Section A: Blood Basics  http://www.psbc.org/hematology/01_index.htm

Although blood appears to be red liquid it is actually composed of yellowish liquid called plasma and billions of cells. The vast majority of these cells are red cells and these give blood its red color. The blood also contains several types of infection-fighting white cells and tiny cell fragments called platelets which are essential for clotting. All blood cells are produced from stem cells located in the red bone marrow. The plasma is the river in which the blood cells travel. It carries not only the blood cells but also nutrients, waste products, antibodies, clotting proteins, hormones, and proteins that help maintain the body's fluid balance. Most of the cells in the blood are red blood cells that transport oxygen. Red blood cells are filled with a molecule called hemoglobin that carries oxygen. White blood cells have the ability to change with needs and have different roles in fighting infection. These cells can leave the bloodstream, sliding out through the vessel walls and attacking invaders at the site of an infection. Platelets are fragments of a much larger cell, a megakaryocyte, which stays in the bone marrow after it differentiates and matures from the stem cell. The platelets leave the bone marrow and circulate throughout the body. When stimulated by substances from damaged tissue, the platelets release substances necessary to help blood clot.

1. Why is blood red? ____________________________________________________
2. Where does hematopoiesis or blood cell formation occur? __________________________
3. Identify the type of blood cell or cellular fragment: Erythrocyte (RBC), Leukocyte (WBC) or platelet
   a. ___________________________ Cell fragments aid in blood clotting.
   b. ___________________________ Main function is to fight disease.
   c. ___________________________ Cells contain hemoglobin which carries oxygen.

Section B: Blood Webquest – RBC & WBC

Red Blood Cells – Click on RBC (tutorial) link and answer the questions.

1. What is the function of RBC? ____________________________________________________________
2. What is erythropoiesis? _________________________________________________________
3. What factors affect the number of RBC? ___________________________________________________
4. What is hemoglobin? _______________________________________________________
5. What is hypoxia? _____________________________________________________________
6. What happens to old RBC? __________________________________________________________

White Blood Cells – Click on WBC (tutorial) link and answer the questions.

1. What is the function of leukocytes? ____________________________________________________
2. What are the types of WBCs and their functions?

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What is diapedesis and why is it important? _____________________________________________
4. What is leukocytosis? ________________________________________________________________

Section C: Blood Type LAB

Blood type is determined by the presence or absence of specific agglutinogens on the surface of erythrocytes. These antigens have been designated as A and B. Antibodies against antigens A or B begin to build up in the blood plasma shortly after birth and remain throughout the rest of a person's life.

<table>
<thead>
<tr>
<th>Anti-A Serum</th>
<th>Anti-B Serum</th>
<th>Blood Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agglutination</td>
<td>No Agglutination</td>
<td>Type A</td>
</tr>
<tr>
<td>No Agglutination</td>
<td>Agglutination</td>
<td>Type B</td>
</tr>
<tr>
<td>Agglutination</td>
<td>Agglutination</td>
<td>Type AB</td>
</tr>
<tr>
<td>No Agglutination</td>
<td>No Agglutination</td>
<td>Type O</td>
</tr>
</tbody>
</table>
**PROCEDURE:**
1. Choose a vial of one patient’s blood. Place three to four drops of the blood in each well (A, B, Rh).
2. Add three drops of the simulated anti-A serum in the A well. Add three drops of simulated anti-B serum in the B well. Add three drops of the anti-Rh serum in the Rh well.
3. Stir each well with a different clean toothpick to avoid contamination. Examine the wells for agglutination which indicates a positive test. Continue testing the remaining patient’s blood.

<table>
<thead>
<tr>
<th>Anti-A Serum</th>
<th>Anti-B Serum</th>
<th>Anti-Rh Serum</th>
<th>Blood Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Smith</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mr. Jones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mr. Green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ms. Brown</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

➢ Click on the ‘Blood Typing Game’ and play the game.

**Section D: Structures of the Heart**
1. The visceral pericardium or the ______________ lines the external surface of the heart.
2. The ______________ are bundles of heart muscle.
3. What serous membrane forms a sac attaching to the sternum and the diaphragm? ______________
4. What membrane lines the heart chambers? _______________________________________________________
5. Where are the SL valves located? ________________________________________________________________
6. Where are the AV valves located? ________________________________________________________________
7. The upper chambers of the heart are called ____________________
8. What prevents oxygenated blood from mixing with deoxygenated blood? _____________________________
9. Which valve is a bicuspid? _________________________________________________________________
10. What is the function of the heart valves? __________________________________________________________
11. What attaches to the valves so they can close? ____________________________________________________
12. The ______________ carries blood from the right ventricle to the lungs.
13. The ______________ carries blood from the left ventricle to all parts of the body.
14. Which chamber has the thickest muscle? __________________
15. The pulmonary arteries take blood to the __________________ for oxygenation.
16. Which veins deliver blood to the right atrium? ________________________________________________________
17. Which chamber pumps blood into the pulmonary arteries? ____________________________
18. Which chamber receives blood from the pulmonary vein? ____________________________________________
19. What vessels supply blood to the myocardium? _____________________________________________________
20. Which structure would normally contain oxygenated blood?
   a. right ventricle   b. right atrium   c. left atrium   d. pulmonary arteries
21. Label the heart.
Section E: Physiology of the Heart
1. Find the link: “Heart Contraction & Blood Flow” and watch. Use the space provided to explain the path of blood through the heart starting with the vena cava.

2. What occurs if the atria are contracting? ____________________________
   Which valves are open? __________________ Which valves are closed? __________________
3. What occurs if the ventricles are contracting? ____________________________
   Which valves are open? __________________ Which valves are closed? __________________
4. How does blood flow in the pulmonary circuit? ____________________________
5. How does blood flow in the systemic circuit? ____________________________

Section F: Cardiac Cycle
1. What does systole mean? ________________________
2. What does diastole mean? ________________________
3. In what chambers does blood enter during the atrial diastole? ________________
   Which valves are open? __________________ Which valves are closed? ________________
4. What occurs during atrial systole? ____________________________
5. What makes the lub sound in the heart? ____________________________
6. What makes the dub sounds in the heart? ____________________________
7. Where is the blood flowing during ventricular systole? ____________________________

Section G: Intrinsic Conduction System of the Heart
1. Where is the electrical impulse generated in the heart? ____________________________
2. What happens when the SA node generates an impulse? ____________________________
3. As the signal spreads across the atria, what node is stimulated? ____________________________
4. What happens when the signal spreads across the ventricles? ____________________________
5. What letter on the ECG indicates the atria contracting? __________
6. What letter on the EKG represents the ventricles contracting? ____________________________
7. How long does it take for the impulse to travel from the SA node throughout the heart? __________
8. Reading an Electrocardiogram - An ECG measures the electrical activity of the heartbeat. With each beat, an electrical impulse causes the muscles to squeeze and pump blood from the heart. The atria contract during the PR interval, and ventricles contract during the QT interval.

   ___ Hypercalcemia: blood calcium levels are too high; causes ST segment to be short or absent
   ___ Hyperkalemia: blood potassium levels are too high; causes tent-shaped T wave
   ___ Tachycardia: heart beats too quickly; waves are normal, but rate is increased
   ___ Ventricular fibrillation (V-fib): uncoordinated contraction of heart; waves are chaotic
### Section H: Blood Vessels

<table>
<thead>
<tr>
<th></th>
<th>Arteries</th>
<th>Veins</th>
<th>Capillaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Contain oxygenated blood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Contain deoxygenated blood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Contain valves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Location of gas exchange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Run parallel to each other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Thinnest vessel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Carries blood away from the heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Carries blood to the heart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Thickest muscular walls</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Section I: Cardiac Output, Blood Pressure & Pulse

Cardiac output is a measure of the amount of blood pumped by both ventricles in a minute. The heart pumps about one million barrels of blood during an average lifetime.

1. To begin with, obtain your resting heart rate for a minute three times and calculate an average resting heart rate. *Heart rate is the number of beats per minute.*

2. To calculate your cardiac output, multiply your average heart rate by the average 75 mL stroke volume:
   \[
   \text{Cardiac output} = \text{Heart Rate (beats/min)} \times \text{Stroke Volume (mL/beat)}
   \]

   \[
   \underline{\underline{\text{______________________________}}} = \underline{\underline{\underline{\text{______________________________}}}} \times 75\text{ mL/beat}
   \]

   Click on ‘Blood Pressure & Pulse’ and go through the tutorial.

3. Rank in order the vessels based on pressure starting with the aorta which has the highest pressure.

   4. What does your pulse indicate? _____________________________________________________________

   5. What is blood pressure? _________________________________________________________________

   6. What does the systolic number indicate? ____________________________________________________

   7. What does the diastolic number indicate? __________________________________________________

   8. Briefly explain what you are listening for when you take someone’s blood pressure. __________

   9. What factors can influence blood pressure? _________________________________________________

   10. Normal blood pressure is said to be in the neighborhood of 120/80. What are the names of the 2 measurements and explain how these 2 measurements are similar and different?

   11. Two men have had medical operations on their circulatory systems. One has had a pace maker and the other has had a defibrillator installed in their chest. One of the men said that they are the same things and the other says they are not but he can’t remember what each one does. Settle their disagreement by explaining what they do.