

Name: \_\_\_\_\_

## Physiology: Cardiovascular System Worksheet: Blood, Vessels, Pressure and Flow

Directions: Write in and circle best answer on this sheet.

### Blood

1. When spun, the 2 main components of blood are \_\_\_\_\_ and \_\_\_\_\_.
2. The plasma of blood is about \_\_\_\_\_% water. The protein \_\_\_\_\_ in plasma is the most abundant in the blood and has a big role in drawing water from the interstitium back into the blood vessels.
3. In terms of viscosity, blood is more \_\_\_\_\_ than water. Normally, blood is about \_\_\_\_\_ times the viscosity of water. This \_\_\_\_\_ its resistance to flow.
4. The major plasma proteins are made by the \_\_\_\_\_. The only exception is \_\_\_\_\_, which are made by \_\_\_\_\_.
5. True or false: The buffy coat is the portion of a blood sample that is made up of proteins. T or F
6. In terms of the pH, venous blood in the systemic circuit is more \_\_\_\_\_ than arterial blood. This is mainly because venous blood contains more \_\_\_\_\_ than arterial blood.
7. LDL's transport lipids in the blood from the \_\_\_\_\_ to the \_\_\_\_\_.
8. List at least 10 of the main substances normally found in dissolved in the plasma:
9. Define hematocrit: \_\_\_\_\_.
10. The average healthy hematocrit values for females is: \_\_\_\_\_ and for males is: \_\_\_\_\_.
11. Circle the statements that are **true** about mature, circulating **erythrocytes**.  
a) they have no nucleus    b) they are packed with mitochondria    c) they survive for an average of 12 days  
d) their average size is 20 to 30  $\mu\text{m}$     e) they are very flexible cells    f) they do not make ATP at all  
g) they contain spectrin in their cell membranes    h) they have enzymes for glycolysis
12. a) A molecule of hemoglobin contains 4 \_\_\_\_\_ portions and 4 \_\_\_\_\_ portions.  
b) At the center of each \_\_\_\_\_ is an \_\_\_\_\_ containing \_\_\_\_\_ molecule.
13. Aging and damaged erythrocytes are removed from the circulation by \_\_\_\_\_ cells, most prominently from the \_\_\_\_\_ when they traverse through the \_\_\_\_\_ capillaries in that organ.
14. What is polycythemia? \_\_\_\_\_.
15. What is thalassemia? \_\_\_\_\_.

## Blood Cells

16. Normally, the % of white blood cells in blood is about \_\_\_\_\_% and the % of red blood cells is \_\_\_\_\_%.
17. All blood cells (red, white or platelets) start with the exact same \_\_\_\_\_ stem cell.
18. With regard to the formation of red blood cells, the myeloid stem cell generates \_\_\_\_\_ cells. The \_\_\_\_\_ are the stem cells for RBCs. As they mature they extrude the nucleus and fill with hemoglobin and become \_\_\_\_\_. Then these cells become \_\_\_\_\_.
19. List the most significant features of red blood cells (RBCs) and how it specializes them for their function:
- 1)
  - 2)
  - 3)
  - 4)
20. List the white blood cells (WBCs) in blood and briefly describe their roles. (*Never Let Monkeys Eat Bananas*)
- 1)
  - 2)
  - 3)
  - 4)
  - 5)
21. Which of the following statements about blood is **true**?
- a) it's about 92% water    b) it's slightly more acidic than water    c) it has a higher viscosity than water  
d) it has a low colloid osmotic pressure    e) a and c
22. Which of the following statements about albumin is true?
- a) it draws water out of the blood vessels and into the body's tissue space (interstitium)  
b) it is the most abundant plasma protein    c) it's made by plasma cells    d) all of these are true
23. Which of the following plasma proteins is *not* produced by the liver?
- a) fibrinogen    b) alpha globulin    c) immunoglobulin    d) beta globulin    e) albumin
24. The first step in hemostasis is \_\_\_\_\_.
- a) coagulation    b) activation of the intrinsic pathway    c) formation of the platelet plug  
d) vascular spasm    e) activation of the common pathway

## Stroke Volume and Venous Return

25. Define venous return. \_\_\_\_\_.
26. Venous return is best indicated by (end-systolic volume/end-diastolic volume?) (circle one choice)
27. After load is: \_\_\_\_\_.

28. When voltage-gated  $\text{Ca}^{2+}$  channels are phosphorylated, their probability of opening is (*increased or decreased?*) and (*more or less?*)  $\text{Ca}^{2+}$  enters the cell. NE \_\_\_\_\_ the force heart muscle contraction. What does phospholamban do in cardiac muscle? \_\_\_\_\_.

### Blood Vessels

29. Closer to the heart, arteries would be expected to have a higher percentage of \_\_\_\_\_ in order to be able to expand and recoil to maintain \_\_\_\_\_.

30. The best description veins is they have: \_\_\_\_\_ walls, \_\_\_\_\_ lumens, \_\_\_\_\_ pressure and contain \_\_\_\_\_ that prevent retrograde flow of blood.

31. An especially leaky type of capillary found in the liver and other tissues is called a \_\_\_\_\_.

32. Arterioles are often referred to as **resistance** vessels. Why?

33. Cocaine use causes vasoconstriction. Is this likely to increase or decrease blood pressure, and why?

34. This blood vessel has endothelium and connective tissue that makes up only a very thin tunica externa, and it conducts blood toward the heart. What type of vessel is this? Ans: \_\_\_\_\_.

35. The endothelium is found in the \_\_\_\_\_ layer of the blood vessel (2 words).

### Blood Flow and the Control of Blood Pressure

36. If blood flow through the aorta is 5 L/min, what's blood flow through the pulmonary artery? \_\_\_\_\_.

37. What is a pressure gradient? \_\_\_\_\_. Liquids and gases flow from areas of \_\_\_\_\_ pressure to areas of \_\_\_\_\_ pressure.

38. How does the cardiovascular system create a region of higher pressure? \_\_\_\_\_.

As blood moves away from the heart, what happens to the pressure of it? \_\_\_\_\_.

The highest pressure in the blood vessels is found in the \_\_\_\_\_ and the lowest in the \_\_\_\_\_.

39. What happens to pressure when the heart relaxes or the blood vessels dilate? \_\_\_\_\_.

### Blood Flows from Higher Pressure to Lower Pressure

40. Consider this information: Fluid is flowing through two identical tubes. In **tube A**, the pressure at one end is 150 mm Hg and the pressure at the other end is 100 mm Hg. In **tube B**, the pressure at one end is 75 mm Hg and the pressure at the other end is 10 mm Hg. Which tube will have the greatest flow? \_\_\_\_\_. Why?

41. In a blood pressure measurement of 110/70, the number 70 is the \_\_\_\_\_.

a) systolic pressure   b) diastolic pressure   c) pulse pressure   d) mean arterial pressure

42. Vessels with the highest pressure are: \_\_\_\_ and vessels with the greatest cross-sectional area are \_\_\_\_.
- a) arteries: arteries    b) arteries: arterioles    c) arteries: capillaries  
 d) arterioles: venules    e) arteries: veins

### Resistance Opposes Flow

43. Define resistance (R). \_\_\_\_\_.
44. When resistance increases, flow (*increases/decreases?*). Express this relationship in a mathematical equation:
45. Name and describe briefly the 3 parameters that influence resistance for fluid flowing through a tube.
- 1)  
 2)  
 3)
46. In humans, which of the factors above plays the most significant role in determining resistance to blood flow (because it can vary and thus not relatively constant as others are)? \_\_\_\_\_.
47. Write the equation known as Poiseuille's Law: \_\_\_\_\_.
48. List and briefly compare 5 ways that arteries and veins differ from each other.
- | Artery | Vein |
|--------|------|
| 1)     | 1)   |
| 2)     | 2)   |
| 3)     | 3)   |
| 4)     | 4)   |
| 5)     | 5)   |
49. When the radius of a tube decreases; what happens to the resistance of that tube? \_\_\_\_\_.
50. Write a simplified equation for the relationship between resistance and radius: \_\_\_\_\_.
51. If the radius of a tube doubles, what happens to the resistance? \_\_\_\_\_.
52. Define the following in terms of *diameter* of vessel and *resistance* to blood flow.  
 Vasoconstriction =  
 Vasodilation =
53. If there is an increase in blood pressure, it's detected by \_\_\_\_\_ that are located in the \_\_\_\_\_.  
 a) an increase in pressure; in the veins    b) baroreceptors: aortic arch and carotid arteries  
 c) mechanoreceptors: aortic arch and carotid arteries    d) chemoreceptors; heart
54. A region in the medulla oblongata that regulates blood pressure by modifying the heart activities is the:  
 a) baroreceptor center    b) angioreceptor center    c) the vasomotor center  
 d) reticular formation center    e) the cardiovascular center

55. The term used to describe abnormally low blood pressure is

- a) tachycardia   b) bradycardia   c) hypotension (less than 120/80 mmHg)  
 d) hypertension (over 140/100 mmHg)   e) hypotension (less than 90/60 mmHg)

### Blood Vessels Contain Vascular Smooth Muscle (VSM)

**Table 1.** Fill in the details for each vessel that help to distinguish it from other vessels.

Blood Vessel	Physical Characteristics	Function(s)
Arteries		
Arterioles		
Capillaries		
Venules		
Veins		

56. A healthy elastic artery \_\_\_\_\_.

- a) is compliant   b) reduces blood flow   c) is a resistance artery   d) has a thin wall and irregular lumen  
 e) has a thick wall with a very large diameter lumen

57. Which of the following statements about blood vessels is **true**?

- a) the longer the vessel, the lower the resistance and the greater the blood flow.  
 b) as the diameter in an arteriole decreases, blood pressure also decreases.  
 c) if there is an increase in blood viscosity, this increases blood flow.  
 d) at rest, most of the blood is in the systemic veins.   e) None of these are true.

58. A small increase in blood vessel diameter (radius, r) promotes a \_\_\_\_\_.

- a) slight increase in resistance   b) huge increase in resistance  
 c) slight decrease in resistance   d) huge decrease in resistance

59. Venous vasoconstriction increases which of the following?

- a) blood pressure within the vein   b) blood flow within the vein   c) return of blood to the heart  
 d) all of these   e) none of these

60. **Sympathetic stimulation** of systemic veins in the cardiovascular system results in

- 1) vasoconstriction of these vessels   2) vasodilation of these vessels   3) an increase venous return  
 4) an increase in blood pressure   5) a decreases in venous return   6) a decrease in blood pressure  
 a) 1, 3 and 4   b) 4, 5 and 6   c) 2, 3, 4 and 1   d) 1 and 5   e) 6, 2 and 5

61. What would happen to your blood pressure immediately after drinking 1 liter of water? Why?

62. How would your body re-establish balance after drinking that water? Why?

**Table 2.** Fill in with table with vasoconstrictors/vasodilators, where they are made and their receptors on.

Vasoconstrictor	Source and Receptors	Vasodilator	Source and Receptors

63. Name 2 cells that release Histamine: 1) \_\_\_\_\_ 2) \_\_\_\_\_.

64. Name 2 things Histamine does: 1) \_\_\_\_\_ 2) \_\_\_\_\_.

65. What is cardiovascular shock?

66. Describe cardiac shock:

67. Describe volumetric shock:

68. Describe anaphylactic shock:

69. Describe septic shock:

70. A form of circulatory shock common in young children with severe diarrhea or vomiting is \_\_\_\_\_.  
 a) obstructive shock    b) anaphylactic shock    c) hypovolemic shock    d) hemorrhagic shock