

Anatomy and Physiology II  
Exam #2 Review

- Mix and match
- Explain the relative percentages of plasma, erythrocytes, leucocytes, and thrombocytes in the blood in a healthy person.

**Plasma - 50-60% of blood**

**Cellular - 40-50% of blood**

**Erythrocytes (red blood cells) - 98% of blood cells**

**Luekocytes (white blood cells) - 1% of blood cells**

**Thrombocytes (platelets) - 1% of blood cells**

3A. What is hematocrit and how is it measured? What does a low hematocrit indicate. What are the common causes of anemia?  
**Hematocrit** - The percentage of the total blood (plasma + cellular portion) made up of red blood cells.

**How is it measured** - By centrifuging the blood, the percentage of the total blood that is packed red blood cells

**Common causes of anemia:**

- **Iron-deficiency: Lack of adequate iron to make red blood cells.**
- **Hemorrhagic: Due to excessive blood loss, ulcers, menstration, trauma, etc.**
- **Pernicious: insufficient hematopoiesis (making of red blood cells), usually caused by lack of Vit B-12.**
- **Hemolytic: Red blood cells rupture due to parasites, toxins, or incompatible blood types.**
- **Sickle cell: Genetic disorder.**

3B. What does a low reticulocyte count indicate?

**Low Reticulocyte count** indicates that red blood cell production is low, precursor to anemia. Reticulocytes are the precursor red blood cells.

**4. Some part of this question is guaranteed.** About what percentage of the leucocytes are, neutrophils, lymphocytes, monocytes, eosinophils, and basophils in a healthy person.

**Never Let Monkey's Eat Bananas.**

**Neutrophils - 60%**

**Lymphocytes - 30%**

**Monocytes - 10%**

**Eosinophils - 1%**

**Basophils - 1%**

**5. Some part of this question is guaranteed.** What are the key identifying characteristics of erythrocytes, neutrophils, lymphocytes, monocytes, eosinophils, basophils, and thrombocytes. What is a granulocyte and an agranulocyte. What is a polymorphonuclear leucocyte?

<b>Name</b>	<b>Type</b>	<b>Description</b>
<b>Erythrocytes</b>	<b>Red</b>	<b>No nucleus</b>
<b>Neutrophils</b>	<b>White</b>	<b>Granular (pink), 2-5 lobes</b>

<u>Lymphocytes</u>	<u>White</u>	<u>Immune, no granular, large nucleus w/ crescent shaped cytoplasm around it</u>
<u>Monocytes</u>	<u>White</u>	<u>2-3x normal cell size, no granulars</u>
<u>Eosinophils</u>	<u>White</u>	<u>Granular (red), 2 lobes</u>
<u>Basophils</u>	<u>White</u>	<u>Granular (dark blue, purple or black), 2 lobes</u>
<u>Thrombocytes</u>	<u>Platelets</u>	<u>Small, fraction of a cell</u>
<u>Granulocytes</u>	<u>White</u>	<u>Cytoplasm has granules (neutrophils, basophils, eosinophils)</u>
<u>Agranulocytes</u>	<u>White</u>	<u>Cytoplasm has no granules (monocytes, lymphocytes)</u>
<u>Polymorpho-Nuclear leucocytes</u>	<u>White</u>	<u>Multiple nodes on the nucleus</u>

Likely to be asked as "here are three cells, how do you tell them apart?" You need to be able to describe the characteristics that would make the cells visibly different.

6. Some part of this question is guaranteed. What are the functions of erythrocytes, neutrophils, lymphocytes, monocytes, eosinophils, basophils, and thrombocytes.

Erythrocytes - Carry oxygen

Neutrophils - Phagocytize foreign

Lymphocytes - Form T-Cells and B-Cells - Specific immune system cells.

Monocytes - phagocytize foreign cells, Form macrophages when in tissue.

Eosinophils - Breaks down heprine & histamine.

Basophils - Involved in allergic reactions, release heparin and histamine.

Thrombocytes - form blood clots.

7. Some part of this question is guaranteed. What are the different blood types. Be able to explain given a person's blood type and which types of blood can be given to that person.

Likely to be asked as "If a person has XX blood type, what type can they receive", or "If you have XX blood type, what types can receive it.

8. What problem can occur if a Rh- mother has a RH+ baby. What is rhogam and how does it prevent the above problem?

Rh- mother does not have the Rh protein. Therefore, she will reject blood which does have the Rh protein. If she gives birth to a child with the Rh protein (Rh+), then she will be exposed to the babies Rh+ blood when the placenta tears and will develop antibodies to the Rh+ blood which will travel into the placenta of subsequent babies and attack their blood (if it is Rh+), called **hemolytic disease of newborns**. To prevent this a chemical called rhogam is given to the mother, this chemical will destroy the Rh+ protein as it enters the mother keeping her from developing the antibody to it.

9. About what percent of the plasma proteins are albumins, globulins, and fibrinogen.

Albumins - 60%

Alpha & Beta Globulins - 36%

Fibronogen - 4%

10A. What functions do albumins, alpha and beta globulins, and gamma globulins have?

Albumins - help maintain osmotic pressure and regulate water balance between the blood and tissues.

Alpha (LDL) & Beta (HDL) Globulins - Help transport fats and fat soluble vitamins.

Gamma Globulins - Antibodies produced by B-Cells.

10B. Some part of this question is guaranteed. What do VLDL, LDL, and HDL do? How is your total cholesterol calculated? What is a high total cholesterol? What percentage of your total cholesterol should you HDL be? How can you increase your HDL?

VLDL - Transport fats from liver to tissue.

LDL - Transport cholesterol to tissues.

HDL - Transport cholesterol from tissue to liver.

High Cholesterol: Over 200

HDL% : It is recommended that HDL should be more then 20%

Increase HDL: Exercise or be a woman

11A. Some part of this question is guaranteed. Explain what happens in the stages of hemostasis?

1. Vascular spasm: Contraction of the ruptured blood vessel to reduce blood loss.
2. Platelet plug formation: Platelets plug the hole to stop the bleeding
3. Clot formation:
  - a. Ca<sup>+2</sup> and thromboplastin (an enzyme) are released from cells when they are damaged or ruptured. Platelets also release thromboplastin.
  - b. Thromboplastin is activated by the Ca<sup>+2</sup> and converts prothrombin (an inactive enzyme) into thrombin (an active enzyme). Note: Clotting factors IV, V, VIII, IX, X, XI, and XII are necessary for this reaction to occur. Clot formation also requires vitamin K.
  - c. Thrombin converts fibrinogen into fibrin.

11B. What is the function of fibrinogen and explain in detail how it is activated to form fibrin.

The clot formation process is:

I. Calcium (Ca<sup>++</sup>) and thromboplastin (an enzyme) are released from platelets and cells when they are damaged or ruptured.

II. Thromboplastin is activated by the calcium and converts prothrombin (an inactive enzyme) into thrombin (an active enzyme). Note, clotting factors IV, V, VIII, IX, X, XI, and XII and vitamin K are necessary for this reaction to occur.

III. Thrombin converts **fibrinogen** into **fibrin**, a long thread-like protein that bonds to cuts in vessel walls and stops the loss of blood from the vessel.

11C. How does fibrinolysis occur?

**Fibrinolysis:** The breakdown of blood clots Plasminogen (an inactive plasma enzyme that is incorporated into blood clots when they are formed) is activated to form plasmin (fibrinolysin) which breaks down the blood clot.

12. What effects do heparin and histamine have?

**Heparin:** Inhibits blood clotting and helps destroy blood clots.

**Histamine:** causes the tissue to swell with water.

13A. Describe the layers of the pericardium and the heart. What are functions of the different layers.

1. **Fibrous pericardium:** The outer most fibrous layer of the pericardium, made of non-elastic dense connective tissue.
2. **Serous pericardium:** Two part inner membrane that surrounds the heart.
  - a. **Parietal layer:** The outer layer of the serous pericardium that is fused to the fibrous pericardium.
  - b. **Visceral layer (epicardium):** A layer of connective tissue that is tightly connected to the surface of the heart.

Note: The parietal layer and visceral layer are very smooth. There is a lubricating fluid between them to reduce friction between the two when the heart moves.

13B. What are the layers of the heart wall and what are the functions of the different layers?

1. **Epicardium (visceral layer of serous pericardium):** The outer most layer of the heart.
2. **Myocardium:** The middle layer of the heart, made up of muscle fibers.
3. **Endocardium:** The smooth layer of endothelium (i.e. the epithelium tissue that lines veins and arteries) overlying a thin layer of connective tissue. It is very smooth to reduce friction as the blood moves through the heart.

14. Which arteries carry blood to the heart?

**Coronary arteries** (left coronary artery and right coronary artery).

RCA - Right Marginal branch

RCA - Posterior interventricular Branch

LCA - Anterior interventricular Branch

LCA - Circumflex Branch

15A. Some part of this question is guaranteed. Describe the layers of blood vessels. How are the layers different in

veins, arteries, and capillaries? How are large arteries different from medium sized arteries?

**elastic lamina (arteries only)** - elastic tissue, separates the tunica media and tunica externa.

**Tunica externa (adventitia)** - outer layer of vessel, elastic fibers and collagen fibers. Thicker in arteries.

**Capillaries** - Walls of a single layer of endothelial cells w/ basement membrane. Do not have a tunica media or tunica externa layers.

**Large arteries** - called elastic arteries because they have more elastic tissue and less smooth muscle in their walls. Blood moves through mainly by elastic recoil. Ex. Aorta, brachiocephalic trunks, common carotids.

**Medium arteries** - called muscular arteries because they have more smooth muscle and less elastic tissue in their wall than large arteries. Contraction of the smooth muscle helps move the blood through these arteries. Ex. Femoral.

**Layers of arteries:**

1. **Tunica Interna:** Inner most layer, endothelium w/ basement membrane
2. **Internal elastic lamina:** between tunica interna and tunica media, elastic tissue
3. **Tunica Media:** Middle layer of vessel, smooth muscle.
4. **External elastic lamina:** between tunica media and tunica externa, elastic tissue
5. **Tunica Externa:** Outer layer, elastic fibers and collagen.

Veins have the three tunica layers, but not the elastic lamina layers (Tunica interna, Tunica media, Tunica externa).

Arteries contract more than veins because they have a smaller lumen and more smooth muscle (thicker tunica media).

Veins have one way valves.

Arteries are more elastic because the tunica externa is thicker, and they have the internal elastic lamina and external elastic lamina layers.

Capillaries lack the tunica externa and tunica media (only have tunica interna) this allows their walls to be permeable and thus the plasma.

Large arteries are more elastic where medium arteries are more muscle.

15B. Explain the order that blood travels through vessels in the body (i.e., arteries, arterioles, capillaries, venules, and veins). How are capillaries different from other vessels? How are veins different from other vessels?

Arteries → Arterioles → Capillaries → Venules → Veins.

**Veins** - Different in that they have valves to keep the blood from moving backwards. The larger lumen in veins provides for a large storage area for blood (60%).

15C. Explain how blood vessels, skeletal muscle, and movements of the diaphragm help move blood through the vessels.

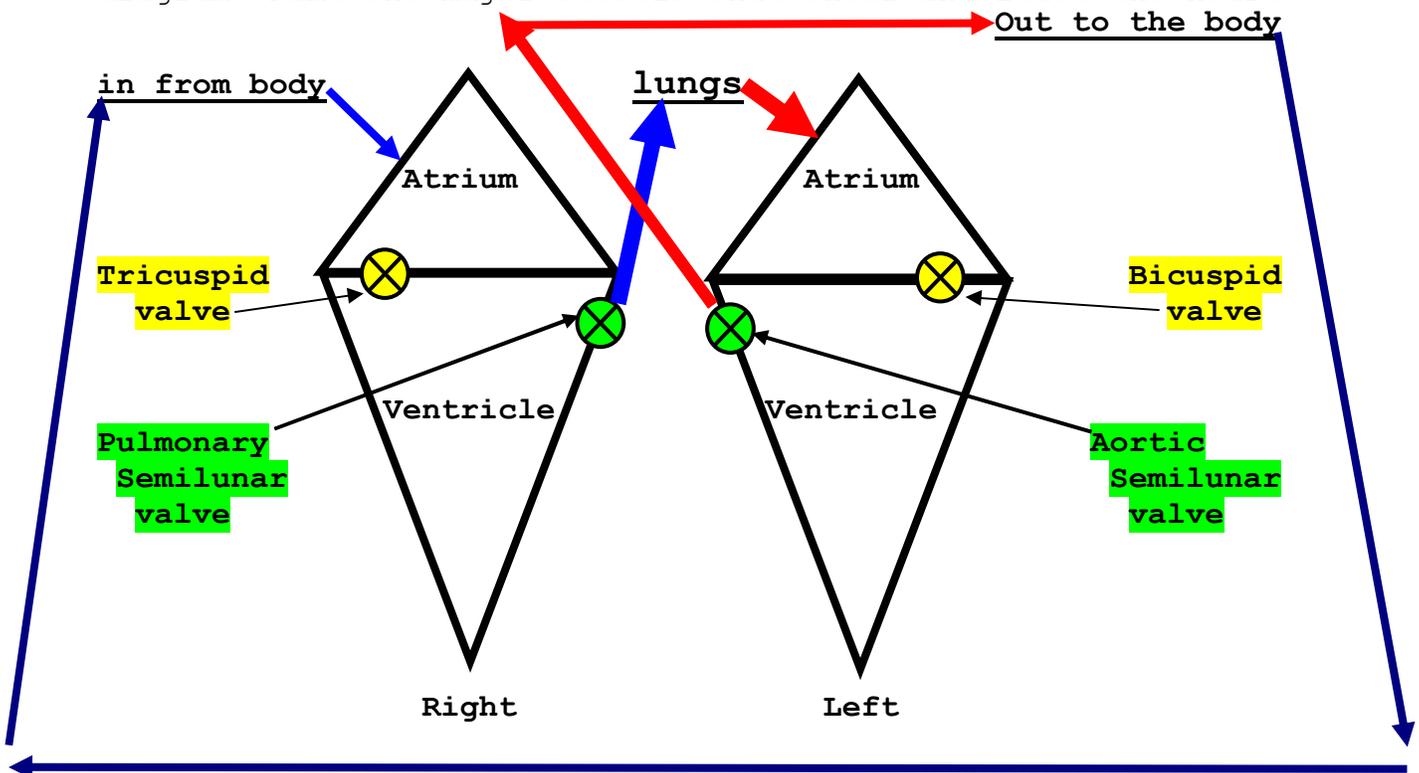
**Arteries** - Elastic fibers in the walls of larger arteries recoil after they are stretched helping to propel the blood.  
Smooth muscle in the walls contracts when stretched also helping to propel the blood.

**Skeletal muscle** - As skeletal muscle contracts it tightens around the veins increasing venous blood pressure and movement of the blood through the veins.

**Respiratory pump** - When the diaphragm moves downward, it decreases the pressure in the thoracic cavity and increases pressure in the abdominal cavity, moving blood from the high pressure zone to the low pressure zone.

15D. How do sympathetic nerves affect vasoconstriction?  
The sympathetic nervous system causes smooth muscle in the veins to contract, which increases the blood pressure and helps the blood move.

16. Some part of this question is guaranteed. You will probably have to draw this diagram and label the parts including the vessels. Diagram how blood moves through the heart to the lungs and the body. Name and show the location of heart valves on your diagram. Name the major vessels that enter and leave the heart.



17. Some part of this question is guaranteed. Explain the order in which the chambers in the heart contract.

Both atria contract and then both ventricles contract

18. Explain how and why heart valves close. What do the papillary muscles do? Why aren't there any heart valves where the blood enters the atria?

The valves are like parachutes and close when blood flows backwards through them.

**Papillary muscles** Pull on the chordae tendinae keeping the valves from everting.

The one way valves in the veins prevent the blood from flowing backwards, when the atria contract

19. Explain the difference between systolic blood pressure and diastolic blood pressure. What cause the heart sounds and what causes a heart murmur.

**Systolic pressure** - The maximum blood pressure that occurs when the ventricles contract

**Diastole** - The lowest blood pressure that occurs between contractions of the ventricles.

**Heart sounds** - (lub - dub)

**Lub** - sound occurs when the tricuspid and bicuspid valves close as the ventricles contract

**Dub** - sound occurs when the pulmonary and aortic semilunar valves close as some blood flows backwards in the arteries

**Heart murmurs** - swishing sounds that are heard between the lub and the dub. These sounds indicate that some blood is leaking through the heart valves.

20A. Some part of this question is guaranteed. How is the heart rate regulated? How is the signal carried through the heart from the S-A node?

1. The SA node sends a signal to the atria and the AV node via the junctional fibers.
2. This causes the atria to contract, the AV node pauses with the signal for the completion of the atrial contraction.
3. The AV node sends the signal on via the bundles of his which passes this signal on to the purkinje fibers.
4. The purkinje fibers distribute the signal to all of the muscle fibers in the ventricles at approximately the same time causing them to both contract.

20B. How do sympathetic and parasympathetic nerves affect the heart rate? What do Beta-blockers do?

A. The basic signal for the heart to contract comes from the sinoatrial node, but the signal can be modified by nerves or

hormones

- B. Sympathetic nerves run to the sinoatrial node and the atrioventricular node and release norepinephrine which bonds to Beta-1 receptors speeding the heart rate up. It also enhances the movement of  $Ca^{+2}$  into the muscle cells of the heart
- C. Parasympathetic nerves run to the heart via the vegas nerve and connect to the sinoatrial node, the atrioventricular node and the pericardium of the atria. They release acetylcholine which slows the heart rate down by moving  $K^+$  out of cells.

Note, the heart rate would be 90-100 beats per minute, but the parasympathetic nerve fibers reduce it to 75 beats per minute.

21. How do extracellular concentrations of  $K^+$  and  $Ca^{++}$  affect heart contractions?

**Excessive potassium ions ( $K^+$ )** in the blood plasma reduces the force of heart contractions, because they can reduce the membrane potential (charge over the membrane) at action potential, to the point that many of the calcium gates on the cell never open. (Reduces the heart rate)

**Excessive calcium ions ( $Ca^{++}$ )** in the blood plasma increases the force of heart contractions. Calcium moves into cardiac muscle from the plasma when the heart cells reach action potential, causing the muscle to contract. More calcium outside the cell increases the diffusion gradient, increasing the amount of calcium that moves into the cell and hence the force of contraction.

**22. Some part of this question is guaranteed. Probably have to draw a normal wave and identify a disorder.** Label an electrocardiogram and explain what is happening in the heart that causes different peaks on the electrocardiogram. Be able to explain how the following intervals are measured QRS, P-Q, S-T, Q-T and what it would indicate if these intervals increase or decrease. What does an enlarged p, R, or Q wave indicate? What does a flatter than normal T wave indicate?

**Disorders:**

<u>Abnormal Image</u>	<u>Condition</u>
<u>Q wave abnormally deep</u>	<u>Recent heart attack</u>
<u>Q below baseline &amp; T wave low</u>	<u>Low <math>O_2</math></u>
<u>High T wave &amp; slow</u>	

<u>heart rate</u>	<u>High <math>K^+</math></u>
<u>Large P wave</u>	<u>Big Atrium</u>
<u>R wave abnormally large</u>	<u>Congestive Heart Failure</u>
<u>P-Q Segment long</u>	<u>Bundle block problem</u>
<u>QRS Spread out</u>	<u>Purkinje fibers problem</u>
<u>Q-T interval abnormally long</u>	<u>Ischemia, MI, or...</u>

## Electrocardiogram (ECG)

