

## Blood / Cardiovascular System

### Course

*Principles of Health Science*

### Unit IX

*Anatomy & Physiology*

### Essential Question

*What are the tissues and systems of the human body?*

### TEKS

130.202 (c) 1C, 1D, 1E, 1G, 1K, 9B

### Prior Student Learning

*Body Planes, Directions and Cavities Lesson*

### Estimated time

1-2 hours

### Rationale

To pursue a career in health care, proficiency in anatomy and physiology is vital.

### Objectives

Upon completion of this lesson, the student will be able to:

- List the functions of the blood
- Describe the components of the blood
- Discuss the ABO blood types
- Discuss the Rh blood factor
- Identify the parts of the heart
- Define pulse and blood pressure
- Recognize diseases and disorders of the blood and cardiovascular system

### Engage

As a class, discuss the following:

How does the heart work within the cardiovascular system and the body as a whole?

### Key Points

- I. Functions of blood
  - A. Transportation
    1. Blood carries oxygen and nutrients from digestive and respiratory systems and delivers them to each cell.
    2. Blood carries waste products from cells to excretory organs.
      - a. Carbon dioxide from cells to lungs
      - b. Other waste products of metabolism to kidneys
  - B. Defense against disease
    1. White blood cells combat bacterial invasion
    2. Antibodies
- II. Components of blood
  - A. Plasma – liquid part of blood. May contain digested food, metabolic wastes, carbon dioxide, oxygen, hormones or enzymes.
  - B. Formed elements
    1. Red blood cells (erythrocytes)
      - a. Contain hemoglobin – formed in red bone marrow

- b. Transport oxygen from lungs to cells and carbon dioxide from cells to lungs
    - 2. White blood cells (leukocytes)
      - a. Formed in bone marrow or lymph tissue
      - b. Destroy invading bacteria
    - 3. Platelets (thrombocytes) – tiny fragments of bone marrow cells; required for clotting of blood.
  - III. A, B, O blood types
    - A. The population is divided into four blood groups called A, B, AB or O. The types are distinguished by the presence or absence of specific proteins on the surface of the red blood cells or in the blood serum.
    - B. Blood type is important in transfusion and for medical-legal identification.
  - IV. Rh factor
    - A. The Rh factor is another protein factor in red blood cells, separate from A, B, O proteins.
    - B. Rh positive blood means the Rh factor (protein) is present in the red blood cells. (85% of the U.S. population is Rh positive).
    - C. Rh negative blood means no Rh antigen is present in red blood cells.
    - D. The Rh factor is important in transfusion and pregnancy.
  - V. Heart structure and function
    - A. Chambers of the heart
      - 1. General Description
        - a. The human heart is a four-chambered muscular organ, the size and shape roughly of a person's closed fist.
        - b. It lies in the mediastinum or the middle region of the thorax.
        - c. There are two upper chambers of the heart known as atria (singular: atrium) and two lower chambers called ventricles.
        - d. The left chambers are separated from the right chambers by an extension of the heart wall called the septum.
      - 2. The Atria (singular: Atrium)
        - a. The atria are the two superior chambers and are called the "receiving chambers" because they receive blood from vessels called veins. The right atrium receives deoxygenated blood from the superior vena cava, the inferior vena cava, and the coronary sinus. The left atrium receives oxygenated blood from the pulmonary veins and the lungs.
        - b. The atria are thin-muscular walled chambers

which allow blood flow into the ventricles.

### 3. The Ventricles

- a. The ventricles are the two inferior chambers. They are often called the “pumping chambers” because they pump blood out of the heart and into blood vessels known as arteries. The right ventricle pumps deoxygenated blood into pulmonary arteries which take blood to the lungs. The left ventricle pumps oxygenated blood into the aorta.
- b. More force is needed to pump blood through the body; the myocardium of each ventricle is thicker than the myocardium of the atria.
- c. The myocardium of the left ventricle is the thickest layer because the left ventricle pumps blood into the whole body while the right ventricle pumps blood into the lungs.

### B. The great blood vessels of the heart

1. The Superior Vena Cava - drains deoxygenated blood from veins in the head, neck, and arm regions into the right atrium.
2. The Inferior Vena Cava - drains deoxygenated blood from veins in the abdomen and legs into the right atrium.
3. Pulmonary Trunk - is the first portion of the pulmonary artery. It arises directly from the right ventricle after the pulmonary semilunar valve. The pulmonary trunk branches to form the left and right pulmonary arteries.
4. Pulmonary Arteries - branch from the pulmonary trunk to take deoxygenated blood to the lungs where carbon dioxide - oxygen gas exchange occurs.
5. Pulmonary Veins - take the oxygenated blood from the lungs into the left atrium of the heart.
6. The Aorta - the largest artery in the body extending from the left ventricle after the aortic semilunar valve. It arches and descends into the lower abdomen.

### C. Heart Valves

1. Tricuspid Valve - located between the right atrium and the right ventricle. It is composed of three flaps (cusps).
2. Pulmonary Semilunar Valve - located between the right ventricle and the pulmonary trunk. It is composed of three half-moon shaped flaps.
3. Bicuspid (Mitral Valve) - located between the left atrium and the left ventricle. It is composed of two flaps (cusps).

- 4. Aortic Semilunar Valve - located between the left ventricle and the aorta. It is composed of three half-moon shaped flaps.
- VI. Pulse and blood pressure
  - A. Pulse is the rhythmic throbbing felt in an artery as a result of the beating of the heart.
  - B. Blood pressure – pressure blood exerts on the inside walls of blood vessels.
    - 1. Systolic – pressure during heart muscle contraction
    - 2. Diastolic – pressure during relaxation of heart muscle
- VII. Flow of blood through the heart
  - A. The superior vena cava drains deoxygenated blood from the head, neck, and arms while the inferior vena cava drains deoxygenated blood from the abdomen and the legs into the right atrium. The coronary sinus drains deoxygenated blood from the myocardium into the right atrium.
  - B. From the right atrium, deoxygenated blood flows through the tricuspid valve into the right ventricle.
  - C. From the right ventricle, deoxygenated blood flows through the pulmonary semilunar valve into the pulmonary trunk.
  - D. The pulmonary trunk branches to form the right and left pulmonary arteries, which take deoxygenated blood to the lungs for gas exchange. Carbon dioxide is released from the blood while oxygen is picked up by the blood.
  - E. Oxygenated blood returns through the right and left pulmonary veins into the left atrium.
  - F. From the left atrium, oxygenated blood flows through the bicuspid (mitral) valve into the left ventricle.
  - G. From the left ventricle, oxygenated blood flows through the aortic semilunar valve into the aorta.
  - H. From the aorta, oxygenated blood flows into arteries, arterioles, capillaries, venules, and veins, eventually reaching the superior and inferior vena cava once again.
  - I. The body's entire blood supply is circulated every minute.
- VIII. Diseases and disorders of the blood and cardiovascular system
  - A. Anemia – condition in which the blood is deficient in the number of red blood cells or in hemoglobin
  - B. Aneurysm – abnormal dilation of blood vessels
  - C. Arteriosclerosis – thickening, hardening, and loss of elasticity of blood vessels
  - D. Atherosclerosis – a disorder of the lining of arteries in which fat is deposited on artery walls
  - E. Coronary occlusion – closing off of a coronary artery
  - F. Coronary thrombosis – closing a coronary artery by a blood clot
  - G. Embolus – blood clot or foreign material carried by the blood

- stream into a small blood vessel causing obstruction
- H. Hemorrhage – copious bleeding
  - I. Hypertension – high blood pressure
  - J. Ischemia – insufficient blood supply to a given part of the body
  - K. Murmur – abnormal heart sound
  - L. Phlebitis – inflammation of a vein
  - M. Thrombus – blood clot
  - N. Varicose veins – dilation of veins, usually in legs

### **Activity**

- I. Participate in Circulation Derby Game.
- II. Explain the flow of blood through the heart.
- III. Label the Human Heart.

### **Assessment**

Cardiovascular System Quiz and Key  
Key – flow of blood through the heart

### **Materials**

<http://www.texasheart.org/HIC/Anatomy/anatomy2.cfm> - Heart anatomy  
Heart Diagram

<http://www.bioedonline.org/>

Utah State Office of Education, (2005). *Medical Anatomy and Physiology Teacher Resource CD*. Utah.

### **Accommodations for Learning Differences**

For reinforcement, the student will color code a diagram of the heart and label the anatomical parts and/or design a poster depicting the pathway of blood through the heart and all body tissues.

For enrichment, the student will research and report on advancements in cardiology treatments.

### **National and State Education Standards**

National Health Science Cluster Standards

HLC01.01 Academic Foundations

Health care workers will know the academic subject matter required (in addition to state high school graduation requirements) for proficiency within their area. They will use this knowledge as needed in their role.

HLC10.01 Technical Skills

Health Care Workers will apply technical skills required for all career

specialties. They will demonstrate skills and knowledge as appropriate.

#### TEKS

130.202 (c)(1) (C) interpret technical material related to the health science industry;

130.202 (c)(1)(D) organize, compile, and write ideas into reports and summaries;

130.202 (c)(1)(E) plan and prepare effective oral presentations; and

130.202 (c)(1)(G) describe biological and chemical processes that maintain homeostasis.

130.202 (c)(K) identify the concepts of health and wellness throughout the life span.

130.202 (c)(9)(B) identify wellness strategies for the prevention of disease.

#### Texas College and Career Readiness Standards

##### English Language Arts

II. B. Understand new vocabulary and concepts and use them accurately in reading, writing, and speaking.

III. B. Develop effective speaking styles for both group and one-on-one situations.

IV. A. Apply listening skills as an individual, and as a member of a group in a variety of settings.

IV. B. 2. Listen actively and effectively in one-on-one communication situations.

##### Science

1.E.1. Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.

1.E.2. Use essential vocabulary of the discipline being studied.

3.A.1. Use correct applications of writing practices in scientific communication.

# **Circulation Derby**

Developed by Dr. J. Stephen Robinson

## **Objective**

Learn the correct order of transit through the vessels, heart chambers, and valves in a single round of the circulatory system.

## **Materials**

1. Satin or sateen cloth (4' x 8') of dark color (sticky cloth)
2. White board or display board large enough for the cloth
3. Can of dry spray adhesive
4. Paper sheets (cut photocopy sheet in half) with names of vessels, heart chambers and valves
5. Small table

## **Preparation**

1. Hang the sateen cloth on whiteboard or on wall.
2. Spray the cloth with dry spray adhesive if needed (preferably the night before).
3. Cut 8 ½ x 11" sheets of paper in half (width-wise) for as many cardiovascular items as are being studied.
4. Write the number of an item (vessel, valve, or chamber) on each sheet. Make a set in black and another in red using clearly legible lettering.
5. Stack the sheets in two separate piles (red and black) in random order.
6. Suspend a string dividing the cloth into left and right halves.
7. Place the table beneath the sticky cloth.
8. Place the two stacks of circulatory items face down on the table.

## **Competition**

1. Divide the class into two equally skilled teams and have them choose team names and a color (red or black).
2. Draw a grid on the whiteboard to tally the points.
3. Line up the teams at one end of the room opposite the sticky cloth. Clear the area between the teams and the sticky cloth.
4. The instructor explains the rules and places one sheet (e.g. RIGHT ATRIUM) on each side of the sticky cloth as the starting point in the circulation.
5. Each team sends one player at a time in rotation to the table to find in the stack of circulatory terms the next landmark encountered in the circulation. In the case of the RIGHT ATRIUM, the student would search for the TRICUSPID VALVE as the next item.
6. The student returns to the team area and tags off the next student who must search for the next ensuing circulatory landmark.
7. This continues until all the landmarks have been used.
8. The winner is the first team to complete the circulatory system with the fewest mistakes and in the least time.
9. The instructor reviews the order with the opposing team critiquing.

10. Scoring is by time with each error adding 15 seconds to the team time.

### **Additional Rules**

1. Other players are not allowed to communicate with the player who is at the Sticky Cloth searching for and putting up a sheet. The team is penalized one point (or 15 seconds) for violating this rule.
2. Players may only put one sheet up on the board or take one down, not both. If a player has made an incorrect choice, it may be corrected by a following player, but only by removing the incorrect sheet. The correct sheet must be put up by a following player.

### **Comments**

Teams will quickly realize the importance of working together as a team. Teams cannot shout out instructions to a player at the board, so if a player goes to the board without a clear idea of which is the next landmark on the circuit, it will cost the team two turns to correct it. They may deliberate together and make a clear decision before their player goes to the board. They will also discover that it is faster to spread the sheets out on the table to locate the proper landmark. I let the teams draw out the circuitry the first time it is played. The second time no pencils or crib sheets are allowed. In a third variation, the players are not allowed to speak at all. Speaking incurs a penalty point.



## Cardiovascular Quiz

1. Name six things transported by the cardiovascular system.
2. What chambers of the heart receive blood from veins?
3. What chambers of the heart are known as pumping chambers?
4. What is systolic?
5. What is diastolic?

What is a pulse?

7. List and describe the four components of blood.
8. What does Rh positive mean?

## Cardiovascular Quiz – KEY

1. Name six things transported by the cardiovascular system.

*Oxygen*

*Carbon dioxide*

*Nutrients*

*Hormones*

*Waste Products*

*Enzymes*

*\*Other choices include electrolytes, water*

2. What chambers of the heart receive blood from veins?

*Atria*

3. What chambers of the heart are known as pumping chambers?

*Ventricles*

4. What is systolic?

*pressure during heart muscle contraction*

5. What is diastolic?

*pressure during relaxation of heart muscle*

6. What is a pulse?

*The rhythmic throbbing felt in an artery as a result of the beating of the heart.*

7. List and describe the four components of blood.

a. *Plasma - the fluid portion of blood*

b. *Erythrocytes - the red blood cells used to carry oxygen and carbon dioxide*

c. *Leukocytes - the white blood cells used to fight infection*

d. *Thrombocytes - the platelets used to clot blood*

8. What does Rh positive mean?

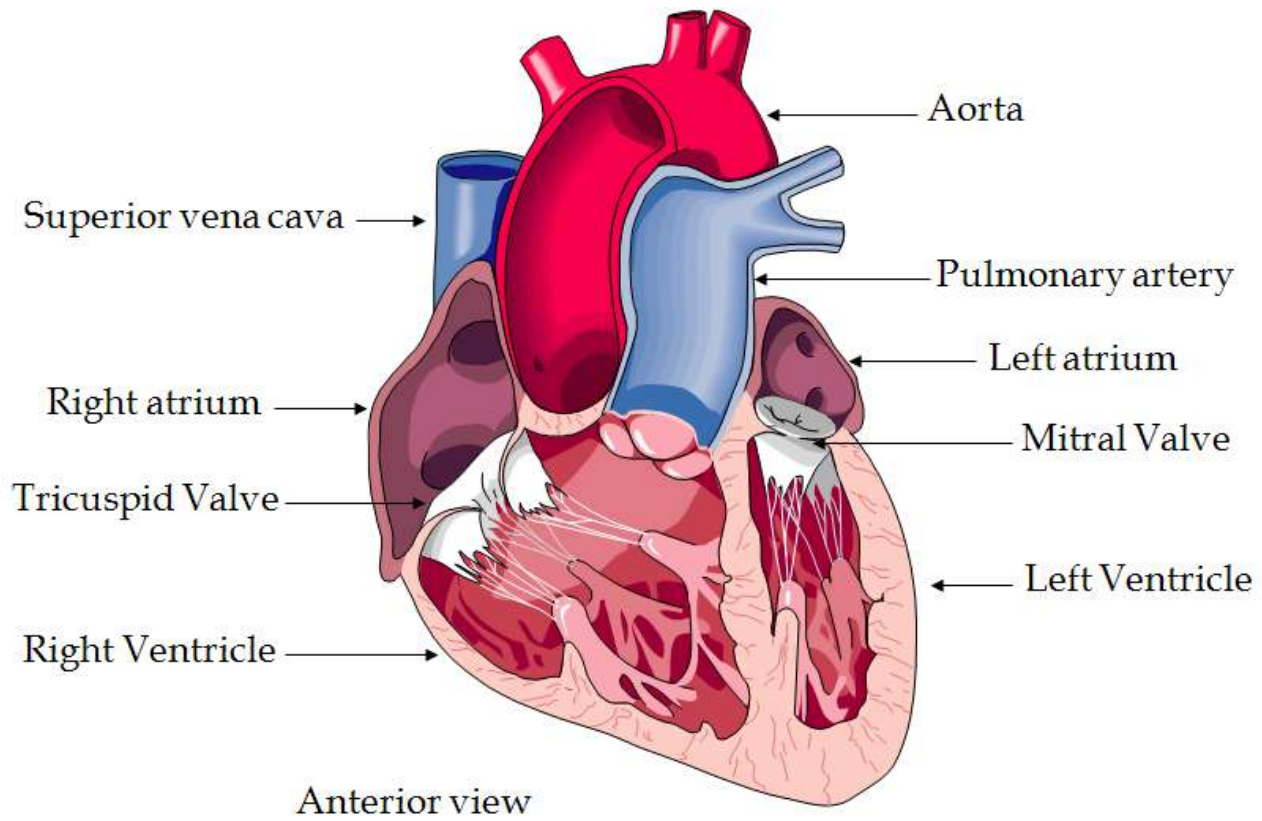
*The person's red blood cells have an additional antigen (protein D).*

## THE FLOW OF BLOOD THROUGH THE HEART - KEY

- A. The superior vena cava drains deoxygenated blood from the head, neck, and arms while the inferior vena cava drains deoxygenated blood from the abdomen and the legs into the right atrium. The coronary sinus drains deoxygenated blood from the myocardium into the right atrium.
- B. From the right atrium, deoxygenated blood flows through the tricuspid valve into the right ventricle.
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- H. From the aorta, oxygenated blood flows into arteries, arterioles, capillaries, venules, and veins, eventually reaching the superior and inferior vena cava once again.
- I. The body's entire blood supply is circulated every minute.

("Medical anatomy and," 2005)

## Heart Diagram



## Label the Human Heart

