**These review questions are for the Cardiovascular system lecture topic. The questions were adapted from several sources, including 1800+ Review Questions for Anatomy and Physiology II (2nd edition) by R. Michael Anson, Ph.D.**

You are required to know and understand all the material on the cardiovascular system that is covered in the lecture and in the laboratory. Questions marked with an asterisk are from material presented in the laboratory section of the course.

**Multiple choice review questions:**

1) Which of the following is **not** considered part of the cardiovascular system?

 A) Heart

 B) Lungs

 C) Blood

D) Blood vessels

2) The two main loops of the cardiovascular system are \_\_\_\_\_ loop and the \_\_\_\_\_ loop. (Choose two correct answers)

 A) Pulmonary

 B) Respiratory

 C) Aorta

D) Systemic

3) Within the pulmonary loop, the

 A) pulmonary arteries carry oxygen-poor blood.

 B) pulmonary veins carry blood toward the lungs

 C) blood returning to the left atrium of the heart is oxygen-poor.

 D) oxygen from the blood diffuses into the lungs.

4) Which is **not** a blood vessel that directly connects to the heart?

 A) Carotid artery

 B) Superior vena cava

 C) Aorta

D) Inferior vena cava

E) Pulmonary artery

F) Pulmonary vein

5) The atrioventricular (AV) valves

 A) are located between the atria and the vena cava

 B) are located between the ventricles and the aorta

 C) are located between the ventricles and the atria

 D) are located within coronary arteries

6) The semilunar valves

 A) prevent the backward flow of blood from the ventricles into the atria.

 B) are open during the relaxation phase of the ventricles.

 C) are closed throughout the cardiac cycle

 D) regulate the passage of blood from the ventricles into the pulmonary

 artery and the aorta.

7) The terms "systole" and "diastole" usually refer to the

 A) contraction phase and relaxation phase of the atria.

 B) relaxation phase and contraction phase of the atria.

 C) contraction phase and relaxation phase of the ventricles.

 D) relaxation phase and contraction phase of the ventricles.

8) The second heart sound (“dup”) results from vibrations generated by the

 A) opening of the AV valves at the start of diastole.

 B) closing of the AV valves at the start of systole.

 C) opening of the semilunar valves at the start of systole.

 D) closing of the semilunar valves at the start of diastole.

9) The following list of events of the cardiac cycle is NOT in the correct sequence. Which arrangement is the correct order of events?

 1 = The ventricles contract

 2 = The ventricles relax

 3 = The atria contract

 4 = The atria relax

 5 = All chambers relax

 A) 3, 2, 1, 4, 5

 B) 1, 3, 5, 4, 2

 C) 3, 1, 4, 2, 5

D) 2, 5, 3, 4, 1

10) The \_\_\_\_\_\_ is the normal pacemaker of the heart.

 A) AV bundle

 B) Left atrium

 C) Right atrium

 D) SA node

11) Action potentials in heart cells require (and can be altered by) all of these ions except

 A) Na+

 B) Cl-

 C) K+

 D) Ca2+.

12) An important function of the AV node is to

 A) rapidly transmit action potentials to the surface of the atria

 B) delay the conduction of the action potential from the atria to the

 ventricles.

 C) serve as a conduit for rapid transmission of action potentials to blood

 vessels

 D) serve as a pacemaker for the contraction of cardiac muscle.

13\*) An ECG measures…

 A) The electrical activity of the heart

 B) The entire cardiac output

 C) The cardiovascular flow rate

D) The cardiac glucose exportation



14\*) In the ECG to the right, what event(s)

 in the heart occur during the P wave?

 A) Ventricles contract

 B) Ventricles relax

 C) Atria contract

D) Atria relax

15\*) In the ECG, what event(s) in the heart occur during the QRS complex?

 A) Ventricles contract

 B) Ventricles relax

 C) Atria contract

D) Atria relax

16\*) In the ECG, what event(s) in the heart occur during the T wave?

 A) Ventricles contract

 B) Ventricles relax

 C) Atria contract

D) Atria relax

17) The inner most tissue layer of any blood vessel is called the

 A) tunica interna

 B) medullary cortex

 C) stratum hemoderma

 D) vasomedia

18) Which of the following statements about arteries and veins is false?

 A) Arteries have more smooth muscle for their diameters than do comparable veins.

 B) Arteries carry blood transported under higher pressure than blood carried by veins.

 C) Only veins have one-way valves to promote flow in one direction.

D) The body changes the diameter of veins to control blood flow to organs

19) The body changes the blood flow to organs mostly through changes in \_\_\_\_\_\_

 A) vessel radius.

 B) blood viscosity.

 C) vessel length.

 D) pressure differential.

20) The skeletal muscle pump can directly increase

 A) cardiac output.

 B) blood volume.

 C) heart rate.

 D) venous return of blood to heart.

21) The exchanges of gases and nutrients between the blood and the tissues occur in blood vessels called

 A) arteries.

 B) arterioles.

 C) capillaries.

 D) veins.

22) The average heart rate for an adult at rest is

 A) 12 beats per minute

 B) 72 beats per minute

 C) 80 beats per minute

 D) 120 beats per minute

23\*) Taking the pulse at the wrist is called taking the \_\_\_\_\_\_ pulse

 A) Carpel

 B) Radial

 C) Brachial

D) Humoral

24\*) Taking the pulse at the neck is called taking the \_\_\_\_\_\_ pulse

 A) Carotid

 B) Jugular

 C) Peripheral

D) Cervical

25\*) The “Lub-dup” sounds of the heart come from what part of the heart?

 A) Ventricles

 B) Atria

 C) Valves

D) Arteries

26\*) When listening to heart sounds with a stethoscope, abnormal heart sounds (such as gurgles or muffled beats) are known as

 A) Cardiac errors

 B) Murmurs

 C) Incomplete rhythm cycles

 D) Infarctions

27) Which term means the volume of blood pumped by each ventricle per beat?

 A) Heart volume

 B) Stroke volume

 C) Venous return

D) Cardiac output

28) During normal ventricular contraction what volume of blood is a typical stroke volume?

 A) 5 liters

 B) 5 ml

 C) 70 ml

 D) 1.25 liters

29) Which term means the volume of blood pumped by the heart per minute?

 A) Heart rate

 B) Stroke volume

 C) Systemic current

D) Cardiac output

30) Which factor causes an increase in stroke volume?

 A) Increased blood pressure

 B) Decreased heart rate

 C) Increased force of contraction

 D) Increased peripheral resistance

31) What is the correct equation for calculating cardiac output?

 A) CO = HR + SV

 B) CO = BP - SV

 C) CO = Systolic + Diastolic

 D) CO = HR x SV

32) At rest the cardiac output of the heart of an average human is \_\_\_\_\_\_\_\_ liters of blood per minute.

 A) three

 B) five

 C) seven

 D) nine

33) If someone's heart has a stroke volume of 0.07 liters (70 ml) and a heart rate of 90 beats/minute, the cardiac output would be

 A) 6300 ml/min.

 B) 770 ml/min.

 C) 70 ml/min.

 D) 1.28 ml/min.

34) Blood pressure is the \_\_\_\_\_\_ force of the \_\_\_\_\_\_ on the \_\_\_\_\_\_\_.

 A) Outward, Blood, Blood vessel walls

 B) Inward, Blood pressure cuff, patient’s brachial region

 C) Inward, Blood vessel walls, Blood

D) Outward, Heart contractions, Blood

35) An average adult blood pressure is

 A) 12-24

 B) 70

 C) 72

D) 120/80

36\*) The following list of events for taking a patient’s blood pressure is NOT in the correct sequence. Which arrangement is the correct order of events?

 1 = The sounds of Korotkoff disappear

 2 = The systolic pressure is determined

 3 = The sphygmomanometer reads about 160

 4 = The diastolic pressure is determined

 5 = The sounds of Korotkoff appear

 6 = The valve on the sphygmomanometer is opened

 A) 6, 3, 2, 1, 4, 5

 B) 1, 3, 5, 6, 4, 2

 C) 3, 6, 5, 2, 1, 4

D) 2, 5, 3, 4, 1, 6

37) The two major factors that determine a person’s blood pressure are (select two answers)

 A) Heart size

 B) Vein lumen diameter

 C) Cardiac output

D) Peripheral resistance

38) Which does **not** increase peripheral resistance?

 A) Higher cardiac output

 B) Smaller lumen size

 C) Larger blood volume

D) Atherosclerosis

39) The kidneys increase blood volume by adding \_\_\_\_\_ to the blood

 A) proteins

 B) Na+

 C) epinephrine

 D) lactic acid

40) Production of angiotensin II would

 A) cause vasodilation of arterioles and muscular arteries.

 B) inhibit the sense of thirst.

 C) cause the kidneys to remove sodium from the blood

 D) raise the blood pressure.

41) Increased salt in diet leads to increased blood pressure by

 A) Increasing the strength of heart muscle contraction

 B) Osmosis of water into blood vessels

 C) Causing blood vessels tunica media to constrict

D) Decreasing the water content of the urine

42) A person who does not have chest pain but who suffers from constant pulmonary edema, shortness of breath, and fatigue is most likely to have

 A) heart attack

 B) anaphylactic shock.

 C) fibrillations

 D) congestive heart failure.

43) The disease \_\_\_\_\_\_\_\_ is defined as plaques (fatty deposits) in the arteries. (Hint: This question is asking the name for plaques in the arteries, NOT the effect of having the plaques).

A) Cardiovascular edema

 B) Congestive heart failure

 C) Atherosclerosis

 D) Chronic hypertension

44) Blood pressure that is consistently above 140/90 is defined as \_\_\_\_\_\_\_\_.

 A) Cardiovascular edema

 B) Congestive heart failure

 C) Atherosclerosis

 D) Chronic hypertension

45) This substance is called a clot buster, and is often immediately given to people suffering from a heart attack or stroke.

 A) anti-embolane

 B) thrombin

 C) TPA (tissue plasminogen activator)

 D) fibrin

46) For a person with severe allergies to bee venom, a bee sting is most likely to cause

 A) congestive heart failure

 B) anaphylactic shock.

 C) heart attack

 D) acute hypertension

**Answer to multiple choice review questions:**

1 = B

2 = A and D

3 = A

4 = A

5 = C

6 = D

7 = C

8 = D

9 = C

10 = D

11 = B

12 = B

13 = A

14 = C

15 = A and D

16 = B

17 = A

18 = D

19 = A

20 = D

21 = C

22 = B

23 = B

24 = A

25 = C

26 = B

27 = B

28 = C

29 = D

30 = C

31 = D

32 = B

33 = A

34 = A

35 = D

36 = C

37 = C and D

38 = A

39 = B

40 = D

41 = B

42 = D

43 = C

44 = D

45 = C

46 = B

**Fill-in-the-blank review questions:**

1) The path of blood from the heart, through the lungs, and back to the heart is known as the \_\_\_\_\_\_\_ loop. The path of blood from the heart, to all the organs of the body (except the lungs), and back to the heart is known as the \_\_\_\_\_\_\_ loop.

2) After each description below, write P if it matches the pulmonary loop and write S if it matches the systemic loop. Some blanks may require both answers.

 a) It goes to the lungs and back:

 b) The blood in its arteries is blue:

 c) Oxygen enters the blood in this loop:

 d) It begins at the heart:

 e) The blood in its arteries is red:

 f) CO2 is present in some or all of this loop:

3) \_\_\_\_\_ is the term for any blood vessel in the body that carries blood away from the heart.

4) \_\_\_\_\_ is the term for any blood vessel in the body that carries blood toward the heart.

5) The word \_\_\_\_\_ refers to lungs, and so the veins returning blood to the heart from the lungs are

called the \_\_\_\_\_ veins.

6) The two uppermost chambers of the heart are the \_\_\_\_\_.

7) The two lowermost chambers of the heart are the \_\_\_\_\_.

8) The muscular wall of each \_\_\_\_\_ (a heart chamber type) is small because its job is simply to pump blood a few inches into the next heart chamber.

9) The right atrium receives blood from two major veins: the superior and inferior \_\_\_\_\_.

10\*) The \_\_\_\_\_ returns blood from all upper body regions (above the diaphragm) to the right atrium.

11\*) The \_\_\_\_\_ returns blood from all lower body regions (below the diaphragm) to the right atrium.

12) Write T(rue) or F(alse) in each blank space:

 a) The ventricles are refilled with blood in diastole\_\_\_\_\_\_\_

b) The semilunar valve is between the atrium and the ventricle\_\_\_\_\_\_

 c) Blood in pulmonary loop arteries is blue \_\_\_\_\_\_\_\_\_\_

 d) The left and right atria contract at the same time\_\_\_\_\_

 e) The left and right ventricles contract at the same time\_\_\_\_\_\_

13) After each description, write LV if it applies to the left ventricle, write RV if it applies to the right ventricle, write LA if it applies to the left atrium, and write RA if it applies to the right atrium. Some descriptions may match more than one answer. Write all matching answers.

 a) Contracts at the same time as the right ventricle \_\_\_\_\_\_\_\_\_

 b) Pumps blood out of the heart \_\_\_\_\_\_\_\_\_\_

 c) Pumps blood within the heart \_\_\_\_\_\_\_\_\_

 d) Has semilunar valves at its exit \_\_\_\_\_\_\_\_\_\_

 e) Has cardiac muscle walls \_\_\_\_\_\_\_\_\_

 f) Carries oxygenated blood \_\_\_\_\_\_\_\_\_

g) Carries deoxygenated blood \_\_\_\_\_\_\_\_\_

14) You are a red blood cell that is about to return to the heart after passing through the systemic loop. Starting with the right atrium as "1", number the following components of the cardiovascular system in the correct order that you would encounter them.

 Right atrium 1

Left atrium \_\_\_\_

 Right ventricle \_\_\_\_

Left ventricle \_\_\_\_

 Pulmonary artery \_\_\_\_

Pulmonary vein \_\_\_\_

 Aorta \_\_\_\_

Right AV valve \_\_\_\_

Left AV valve \_\_\_\_

Lungs \_\_\_\_

Aortic semi-lunar valve \_\_\_\_

Pulmonary semi-lunar valve \_\_\_\_\_

15) Using the list of cardiovascular system parts listed in the problem 14 above as possible answers, list the parts of the cardiovascular system that carry oxygenated blood.

16) The two large arteries leaving the heart (one from the right ventricle and one from the left ventricle) are the \_\_\_\_\_ and the \_\_\_\_\_.

17) Most of the work of the heart is performed by the \_\_\_\_\_\_\_ ventricle as it forces blood into the aorta.

18) The larger, more muscular chambers of the heart are the \_\_\_\_\_\_ (a chamber type).

19) The \_\_\_\_\_ (which chamber of the heart?) pumps blood to the lungs; the \_\_\_\_\_ (which

chamber of the heart?) pumps blood to the body via a huge artery called the aorta.

20) The amount of force required to pump blood through the entire body is greater than the

force needed to pump blood through the lungs, so the \_\_\_\_\_ ventricle is larger and more muscular than the \_\_\_\_\_ ventricle.

21) Blood has to travel further in the \_\_\_\_\_ loop than in the \_\_\_\_\_ loop: Because of the difference in loop length, more strength and blood pressure are required to keep it moving in the longer loop.

22) Blood in the pulmonary veins is higher/lower (circle one) in oxygen compared to blood in the pulmonary arteries.

23) The \_\_\_\_\_\_\_ valves separate the atria from the ventricles.

24) The \_\_\_\_\_\_\_ valves are located at the start of the pulmonary artery and the aorta and prevent the back flow of blood into the ventricles.

25) The AV valves and the semilunar valves open and then slam shut with each beat of the heart. This constant opening and closing would damage most tissues, but the heart valves are not harmed because they are made of a very strong and tough leather-like tissue. What tissue are they made out of? (hint: It may help to review the tissue types chapter).

26) There are/aren’t (circle one) valves preventing backflow of blood from the atria into the

veins that return blood to the heart.

27\*) If a valve in the heart malfunctions, and allows blood to flow in both directions, an abnormal heart sound called a \_\_\_\_\_ occurs.

28) The \_\_\_\_\_ valves prevent backflow from the ventricles into the atria. These valves shut when the ventricles contract/relax (circle one).

29) The \_\_\_\_\_ valves prevent backflow of blood from the aorta and pulmonary artery into the ventricles. These valves shut when the ventricles contract/relax (circle one).

30\*) Name the blood vessels shown in the heart diagram

on the right. Hints: All these vessel connect directly

to chambers in the heart. A, B, and E are veins.

C and D are arteries.

31\*) Name the blood vessels shown in the diagram

on the right. Hints: F, G, and H are parts of the aorta.

32\*) The pulmonary semilunar valve separates

the \_\_\_\_\_ ventricle from the \_\_\_\_\_ artery.

33\*) The aortic semilunar valve separates

the \_\_\_\_\_ ventricle from the \_\_\_\_\_.

34\*) The right AV valve is also called the \_\_\_\_\_ valve.

35\*) The left AV valve is also called the \_\_\_\_\_ valve

or the \_\_\_\_\_\_ valve.

36\*) The \_\_\_\_\_ valves (which make the “dup”

 noise of the “lub-dup” heartbeat sound) can best be

heard by placing a stethoscope at the second

intercostal space (which is slightly above the breast).

37\*) The \_\_\_\_\_ valves (which make the “lub” noise of the “lub-dup” heartbeat sound) can best be

heard by placing a stethoscope at the fifth intercostal space (which is slightly below the breast).

38) The \_\_\_\_\_ (which chamber of the heart?) receives blood that has just left the lungs.

39) Name all the lettered parts of the heart below. Letter K is the tissue that the wall of the heart of made out of.

40) \_\_\_\_\_ refers to the time during which the ventricles of the heart are contracting, while \_\_\_\_\_

refers to the period of ventricular relaxation.

41) The first heart sound is caused by closure of the \_\_\_\_\_\_\_ valves and the second heart sound is caused by closure of the \_\_\_\_\_\_\_ valves.

42) During ventricular systole, the atria are in \_\_\_\_\_.

43) At the end of each cardiac cycle, ventricles are in diastole/systole (circle one) and the atria are in

diastole/systole (circle one).

44) Write the letters of all descriptions below that occur when the atria begin contracting.

a) Semilunar valves open b) Ventricles begin systole

c) Ventricles are in diastole d) AV valves are shut

e) The “lub” sound occurs f) The “dup” sound occurs

g) The atria are in diastole

45) Using the same letters listed in problem 44, write the letters of all descriptions below that occur when the atria begin relaxing.

46) Using the same letters listed in problem 44, write the letters of all descriptions below that occur when the ventricles begin contracting.

47) Using the same letters listed in problem 44, write the letters of all descriptions below that occur when the ventricles begin relaxing.

48) The heart beat sounds are often described as lub-dup, pause, lub-dup, pause, etc. Write the letters of all events listed below that occur when the lub sound occurs.

 a) The atria are relaxing b) The atria are contracting

 c) The ventricles are relaxing d) The ventricles are contracting

49) Using the letters from problem 48, write the letters of all events listed below that occur when the dup sound occurs.

50\*) Using the letters from problem 48, write the letters of all events listed below that occur during the first part of the pause.

51\*) Using the letters from problem 48, write the letters of all events listed below that occur during the second part of the pause.

52) The semilunar valves are open/closed (circle one) during contraction of the ventricles.

53) The first of the two heart sounds (“lub”) is due to the \_\_\_\_\_ valves closing.

54) The second of the two heart sounds occurs when the \_\_\_\_\_ valves shut.

55) The specialized heart tissue that generates and conducts action potentials to cause the heart chambers to contract and relax is called the \_\_\_\_\_\_ tissue of the heart.

56) The normal beating of the heart is initiated by the \_\_\_\_\_ node, a cluster of conducting tissue

in the \_\_\_\_\_\_ chamber of the heart. Because this clump of conducting tissue sets the overall heart rate, it is often called the \_\_\_\_\_\_ of the heart.

57) After the SA node, the next major clump of conducting tissue is the \_\_\_\_\_ node. This node receives signals from the SA, and delays briefly, and then sends the signals downward toward the ventricles.

58) The AV node is located in the \_\_\_\_\_\_\_ chamber of the heart.

59) Like neurons, heart cells require the ions Na+ and K+ to depolarize and repolarize. But unlike neurons, heart cells also require the ion \_\_\_\_\_\_\_ to depolarize.

60) Abnormal rapid chaotic contraction and relaxation of the heart (when there is no effective pumping of blood) are called \_\_\_\_\_\_\_.

61\*) The \_\_\_\_\_\_\_ are the conducting tissues located in the septum of the heart (the septum is the area between the left ventricle and the right ventricle). These conducting tissues pass signals downward from the AV node to the apex (the lower tip) of the heart.

62\*)\_\_\_\_\_\_\_\_ conduct the electrical signals upward from the apex of the heart up into the \_\_\_\_\_\_\_.

63\*) A(n) \_\_\_\_\_ is a recording of all of the electrical activity of the heart.

64\*) When taking an ECG of a patient, the electrical leads are attached to which three places?

 \_\_\_\_\_\_\_, \_\_\_\_\_\_\_, and \_\_\_\_\_\_\_.

65\*) The \_\_\_\_\_ is the highest, strongest group of waves on a normal ECG.

66\*) The QRS complex causes relaxation/contraction (circle one) of the atria/ventricles (circle one).

67\*) The first wave on a normal ECG, a small peak, causes relaxation/contraction (circle one) of the atria/ventricles (circle one). This wave is called the \_\_\_\_\_ wave.

68\*) After a brief delay, a third and final wave follows the QRS complex. This third wave is called the \_\_\_\_\_ wave and it causes relaxation/contraction (circle one) of the atria/ventricles (circle one).

69\*) If a \_\_\_\_\_ wave on an ECG is occasionally not followed by a \_\_\_\_\_; this indicates a second degree heart block.

70) The central space in a blood vessel through which blood flows is called the \_\_\_\_\_\_.

71) The innermost wall of the blood vessels is called the \_\_\_\_\_ and it is made of \_\_\_\_\_ (which tissue type?).

72) \_\_\_\_\_ is the middle tunic of blood vessels, and primarily consists of \_\_\_\_\_ tissue.

73) The \_\_\_\_\_ refers to the outermost layer of the blood vessel wall. Its function is to \_\_\_\_\_\_.

74) The outermost layer of blood vessels is composed mostly of \_\_\_\_\_ tissue.

75) \_\_\_\_\_\_\_ (a blood vessel type), because of their thicker muscular layer, have a narrower lumen than the \_\_\_\_\_\_\_ (another blood vessel type).

76) Below is a diagram of a blood vessel. The inner white circle is the lumen (hollow space where the blood flows through). All the other circles are layers of tissue. In each blank label, write the name of the tissue layer and write the type of tissue it is composed of. Be as specific as possible for full credit.

 a)

 b)

 c)

77) Judging from the thinness of the middle layer of the above diagram, the blood vessel is probably an artery/vein (circle one)

78\*) The figure below shows an artery and a vein. The artery is blood vessel A/B (circle one letter). The vein is blood vessel A/B (circle one letter).



79) The effect of the contraction of skeletal muscle on blood flow through the veins is often described as the skeletal muscle \_\_\_\_\_\_ because it helps to return blood to the heart.

80) To increase the amount of blood flow to an organ, the \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_ (two blood vessel types) undergo \_\_\_\_\_\_\_ (a term that means opening wider).

81) The smallest arteries are called \_\_\_\_\_\_.

82) The smallest veins are called \_\_\_\_\_\_.

83) When the lumen of a blood vessel becomes smaller due to contraction of the smooth muscle in the vessel’s wall, the vessel is said to be \_\_\_\_\_\_. When the lumen becomes larger due to the muscle relaxing, the vessel is said to be \_\_\_\_\_\_.

84) Veins, especially those of the limbs, include \_\_\_\_\_ to prevent blood from flowing backwards.

85) Varicose veins are veins that swell and distend visibly due to damage to their \_\_\_\_\_.

86\*) Name arteries A – E in the figure below.



87\*) Name veins A – F in the figure below.



88\*) Name arteries A – B in the figure below.



89\*) Name veins A – B in the figure below.



90) \_\_\_\_\_ are the tiniest blood vessels. Gases and nutrients in these blood vessels are exchanged with gases and wastes in the tissues.

91) Blood enters the capillaries from \_\_\_\_\_\_\_ vessels and exits the capillaries into \_\_\_\_\_\_\_ vessels.

92) Which tunics that are present in arteries and veins are absent in capillaries? \_\_\_\_\_\_\_

93) Gases and some small molecules can pass directly through the cells of the capillary walls by \_\_\_\_\_, but larger molecules and WBCs must exit the capillary by \_\_\_\_\_\_.

94) What is the average adult resting heart rate? \_\_\_\_\_\_\_\_

95\*) Above the shoulders, the best place to feel the pulse is the \_\_\_\_\_ artery, which is located on the \_\_\_\_\_\_\_ (which body part?).

96\*) On the forearm, the best place to feel the pulse is the \_\_\_\_\_ artery, which is located on the \_\_\_\_\_\_\_ (which body part?).

97\*) When taking the radial pulse in a patient, which finger do you **not** use to feel the pulse? \_\_\_\_\_

Why is this finger not used to feel the patient’s pulse? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

98\*) You are taking a patient’s pulse. If you feel 37 pulses in 30 seconds, what is the patient’s heart rate?

99\*) If you took a patient’s radial pulse and you felt pulses but the pulses were very weak (in other words, you had difficulty feeling the pulses), the patient has what abnormal condition? \_\_\_\_\_\_\_.

100\*) The figure below is an ECG made during a 10 second period. What is the patient’s heart rate?



101) The \_\_\_\_\_ division of the nervous system contains neurons whose function is to accelerate heart rate.

102) The \_\_\_\_\_ division of the nervous system contains neurons whose function is to decelerate heart rate.

103) Endurance training often results in an increase/decrease (circle one) of the **resting** cardiac rate.

104\*) During exercise, the heart rate increases/decreases (circle one).

105) Stroke volume is the amount of blood pumped by each \_\_\_\_\_ per \_\_\_\_\_.

106) An average adult's stroke volume is \_\_\_\_\_.

107) The major factor influencing stroke volume is the \_\_\_\_\_. (Hint: It relates to a certain volume of blood).

108) If a person started to hemorrhage, their stroke volume would increase/decrease (circle one)

109) The stroke volume can be changed by the \_\_\_\_\_\_ of ventricular contraction.

110) Athletic endurance training makes the heart muscle stronger. You would therefore expect that athletes have an increased/decreased (circle one) in the stroke volume.

111) Cardiac output is the amount of blood pumped by \_\_\_\_\_ in one \_\_\_\_\_.

112) The formula relating cardiac output, stroke volume and heart rate is \_\_\_\_\_. (Note: be able

to use this formula mathematically)

113) A person has a stroke volume of 100 ml per beat and a heart rate of 60 beats per minute. What is their cardiac output?\_\_\_\_\_. (For full credit, include the proper units of cardiac output, not just the number).

114) For each factor, state whether it increases or decreases the heart rate:

 a) Being older \_\_\_\_\_\_\_\_

 b) Epinephrine \_\_\_\_\_\_\_\_

 c) The parasympathetic nervous system \_\_\_\_\_\_\_\_

 d) These study problems \_\_\_\_\_\_\_\_

e) Low stroke volume

 f) Being female

 g) Aerobic exercise (when exercising) \_\_\_\_\_\_\_\_\_

 h) Regular aerobic exercise (when not exercising)

115) When you exercise, the contractions of your muscles pump more blood back to your heart. This is called the \_\_\_\_\_\_\_ and it increases the \_\_\_\_\_\_\_\_\_ (a term meaning the volume of blood that returns to the heart per beat). Increasing the volume of returned blood will increase/decrease (circle one) the stroke volume.

116\*) A person has a stroke volume of 100 ml per beat and a resting heart rate of 50 beats per minute.

 a) This person is athletic/out of shape (circle one)

 b) What is their cardiac output? \_\_\_\_\_\_\_\_\_\_

117) If a person started to hemorrhage, their body would increase/decrease/maintain (circle one of the three) their heart rate in an attempt to increase/decrease/maintain (circle one of the three) their cardiac output.

11**8**) What are the units of blood pressure? \_\_\_\_\_. What is an average blood pressure reading? \_\_\_\_\_

119) Blood pressure readings always contain two numbers. The higher is called the \_\_\_\_\_\_ pressure and the lower is called the \_\_\_\_\_\_ pressure.

120) The blood pressure during the contraction of the ventricles is the \_\_\_\_\_ pressure, and is

normally \_\_\_\_\_ in a healthy adult.

121) The blood pressure during the relaxation of the ventricles is the \_\_\_\_\_ pressure, and is

normally \_\_\_\_\_ in a healthy adult.

122\*) Blood pressure is always measured in \_\_\_\_\_ (One of the three types of blood vessels).

123) The blood pressure in the systemic loop is higher/lower (circle one) at the end of the loop compared to the beginning.

124) In an average adult, when the ventricles contract, \_\_\_\_\_\_\_ mmHg of blood pressure is generated. The purpose of this pressure is to eject blood out of the heart.

125\*) Blood pressure is measured by using an inflatable cuff device called a \_\_\_\_\_.

126\*) When taking the blood pressure of a patient with the sphygmomanometer, you are measuring the pressure in the patient’s \_\_\_\_\_\_\_\_ artery.

127\*) The first sounds heard through the stethoscope (after fully inflating the cuff and then letting a small amount of air out) during a blood pressure measurement are called the sounds of \_\_\_\_\_. They are caused by \_\_\_\_\_. The cuff pressure at this point is equal to the patient’s \_\_\_\_\_ pressure.

128\*) During a blood pressure determination, the point at which sounds of blood flow can no

longer be heard during the release of pressure from the cuff corresponds to the \_\_\_\_\_ pressure. The blood is flowing smoothly and silently at this point, a type of flow called \_\_\_\_\_ flow.

129) The blood pressure is proportional to (controlled by) the \_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_

130) The resistance to blood flow by the blood vessels is called the \_\_\_\_\_\_\_.

131) The two things that can change the peripheral resistance are \_\_\_\_\_ and \_\_\_\_\_.

132) As blood volume increases, peripheral resistance increases/decreases (circle one).

133) Blood loss causes blood pressure to increase/decrease (circle one).

134) For each pair of terms below, circle the term in that has higher blood pressure or that results in higher blood pressure.

 a) Systole/diastole

 b) Capillary/Arteriole

 c) Large lumen size/small lumen size

d) High blood volume/Low blood volume

e) Relaxation/Stress

f) Low salt diet/High salt diet

g) Vein/Artery

h) Sympathetic/Parasympathetic nervous systems

135) Two of the factors that affect blood pressure are blood volume and lumen size.

 a) If blood volume increases, blood pressure will increase/decrease (circle one)

b) If lumen size increases, blood pressure will increase/decrease (circle one)

c) Eating a diet that is high in sodium will increase your blood pressure. The sodium increases blood pressure by changing lumen size/blood volume (circle one).

d) Eating a diet that is high in fat will increase your blood pressure. The fat increases blood pressure by changing the lumen size/blood volume (circle one).

136) The larger/smaller (circle one) the blood vessel diameter, the higher the peripheral resistance.

 (Note: be able to use this concept and be able to interpret the answer as to whether blood pressure went up or down.)

137) The sympathetic nervous system can raise blood pressure by causing \_\_\_\_\_\_\_ of blood vessels.

138) The \_\_\_\_\_ (a pair of organs) are the major organs that adjust blood pressure.

139) The kidneys can increase blood pressure by adding \_\_\_\_\_ to the blood, which increases blood volume through osmosis.

140) Another way the kidneys can increase blood pressure is by releasing the protein \_\_\_\_\_, which leads to the activation of the powerful vasoconstrictor protein \_\_\_\_\_.

141) Sodium in the diet increases your blood pressure by increasing the blood volume. Sodium increases the blood volume by drawing water from the tissues into the blood using the process of \_\_\_\_\_\_\_.

142) Excess fat in the diet increases your blood pressure because it increases \_\_\_\_\_\_\_.

143) \_\_\_\_\_ is the clogging of blood vessels (especially coronary arteries) by fatty deposits.

144) \_\_\_\_\_ is chronically increased by atherosclerosis because fatty deposits called \_\_\_\_\_ make the lumen smaller, which increases \_\_\_\_\_\_.

145) Eating foods with high levels of \_\_\_\_\_\_\_ (a lipid molecule) is a major cause of atherosclerosis.

146) Although aging does lead to changes in the heart, the general consensus is that \_\_\_\_\_

and \_\_\_\_\_ (two unhealthy lifestyle choices), not aging, are usually the main causes of cardiovascular disease.

147) Long-term high blood pressure (\_\_\_\_\_) damages the heart and, in untreated, eventually can cause congestive heart failure.

148) Blood pressure is in the 'hypertensive' range when it is \_\_\_\_\_ or greater. (Give the exact blood pressure numbers).

149) \_\_\_\_\_ refers to a condition in which the heart is weak. Its pumping efficiency is sufficient to keep the person alive but inadequate to keep them in good health.

150) In a person with congestive heart failure, fluid will accumulate in the \_\_\_\_\_\_\_ and in the \_\_\_\_\_\_\_

(two regions of the body).

151) Fluids build up in the lungs of congestive heart failure victims. This is because the left/right (circle one) ventricle tends to weaken more than the other ventricle, so blood pools in the pulmonary loop.

152) A blood clot in an unbroken blood vessel is called a(n) \_\_\_\_\_\_\_, and a blood clot in a blood vessel can easily become a(n) \_\_\_\_\_\_\_, which means anything that can block a blood vessel.

153) A heart attack is caused by sudden blockage of the \_\_\_\_\_\_ arteries.

154) Unexplained pain in the left arm should be treated seriously because it may be \_\_\_\_\_.

155) A heart attack is also called a \_\_\_\_\_\_\_ or a \_\_\_\_\_\_\_.

156) The \_\_\_\_\_ arteries deliver oxygen-rich blood to the muscles of the heart itself.

157) During a myocardial infarction, chest pain called \_\_\_\_\_\_\_ is often also felt as pain in the \_\_\_\_\_\_\_.

158) If a person has coronary artery disease, doctors can insert an inflatable balloon-like device into the clogged artery to push aside the blockage. This procedure is called \_\_\_\_\_\_\_.

159) Atherosclerosis (clogging of the arteries with fat) can lead to two disorders that cause the heart to not work correctly: A heart attack and congestive heart failure. These two disorders, however, are very different in terms of what goes wrong in the heart and what their symptoms are. After each description below, write and H if it matches a heart attack and write C if it matches congestive heart failure. Some blanks may require both answers.

 a) It comes on suddenly: \_\_\_\_\_\_\_

 b) Angina pectoris is a symptom: \_\_\_\_\_\_\_

 c) The blood does not circulate as well as is needed by the body: \_\_\_\_\_\_

 d) Fatigue and swollen legs are common symptoms: \_\_\_\_\_\_\_

 e) It is caused by the heart slowly wearing itself out over many years: \_\_\_\_\_\_\_

 f) It is caused by a blood vessel in the heart becoming suddenly blocked: \_\_\_\_\_\_\_

 g) A person with a low fat but high salt diet would be at risk for it: \_\_\_\_\_\_\_

160) Up and down pressure, applied by the hands of a rescuer to the chest of a person without a heart beat, is known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

161) The term \_\_\_\_\_\_\_ means hypoperfusion (too little blood flow) to the organs because of decreased blood volume.

162) One major cause of shock is loss of \_\_\_\_\_\_ from the body.

163) The rapid fall in blood volume and pressure that occurs as a result of a severe allergic reaction (such as to bee stings, penicillin, or peanuts) is called \_\_\_\_\_\_\_ shock.

164) Anaphylactic shock occurs because certain immune cells release the molecule \_\_\_\_\_\_, which causes excessive vasodilation and leaky blood vessels.

**Answer to fill-in-the-blank review questions:**

1) Pulmonary loop

 Systemic loop

2) P

 P

 P

 PS

 S

 PS

3) Artery

4) Vein

5) Pulmonary

 Pulmonary

6) Atria

7) Ventricles

8) Atrium

9) Vena cava

10) Superior vena cava

11) Inferior vena cava

12) a) T

 b) F

 c) T

 d) T

 e) T

13) a) LV

 b) RV, LV

 c) RA, LA

 d) RV, LV

 e) RA, LA, RV, LV

 f) LA, LV

 g) RA, RV

14) 1

 8

 3

 10

 5

 7

 12

 2

 9

 6

 11

 4

15) Left Atrium

 Left ventricle

 Pulmonary vein

 Aorta

Left AV valve

Lungs

Aortic semi-lunar valve

16) Pulmonary artery

 Aorta

17) Left

18) Ventricles

19) Right ventricle

 Left ventricle

20) Left

 Right

21) Systemic

 Pulmonary

22) Higher

23) Atrioventricular (AV)

24) Semi-lunar

25) Dense connective tissue

26) Aren’t

27\*) Murmur

28) AV values

 Contract

29) Semi-lunar

 Relax

30\*) A = Superior vena cava

 B = Inferior vena cava

 C = Aorta

 D = Pulmonary artery

 E = Pulmonary vein

31\*) A = Right common carotid artery

 B = Right subclavian artery

 C = Brachiocephalic artery

 D = Left common carotid artery

 E = Left subclavian artery

 F = Ascending aorta

 G = Aortic arch

 H = Descending aorta

32\*) Right ventricle

 Pulmonary artery

33\*) Left ventricle

 Aorta

34\*) Tricuspid valve

35\*) Bicuspid

 Mitral

36\*) Semilunar valves

37\*) AV valves

38) Left atrium

39) A = Superior vena cava

 B = Right atrium

 C = Right AV valve (tricuspid valve)

 D = Inferior vena cava

 E = Right ventricle

 F = Aorta

 G = Pulmonary artery

 H = Left atrium

 I = Pulmonary semilunar valve

 J = Left ventricle

 K = Cardiac muscle

40) Systole

 Diastole

41) AV valves

 Semilunar

42) Diastole

43) Diastole

 Diastole

44) c

45) a, b, d, e, g

46) a, b, d, e, g

47) c, f, g

48\*) a, d

49\*) a, c

50\*) a, c

51\*) b, c

52) Open

53) AV valve

54) Semilunar valve

55) Conducting tissue

56) SA (sino-atrial) node

 Right atrium

 Pacemaker

57) AV (atrio-ventricular)

58) Right atrium

59) Ca2+

60) Fibrillations

61\*) Bundles of His

62\*) Purkinje fibers

63\*) ECG (electrocardiogram)

64\*) Left wrist

 Right wrist

 Ankle

65\*) QRS

66\*) Contraction

 Ventricles

67\*) Contraction

 Atria

 P wave

68\*) T wave

 Relaxation

 Ventricles

69\*) P wave

 QRS wave complex

70) Lumen

71) Tunica interna

 Simple squamous

72) Tunica media

 Smooth muscle tissue

73) Tunica externa

 Protect the blood vessel

74) Dense connective tissue

75) Arteries

 Veins

76) a) Tunica externa, Dense connective tissue

 b) Tunica media, Smooth muscle tissue

 c) Tunica interna, Simple squamous epithelial

77) Vein

78\*) B

 A

79) Pump

80) Arteries

 Arterioles

 Dilation

81) Arterioles

82) Venules

83) Contracted

 Dilated

84) One-way valves

85) One-way valves

86\*) A = Right common carotid artery

 B = Right subclavian artery

 C = Abdominal aorta

 D = Right iliac artery

 E = Right femoral artery

87\*) A = Right jugular vein

 B = Right subclavian vein

 C = Superior vena cava

 D = Inferior vena cava

 E = Right iliac vein

 F = Right femoral vein

88\*) A = Right brachial artery

 B = Right radial artery

89\*) A = Right brachial vein

 B = Right radial vein

90) Capillaries

91) Arteriole

 Venule

92) Tunica externa

 Tunica media

93) Diffusion

 Gaps in capillary wall

94) 72 beats per minute (bpm)

95\*) Carotid artery

 Neck

96\*) Radial artery

 Wrist

97\*) Thumb

 The thumb has its own pulse that might be

 mistaken for the patient’s pulse.

98\*) 74 beats per minute

99\*) Very low blood pressure

100\*) 36 beats per minute

101) Sympathetic

102) Parasympathetic

103) Decrease

104\*) Increases

105) Ventricle

 Beat

106) 70 ml/beat

107) Venous return

108) Decrease

109) Strength

110\*) Increase

111) Heart

 Minute

112) CO = SV x HR

113) 6000 ml/minute

114) Decrease

 Increase

 Decrease

 Increase (if they frighten you!)

 Increase

 Increase

 Increase

 Decrease

115) Skeletal muscle pump

 Venous return

 Increase

116\*) Athlete

 5000 ml/minute

117) Increase

 Maintain

118) mmHg (millimeters of mercury)

 120/80 mmHg

119) Systolic

 Diastolic

120) Systolic

 120 mmHg

121) Diastolic

 80 mmHg

122\*) Arteries

123) Lower

124) 120

125\*) Sphygmomanometer

126\*) Brachial artery

127\*) Korotkoff

 Turbulent flow (flow only during systole)

 Systolic

128\*) Diastolic

 Laminar

129) Cardiac output

 Peripheral resistance

130) Peripheral resistance

131) Blood volume

 Lumen size

132) Increases

133) Decrease

134) Systole

 Arteriole

 Large lumen size

 High blood volume

 Stress

 High salt diet

 Artery

 Sympathetic nervous system

135) Increase

 Decrease

 Blood volume

 Lumen size

136) Smaller

137) Contraction

138) Kidneys

139) Sodium

140) Renin

 Angiotensin II

141) Osmosis

142) Peripheral resistance

143) Atherosclerosis

144) Blood pressure

 Plaques

 Peripheral resistance

145) Cholesterol

146) High fat diet

 Smoking

147) Chronic hypertension

148) 140/90 mmHg

149) Congestive heart failure

150) Lungs

 Legs

151) Left ventricle

152) Thrombus

 Embolus

153) Coronary

154) Heart attack

155) Myocardial infarction

 Coronary

156) Coronary

157) Angina pectoris

 Left arm or left shoulder

158) Angioplasty

159) a) H

 b) H

 c) HC

 d) C

 e) C

 f) H

 g) C

160) Cardiopulmonary resuscitation (CPR)

161) Shock

162) Blood

163) Anaphylactic shock

164) Histamine

**Short answer review questions:**

1) Blood is sometimes blue and sometimes red. What is it that determines whether the blood is red or blue?

2) The SA node in the heart sends signals to contract the atria. The AV node receives the contraction signal from the SA node, delays a moment, then sends the signal to contract the ventricles. Explain why the AV node delays before sending the contraction signal to the ventricles.

3) Arteries have a thick tissue layer in their wall called the tunica media. What type of tissue is the tunica media and what is its main function?

4) Although the heart is the major pump that circulates the blood, there is a second system that the body uses to help push blood in veins back to the heart. Describe this system (a diagram may be helpful) and state why it could not function in arteries and capillaries.

5) Capillaries deliver oxygen to the cells of the tissues. However, the oxygen in the capillary does not go directly from the capillary to the cells of the tissue. What substance does the oxygen pass through between the capillary and the cell, and where does this substance come from?

6) CO2 and antibodies (a type of large protein molecule in the blood) can both move between the blood in the capillaries and the tissue fluid. But each molecule uses a different method of passing through the capillary wall. For each molecule, state how it passes through the capillary wall and also state why it uses that particular method of passage (and not some other method).

7) Unlike skeletal muscle, cardiac muscle does not get its contractions signals from neurons. Nevertheless, there are motor neurons that synapse with the heart (mostly in the right atrium). What are the names of these motor neurons and what is their function?

8) Blood pressure is always given as two numbers. Explain what makes the first number higher than the second.

9) The sympathetic nervous system can increase blood pressure in several ways, including increasing cardiac output. Describe in detail one way that the sympathetic division increases blood pressure that does **not** involve the heart.

10) Explain at a molecular level how sodium in the diet increases your blood pressure.

11) Explain at a blood vessel level how the fat in the diet increases your blood pressure.

12) Explain all the ways the kidneys counteract low blood pressure. Your explanations should include exactly what the kidneys add to the blood and how this raises the blood pressure.

13) To treat shock, doctors sometimes inject “plasma expanders” into the patient. Plasma expanders are large solutes (such as starch or proteins) that are too large to exit the blood vessels. Explain at a molecular level how plasma expanders treat shock.

**Answers to short answer review questions:**

1) The amount of oxygen determines blood color. Blood that is high in oxygen is red, whereas blood that is low in oxygen is blue.

2) The AV node delays the contraction signal to give time for the atria to fill the ventricles with blood.

3) The tunica media is smooth muscle. Its main purpose is to act as a valve for the blood vessel. If the body needs less blood flow to an organ, the smooth muscle of that organ’s arteries constricts, reducing the lumen size (and therefore decreasing the blood flow). If the body requires more blood flow to an organ, the smooth muscle of that organ’s arteries relaxes, increasing the lumen size (and therefore increasing the blood flow).

4) The second “pump” of the blood is the skeletal muscles pump. Whenever we use our skeletal muscles, they squeeze on the veins inside the muscles. This propels the blood in the veins in only one direction: Back toward the heart. This is because veins have one-way valves that point toward the heart. Capillaries and arteries lack valves and therefore cannot be used by the skeletal muscle pump.

5) The oxygen (and all other molecules that the capillaries supply to the cells) first enters the tissue fluid before it enters the cells themselves. The tissue fluid is a watery liquid that surrounds all the cells of the body. All materials that exit the capillaries first dissolve into the tissue fluid. The tissue fluid comes from the plasma (the watery part of the blood) that has leaked through tiny openings in the capillary wall.

6) The CO2 diffuses through the cells that make up the capillary wall, whereas antibodies pass through small gaps between the cells of the capillary wall. The size of the molecules explains the difference: Small molecules (especially non-polar ones like CO2) can pass easily through a cell membrane. Large molecules (like antibodies and other proteins) are much too large to diffuse through a cell membrane, and must instead use the gaps in the capillary wall to exit the blood vessel.

7) The motor neurons that synapse with the heart are the motor neurons of the sympathetic and the parasympathetic divisions of the nervous system. Although they do not directly cause the heart muscle cells to contract, they do affect the rate that the SA node (the heart’s pacemaker, located in the right atrium) sends contraction and relaxation signals to the heart.

8) The first and higher blood pressure number is called the systolic pressure. It is the blood pressure when the heart is contracting on the blood. The second and lower blood pressure number is called the diastolic pressure. It is the blood pressure when the heart is relaxing. The systolic pressure is always higher because the pressure of any liquid is increased by squeezing the liquid, and that is what happens when the heart contracts during systole.

9) The sympathetic nervous system can increase blood pressure by causing contraction of the tunica media (smooth muscle layer) of many arteries. This decreases the lumen size of the blood vessel, which increases peripheral resistance, which increases blood pressure.

10) Sodium in the diet causes high sodium levels in the blood. The high sodium draws water by osmosis into the blood from surrounding tissues. This increases the blood volume, which increases peripheral resistance, which increases blood pressure.

11) Fat in the diet causes plaques (fatty deposits in the blood vessels). Since the plaques partially block the blood vessel, they effectively make the lumen smaller. Smaller lumen size increases peripheral resistance, which increases blood pressure.

12) When the blood pressure is low, the kidneys can add sodium to the blood. The sodium increases blood volume by adding water to the blood via osmosis. The kidneys can also increase blood pressure by adding the protein rennin to the blood. Renin leads to the activation of a protein called angiotensin II. The angiotensin II increases blood pressure by causing vasoconstriction (a decrease of the lumen size of blood vessels, which increases blood pressure by increasing peripheral resistance) and also by causing the adrenal gland to release the hormone aldosterone, which causes the kidneys to add sodium to the blood.

13) Shock is hypoperfusion due to low blood volume. Plasma expanders counteract shock by increasing blood volume. The solutes of plasma expanders (such as starch and proteins) are too large to exit the blood vessel. These solutes therefore increase the solute concentration of the blood and thereby draw water into the blood by osmosis.