventricular ejection occurs once the afterload has been overcome.

True False

98. The refractory period in cardiac muscle is much shorter than the refractory period in skeletal muscle to ensure that the heart can quickly be re-stimulated to produce alternate periods of contraction and relaxation.

True False

99. The long refractory period of cardiac muscle prevents tetanic contractions of the heart.

True False

100. High blood pressure decreases the afterload and increases the preload.

True False

101. Under normal conditions, all of the EDV is ejected before ventricular diastole begins.

True False

102. Contraction of the spirally arranged cardiac muscle fibers produces a wringing effect for efficient pumping.

True False

103. The AV and semilunar valves are never open at the same time.

True False

104. A pacemaker potential depends on the increased inward current of calcium ions.

True False

105. The first heart sound signals the onset of ventricular depolarization.

True False

106. Complete heart block results from a damaged AV node.

True False

107. The second heart sound is due to closure of the AV valves.

True False

108. The stroke volume is the total volume of blood ejected by both ventricles each minute.

True False

109. Pacemaker activity by the Purkinje fibers is an example of an ectopic focus.

True False

110. Normally, the stroke volume of the right side of the heart is the same as the stroke volume of the left side of the heart.

True False

111. One important function of the intrinsic control of the heart (Frank-Starling law of the heart) is to equalize the left and right cardiac outputs.

True False

112. The extent of ventricular filling is the preload of the heart, whereas the magnitude of the arterial blood pressure is the afterload of the heart.

True False

113. Parasympathetic stimulation slows the rate of depolarization of the SA node and thus decreases the heart rate.

True False

114. An increased heart rate can result due to a decrease in parasympathetic stimulation or an increase in sympathetic stimulation of the heart.

True False

115. The addition of ACh to the SA node would decrease the number of T waves observed per minute on an ECG.

True False

116. Cardiac output is equal to the EDV-ESV.

True False

117. Norepinephrine increases calcium permeability in cardiac muscle cells and thus increases the heart's contractility.

True False

118. The average resting heart rate is normally established by the rhythm of autorhythmic cells located near the base of the right atrium.

True False

119. The amount of blood pumped out of the heart during each beat is known as the cardiac output.

True False

120. Increased EDV results in decreased stroke volume, and increased stroke volume results in increased ESV.

True False

121. Parasympathetic stimulation of the heart increases cardiac reserve by allowing more time for the heart to relax between contractions.

True False

122. According to the Frank-Starling law of the heart, the shorter the initial length of the cardiac muscle fibers prior to contraction, the more forceful will be the subsequent contraction because the fibers are already partially contracted.

True False

123. Left-sided congestive heart failure can lead to pulmonary edema.

True False

124. Most blood flow through the coronary vessels occurs during ventricular systole when the heart is driving blood forward.

True False

125. The heart utilizes glucose almost exclusively for energy production.

True False

126. Not all forms of cholesterol are equally harmful to the heart.

True False

127. **Complete each of the following statments.**

The _____ is the normal pacemaker of the heart.

_____

128. **Complete each of the following statments.**

The _____ delay ensures that atrial systole is complete before ventricular systole begins.

_____

129. **Complete each of the following statments.**

The refractory period in skeletal muscle is _____ than the refractory period in cardiac muscle.

_____

130. **Complete each of the following statments.**

A swishy murmur heard between the second and first heart sounds is indicative of a(n) _____ (stenotic or insufficient) _____ (AV or semilunar) valve.

_____

131. **Complete each of the following statments.**

The _____ is equal to the cardiac output divided by the heart rate.

_____

132. **Complete each of the following statments.**

The _____ is the volume of blood pumped by each ventricle/minute.

_____

133. **Complete each of the following statments.**

The _____ volume is the blood in the ventricle when ejection is complete, whereas the _____ volume is the blood in the ventricle just before ejection begins.

_____

134. **Complete each of the following statments.**

Myocardial _____ is the insufficient circulation of oxygenated blood to cardiac muscle in order to maintain its aerobic metabolism.

_____

135. **Complete each of the following statments.**

During the period of _____ and the period of _____ in the cardiac cycle, all heart valves are closed.

_____

136. **Complete each of the following statments.**

_____ carries cholesterol to cells, whereas _____ transports it away from cells.

_____

137. **Complete each of the following statments.**

The _____ extracts cholesterol from the blood and converts it into _____, which are secreted into the bile.

_____

138. **Complete each of the following statments.**

Vitamins _____ and _____ have been shown to slow plaque deposition in coronary arteries.

_____

139. **Complete each of the following statments.**

A(n) _____ is a clot attached to the wall of a vessel.

_____

140. **Complete each of the following statments.**

PAF is released from the _____ lining of vessels.

_____

141. **Complete each of the following statments.**

The _____ are the kinds of blood vessels that experience congestion for congestive heart failure.

_____

142. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Increasing stroke volume _____ cardiac output.

_____

143. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in stroke volume _____ ESV.

_____

144. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Increasing the afterload _____ the length of time the heart is in isovolumetric contraction.

_____

145. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Decreasing preload _____ contractility, which then _____ stroke volume.

_____

146. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Norepinephrine _____ the SA node's permeability to $Ca2^{+}$, which then _____ the length of time between subsequent heart beats.

_____

147. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Decreasing venous return _____ preload and _____ EDV.

_____

148. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Acetylcholine _____ the SA node's permeability to potassium ions; as a result, the length of time between successive T waves _____.

_____

149. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Becoming more physically fit _____ a person's cardiac reserve.

_____

150. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in venous return _____ the end-diastolic volume.

_____

151. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in afterload _____ the length of time available for ventricular ejection.

_____

152. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in the length of the cardiac muscle fibers prior to contraction _____ the number of heart sounds heard.

_____

153. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Increasing the time when all heart valves are closed _____ the length of time that a lub heart sound lasts.

_____

154. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in parasympathetic activity _____ the stroke volume.

_____

155. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in the parasympathetic activity _____ the AV-nodal delay.

_____

156. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in cardiac sympathetic activity _____ the stroke volume.

_____

157. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in parasympathetic activity _____ the atrial contractility.

_____

158. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in cardiac sympathetic activity _____ the velocity of impulse conduction through the heart.

_____

159. **Sequencing**

Indicate the proper order of events during the cardiac cycle by placing numbers in the blanks preceding the events in sequence. (Some steps may have been omitted.) The first event is labeled as your starting point.

1	AV valve open; aortic valve closed; ventricular filling occurring
	Blood ejected from the ventricles
	Isovolumetric ventricular relaxation
	Atrial contraction
	AV valve opens; ventricular filling occurs again; one cardiac cycle is complete
	Aortic valve opens
	SA node discharges
	Ventricular filling complete
	Ventricular relaxation begins
	Aortic valve closes
	Isovolumetric ventricular contraction
	Ventricular contraction begins; AV valve closes

Chapter 9 a--Cardiac Physiology Key

1. The systemic circulation

A. receives more blood than the pulmonary circulation does
B. receives blood from the left ventricle
C. is a low pressure system compared to the pulmonary circulation
D. receives blood from the right ventricle and is a high pressure system compared to the pulmonary circulation
E. receives more blood than the pulmonary circulation does, and receives blood from the left ventricle.

2. Which valve(s) prevent regurgitation of blood from a right ventricle to the atrium?

A. tricuspid
B. mitral
C. pulmonary
D. tricuspid and pulmonary
E. all of these

3. Semilunar valves

A. prevent backflow of blood from the ventricles to the atria
B. prevent backflow of blood from the atria to the ventricles
C. prevent backflow of blood from the ventricles to the arterial trunks
D. prevent backflow of blood from the arterial trunks to the ventricles
E. none of these

4. The wall of the left ventricle is thicker than the wall of the right ventricle because the

A. left ventricle must pump much more blood than the right ventricle so it must have stronger walls
B. right ventricle must pump much more blood than the left ventricle so it has a larger chamber to accommodate the blood and a correspondingly thinner wall
C. left ventricle must pump the same amount of blood into a higher-resistance, higher-pressure system
D. right ventricle must create higher tension within its walls
E. left ventricle must pump oxygenated blood, which requires more energy than pumping deoxygenated blood

5. Adjacent cardiac muscle cells are joined together end-to-end in the ventricles by

A. intercalated discs
B. sarcomeres
C. Purkinje fibers
D. sinoatrial nodes
E. atrioventricular nodes

6. The primary function of the pericardial sac is to

A. prevent excessive expansion of the heart as it fills with blood
B. secrete a fluid that reduces friction as the heart beats
C. serve as a reservoir for blood to be used during strenuous exercise
D. provide oxygen and nutrients to the heart muscle
E. catch and kill any bacteria in the blood flowing through the heart chambers

7. The chordae tendineae

A. keep the AV valves from everting during ventricular systole
B. hold the AV valves open during diastole
C. hold the right and left ventricles together
D. transmit the electrical impulse from the atria to the ventricles
E. contract when the ventricles contract

8. The heart chamber that has the greatest work load is

A. the right ventricle
B. the left ventricle
C. the left atrium
D. the right atrium
E. both atria

9. A lumen that contains blood with a comparatively higher concentration of oxygen is in the

A. right ventricle
B. inferior vena cava
C. pulmonary artery
D. pulmonary vein
E. coronary veins

10. The aortic valve

A. prevents the backflow of blood into the aorta during ventricular diastole
B. prevents the backflow of blood into the left ventricle during ventricular diastole
C. prevents the backflow of blood into the right ventricle during ventricular diastole
D. closes when the first heart sound is heard
E. none of these

11. The right half of the heart pumps blood through the ____ circuit and the left half pumps blood through the ____ circuit.

A. systolic; diastolic
B. coronary; pulmonary
C. systemic; pulmonary
D. pulmonary; systemic
E. systemic; coronary

12. Blood returning from the lungs

A. enters the right atrium
B. enters the left atrium
C. is poorly oxygenated
D. enters the right atrium and is poorly oxygenated
E. enters the left atrium and is poorly oxygenated

13. Choose a correct sequence of blood flow during one pass through the heart and lungs (some steps may have been omitted):

A. right atrium®bicuspid valve®pulmonary vein
B. aortic valve®right ventricle®lung
C. lung®pulmonary artery®left atrium
D. right ventricle®bicuspid valve®aortic valve
E. none of these

14. The low-resistance pathway that permits electrical activity to pass from cell-to-cell in myocardial tissue is the

A. desmosome
B. septum
C. gap junction
D. T-tubule
E. sarcoplasmic reticulum

15. What component of the cardiac conduction system distributes electrical signals through the papillary muscles directly?

A. AV nodes
B. AV bundle
C. bundle of His
D. Purkinje fibers
E. SA node

16. The plateau of the cardiac action potential results from the opening of voltage-gated slow ____ channels in the plasma membrane of the ____ cell.

A. sodium; contractile
B. potassium; autorhythmic
C. calcium; contractile
D. chloride; pacemaker
E. potassium; contractile

17. Which of the following statements about action potentials in the heart is correct?

A. The rising phase of the action potential in autorhythmic cells is due to a rapid Ca^{2+} influx.
B. The rising phase of the action potential in contractile cells is due to a rapid Na^{+} influx.
C. The plateau phase of the action potential in contractile cells is due to a slow Ca^{2+} influx.
D. The rising phase of the action potential in autorhythmic cells is due to a rapid Ca^{2+} influx, and the rising phase of the action potential in contractile cells is due to a rapid Na^{+} influx
E. all of these

18. On a normal ECG, a wave for repolarization of the atria is not recorded. Why?

A. The leads are not placed in a position to pick it up.
B. No repolarization of the atria occurs normally.
C. It occurs simultaneously with ventricular depolarization and is masked by the QRS complex.
D. It does not travel through body fluids.
E. It is too small to be picked up by external recording electrodes.

19. Which of the following criteria must be met for the heart to function efficiently?

A. Excitation and contraction of the cardiac muscle fibers of each heart chamber should be coordinated to ensure efficient pumping.
B. The atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete.
C. The right side of the heart should contract first to ensure that oxygenated blood is delivered to the heart before the left side contracts.
D. Excitation and contraction of the cardiac muscle fibers of each heart chamber should be coordinated to ensure efficient pumping, and the atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete.
E. The atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete, and the right side of the heart should contract first to ensure that oxygenated blood is delivered to the heart before the left side contracts.

20. The AV nodal delay ensures that:

A. The atria contract and empty their contents into the ventricles prior to ventricular systole.
B. The ventricles contract prior to atrial systole.
C. Tetanic contractions of cardiac muscle are impossible.
D. Ventricular diastole occurs before systole.
E. Atrial diastole occurs before atrial systole.

21. The normal pacemaker of the heart is the

A. SA node
B. AV node
C. bundle of His
D. Purkinje system
E. ventricular myocardium

22. The function of the atrioventricular node is to

A. excite the left and right atrium
B. control the heart rate
C. prevent the atria and ventricles from contracting simultaneously
D. repolarize the heart after systole
E. none of these

23. The direction of the impulse through the conduction system of the heart is normally:

A. AV node¾SA node¾bundle of His¾Purkinje fibers
B. AV node¾bundle of His¾SA node-¾Purkinje fibers
C. bundle of His¾AV node¾Purkinje fibers¾SA node
D. SA node¾AV node¾bundle of His¾Purkinje fibers
E. SA node¾bundle of His¾Purkinje fibers¾AV node

24. The QRS complex represents

A. depolarization of the atria
B. depolarization of the ventricles
C. the AV nodal delay
D. repolarization of the ventricles
E. the time during which the heart is contracting

25. The fastest rate of autorhythmicity is normally carried out by the

A. AV bundle
B. AV node
C. bundle of His
D. Purkinje fibers
E. SA node

26. Depolarization occurs at the AV node

A. during the P wave
B. between the P wave and QRS complex
C. during the QRS complex
D. between the QRS complex and T wave
E. during the T wave

27. Which of the following ECG waves represents ventricular repolarization?

A. P wave
B. QRS complex
C. T wave
D. PR segment
E. Ventricular repolarization occurs simultaneously with atrial depolarization and consequently cannot be recorded.

28. Which is the normal sequence of the spread of cardiac excitation?

1. AV node
2. SA node
3. atria
4. Purkinje fibers
5. bundle of His
6. ventricular myocardium

A. 2¾3¾1¾5¾4¾6
B. 3¾2¾1¾4¾5¾6
C. 2¾3¾1¾4¾5¾6
D. 1¾2¾3¾4¾5¾6
E. none of these

29. Extrasystole of the heart means that it

A. beats too slowly
B. fills with too much blood
C. has a complete block
D. loses blood
E. produces a premature beat

30. The SA is the heart's normal pacemaker because

A. It has the fastest rate of autorhythmicity.
B. It has both sympathetic and parasympathetic innervation.
C. It lies in the right atrium.
D. Activation of K^+ channels occurs more rapidly in this region than elsewhere in the heart.
E. None of these.

31. Fibrillation is the

A. backflow of blood throughout the heart
B. coordinated function of nodal cells
C. failure of the heart valves to function
D. flow of blood through the heart's fibrous skeleton
E. uncoordinated excitation and contraction of cardiac cells

32. The AV node

A. is the normal pacemaker of the heart
B. is the only electrical connection between the atria and the ventricles
C. rapidly conducts the impulse from the atria to the ventricles so that they contract simultaneously
D. is not innervated by the vagus nerve
E. has the slowest rate of depolarization in the heart

33. The electrocardiogram is most useful in determining which component of cardiac output?

A. stroke volume
B. heart rate
C. ejection fraction
D. end-diastolic volume
E. murmurs

34. An ectopic focus is the place where

A. An abnormally excitable area of the heart initiates a premature action potential.
B. All of the electrical impulses of the heart terminate normally.
C. An ECG lead is attached on the outside of the chest.
D. A heart valve is attached.
E. The chordae tendineae attach to a valve.

35. The function of the ventricular conduction system of the heart is to

A. spread the action potential throughout the ventricle to ensure a single, coordinated contraction of the both ventricles
B. spread the action potential in the absence of sympathetic stimulation
C. spread the action potential throughout the atria and ventricles
D. slow down the original action potential so it has time to spread through the ventricles evenly
E. spread the action potential throughout the ventricle to ensure a single, coordinated contraction of the both ventricles, and slow down the original action potential so it has time to spread through the ventricles evenly

36. The refractory period of cardiac muscle

A. lasts almost as long as the contraction period
B. is much longer than the refractory period in skeletal muscle
C. prevents tetanic contraction of the heart to occur to ensure smooth, coordinated ejection of blood from the ventricles
D. all of these
E. lasts almost as long as the contraction period and is much longer than the refractory period in skeletal muscle

37. The membrane potential of cardiac muscle cells at rest is about ____ mV.

A. -110
B. -90
C. -70
D. -50
E. -30

38. Why can't tetanus occur in the heart?

A. There are no distinct motor units in the heart.
B. There is inadequate oxygen supply via the coronary circulation to metabolically support a sustained contraction.
C. The refractory period in cardiac muscle lasts almost as long as the contraction.
D. The heart contracts with maximal force every beat so it is impossible to increase the strength of its contraction.
E. Vagal stimulation slows down the heart rate to prevent summation of contractions.

39. During isovolumetric phases of the cardiac cycle,

A. The atria are contracting.
B. All heart valves are closed.
C. Blood is being ejected into the aorta.
D. The ventricles can only be relaxing.
E. The atria are contracting and all heart valves are closed.

40. 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

41. The cardiac output is equal to

A. (EDV - ESV) x HR
B. heart rate x EDV
C. the difference between the stroke volume at rest and the stroke volume during exercise
D. the stroke volume minus the ESV
E. heart rate x blood pressure

42. Which factor(s) would decrease cardiac output?

A. increased venous return
B. decreased vagal stimulation of the heart
C. increased preload
D. decreased preload
E. increased venous return and increased preload

43. If the connection between the SA node and AV node becomes blocked,

A. The QRS complex will be absent on an ECG.
B. The ventricles will beat more slowly.
C. The atria will beat slower.
D. Tachycardia will occur.
E. The QRS complex will be absent on an ECG and tachycardia will occur.

44. Which is true when your sympathetic nervous system is more active?

A. The SA node depolarizes more rapidly.
B. The myocardium repolarizes more rapidly.
C. More Ca^{2+} becomes available and causes more forceful heart contractions.
D. Norepinephrine is stimulating the heart.
E. All of these.

45. Which of the following decreases ESV?

A. acetylcholine
B. preload
C. afterload
D. parasympathetic activity
E. vagal activity

46. What percentage of ventricular filling is normally accomplished before atrial contraction begins?

A. 0%
B. 20%
C. 80%
D. 50%
E. 100%

47. Vagal influences on the heart result in

A. enhanced calcium permeability at the SA node
B. enhanced potassium permeability at the SA node
C. less frequent depolarization of the SA node
D. enhanced calcium permeability at the SA node and enhanced potassium permeability at the SA node
E. enhanced potassium permeability at the SA node and less frequent depolarization of the SA node

48. A condition in which the heart is contracting in an uncontrolled, rapid, and irregular manner:

A. is heart block
B. is fibrillation
C. can be treated with administration of an electrical current
D. is heart block and fibrillation
E. is fibrillation and can be treated with administration of an electrical current

49. The heart

A. is sympathetically innervated via cardiac nerve fibers
B. is parasympathetically innervated by vagus nerve fibers
C. is innervated by the phrenic nerve
D. is innervated by only the sympathetic division of the autonomic nervous system
E. is sympathetically innervated via cardiac nerve fibers and is parasympathetically innervated by vagus nerve fibers

50. When the heart is sympathetically stimulated,

A. ESV will increase.
B. It is responding to acetylcholine.
C. It is responding to norepinephrine.
D. Ca^{2+} channels are opening in greater numbers.
E. It is responding to norepinephrine, and Ca^{2+} channels are opening in greater numbers.

51. The second heart sound is produced by the

A. opening of the AV valves
B. closing of the AV valves
C. opening of the semilunar valves
D. closing of the semilunar valves
E. blood rushing through the AV valves during diastole, creating a turbulent flow

52. The first heart sound

A. occurs when the AV valves open
B. occurs when the semilunar valves close
C. signals the onset of ventricular diastole
D. occurs when the AV valves close, and signals the onset of ventricular systole
E. occurs when the semilunar valves close, and signals the onset of ventricular diastole

53. The aortic valve opens

A. when ventricular pressure exceeds aortic pressure
B. at the start of ventricular systole
C. just after the isovolumetric relaxation phase
D. just before the isovolumetric contraction phase
E. none of these

54. During isovolumetric contraction,

A. Rapid filling of the ventricles occurs.
B. No blood enters or leaves the ventricles.
C. The maximum volume of blood is ejected.
D. The maximum rate of ejection occurs.
E. *Both* the maximum volume of blood is ejected *and* the maximum rate of ejection occurs.

55. The period lasting from closure of the AV valve to opening of the aortic valve is known as

A. isovolumetric ventricular contraction
B. isovolumetric ventricular relaxation
C. the rapid ejection phase
D. the rapid filling phase
E. none of these

56. A heart valve opens and closes due to

A. being pulled by the heart muscle
B. pressure differences on the valve's two sides
C. Na^+ and K^+ fluxes during ventricular depolarization
D. turbulent flow in the atria and ventricles
E. none of these

57. Cardiac output

A. is the volume of blood pumped by each ventricle during each contraction or beat
B. is the volume of blood pumped by each ventricle per minute
C. equals heart rate x stroke volume
D. is the volume of blood pumped by each ventricle during each contraction or beat, and equals heart rate x stroke volume
E. is the volume of blood pumped by each ventricle per minute, and equals heart rate x stroke volume

58. The dicrotic notch on the aortic pressure curve is due to

A. a disturbance set up by the aortic valve closing
B. a disturbance set up when the AV valves close
C. elastic recoil of the aorta during ventricular diastole
D. turbulent flow through a stenotic valve
E. atherosclerosis in the aorta

59. An insufficient AV valve

A. fails to open completely
B. is not connected to chordae tendineae
C. produces a gurgling diastolic murmur
D. allows blood to backflow into a ventricle during diastole
E. none of these

60. Atrial flutter is characterized by a ____ rhythm, as impulses pass from the AV node to the ventricles.

A. 1:1
B. 2:1
C. 3:4
D. 5:2
E. 7:1

61. A whistling murmur heard between the second and first heart sound would be indicative of

A. a stenotic AV valve
B. an insufficient AV valve
C. a myocardial infarction
D. an insufficient semilunar valve
E. No conclusions can be reached based on the information provided.

62. At rapid heart rates

A. Systole and diastole shorten equally.
B. Systole stays almost constant, but diastole shortens.
C. Systole lengthens and diastole shortens
D. Diastole lengthens and systole shortens.
E. None of these.

63. Twelve complete ECG patterns are recorded over 10 seconds, which means the heart rate is ____ beats per minute.

A. 60
B. 72
C. 90
D. 108
E. 120

64. If stroke volume is 80 ml and the heart rate is 70 beats per minute, the cardiac output is

A. 150 ml/min
B. 560 ml/min
C. 5,600 ml/min
D. 8,700 ml/min
E. none of these

65. If the cardiac output is 4,800 ml/min and the heart rate is 60 beats per minute, the stroke volume averages ____ ml.

A. 60
B. 70
C. 80
D. 120
E. 140

66. According to the Frank-Starling law of the heart,

A. Shortening cardiac muscle fibers prior to contraction causes a more forceful contraction.
B. Increasing venous return increases EDV, which leads to an increased stroke volume.
C. As cardiac output decreases, blood pools in the vasculature and increases arterial blood pressure.
D. The left ventricle must pump more blood than the right ventricle since the left ventricle must pump blood to more regions of the body.
E. The greater the stroke volume, the smaller the subsequent ESV, because as more blood is squeezed out, the heart cannot fill as completely.

67. During heart failure,

A. The Frank-Starling curve is shifted to the left.
B. The heart pumps out a smaller stroke volume than normal for a given EDV.
C. A compensatory increase in sympathetic activity increases the contractility of the heart to normal in the early stages of the disease.
D. All of these.
E. The heart pumps out a smaller stroke volume than normal for a given EDV, and a compensatory increase in sympathetic activity increases the contractility of the heart to normal in the early stages of the disease.

68. The term *systole* means

A. closure
B. conduction
C. contraction
D. opening
E. relaxation

69. Parasympathetic innervation to the heart:

A. involves the vagus nerve
B. decreases the rate at which the pacemaker potential reaches threshold
C. decreases the strength of ventricular contraction
D. all of these
E. involves the vagus nerve and decreases the strength of ventricular contraction

70. Sympathetic stimulation of the heart

A. increases the heart rate
B. increases the heart's contractility
C. shifts the Frank-Starling curve to the left
D. involves the release of norepinephrine
E. all of these

71. Select the incorrect statement about rheumatic fever.

A. It causes a heart murmur.
B. It is an autoimmune disease.
C. It is triggered by a streptococcus bacterium.
D. The heart conduction system is disrupted.
E. The heart valves become inflamed and scarred.

72. Increased ____ permeability of nodal cells hyperpolarizes the SA node.

A. chloride
B. iodide
C. potassium
D. sodium
E. zinc

73. The parasympathetic nervous system has little effect on ____ activity.

A. atrial
B. AV node
C. heart rate
D. SA node
E. ventricular

74. If the EDV were held constant, increased cardiac output could be accomplished by

A. decreased sympathetic stimulation of the heart
B. decreased parasympathetic stimulation of the heart
C. decreased contractility
D. increased length of isovolumetric contraction
E. increased arterial blood pressure

75. Which of the following is not associated with an increase in stroke volume?

A. increased end-diastolic volume
B. increased contractility of the heart
C. increased end-systolic volume
D. increased preload
E. increased venous return

76. Vasodilation of coronary arteries is induced by

A. adenosine
B. nitroglycerin
C. nitric oxide
D. all of these
E. adenosine and nitroglycerin

77. The cardiac muscle

A. extracts oxygen and nutrients from the blood within its chambers
B. receives its blood supply primarily during ventricular systole when blood is forced into the vessels supplying the heart
C. receives its blood supply as all blood returning to the heart from the lung passes through the cardiac circulation before being pumped to the systemic circulation
D. receives most of its blood supply during ventricular diastole by means of the coronary circulation
E. none of these

78. A metabolic predictor of heart disease that is independent of one's cholesterol/lipid profile is

A. HDL
B. VLDL
C. homocysteine
D. methionine
E. creatine

79. The pulmonary circulation carries oxygenated blood from the lungs through the coronary circulation and then into the aorta.

FALSE

80. The right ventricle pumps deoxygenated blood through the tricuspid valve and into the pulmonary arteries.

FALSE

81. The aortic valve prevents backflow of blood from entering the left ventricle during ventricular diastole.

TRUE

82. The mitral valve prevents regurgitation of blood back into the left atrium from the left ventricle.

TRUE

83. The function of the chordae tendineae and papillary muscles is to hold the AV valves open during diastole to ensure complete ventricular filling.

FALSE

84. The AV valve controls the amount of blood entering the atrium from the venous system.

FALSE

85. The SA node is the only part of the heart that can function as the heart's pacemaker.

FALSE

86. The only point of electrical contact between the atria and the ventricles is the AV valve.

FALSE

87. An action potential spreads through the atria by gap junctions, but there are no gap junctions present in the ventricles, so the impulse must be propagated throughout the ventricular myocardium by the bundle of His and Purkinje system.

FALSE

88. An action potential impulse passes through the internodal pathways between the P wave and Q waves on an ECG.

TRUE

89. Ventricular systole is displayed as the QRS on the ECG, and ventricular diastole is displayed as the T wave.

FALSE

90. With 2:1 rhythm, the atrial rate is very rapid and the ventricular rate is normal or above normal, whereas with 2:1 block, the atrial rate is normal but the ventricular rate is below normal.

TRUE

91. The plateau phase of the action potential in a contractile cardiac muscle cell occurs as a result of activation of slow Ca^{2+} channels.

TRUE

92. Oxygenated blood flows through semilunar valves, whereas deoxygenated blood flows through AV valves.

FALSE

93. Diastole refers to the period of cardiac repolarization.

FALSE

94. Atrial systole is responsible for the first heart sound, whereas the ventricular systole is responsible for the second heart sound.

FALSE

95. Ventricular filling occurs more rapidly early in diastole than it does later in diastole.

TRUE

96. Atrial systole contributes most of a ventricle's EDV.

FALSE

97. Ventricular ejection occurs once the afterload has been overcome.

TRUE

98. The refractory period in cardiac muscle is much shorter than the refractory period in skeletal muscle to ensure that the heart can quickly be re-stimulated to produce alternate periods of contraction and relaxation.

FALSE

99. The long refractory period of cardiac muscle prevents tetanic contractions of the heart.

TRUE

100. High blood pressure decreases the afterload and increases the preload.

FALSE

101. Under normal conditions, all of the EDV is ejected before ventricular diastole begins.

FALSE

102. Contraction of the spirally arranged cardiac muscle fibers produces a wringing effect for efficient pumping.

TRUE

103. The AV and semilunar valves are never open at the same time.

TRUE

104. A pacemaker potential depends on the increased inward current of calcium ions.

TRUE

105. The first heart sound signals the onset of ventricular depolarization.

FALSE

106. Complete heart block results from a damaged AV node.

TRUE

107. The second heart sound is due to closure of the AV valves.

FALSE

108. The stroke volume is the total volume of blood ejected by both ventricles each minute.

FALSE

109. Pacemaker activity by the Purkinje fibers is an example of an ectopic focus.

TRUE

110. Normally, the stroke volume of the right side of the heart is the same as the stroke volume of the left side of the heart.

TRUE

111. One important function of the intrinsic control of the heart (Frank-Starling law of the heart) is to equalize the left and right cardiac outputs.

TRUE

112. The extent of ventricular filling is the preload of the heart, whereas the magnitude of the arterial blood pressure is the afterload of the heart.

TRUE

113. Parasympathetic stimulation slows the rate of depolarization of the SA node and thus decreases the heart rate.

TRUE

114. An increased heart rate can result due to a decrease in parasympathetic stimulation or an increase in sympathetic stimulation of the heart.

TRUE

115. The addition of ACh to the SA node would decrease the number of T waves observed per minute on an ECG.

TRUE

116. Cardiac output is equal to the EDV-ESV.

FALSE

117. Norepinephrine increases calcium permeability in cardiac muscle cells and thus increases the heart's contractility.

TRUE

118. The average resting heart rate is normally established by the rhythm of autorhythmic cells located near the base of the right atrium.

FALSE

119. The amount of blood pumped out of the heart during each beat is known as the cardiac output.

FALSE

120. Increased EDV results in decreased stroke volume, and increased stroke volume results in increased ESV.

FALSE

121. Parasympathetic stimulation of the heart increases cardiac reserve by allowing more time for the heart to relax between contractions.

FALSE

122. According to the Frank-Starling law of the heart, the shorter the initial length of the cardiac muscle fibers prior to contraction, the more forceful will be the subsequent contraction because the fibers are already partially contracted.

FALSE

123. Left-sided congestive heart failure can lead to pulmonary edema.

TRUE

124. Most blood flow through the coronary vessels occurs during ventricular systole when the heart is driving blood forward.

FALSE

125. The heart utilizes glucose almost exclusively for energy production.

FALSE

126. Not all forms of cholesterol are equally harmful to the heart.

TRUE

127. **Complete each of the following statments.**

The _____ is the normal pacemaker of the heart.

SA node

128. **Complete each of the following statments.**

The _____ delay ensures that atrial systole is complete before ventricular systole begins.

AV nodal

129. **Complete each of the following statments.**

The refractory period in skeletal muscle is _____ than the refractory period in cardiac muscle.

shorter

130. **Complete each of the following statments.**

A swishy murmur heard between the second and first heart sounds is indicative of a(n) _____ (stenotic or insufficient) _____ (AV or semilunar) valve.

insufficient, AV

131. **Complete each of the following statments.**

The _____ is equal to the cardiac output divided by the heart rate.

stroke volume

132. **Complete each of the following statments.**

The _____ is the volume of blood pumped by each ventricle/minute.

cardiac output

133. **Complete each of the following statments.**

The _____ volume is the blood in the ventricle when ejection is complete, whereas the _____ volume is the blood in the ventricle just before ejection begins.

end-systolic, end-diastolic

134. **Complete each of the following statments.**

Myocardial _____ is the insufficient circulation of oxygenated blood to cardiac muscle in order to maintain its aerobic metabolism.

ischemia

135. **Complete each of the following statments.**

During the period of _____ and the period of _____ in the cardiac cycle, all heart valves are closed.

isovolumetric contraction, isovolumetric relaxation

136. **Complete each of the following statments.**

_____ carries cholesterol to cells, whereas _____ transports it away from cells.

LDL, HDL

137. **Complete each of the following statments.**

The _____ extracts cholesterol from the blood and converts it into _____, which are secreted into the bile.

liver, bile salts

138. **Complete each of the following statments.**

Vitamins _____ and _____ have been shown to slow plaque deposition in coronary arteries.

A, C

139. **Complete each of the following statments.**

A(n) _____ is a clot attached to the wall of a vessel.

thrombus

140. **Complete each of the following statments.**

PAF is released from the _____ lining of vessels.

endothelium

141. **Complete each of the following statments.**

The _____ are the kinds of blood vessels that experience congestion for congestive heart failure.

veins

142. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Increasing stroke volume _____ cardiac output.

increases

143. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in stroke volume _____ ESV.

decreases

144. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Increasing the afterload _____ the length of time the heart is in isovolumetric contraction.

increases

145. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Decreasing preload _____ contractility, which then _____ stroke volume.

decreases, decreases

146. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Norepinephrine _____ the SA node's permeability to $Ca2^{+}$, which then _____ the length of time between subsequent heart beats.

increases, decreases

147. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Decreasing venous return _____ preload and _____ EDV.

decreases, decreases

148. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Acetylcholine _____ the SA node's permeability to potassium ions; as a result, the length of time between successive T waves _____.

increases, increases

149. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Becoming more physically fit _____ a person's cardiac reserve.

increases

150. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in venous return _____ the end-diastolic volume.

increases

151. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in afterload _____ the length of time available for ventricular ejection.

decreases

152. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in the length of the cardiac muscle fibers prior to contraction _____ the number of heart sounds heard.

has no effect on

153. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

Increasing the time when all heart valves are closed _____ the length of time that a lub heart sound lasts.

has no effect on

154. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in parasympathetic activity _____ the stroke volume.

has no effect on

155. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in the parasympathetic activity _____ the AV-nodal delay.

increases

156. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in cardiac sympathetic activity _____ the stroke volume.

increases

157. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in parasympathetic activity _____ the atrial contractility.

decreases

158. **Complete each of the following statements with *increases*, *decreases*, or *has no effect on*.**

An increase in cardiac sympathetic activity _____ the velocity of impulse conduction through the heart.

increases

159. **Sequencing**

Indicate the proper order of events during the cardiac cycle by placing numbers in the blanks preceding the events in sequence. (Some steps may have been omitted.) The first event is labeled as your starting point.

1	AV valve open; aortic valve closed; ventricular filling occurring
	Blood ejected from the ventricles
	Isovolumetric ventricular relaxation
	Atrial contraction
	AV valve opens; ventricular filling occurs again; one cardiac cycle is complete
	Aortic valve opens
	SA node discharges
	Ventricular filling complete
	Ventricular relaxation begins
	Aortic valve closes
	Isovolumetric ventricular contraction
	Ventricular contraction begins; AV valve closes

1, 8, 11, 3, 12, 7, 2, 4, 9, 10, 6, 5