Heart

The first 91 items are multiple choice.

1. Tom was stabbed with a Samurai sword. It pierced the left side of his chest, went straight through his heart and exited his upper back. Which of the following was the SECOND structure pierced by the sword?
   a. Epicardium
   b. Myocardium
   c. Fibrous pericardium
   d. Visceral serous pericardium
   e. Parietal serous pericardium

2. Which of the following typically depolarizes LAST?
   a. Sinoatrial node
   b. Purkinje fibers
   c. Atrial contractile cells
   d. Atrioventricular bundle
   e. Atrioventricular node

3. Which of the following contains deoxygenated blood?
   a. Left atrium
   b. Pulmonary vein
   c. Right coronary artery
   d. Coronary sinus
   e. Aorta

4. Which of the following is NOT TRUE?
   a. The base of the heart rests on the diaphragm.
   b. The left ventricle is the pump of the systemic circuit.
   c. The heart is found in the mediastinum.
   d. The heart contains 2 pumps arranged in series.
   e. The left ventricle generates more pressure than the right ventricle.

5. Ridges in the right ventricular wall are called:
   a. Fossa ovalae
   b. Trabeculae carneae
   c. Papillary muscles
   d. Chordae tendineae
   e. Fibrocytic inclusions

6. Blood is prevented from backflowing INTO the right ventricle by the:
   a. Pulmonary semilunar valve
   b. Aortic semilunar valve
   c. Tricuspid valve
   d. Mitral valve
   e. Eustachian valve
Heart

7. The aortic semilunar valve is open during _______ of the 4 phases of the cardiac cycle.
   a. 1  
   b. 2  
   c. 3  
   d. 4

8. During isovolumetric relaxation, the AV valves are ________ and the semilunar valves are _________.
   a. Open – open  
   b. Closed – closed  
   c. Open – closed  
   d. Closed – open

9. All of the following vessels empty into the right atrium EXCEPT:
   a. Superior vena cava  
   b. Pulmonary trunk  
   c. Inferior vena cava  
   d. Coronary sinus  
   e. A and B

10. What structures work to prevent prolapse (i.e., flipping up) of the atrioventricular valves?
    a. Trabeculae carneae  
    b. Papillary muscles  
    c. Pectinate muscles  
    d. Autorhythmic cells  
    e. All of the above

11. A(n) _________ in heart rate would cause time for filling to _________ which would cause the end diastolic volume to ___________.
    a. Increase – increase – increase  
    b. Decrease – decrease – decrease  
    c. Increase – increase – decrease  
    d. Decrease – increase – increase  
    e. None of the above

12. Suppose a red blood cell is in the coronary sinus. What heart chamber was it most recently in?
    a. Right ventricle  
    b. Right atrium  
    c. Left ventricle  
    d. Left atrium

13. Suppose a red blood cell is in the pulmonary trunk. What heart valve will it pass next?
    a. Mitral  
    b. Pulmonary semilunar  
    c. Aortic  
    d. Eustachian  
    e. Tricuspid

Examine the graph below. Note the 4 lettered points. Use those points as your answer choices for the next 5 questions.
15. At which point is ventricular volume falling?
16. Which point would best be considered to be just before the depolarization of the SA node?
17. At which point is the mitral valve open?
18. At which point is ventricular volume constant and ventricular pressure falling?
19. At which point is the aortic semilunar valve open?

20. John’s heart rate is 50 beats/min. During each cardiac cycle, 50 mL of blood is ejected from his left ventricle. How much TOTAL BLOOD exits his HEART per minute?
   a. 3000 mL
   b. 50 mL
   c. 5000 mL
   d. 10000 mL
   e. 2 L

21. Suppose that at this very moment Mr. Zolak’s left ventricular pressure is greater than his aortic pressure. Thus the next sound his heart will make will be due to 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

22. The only electrical connection between the atria and the ventricles is via the:
   a. Fibrous skeleton of the heart
   b. AV node and AV bundle
   c. Purkinje fibers
   d. Ampulla of Vater
   e. Superior vena cava

23. The depression in the adult interatrial septum is the ________________.
Heart

a. Fossa ovalis
b. Foramen rotundum
c. Fossa ovale
d. Foramen ovalis
e. None of the above

24. On the Ides of March 44 BCE, the Roman dictator Julius Caesar was stabbed some 23 times by a group of conspirators including the oft mentioned Brutus. Supposedly the fatal wound was one that pierced his heart. Which of the following structures would have been pierced first as the dagger was plunged into Caesar’s thorax?
   a. Parietal pericardium
   b. Fibrous pericardium
   c. Visceral pericardium
   d. Myocardium
   e. Exocardium

25. Which of the following has the fastest rate of spontaneous rhythmic depolarization?
   a. Purkinje fibers
   b. Cardiac contractile cells
   c. Cells of the AV node
   d. Cells of the AV bundle
   e. Red blood cells

28. You radioactively labeled a red blood cell so that you could monitor its path through the heart. You see the labeled RBC in the right ventricle. Moments later, you see it in the right coronary artery. How many heart valves must the labeled RBC have passed through during the monitoring?
   a. At least 7
   b. At least 5
   c. At least 3
   d. Only 1
   e. None of the above

29. Cardiac output is 5 L/min, end systolic volume is 100 mL, and end diastolic volume is 150 mL. Calculate heart rate.
   a. 50 bpm
   b. 75 bpm
   c. 100 bpm
   d. 200 bpm
   e. Heart rate cannot be determined

30. Why does stroke volume increase when heart rate slows down?
   a. Because the filling time decreases.
   b. Because end diastolic volume decreases.
   c. Because preload increases.
   d. Because contractility decreases.
   e. Because the number of cardiac cycles per minute increases.

31. The ____________ prevents backflow from the right ventricle into the right atrium.
   a. Papillary flap
Heart

b. Tricuspid valve
c. Mitral valve
d. AV semilunar valve
e. Left AV valve

32. During isovolumetric contraction, the AV valves are _______ and the semilunar valves are ________.
   a. Open – open
   b. Closed – closed
   c. Open – closed
   d. Closed – open
   e. The answer to this question cannot be determined.

33. Which of the following statements is TRUE?
   I. Contraction of the papillary muscles creates tension in the chordae tendineae
   II. The mitral valve is the only valve with chordae tendineae
   III. The AV valves are closed during atrial systole
   a. I only
   b. II only
   c. III only
   d. I and II only
   e. I, II, and III

34. The right side of the heart is associated with the __________ circulation and the left side of the heart is associated with the ________ circulation.
   a. Thoracic; coronary
   b. Coronary; systemic
   c. Systemic; pulmonary
   d. Coronary; pulmonary
   e. Pulmonary; systemic

35. The “lub” sound of the heart is caused by the ______ of the ______.
   a. Opening; AV valves
   b. Closing; AV valves
   c. Opening; semilunar valves
   d. Closing; semilunar valves
   e. None of the above

36. Which of the following is NOT TRUE?
   a. $SV + ESV = EDV$
   b. Stroke volume is the amount of blood pumped by each ventricle per second.
   c. Cardiac output is the volume of blood pumped by each ventricle per minute.
   d. Cardiac output is the product of heart rate and stroke volume
   e. None of the above

37. Which of the following is the FARTHEST from the endocardium?
   a. Parietal serous pericardium
   b. Myocardium
Heart

c. Visceral serous pericardium
d. Fibrous pericardium
e. Epicardium

38. Which of the following will contain DEOXYGENATED blood?
   a. Left atrium
   b. Left auricle
   c. Right pulmonary vein
   d. Coronary sinus
   e. Systemic arteries

39. Which of the following is TRUE?
   a. The heart is located in the mediastinum.
   b. The heart chambers are lined by simple squamous epithelium.
   c. The apex of the heart points towards the left hip.
   d. The atria function as receiving chambers for blood.
   e. All of the above

40. Which of the following is the pacemaker of the heart?
   a. Sinoatrial node
   b. Senoauricular node
   c. Cardioacceleratory center of the medulla oblongata
   d. AV node
   e. Arteriovenous node

41. Which of the following links AV valve flaps to the papillary muscles?
   a. Pectinates
   b. Trabeculae carnea
   c. Chordae tendineae
   d. Moderator banditos
   e. Venae cavae

42. Which of the following physically and electrically separates the atria from the ventricles?
   a. Tricuspid and bicuspid orifices
   b. Gap junctions
   c. Right and left bundle branches
   d. Fibrous skeleton of the heart
   e. Blood

43. The __________ is an opening in the fetal __________.
   a. Fossa ovalis – atrial septum
   b. Fossa ovalis – ventricular septum
   c. Foramen ovale – atrial septum
   d. Foramen ovale – ventricular septum
   e. None of the above are correct

44. Which of the following is TRUE?
   a. Right ventricular cardiac output is usually less than left ventricular cardiac output.
   b. Left ventricular cardiac output is usually less than right ventricular cardiac output.
Heart

c. Right ventricular stroke volume is usually less than left ventricular stroke volume.
d. Left ventricular stroke volume is usually less than right ventricular stroke volume.
e. None of the above

45. Which of the following has the SLOWEST rate of spontaneous depolarization?
   a. Cells of the SA node
   b. Purkinje fibers
   c. Cells of the AV bundle
   d. Cells of the AV node
   e. Cells of the bundle branches

46. If ventricular pressure is 131 mmHg and aortic pressure is 127 mmHg, then what phase of the cardiac cycle is the heart in?
   a. Ventricular filling
   b. Ventricular ejection
   c. Atrial systole
   d. Isovolumetric relaxation
   e. Isovolumetric contraction

47. Pericardial fluid is found between the parietal serous pericardium and the ____________.
   a. Fibrous pericardium
   b. Desmosomes
   c. Endocardium
   d. Epicardium
   e. Myocardium

48. Cardiac contractile cells are electrically linked by __________ which are part of ____________.
   a. Desmosomes – intercalated discs
   b. Gap junctions – intercalated discs
   c. Gap junctions – desmosomes
   d. Collagen fibers – intercalated discs
   e. Desmosomes – collagen fibers

49. Which chamber of the heart has the thickest wall?
   a. Right atrium
   b. Left atrium
   c. Right ventricle
   d. Left ventricle

50. As blood flows from the left atrium all the way to the coronary arteries, it will pass ____ valves.
   a. 1
   b. 2
   c. 3
   d. 4

51. Which of the following does NOT empty into the right atrium?
   a. Coronary sinus
   b. Inferior vena cava
Heart

c. Pulmonary trunk
d. Superior vena cava
e. More than one of the above

52. If blood is moving from the left ventricle to the aorta, then which of the following is TRUE?
   a. Left ventricular pressure > aortic pressure
   b. Left ventricular pressure < aortic pressure
   c. Left ventricular pressure = aortic pressure

53. The sequence of contraction of the heart chambers is:
   a. Random
   b. Left chambers followed by right chambers
   c. Both atria followed by both ventricles
   d. Both ventricles followed by both atria

54. Compared to the blood in the superior vena cava, the blood in the left coronary artery typically has:
   a. A higher CO₂ content
   b. A lower CO₂ content
   c. A temperature that is elevated by approximately 8.54° Fahrenheit
   d. Twice as many red blood cells
   e. The same amount of CO₂

55. Atropine is a chemical that decreases parasympathetic activity on the heart. Atropine would therefore cause the rate of depolarization of the atrioventricular cells to:
   a. Increase
   b. Decrease
   c. Stay the same

56. Which of the following can occur when the tricuspid valve is CLOSED?
   I. Atrial systole
   II. Atrial diastole
   III. Ventricular diastole
   IV. Ventricular systole
   a. I, II, and III
   b. I, II, and IV
   c. II, III, and IV
   d. II
   e. IV

For the next 4 questions, consider the following:
Larry conducted an experiment in which he measured the volume of blood in the left ventricle at various times during the cardiac cycle. The following is the data Larry obtained: (note – the ESV and EDV are labeled)
### Heart

<table>
<thead>
<tr>
<th>Time (milliseconds)</th>
<th>Volume of blood in the left ventricle (milliliters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>100</td>
<td>130 (EDV)</td>
</tr>
<tr>
<td>125</td>
<td>130</td>
</tr>
<tr>
<td>175</td>
<td>90</td>
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<td>300</td>
<td>65 (ESV)</td>
</tr>
<tr>
<td>375</td>
<td>65</td>
</tr>
<tr>
<td>550</td>
<td>85</td>
</tr>
</tbody>
</table>

57. Between 0 and 100 milliseconds, the left ventricle is most likely in:
   a. Diastole
   b. Systole
   c. Tetanus
   d. Hyperpolarization
   e. None of the above

58. At time = 118 milliseconds, the left ventricle is most likely in _________ while the left atrium is most likely in _________.
   a. Systole; Systole
   b. Systole; Diastole
   c. Diastole; Diastole
   d. Diastole; Systole
   e. None of the above

59. The stroke volume of the left ventricle was:
   a. 55mL
   b. 60mL
   c. 65mL
   d. 80mL
   e. 95mL

60. At time = 325 milliseconds, the pressure exerted on the aortic semilunar valve by arterial blood is probably ________________ the pressure exerted on the aortic semilunar valve by the blood in the left ventricle.
   a. Greater than
   b. Less than
   c. The exact same as

61. Put the following components of the conduction system of the heart in the correct order:
   1. Purkinje Fibers
   2. SA node
   3. AV bundle
Heart

4. AV node
5. Bundle Branches

a. 2 – 3 – 4 – 5 – 1
b. 2 – 4 – 3 – 5 – 1
c. 2 – 4 – 3 – 1 – 5
d. 4 – 2 – 5 – 1 – 3
e. 2 – 4 – 1 – 3 – 5

62. During which of the following events could the AV valves be found to be closed?
   1. Atrial filling
   2. Ventricular diastole
   3. Isovolumetric contraction
   4. Ventricular ejection
   5. Isovolumetric relaxation

   a. 1, 3, 4, and 5
   b. 2, 3, 4, and 5
   c. 1, 2, 3, 4, and 5
   d. 3, 4, and 5
   e. 4 only

63. Severing the vagus nerve would:
   a. Decrease the ability of parasympathetic signals to get to the heart
   b. Have no effect on the extrinsic control of the heart
   c. Decrease the ability of sympathetic signals to get to the heart
   d. All of the above
   e. 2 of the above

64. Arrange the following from SUPERFICIAL TO DEEP.
   1. Epicardium
   2. Parietal pericardium
   3. Myocardium
   4. Endocardium

   a. 4,3,1,2
   b. 1,3,4,2
   c. 2,1,3,4
   d. 2,4,3,1
   e. 3,4,1,2

65. Which of the following is TRUE?
   a. The 2 atria sit at the apex of the heart, superior to the 2 ventricles
   b. The left ventricle is more massive than the right ventricle because it pumps a greater volume of blood
Heart

c. All arteries carry oxygenated blood
d. Internal ridges of muscle are known as pectinate muscles in the atria and trabeculae carneae in the ventricles
e. Chordae tendineae are responsible for the closing of the AV valves

66. Consider the following statements.
   I. The AV bundle is the only electrical connection between the atria and the ventricles
   II. The AV node delay ensures that the atria contract prior to the ventricles
   III. The ventricles begin their contraction at their superior portion

   a. I, II, and III are all true
   b. Only I and II are true
   c. Only I and III are true
   d. Only II and III are true
   e. Only I is true

67. Which of the following is TRUE?
   a. The closing of the AV valves causes the 2nd heart sound
   b. The closing of the semilunar valves occurs during atrial systole
   c. The opening of the semilunar valves requires more pressure than the shutting of the AV valves
   d. All of the above
   e. 2 of the above

85. In which situation would 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 EDV and the ESV is small
   e. When sympathetic stimulation to the heart is low

86. What effect would compressing the inferior vena cava just below the diaphragm have on cardiac function?
   a. Stroke volume would increase dramatically
   b. Cardiac output increase dramatically
   c. Sympathetic stimulation of the heart would increase
   d. All of the above are correct
   e. Both A and B are correct

87. If the papillary muscles fail to contract:
   a. The ventricles will not pump blood
   b. The atria will not pump blood
   c. The semilunar valves will not open
   d. The AV valves will not close properly
   e. 2 of the above are correct

88. According to the Frank-Starling Law of the Heart, the cardiac output is directly related to:
   a. Mass of the ventricular myocardium
   b. Pulse pressure
   c. End diastolic volume
Heart

d. End systolic volume

e. Gradient of acetylcholine inactivation

89. The 1st heart sound is heard when the:
   a. AV valves open
   b. AV valves shut
   c. Semilunar valves open
   d. Semilunar valves shut
   e. Blood enters the pulmonary and aortic trunks

90. The following are a list of vessels and structures associated with the heart.
   1) Right atrium
   2) Left atrium
   3) Right ventricle
   4) Left ventricle
   5) Vena cavae
   6) Aorta
   7) Pulmonary trunk
   8) Pulmonary veins

   What is the correct order for the flow of blood entering from the systemic circulation?
   a. 1,2,7,8,3,4,6,5
   b. 1,7,3,8,2,4,6,5
   c. 5,1,3,7,8,2,4,6
   d. 5,3,1,7,8,4,2,6
   e. 5,1,3,8,7,2,4,6

91. The visceral pericardium is the same as the:
   a. Mediastinum
   b. Parietal pericardium
   c. Epicardium
   d. Myocardium
   e. Endocardium

For the next 46 items, use the following answer choices:
   a. Increase
   b. Decrease
   c. Not change

1. Caffeine would cause the time between heartbeats to:
2. Increased output of the cardioinhibitory center would cause heart rate to:
3. Increased sympathetic activity would cause the strength of the heart’s contraction to:
4. If stroke volume increased while heart rate did not change, cardiac output would:
5. As blood traveled from the pulmonary arteries to the pulmonary veins its oxygen content would:
6. During isovolumetric relaxation right ventricular volume will:
7. An increase in the activity of the cardioacceleratory center will cause filling time to:
Heart

8. A decrease in the activity of the cardioinhibitory center will cause heart rate to:
9. Norepinephrine will cause contractility to:
10. An increase in venous return will cause stroke volume to:
11. A decrease in preload will cause stroke volume to:
12. An increase in afterload will cause stroke volume to:
13. A decrease in vagal tone will cause cardiac output to:
14. A rise in plasma levels of epinephrine will cause the time between heart beats to:
15. An increase in arterial blood pressure will cause afterload to:
16. An increase in contractility will cause end systolic volume to:
17. A decrease in the activity of the cardioacceleratory center will cause heart rate to:
18. An increase in ventricular filling time will cause stroke volume to:
19. During isovolumetric contraction, left ventricular volume will:
20. Norepinephrine causes the length of ventricular diastole to:
21. Cutting both vagus nerves will cause heart rate to:
22. During exercise, cardiac output will:
23. If the time between heart beats increases, the end diastolic volume will:
24. An increase in the stretch of the left ventricle (within normal limits) would cause the stroke volume of the
   left ventricle to:
25. An increase in plasma levels of epinephrine will cause heart rate to:
26. As blood flows from the right ventricle all the way to the left atrium, its oxygen content will:
27. A decrease in contractility of the heart would cause the end systolic volume to:
28. A drug that blocked the action of acetylcholine would cause the heart rate to:
29. During isovolumetric relaxation, left ventricular pressure will:
30. During isovolumetric contraction, right ventricular volume will:
31. Deactivation of the cardioacceleratory center will cause the depolarization rate of the autorhythmic cells of
   the SA node to:
32. An increase in the number of signals travelling to the heart via the 10th cranial nerve will cause the rate of
   cardiac contraction to:
33. An increase in cardiac contractility will cause stroke volume to:
34. An increase in end diastolic volume will cause preload to:
35. A drug that blocked the action of norepinephrine would cause stroke volume and heart rate to:
36. Thyroxine will cause the number of cardiac cycles per minute to:
Heart

37. As blood travels from the left superior pulmonary vein all the way to the coronary sinus, you would expect its CO₂ content to:

38. During isovolumetric contraction of the left ventricle, pressure in the left ventricle will:

39. Muscarine is a chemical that prevents acetylcholine from binding to cardiac autorhythmic cells. Thus, IV infusion of muscarine would cause heart rate to:

40. When the left ventricle contracts, the diameter of the left ventricular chamber will:

41. If heart rate remains the same and skeletal muscle activity increases, end diastolic volume will:

42. During isovolumetric contraction, ventricular volume will:

43. As blood flows from the coronary sinus to the ascending aorta, its oxygen content will:

44. During isovolumetric relaxation, blood volume within the left atrium will:

45. As heart rate increases, ventricular filling time will:

46. A massive increase in afterload would cause the length of time between the 1st and 2nd heart sounds to:

Here are some short answer questions:

1. Larry is a healthy adult male. At one specific moment in his cardiac cycle:
   - his aortic pressure was 82 mmHg,
   - his left ventricle pressure was 78 mmHg and rising,
   - and his left atrial pressure was 16 mmHg.

   Tell me everything you can about Larry’s heart at that precise moment.

2. Teddy has a heart rate of 50 beats/minute. His cardiac output is 5 L/minute. His end diastolic volume is 150 mL. Calculate his stroke volume and end systolic volume.

3. Consider an adult RBC traveling from the right ventricle all the way to the right coronary artery. What’s the minimum number of valves it must have passed? Name them in order.