

# CIRCULATORY SYSTEM

*The circulatory system consists of the heart, blood, and the blood vessels. Its role is to transport nutrients, hormones, gases, and waste products throughout the body. After reading Chapter 13: Circulation on pages 239-259, follow the questions to help you understand how this system operates.*

## Blood Vessels

(pp. 240-241)

There are three types of blood vessels within the circulatory system: the *arteries, capillaries, and veins.*

1. State the function of each of the following blood vessels:
  - a. arteries
  - b. veins
  - c. capillaries
2. Explain how structure is related to function in the following blood vessels:  
(fig. 13.1 p. 240, pp. 240-41 )
  - a. arteries
  - b. veins
  - c. capillaries
3. Fig. 13.2 on p. 241 shows a capillary bed with the sphincter muscles in the closed and opened positions. Look at the diagram and explain how capillaries are designed to re-route the blood. (pp. 240-241 )
4. Some veins have valves. Explain the function of these valves.
5. Be able to identify a cross-section of the blood vessels as seen in Fig. 13.1 on p. 240

6. Be able to identify the following vessels on a diagram and on your pig from the dissection lab. Vessels *a-m* may be identified on *fig. 13-8* (p. 247); structures *o, q, and r* can be found on the heart diagram on p. 242. (Note: the term *superior vena cava* is sometimes used in replace of anterior vena cava and *inferior vena cava* used instead of posterior vena cava.)

- |                        |                        |
|------------------------|------------------------|
| a. jugular vein        | j. renal vein          |
| b. subclavian artery   | k. iliac artery        |
| c. subclavian vein     | l. iliac vein          |
| d. carotid artery      | m. pulmonary vein      |
| e. anterior vena cava  | n. pulmonary artery    |
| f. posterior vena cava | o. aorta               |
| g. hepatic vein        | p. mesenteric arteries |
| h. hepatic portal vein | q. coronary artery     |
| i. renal artery        | r. coronary vein       |

## The Heart: Its Structure and Function

(pp. 242-245)

1. Below is a chart with the main parts of the heart listed. Using *fig. 13-3* and *13-4* on pages 242, identify and state the function of the following parts of the heart:

<i>Part of the Heart</i>	<i>Function</i>
a. left ventricle	_____
b. right ventricle	_____
c. right atrium	_____
d. left atrium	_____
e. septum	_____
f. tricuspid valve	_____
g. atrioventricular valves	_____
h. bicuspid valve	_____
i. semi lunar valve	_____
j. anterior vena cava	_____
k. posterior vena cava	_____
l. aorta	_____

m. pulmonary arteries

\_\_\_\_\_

n. pulmonary veins

\_\_\_\_\_

o. pulmonary trunk

\_\_\_\_\_

p. chordae tendineae

\_\_\_\_\_

2. The heartbeat is controlled by special tissues found within the heart called *nodal tissues*. These tissues are listed below. Give their location and function. (fig. 13.6 p. 245 know this diagram).

Heart tissue	Location of tissue	Function
S-A Node		
A-V Node		
Purkinje Fibers		

3. The heart beat is "intrinsic". Explain what this means.
4. Which tissue of the heart is called the "pacemaker"?

## Circulation

(pp. 246-248)

1. The blood vascular system is divided up into two main systems, the *pulmonary* system and the *systemic* system. Complete the following chart on these two systems.

System	Location	Direction of flow
pulmonary system		
systemic system		

2. What is a *portal system*?
3. Name the most important artery found in the body.
4. In a list format, trace the path of a blood cell from the left ventricle through the mesenteric arteries and back to the left ventricle. (p. 247, fig. 13.8)
5. Define the following terms: (pp. 248 )
- a. systole
  - b. diastole

- c. pulse
- d. hypertension
- e. hypotension

6. Blood pressure is measured with an instrument called a *sphygmomanometer*. The measurements are written as a fraction. Identify the normal, high and low blood pressure readings from those given below. (p248).

- |           |                                 |                               |                              |
|-----------|---------------------------------|-------------------------------|------------------------------|
| a. 120/80 | <input type="checkbox"/> Normal | <input type="checkbox"/> High | <input type="checkbox"/> Low |
| b. 200/75 | <input type="checkbox"/> Normal | <input type="checkbox"/> High | <input type="checkbox"/> Low |
| c. 80/40  | <input type="checkbox"/> Normal | <input type="checkbox"/> High | <input type="checkbox"/> Low |

7. Explain how systolic and diastolic blood pressure readings are obtained.

One of your objectives is to be able to explain the differences between fetal and adult blood circulation. The *ductus venosus*, *ductus arteriosus*, *foramen ovale*, *umbilical arteries* and *umbilical vein* are present in the fetal but not adult circulation. A fetus gets its oxygen not from the lungs, but from the placenta. Carbon dioxide is also removed by the placenta. The lungs are collapsed at this time and therefore offer considerable resistance to blood flow. The following questions are designed to introduce you to these differences. If you have not dissected the fetal pig yet you should start now. Use your pig dissection guide and the text pp 452-453. or reference.

8. Below is a list of structures found in fetal circulation. Answer the questions that follow each structure.

### Ductus Venosus

- a. location in the pig
- b. the function of the ductus venosus
- c. direction of blood flow
- d. What vessel does the ductus venosus lead to?
- e. Is the blood in the ductus venosus high or low in oxygen?

### **Ductus Arteriosus**

- a. location in the pig
- b. direction of flow in this vessel
- c. Is the blood oxygen level high or low?

### **Foramen Ovale**

- a. location in the pig
- b. What is its function?

### **Umbilical Arteries**

- a. location in the pig
- b. direction of blood flow
- c. type of blood carried

### **Umbilical Vein**

- a. location in the pig
- b. direction of blood flow
- c. type of blood carried

9. Trace the pathway of blood high in oxygen from the mother to the fetal pig. Start with the umbilical vein and complete the circuit ending with the umbilical arteries. List all the vessels and structures that are met along the way.
  
10. After the pig is born, there are certain fetal changes that occur. How do the following structures change immediately prior to and after the pig is born?
  - a. foramen ovale
  - b. ductus venosus
  - c. ductus arteriosus
  - d. umbilical vein and arteries
  - e. flow of blood through the fetal heart

# Homeostasis: Circulation and Blood Pressure

Homeostasis is the body's way of keeping all physiological conditions working with some stability and consistency. If the body loses its internal consistency, mechanisms will come into play to bring back stability to the body systems. The following questions are designed to teach you about homeostasis and circulation.

1. The control of blood pressure is a good example of homeostasis in action. After reading about blood pressure on p. 248, explain how the following will regulate or affect blood pressure:
  - a. the sympathetic nervous system (p. 337)
  - b. the parasympathetic nervous system (p. 337)
  - c. smoking
  - d. diet (pp. 257)
  - e. obesity
  
2. On page 248 fig. 13.9 is a graph illustrating how velocity and blood pressure and cross-sectional area are related.
  - a. In which of the vessels is the blood pressure highest? Lowest?
  - b. Why does the line oscillate?
  - c. Which blood vessels have the largest surface area to volume ratio?
  - d. Explain why the velocity and blood pressure is lowest in capillaries.

## Lymphatic System

(pp. 262-264)

1. List the main functions of the lymphatic system.
  
2. Describe the function of the following parts of the lymphatic system:  
(pp. 262-3.)
  - a. lymph capillaries
  - b. lymph veins
  - c. lacteals

d. lymph nodes

e. valves

3. The lymphatic system is often described as a "one-way system". Explain why.
4. Trace the pathway of lymph fluid from the lacteals in the small intestine through the lymphatic system to the left subclavian veins and name the vessels involved.
5. The fluid found in the lymph system is called *lymph*. What is its composition?
6. What is the source of lymph? (pp. 254)
7. Describe the location of lymph nodes and state their function.
8. What type of tissue is found in lymph nodes?
9. What are *lymphocytes*?
10. What is the function of lymphocytes?
11. Name some organs that contain lymphoid tissue.
12. Describe how the inflammatory response occurs. Use the following headings as your guide: (pp.264)
  - a. how bacteria or viruses affect cells
  - b. basophil response to bacteria
  - c. blood vessel reaction to histamine
  - d. capillary reaction to histamine
  - e. how neutrophils and monocytes enter the inflamed area
  - f. how neutrophil deals with the foreign bacteria or virus
  - g. macrophages' role

# Blood Components

1. What percent of the blood is:  
(pp. 249-254)

a. plasma

b. blood cells

2. List seven components of blood plasma. (table 13.10 p. 249)

a. \_\_\_\_\_

e. \_\_\_\_\_

b. \_\_\_\_\_

f. \_\_\_\_\_

c. \_\_\_\_\_

g. \_\_\_\_\_

d. \_\_\_\_\_

3. Fill-in the following chart on blood cells. (pp. 249-254)

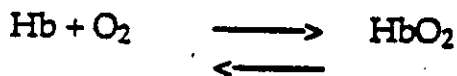
Blood Cell	Origin	Shape	Presence of nucleus	Life span	Function
Erythrocytes					
Leukocytes					
Platelets					

## Transport of Oxygen and Carbon Dioxide

(pp. 290)

The blood plays a very important role in the transport of CO<sub>2</sub> from tissues to the lungs and O<sub>2</sub> from the lungs to the tissue.

1. Explain why red blood cells carry more oxygen than the plasma.
2. Which mineral forms a part of the hemoglobin molecule?
3. What is the role of hemoglobin in red blood cells? (p. 290).
4. Below is an equation illustrating the transportation of oxygen by hemoglobin in the red blood cell. (p. 290)



- a. What is the difference between Hb and HbO<sub>2</sub>?



5. Where in the circulatory system and under which conditions would you expect the following to occur? (p. 290 )
- Hb to take on oxygen
  - HbO<sub>2</sub> to give up its oxygen
6. Hemoglobin exists as reduced hemoglobin and oxyhemoglobin. Where in the circulatory system would you expect to find:
- oxyhemoglobin (HbO<sub>2</sub>)
  - reduced hemoglobin (HHb)
7. Explain how the blood transports and exchanges:  
(pp. 246, p. 290 )
- oxygen
  - carbon dioxide
8. Explain the *role* played by *carbonic anhydrase* in the transport of carbon dioxide by blood.
9. Why is it important to tie up the hydrogen ions which are released when CO<sub>2</sub> combines with water?

## Blood Typing

(pp. 276 )

Blood transfusions from one person to another depend on the blood type. The following questions will focus on types of blood.

1. Read the section in your text on "blood typing" p. 276 Which of the following blood types have:
- A antigens
  - B antigens
  - A and B antigens
  - no antigens

2. Which of the following blood types have
  - a. antibody *b*
  - b. antibody *a*
  - c. no antibodies
  - d. antibodies *a* and *b*
3. Outline the main principle that determines whether one blood type can be transfused to another. (p.276)
4. What would occur if you carried out the following blood transfusions:

<i>Donor</i>	<i>Recipient</i>	<i>Reaction</i>
A	B	_____
O	A	_____
O	B	_____
O	AB	_____
AB	A	_____

5. Explain why *erythroblastosis* occurs. (p.277)
6. Describe how you would solve the problem of *erythroblastosis*.

## Blood Clotting

When a blood vessel is cut, blood begins the healing process by clotting. The following questions will focus in on this process.

1. Describe the series of events that occur to bring about blood clotting.
2. Explain with reasons how the following will affect blood clotting:
  - a. lack of vitamin K
  - b. lack of  $Ca^{++}$

## Blood Disorders

(Merk Manual, Text Chapters )

Choose any two of the following disorders and state the *characteristics, possible causes, and corrective measures* for any two of the following:

heart attack

thrombosis

stroke

hypertension

atherosclerosis

erythroblastosis

varicose veins

aneurysm

anemia

infectious mononucleosis

phlebitis

leukemia

hemophilia

embolus

angina

fainting

## Sample Exam Questions

1. Outline the main points you would use to discuss how the blood transports:
  - a. oxygen
  - b. carbon dioxide
2. Describe how the body reacts to an inflammation response.
3. Why is carbon monoxide a poisonous gas?
4. How does the shape of a red blood cell (*erythrocyte*) increase its efficiency in transporting oxygen?
5. Why are valves necessary in the heart, some veins, and in the lymphatic system?
6. Explain how the following would affect normal heart function:
  - a. blocking of the AV node
  - b. blocking of the SA node
  - c. plugged coronary arteries
  - d. a faulty tricuspid valve
  - e. severing of the *chordae tendineae*
7. Compare and contrast fetal and adult circulation.