Student Exploration: Circulatory System

**Vocabulary:** artery, atrium, blood vessel, capillary, circulatory system, heart, platelet, pulmonary artery, pulmonary vein, red blood cell, urea, ventricle, vein, white blood cell

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

1. Why do you need blood? __**IT CARRIES THE NUTRIENTS THAT OUR CELLS NEED.**__

2. What organ pushes blood through your body? __**HEART**__

**Gizmo Warm-up**

The Circulatory System Gizmo™ shows the heart and blood vessels that make up the circulatory system. Look at the heart.

1. How many chambers does the heart have? __**4**__

2. Do you see tiny "doors" that open and close as blood is pumped through the heart? __**Yes**__ These are valves. Valves keep blood from flowing backward in the heart and blood vessels.

3. Turn on Show labels. What are the names of the chambers? __**Right atrium, right ventricle, left atrium, left ventricle**__

4. Click PLAY and listen for the two parts of the heartbeat, nicknamed "lub" and "dub." (Note: The recording is not in sync with the heart animation.) Observe the heart.
   
   A. Which chambers contract during "lub"? __________
   
   B. Which chambers contract during "dub"? __________

5. Challenge: Why do you think the left atrium and left ventricle are shown on the right side of the diagram? __**They are on the left side of the body.**__
Activity A: Blood flow

Get the Gizmo ready:
- Turn off Show labels.
- Turn on Show blood flow.

Question: How does blood flow through the heart?

1. Observe: Blood in each chamber of the heart is represented by little balls. Observe the balls as they move through the heart and lungs.

2. Label: Turn on Show labels. Label the four chambers of the heart on the diagram. Then draw arrows to show the direction that blood flows through the heart.

Starting at the right atrium, in what order does blood flow through the four chambers?
right atrium, right ventricle, left atrium, left ventricle

3. Analyze: Observe the path of blood that leaves each ventricle.
   A. Where does blood from the right ventricle go? to the lungs
   B. Where does blood from the left ventricle go? to the body

4. Collect data: Use the syringe to collect a blood sample from the right ventricle (on the left side of the heart diagram). Look at the Data from blood sample numbers.
   A. What is the concentration of oxygen in this sample? 34.9 mmHg
   B. What is the concentration of carbon dioxide in this sample? 49.6 mmHg

5. Collect data: Now collect a blood sample from the left atrium.
   A. What is the concentration of oxygen in this sample? 91.6 mmHg
   B. What is the concentration of carbon dioxide in this sample? 38.2 mmHg

6. Draw conclusions: Between the right ventricle and the left atrium, blood goes through the lungs. Based on the data you have collected, what happens in the lungs?

Blood is re-oxygenated in the lungs and carbon dioxide is sent out.
Activity B: Blood circulation

Get the Gizmo ready:
- Check that Show labels is on.
- Turn on Show blood flow.

Question: How is blood carried to different parts of the body?

1. **Observe:** Watch the blood after it leaves the left ventricle. What are some places that blood goes after leaving the heart? Head, arms, liver, intestines, kidney, trunk, and legs (Systemic circulation)

2. **Compare:** The Gizmo shows three types of blood vessels. Arteries carry blood away from the heart, capillaries carry blood to body cells, and veins carry blood back to the heart. Locate examples of arteries, veins, and capillaries.

   Use the syringe to take blood samples from several different veins and arteries.
   - A. Which type of blood vessel *usually* carries oxygen-rich blood? **artery**
   - B. Which type of blood vessel *usually* carries oxygen-poor blood? **vein**
   - C. In which type of blood vessel is oxygen released into body cells? **capillary**

3. **Challenge:** The pulmonary artery carries blood from the right ventricle to the lungs. The pulmonary vein carries blood from the lungs back to the left atrium. Locate these blood vessels, and use the syringe to take a blood sample from each.
   - A. How is the blood in the pulmonary artery different from blood in other arteries?
     **Blood in the pulmonary artery is low in O₂**
   - B. How is the blood in the pulmonary vein different from blood in other veins?
     **Blood in the pulmonary vein is high in O₂**

4. **Extend your thinking:** How is the circulatory system similar to a road-and-highway system?
   - *Both transport objects to the places they need to go.*
**Extension:**

**What's in your blood?**

- **Get the Gizmo ready:**
  - Take a blood sample from any blood vessel using the syringe.

**Question: What is inside blood?**

1. **Observe:** Look at the *Microscopic view of blood sample.* Sketch what you see in the space at right. (If you like, you could also click the camera icon to take a Gizmo snapshot, and then paste your snapshot into a blank word-processing document.)

Find and label the following objects in your sketch:

- **Red blood cells** (small, round cells that carry oxygen)
- **White blood cells** (large, irregular cells that fight disease)
- **Platelets** (tiny fragments that help to stop bleeding when you are cut)

2. **Collect data:** Blood carries many vital substances. Four of these are listed above the *Microscopic view.* Oxygen and sugar are needed by all body cells. Carbon dioxide and urea are waste products. What are the concentrations of each substance in this sample?

   Oxygen: _______  Carbon dioxide: _______  Sugar: _______  Urea: _______

3. **Investigate:** Take samples of blood from all over the body. Try to determine where sugar enters the blood, and where it is removed.

   A. Where does sugar enter the blood? __________________________________________
   
   B. How can you tell where sugar enters the blood? ________________________________
      __________________________________________
   
   C. Where is sugar removed from the blood? ________________________________
   
   D. How can you tell? _________________________________________________________
      __________________________________________

4. **Investigate:** Take blood samples to determine where urea enters the blood and is removed.

   A. Where does urea enter the blood? __________________________________________
   
   B. Where is urea removed from the blood? ____________________________________