11. Label the entire heart. Color the structures blue or red according to the type of blood they carry or hold.

![Heart Diagram]

E. Use the words in the following list to complete the story on circulation.

- aorta
- aortic semilunar
- bicuspid valve
- carbon dioxide
- descending aorta
- inferior vena cava
- left atrium
- left ventricle
- liver
- lung
- mitre
- oxygen
- pulmonary artery
- pulmonary semilunar valve
- pulmonary veins
- right atrium
- right ventricle
- tricuspid valve

**CIRCULATION OF A RED BLOOD CELL**

I am tired. I am a red blood cell that has journeyed through this maze of blood vessels for the past 100 days. I am on my way back to the PUMP factory, carrying with me carbon dioxide thrown out as waste by a muscle cell.

I will be glad to get there to unload this baggage, and then I will pick up oxygen for one of my last trips. The major road from the muscle is called the \[\text{aorta}\] \[\text{aortic semilunar}\] \[\text{bicuspid valve}\], which goes to the right upper room or \[\text{right atrium}\] at the factory. After getting dumped there, I feel the walls start to vibrate and close around me. I get pushed through a door marked \[\text{right atrium}\] \[\text{right ventricle}\] \[\text{tricuspid valve}\].

I am now in the lower room called the \[\text{inferior vena cava}\] \[\text{left atrium}\] \[\text{left ventricle}\] \[\text{liver}\]. Just as I get comfortable I hear that same sound again, and these walls start to move from the other side, pushing me upward through another door, which looks like a half moon. This one is called the \[\text{descending aorta}\] \[\text{inferior vena cava}\] \[\text{left atrium}\] \[\text{left ventricle}\] \[\text{liver}\].
I find myself pushed through the _______________ tunnel, which goes from the heart to a spongy-looking building complex with lots of wings; this is known as the _______________ factory.

When I arrive I am sent to a small chamber, and there I drop off my _______________. “Wait,” the supervisor calls out. “You have to take this little fellow back to the PUMP factory with you.” As I leave the buildings, I am pointed in the direction of a maze of four highways also known as the _______________. I am told that any of those roads will get me back to the PUMP factory.

I choose the least-crowded lane and land back at the PUMP factory on the left side of the building. I am now in the _______________ chamber. OH! NO! It is happening all over again. The room starts to shake, the walls start closing in, and my little friend Oxy and I are pushed through a door marked _______________ valve. This one has a funny top to it; it looks like a bishop’s _______________. Now, here I am, in the _______________, and before you know it the walls are pushing at me again. Up, up, and away through the _______________ valve. Oxy and I are in a bigger tunnel this time; it is called the _______________. At the end of this road is a curve with three major arteries coming off it; we will take the road going south, marked _______________.

This is my route back to the _______________, taking Oxy along. I am so tired of getting pushed and shoved. I think I will just drop Oxy off and stay there and retire to the recycle plant.

Can you guess the name of the pump?

F. The following illustrates the action that occurs during the cardiac cycle. Complete the blanks using the words provided. Words may be used more than once.

<table>
<thead>
<tr>
<th>atria</th>
<th>contraction</th>
<th>pulmonary artery</th>
<th>semilunar</th>
</tr>
</thead>
<tbody>
<tr>
<td>atria</td>
<td>closed</td>
<td>pulmonary veins</td>
<td>tricuspid</td>
</tr>
<tr>
<td>bicuspid</td>
<td>open</td>
<td>relax</td>
<td>ventricles</td>
</tr>
</tbody>
</table>

Depolarization

1. The SA node stimulates the _______________ of both atria. Blood flows from the _______________ into the _______________. The ventricles are relaxed, the _______________ valves are _______________, and blood cannot enter the _______________ and _______________.

2. The AV node receives the impulse from the SA node and stimulates the _______________ of both atria, which pumps blood into the _______________ and _______________. The atria are _______________ and _______________, and the _______________ and _______________ valves are closed.

Repolarization

3. Ventricles, _______________, and semilunar valves are _______________, which prevents blood from flowing back into the _______________. The heart rests.
In this project, you will follow the flow of blood through the heart. Your heart has two jobs to do, and its two sides have separate responsibilities: The left side pumps oxygen-enriched blood from your lungs to your body’s cells, and the right side pumps oxygen-poor, waste-carrying blood back from your body’s cells to your lungs.

When blood has made one “round trip,” it has completed one “heart cycle.” Although this project will guide you through the heart cycle by examining what happens in one chamber at a time, it is important for you to know that blood flows through both sides of the heart simultaneously (at the same time). That is, when the right atrium contracts and pumps its blood, the left atrium contracts at the same time. The same is true for the ventricles—both the right and left ventricles contract and pump blood at the same time.

In biological drawings, it is standard to use blue to represent deoxygenated blood and red to represent oxygenated blood. (This practice is not just to make your drawing colorful; oxygen-rich blood actually looks bright red, and oxygen-poor blood looks bluish or purple.) You will, therefore, use blue circles to follow deoxygenated blood through the right side of the heart and red circles to follow oxygenated blood through the left side of the heart.

Obtain the following materials:

- ten blue circles and ten red circles (you can make them by using a hole punch on blue and red construction paper)
- colored pencils or markers

Procedure

1. Each stage will instruct you to place colored circles on the “number” diagram. Be sure to place the circles on the correct numbers and to use the correct color (red or blue).

2. On the “heart sequence” page, sketch and color the circles for each stage.

3. Before going to the next stage, remove the circles from the “number” diagram so that they can be reused for the next stage. The idea, of course, is to show the movement of the blood in successive stages.

Stage one: Deoxygenated blood enters the right atrium through the superior and inferior venae cavae. Place blue circles on numbers 1, 2, 3, 4, 5, 6, 7, and 8. Sketch and color these circles on Diagram A.

Stage two: When the right atrium is full, it contracts and forces blood through the tricuspid valve and into the right ventricle. Remove the blue circles from stage one and place them on numbers 9, 10, 11, 12, and 13. Sketch and color these circles on Diagram B.
Stage three: After the blood passes into the right ventricle, the tricuspid valve slams shut. The muscular wall of the right atrium contracts, forcing the blood through the pulmonary artery and to the lungs. Remove the blue circles from stage two and place them on numbers 14, 15, 16, 17, 18, 19, 20, 21, 22, and 23. Sketch and color these circles on Diagram C.

Stage four: The blood returns from the lungs to the left atrium through the pulmonary veins. While in the lungs, the red blood cells become saturated with oxygen and change from a bluish color to a bright red. Remove the circles from stage three. Place red circles on numbers 24, 25, 26, 27, 28, 29, 30, and 31. Sketch and color these circles on Diagram D.

Stage five: When the left atrium is full, it contracts and forces blood through the bicuspid valve and into the left ventricle. Remove the red circles from stage four and place them on numbers 32, 33, 34, 35, 36, 37, and 38. Sketch and color these circles on Diagram E.

Stage six: The last stage of the heart cycle occurs when the bicuspid valve slams shut and the oxygen-enriched blood is pumped out of the left ventricle through the aorta. From the aorta, the blood is directed to the body’s cells. Remove the red circles from stage five and place them on numbers 39, 40, 41, 42, 43, 44, 45, 46, and 47. Sketch and color these circles on Diagram F.

Level One Questions:

1. Through which veins does deoxygenated blood enter the right atrium?

2. What structure must the blood pass through before it enters the right ventricle?

3. Where is the blood pumped after it leaves the right ventricle?

4. What is the job of the pulmonary veins?

5. What happens when the left atrium is full?

6. Describe the last stage of the heart cycle.
7. Hyperventilation: 

N. How do you correct hyperventilation?

O. Use the words from the following list to complete the rhymes.

alveolar duct bronchus larynx trachea
alveoli capillary mucus vein
artery cilia nasal cavity voice box
bronchi inhaled pharynx

I was floating by in the evening breeze
when I got inhaled by a great big sneeze.

Next thing I knew I was inhaled inside
to the ______________________ on the right side.

The place was warm, moist, and had ___________ so thick
with little hairs called ____________, they make you want to itch.

I did not have much chance to look around;
I went over the cliff and down, down, down.

I landed in a place called the _____________ or throat;
it was so full of watery juice, I thought I needed a boat.

I was quickly pulled through a place with a high pitch,
the ______________ or voice box where air rushes by real quick.

Off to another tube, lined with those little hairs;
windpipe or ______________, I spent little time there.

I landed then on what looked like a tree;
the _____________ I believe, what side should it be?

The ______________ branches keep getting narrower and end in the ______________
________________________, into the air sacs or ______________ I quickly get sucked.

I pass through the wall onto the ______________ train:
off to a new adventure as I board an ______________ and not a ____________.