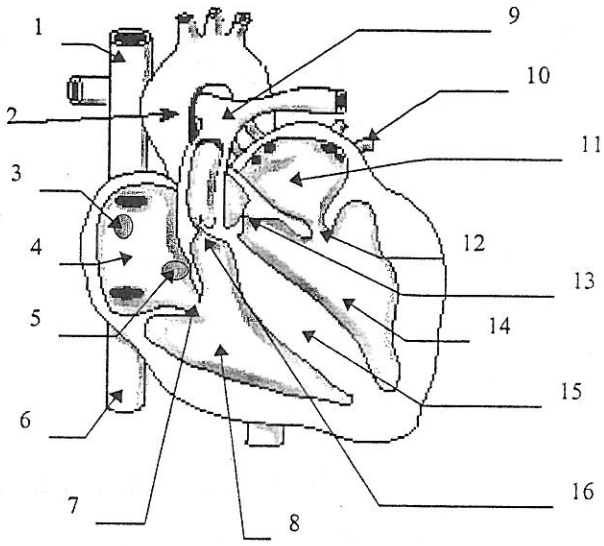
1. superior vena cava	2. aorta	3. SA node
4. right atrium	5. av node	6. inferior vena cava
7. tricuspic valve	8. right ventricle	9. pulmonary trunk/artery
10. left pulmonary vein	11. left atrium	12. bicuspid valve
13. aortic semilunar valve	14. left ventricle	15. septum
16. pulmonary semilunar valve		

13. Match the structures in the key to the statements below:

Key: **ARTERY** **VEIN** **CAPILLARY**

i. has the thickest walls: **ARTERY**
ii. has valves: **VEIN**
iii. has the greatest total cross-sectional area: **CAPILLARY**
iv. takes blood away from the heart: **ARTERY**
v. takes blood to the heart: **VEIN**
vi. exchanges carbon dioxide and oxygen with tissues: **CAPILLARY**

14. The path of blood through the heart. Starting with vena cava, list the structures in order through which blood flows. Use the parts in the column on the left.



Structures (Alphabetical listing)	Correct Order
1. aorta	1. **vena cava**
2. bicuspid valve	2. **right atrium**
3. left atrium	3. **tricuspid valve**
4. left ventricle	4. **right ventricle**
5. lungs	5. **pulmonary semilunar valve**
6. pulmonary artery	6. **pulmonary artery**
7. pulmonary semilunar valve	7. **lungs**
8. pulmonary veins	8. **pulmonary veins**
9. right atrium	9. **left atrium**
10. right ventricle	10. **bicuspid valve**
11. semilunar valve	11. **left ventricle**
12. tricuspid valve	12. **semilunar valve (aortic)**
13. vena cava	13. **aorta**

15. The heart beats about **70** times a minute. What actually happens is that the **SINOATRIAL** node initiates the contraction of the **ATRIA** (chambers). The nervous stimulus is picked up by the **ATRIOVENTRICULAR** node, and this initiates the contraction of the **VENTRICLES** (chambers). When the chambers are not actually contracting, they are relaxing. Contraction is termed systole, and resting is termed **DIASTOLE**.
16. When the atria contracts, this forces the blood through the **ATRIOVENTRICULAR** valves into the **VENTRICLES**. The closing of these valves is the lub sound. Next the ventricles contract and force the blood into the arteries. Now the **SEMILUNAR** valves close, and this is the DUPP sound. A heart murmur is caused by **LEAKY VALVES**.

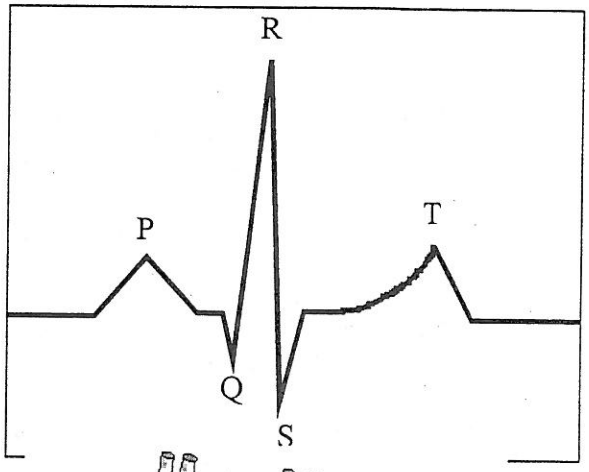
17. Of what significance is each of the following in an electrocardiogram?

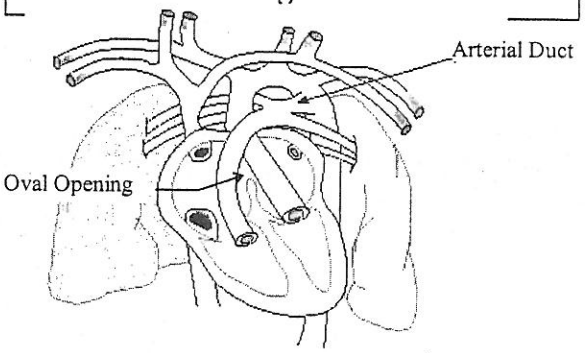
Name: _____ Block: _____ Date: _____

i. P wave: **ATRIA SYSTOLE**
ii. QRS wave: **VENTRICULAR SYSTOLE**
iii. T wave: **VENTRICULAR RECOVERY**

18. Using the diagram of the circulatory system in your text that shows the major blood vessels, trace the path of blood from:
i. the left ventricle to the legs: **LEFT VENTRICLE, AORTA, ILIAC ARTERIES, LEGS**
ii. the legs to the right atrium: **ILIAC VEINS, INFERIOR VENA CAVA, RIGHT ATRIUM**
iii. the aorta to the liver: **AORTA, MESENTERIC ARTERY, INTESTINE, HEPATIC PORTAL VEIN, LIVER**
iv. the liver to the vena cava: **LIVER, HEPATIC VEIN, INFERIOR VENA CAVA**

19. a) Label the indicated parts of the fetal heart at righ:
b. List the four structural differences between the fetal circulatory system and the adult, as well as the function of each difference.





Structure A	*Oval opening (foramen ovale)*
Function	*Allows blood to pass from right atrium to left atrium*
Structure B	*Arterial duct (ductus arteriosus)*
Function	*Connects blood flow from pulmonary trunk to aorta*
Structure C	*Umbilical ateries and veins*
Function	*Bring fetus' blood to and from placenta for exchange of gases, nutrients, and wastes.*
Structure D	*Venous duct (ductus venosus)*
Function	*Connects umbilical vein to vena cava bypassing fetus' liver*

20. There are only two types of lymph vessels, the lymph **CAPILLARIES** and the lymph **VEINS**.
21. Mix and match the correct term for each description on the left.

O	___	1.	largest artery
F	___	2.	returns tissue fluid to the circulatory system
A	___	3.	prevent blood from flowing in the wrong direction
E	___	4.	vessel transporting blood through kidneys
G	___	5.	vessel transporting blood through legs
K	___	6.	localized swelling due to excess tissue fluid
M	___	7.	supply blood to the heart
C	___	8.	the highest arterial pressure
L	___	9.	the lowest arterial pressure
H	___	10.	condition of high blood pressure
N	___	11.	"hardening of the arteries"
B	___	12.	a stationary clot along an arterial wall
J	___	13.	a dislodged, moving thrombus
D	___	14.	when a portion of the brain dies due to a lack of oxygen
P	___	15.	chest pain (including pain in the left arm)
I	___	16.	occurs when circulation to part of the heart is blocked

A	valves
B	thrombus
C	systolic blood pressure
D	stroke
E	renal
F	lymphatic system
G	iliac
H	hypertension
I	heart attack
J	embolism
K	edema
L	diastolic blood pressure
M	coronary arteries
N	atherosclerosis
O	aorta
P	angina pectoris

22. How is a lymph capillary like a blood capillary? a) they both contain blood b) they both contain valves c) they both have thin walls d) they are both connected to the vena cava **C**
23. If you press a finger down on a prominent vein, say, on the back of your hand and then slide the finger distally to a new pressure point closer to the fingers, would you expect the section of vein you just moved along to refill with blood? Suppose you had moved the finger proximally toward the upper arm?
In the first case, blood would have to flow backward in the vein to refill the section you emptied; however, the valves in the vein prevent backflow, and the vein should remain empty or refill only slowly. In the second case, the emptied section of vein would be quickly refilled by blood traveling toward the heart.
24. Explain how the blood that right now is arriving at your fingertips will get back to your heart. What will drive its movement? *It will move from capillary beds to small venules, then to larger venules and then through radial veins, brachial vein, subclavian vein, superior venae cavae, and finally back to your right atrium. Skeletal muscle contactions alongside of veins power the movement of blood back to the heart.*

Biology 12 - Circulation Study Guide

1. What are the **three types of blood vessels** in the circulatory system? What are the functions of each?
   -arteries: carry blood away from the heart.
   -veins: carry blood from capillaries back to the heart
   -capillaries: microscopic tubes that allow for exchange of nutrients, wastes, and gases between the blood and tissues.
2. How are veins **similar** to arteries? How are they **different**?

Similarities	**Differences**
-both carry blood	-veins take blood to heart and arteries take blood away
-both have similar layered construction consisting of:	-walls of veins are thinner and less muscular
-outer layer of fibrous connective tissue	-veins have valves to prevent blood from flowing away
-middle layer of smooth muscle and elastic tissue	-veins hold a greater volume of blood (approximately 75%) compared to arteries (approximately 20%).
-inner layer of endothelium	

-3 layers

3. How are **arterioles** related to **blood pressure**?
   -Arteroiles are able to constrict or dilate. The greater the number of arterioles that are dilated, the lower the blood pressure. The greater the number of arteroiles that are constructed, the higher the blood pressure.
4. Make a sketch of a capillary bed that shows arteries, arterioles, veins, venules, and capillaries.
   - see drawing in textbook (what about arteriole sphincter?)
5. **Give the <u>function</u>** for each of the following **blood vessels**. Use the diagram in your text on p. 235 and find each of these blood vessels on the picture.

   a. subclavian arteries and veins
      -deliver blood to and from arms/upper body
   b. jugular veins2
      -return blood from head to superior vena cava
   c. carotid arteries
      -deliver blood from aorta to head
   d. mesenteric arteries
      -deliver blood to the digestive tract
   e. anterior and posterior vena cava
      -return deoxygenated blood to the right atrium
   f. pulmonary veins and arteries
      -pulmonary veins: return oxygenated blood from the lungs to the left atrium
      -pulmonary arteries: bring deoxygenated blood from the right ventricle to the lungs
   g. hepatic vein
      -carry blood from liver to inferior vena cava
   h. hepatic portal vein
      -carry nutrient rich blood from the digestive tract to the liver for processing
   i. renal arteries and veins
      -carry blood to and away from the kidneys for filtering.
   j. iliac arteries and veins
      -carry blood to and away from legs and lower body
   k. coronary arteries and veins
      -carry nutrient/O_2 rich blood from the aorta to the heart muscle itself and then from there carry waste/CO_2 rich blood to the right atrium
   l. aorta
      -carry oxygenated blood away from left ventricle of heart

6. Draw a **labelled sketch** of the heart that shows the following:
   a. left and right atria
   b. left and right ventricles
   c. septum
   d. aortic and pulmonary semilunar valves
   e. tricuspid and bicuspid valves
   f. aorta
   g. inferior & superior vena cava
   h. chordae tendinae
   i. pulmonary artery
   j. pulmonary arteries and veins
   k. SA Node
   l. AV Node
   m. Purkinje fibres

-see drawing in textbook

7. The heart is described often as a **"double pump."** Explain **why** this is so and where these two pumps pump to
-The right side of the heart pumps blood through a different 'circuit' of blood vessels than the left. The right ventricle pumps deoxygenated blood to the lungs and the left ventricle pumps oxygenated blood to the rest of the body. These are the pulmonary and systemic circuits respectively. The 2 ventricles pump blood by simultaneous contractions but through separate circuits.

8. What is the difference in structure and function between the **atrioventicular** valves and the **semilunar** valves. **Relate** the **structure** of the **mitral valve** to its **function**.
-The 2 atrioventricular valves are made of flaps or "cusps" of tissue (3 cusps for the right atrioventricular valve and 2 cusps for the left atrioventricular valve). Atrioventricular valves prevent backward flow of blood from the ventricle to the atrium during ventricular systole (contraction). The 2 semilunar valves are valves in the shape of half moons. Semilunar valves prevent backward flow of blood from the pulmonary trunk or aorta into the ventricles during ventricular diastole (relaxation).
The left atrioventricular valve is bicuspid and is often called the mitral valve because it looks like a Bishop's (Mitei's) Hat. It is 2 flaps of tissue (cusps) that have fibrous strings called chordae tendinae anchoring them to wall of ventricles. When the left atrium contracts blood is forced through the Mitral valve into the left ventricle. When the left ventricle contracts, the Mitral valve closes to prevent backward flow of blood into the left atrium. The Mitral valve doesn't flip inside-out back up into the left atrium because the chordae tendineae are anchoring it.

9. **Trace the path of a blood cell** from the **aorta** through the body and back to the **left ventricle**. List all the circulatory structures, in the correct order that the blood cell would pass through.
-RBC pathway:
-Aorta → artery (i.e. iliac artery) → arteriole (i.e. iliac arteriole) → capillaries (i.e. capillaries in leg muscle) → venule (i.e. iliac venule) → vein (i.e. iliac vein) → vena cava (inferior in this e.g.) → right atrium → thru the right atrioventricular (tricuspid) valve → right ventricle → thru pulmonary semilunar valve → pulmonary trunk → either the right or left pulmonary artery → pulmonary arterioles → lung capillaries → pulmonary venule → either the right or left pulmonary vein → left atrium → thru left atrioventricular (bicuspid or mitral) valve → left ventricle → aortie semilunar valve → return to Aorta

10. Describe **functions** of the **SA node**, **AV node**, and **Purkinje fibres**. Why is the heartbeat described as being **"intrinsic"**? Why is the SA node called the **"pacemaker"** node?
SA node (sinoatrial node): -initiates the heartbeat by sending out an excitation impulse every .85 seconds
-causes artria to contract
AV node (atrioventricular node): -receives the signal from the SA node and then sends its own impulse signal along conducting fibres called Purkinje Fibers which cause the ventricles to contract.
-heartbeat is called intrinsic because it occurs without signals from the brain
-SA node is the "pacemaker" node because its responsible for maintaining the regular, rhythmic beating of the whole heart

11. Using such words as **systole** and **diastole**, describe the events that happen in the cardiac cycle for a person whose heart is beating at 70 beats per minute.
Cardiac Cycle: ="heartbeat"
-occurs ~ 70 times/ min.
Each heartbeat takes 0.85 sec. And can be divided into the following:
-0.15 sec atria are in systale (contracting) and ventricles are in dicestole (relaxing)
-0.30 sec atria are in dicestole (relaxing) and

ventricles are in systole (contracting)

-0.40 sec atria and ventricles are both in dicestole

12. What is an **ECG** and what is it used for? Make a **labelled sketch** of a normal ECG.

ECG: -used to access if heart is functioning properly by measuring ionic changes occurring during the contractions and relaxations of the atria and ventricles

SEE DRAWING IN TEXT

13. Explain how the **brain** controls the **rate** of the heartbeat. Be sure to specifically mention the exact part of the brain is involved. What **factors** determine whether the systematic or parasympathetic system is activated?

Heart rate is under nervous control. There is a heart-rate centre in the Medulla Oblongata (evolutionary ancient) part of brain which can speed up or slow down heart rate according to stimuli such as stress, O_2 levels, and blood pressure, that are detected by the autonomic Nervous System. The autonomic nervous system controls internal organs automatically and can be divided into sympathetic and parasympathetic divisions. The Sympathetic system is responsible for "fight or flight" responses like accelerating heart rate. The Parasympathetic Nervous system promotes responses associated with a relaxed state such as slowing the heartbeat.

14. Look very carefully at the graph on p. 233. **Compare and contrast blood pressure, blood velocity**, and **total cross-sectional area** for arteries, capillaries, and veins.

In the:	Arteries	Capillaries	Veins
B.P.	highest	low	v. low
Blood Velocity	highest	low	v. low
Total X-section	lowest	v.high	low

15. What **causes** blood to flow in **arteries**? What causes blood to flow in **veins**?

Blood Pressure, which is created by the pumping of the heart, is what causes blood to flow in the arteries. As blood flows into arterioles and then capillaries, BP and blood velocity decreases due to increasing cross-sectional area. Slow moving blood in the capillaries allows adequate time to exchange of nutrients, wastes, and gases to occur between the blood and cells.

Blood Pressure is not great enough on the venule side of the capillary bed to move blood adequately through veins. Movement of blood in veins is achieved by:

1.) Skeletal muscles contracting and squeezing blood in veins back towards heart. Blood can only flow back to the heart in veins due to the many one way valves they Contain.
2.) When the chest cavity expands during inhalation, BP lowers, drawing blood up to The heart (blood flows to area of reduced pressure-like in a vacuum)

16. What is the **pulmonary circuit**? List the structures through which blood flows in the pulmonary circuit.

Pulmonary Circuit: part of blood from the heart through the lungs

Pathway:

Right atrium → right ventricle → pulmonary trunk → pulmonary arteries (left and right) → pulmonary arterioles → pulmonary capillaries where O_2 and CO_2 are exchanged → pulmonary venules (now with oxygenated blood) → pulmonary veins → left atrium.

17. What is the **systemic circuit**? List the structures through which blood flows in the systemic circuit.

Systemic Circuit: path of blood through all other blood vessels besides those in Pulmonary Circuit.

Pathway:

Left ventricle → aorta → arteries, arterioles, capillaries, venules, and veins of all tissues and Organs of the body (i.e. coronary/cardiac, sunclavian, carotid/jugular, mesenteric, hepatic Portal/hepatic, renal, iliac) → vena cava → right atrium

18. **Normal blood pressure** is **120/80**. Explain in **detail** what these two numbers mean. What is the name of the **instrument** that measures blood pressure? Would it be possible to have a blood pressure of 80/120? Why or why not?

120/80:

120 is systolic pressure: which is highest brachial artery pressure (measured in mm of Hg) for a person at rest, and occurs when the heart is ejecting blood from the left ventricle.

80 is diastolic pressure: which is lowest brachial artery pressure for a person at rest, and occurs when the heart ventricles are relaxing.

-a Sphygmomanometer is instrument used to measure B.P.

-not possible to have B.P. of 30/120 because pressure is always greater in the arteries after the ventricles contract (systolic) than when the ventricles are relaxed and filling with blood (diostolic)

19. What are **hypertension** and **hypotension**? List at least 3 factors or lifestyle habits that are thought to be associated with hypertension. Why is hypertension called the **"silent killer"**?

Hypertension: higher blood pressure than normal.

i.e. –160/95 or above for female
-above 130/90 for male under 45 years old
-above 140/95 for male over 45 years old

Hypotension: lower blood pressure than usual.

Hypertension associated with these factors:

-diet high in salt causes H_2O to be retained
-stress causes blood vessels to constrict
-diet high in Saturated fat and cholesterol causes plaque build up and blocking of arteries
-smoking
-obesity (30% or more overweight)
-lack of regular exercise

Hypertension is called the "Silent Killer" because it may not be detected until a stroke or heart attack occurs. Therefore get regular B.P. checks and adopt healthy lifestyle.

20. Describe the characteristics and causes of **atherosclerosis**.

Atherosclerosis:

Characteristics:

-accumulation of deposits of fatty materials, like cholesterol, called plaque
-plaque protrudes into blood vessel interfering with blood flow
-"hardening of arteries"
-increase risk of heart attack, stroke, and serious arterial disease
-begins in early adulthood and progresses through middle age

Causes:

-diet high in saturated fat and cholesterol leads to high levels of low-density lipoproteins (LDL). This is "bad" lipoprotein because it takes cholesterol from the liver to the tissue causing levels of cholesterol to build up in cells lining arteries → plaque → cardiovascular disease HDL (high-density lipoprotein) is considered "good" lipoprotein because it carries cholesterol out of tissues to the liver

21. Differentiate between a **heart attack** and a **stroke**. How is diet related to these killers?

Heart Attack - when a portion of the heart dies due to a lack of oxygen. Blockage of coronary arteries leads to heart attacks
- Angina pectoris may precede heart attack

Stroke: when a portion of the brain dies due to a lack of oxygen. Usually caused by an arteriole being blocked by an embolism or it bursting. Paralysis or death usually results

Diet high in saturated fats and cholesterol leads to cholesterol plaque deposits resulting in heart attacks, strokes, etc.

22. Describe in detail the 4 structural differences between the **fetal circulatory system** and the **adult circulatory system**. Make a sketch of these 4 structures in the fetal circulatory system.

1. Oval Opening (foramen ovale) is an opening between the two atria that allows some blood to pass from right atrium to left atrium; by passing the pulmonary circuit. Fetus can't breath in the womb, so sending blood to the fetus' lungs for gas exchange is useless
2. Arterial Duct (ductus arteriosus): is a duct connecting the pulmonary artery to the aorta, to once again bypass pulmonary circuit.

3. Umbilical Arteries and Veins: from the iliac arteries umbilical arteries lead to the placenta where CO_2 exchanged for O_2 and wastes for nutrients. Umbilical veins return oxygenated blood back to the fetus.
4. Venous Duct (ductus venosus): connects the umbilical vein to the verrae cava to bring blood back to baby's heart. Bypasses baby's liver therefore important mom doesn't ingest harmful chemicals (i.e. alcohol) because they won't be detoxified by baby's liver.

Name: _____ Block: _____ Date: _____

Biology 12 - Blood!

⇒ Part A: Definitions: Define the following terms, **IN YOUR OWN WORDS, IN AS FEW WORDS AS CLARITY ALLOWS**.

1. formed elements	solid part of blood consisting of eurythrocytes, thrombocytes, leukocytes
2. oxyhemoglobin	HbO_2: hemoglobin that has formed a loose association with oxygen
3. reduced hemoglobin	HHb: hemoglobin that has given up its oxygen and picked up a H^+
4. heme	the non-protein, iron-containing pigment in Hb that binds O_2
5. clotting	the process of sealing up injuries to CV system, requires plasma proteins and platelets
6. platelets	thrombocytes, formed elements that function in blood clotting
7. fibrinogen	inactive form of fibrin, a plasma protein needed for clotting
8. thrombin	enzyme that activates fibrinogen to fibrin in blood clotting
9. fibrin	protein fragments that join end to end to form framework of blood clots
10. serum	plasma that has had its fibrinogen removed
11. granulocytes	leukocytes with specks (lysosomes) in cytoplasm, includes neutrophils
12. agranulocytes	leukocytes without specks (lysosomes) in cytoplasm, includes lymphocytes
13. antigens	anything (esp. proteins) that can be recognized by antibodies
14. antibodies	immunoglobulins derived from lymphocytes that specifically bind to invading pathogens
15. inflammatory reaction	body response to injury, marshalls white blood cells to injured areas
16. mononucleosis	condition caused by infection by Epstein-Barr virus, causes excessive # of B-lymphocytes
17. phagocytosis	cell eating: endocytosis of large particles. Many leukocytes (e.g. neutrophils, monocytes) are phagocytes
18. macrophages	leukocytes formed from monocytes that act as scavangers for bacteria and debris
19. bradykinin	chemical released from injured cells that initiates release of histamine, sensation of pain
20. histamine	chemical released from mast cells that causes inflammation, enlargement of capillaries
21. pus	"battleground remants" of inflammatory response, made of dead bacteria, debris, leukocytes
22. agglutination	clumping of red blood cells due to antibodies binding antigens on the red blood cells
23. Rh factor	red blood cell antigen responsible for fetal erythroblastosis
24. fetal erythroblastosis	condition in which antibodies from a Rh- mother attack the RBC of a Rh+ fetus
25. blood	liquid connective tissue consisting of plasma and formed elements that transports wastes, nutrients, gases

Part B - Short Answers

1. The smallest of the white cells is the **LYMPHOCYTE**, which has a **MONO**nucleus and makes **ANTIBODIES**.
2. Oxygen is transported about the body in combination with **HEMOGLOBIN**.
3. At the arterial side of a capillary, **BLOOD PRESSURE** aids the passage of water out of the blood. At the venous side, **OSMOTIC PRESSURE** brings about the passage of water into the blood.
4. Small organic molecules such as glucose are transported in the **PLASMA** portion of blood.
5. Blood clotting is dependent on both a formed element, **PLATELETS**, and two proteins in the blood, **FIBRINOGEN** and **PROTHROMBIN**.

6. White cells are divided into the **AGRANULOCYTES** and the **GRANULOCYTES**; the latter have **GRANULES** in the cytoplasm.
7. Antibodies are protein molecules, which combine with **ANTIGENS**.
8. Neutrophils function by **PHAGOCYTIZING** bacteria.
9. Blood type AB has **A** and **B** antigens on the red cells and **NO** antibodies in the plasma.
10. An Rh-negative woman may form **Anti Rh ANTIBODIES** that destroy her Rh-**POSITIVE** baby's **RED CELLS**.
11. Fill in the following table:

PlasmaConstituent	Function	Source
Water	Maintains blood **VOLUME** and **TRANSPORTS** molecules	Absorbed from **LARGE INTESTINE**
Plasma Proteins a. Albumin b. Fibrinogen c. Globulins	All maintain blood **OSMOTIC PRESSURE** & **PH** **TRANSPORT** **CLOTTING** Fight **INFECTION**	 **LIVER** **LIVER** **LYMPHOCYTES**
Gases a. Oxygen b. CO_2	 **CELLULAR RESPIRATION** End product of **METABOLISM**	 **LUNGS** **TISSUES**
Nutrients: Fats, glucose, amino acids, etc.	**FOOD** for cells	Absorbed from **INTESTINAL VILLI**
Salts	Maintain blood **OSMOTIC PRESSURE/PH**, aid **METABOLISM**	Absorbed from **INTESTINAL VILLI**
Wastes	**END PRODUCTS OF METABOLISM**	**TISSUES**
Hormones, vitamins etc.	**AID METABOLISM**	**VARIED**

12. Life cycle of red blood cells: The red cells, scientifically called **ERYTHROCYTES**, are made in the **RED BONE MARROW**. Upon maturation, they are small, biconcave disks that lack a **NUCLEUS**, but they are filled with the complex protein called **HEMOGLOBIN**, which transports oxygen about the body. After about 120 days, the red cells are destroyed in **LIVER** or **SPLEEN**.
13. Life cycle of white cells: Most white cells, scientifically called **LEUKOCYTES**, are made in the **BONE MARROW**, but lymphocytes are also made in the **LYMPH NODES**. White cells are divided into two types, the **AGRANULOCYTES** and the **GRANULOCYTES**. Leukocytes with many-lobed nuclei are called **POLYMORPHONUCLEAR**.
14. Fill in the following table with the contrasting word or phrase:

Neutrophil	Lymphocyte
polymorphonuclear	**MONONUCLEAR**
GRANULAR	agranular
phagocytic	**MAKES ANTIBODIES**
MADE IN RED BONE MARROW	made in lymphoid tissue

15. The two ways that white cells fight infection are:

PHAGOCYTIZING INVADERS
MAKING ANTIBODIES AGAINST FOREIGN ANTIGENS

16. Blood clotting: These are the reactions that occur when blood clots. Put a check ✓beside those substances that are always present in the blood. Put an X beside those substances that arise after blood begins the process of clotting. Put a star beside those substances that act as enzymes. Underline the words that indicate the actual clot.

✓	platelets	X, ★	Prothrombin activator (Thromboplastin) aka
✓	prothrombin	X, ★	thrombin
✓	fibrinogen	X,	fibrin threads

17. The capillaries are the most important part of the circulatory system because **EXCHANGE OCCURS AT CAPILLARIES**.

18. Blood typing is based on antigen-antibody reaction, which takes place when an antigen is brought into contact with an antibody of the same type letter. The antigen-antibody reaction causes clumping or agglutination of the red cells. In the plasma, the antibodies present will not be of the same type letter as the antigen. Why not? **BECAUSE AGGLUTINATION WOULD OCCUR**
19. Fill in the following table:
    *note: all antibodies are removed from donor's blood before transfusion to the recipient therefore only the donor's antigens need to be considered when determining matches.

Blood Type of Antigen	Antibody	Can Receive From	Can Donate To
A	b	A,O	A,AB
B	a	B,O	B,AB
AB	-	A,B,AB,O	AB
O	a,b	O	A,B,AB,O

20. Which combination can lead to fetal erythroblastosis? Rh **NEGATIVE** mother and Rh **POSITIVE** father.
21. Which of the following is NOT a blood protein? a) collagen b) prothrombin c) albumin d) fibrinogen e) globulin. **A**
22. Plasma is a) the same as tissue fluid b) the liquid remaining after blood clots c) the liquid part of blood d) all of these **C**
23. In which way is a neutrophil like a lymphocyte? a) they both produce antibodies b) they are both phagocytic c) they are both made in lymphoid tissue d) they both have a many-lobed nucleus e) they are both white cells f) all of these **E**
24. Water leaves capillaries at their arterial ends because a) osmotic pressure gradients are in opposite directions b) blood pressure is greater than the osmotic pressure c) a gradient is established for passive diffusion d) osmotic pressure is always greater than blood pressure e) b and d **B**
25. Water reenters capillaries at their venule ends because of a) active transport from interstitial fluid b) a protein concentration gradient c) increasing blood pressure d) increasing hemoglobin production **B**
26. An Rh-positive fetus being carried by an Rh-negative mother a) develops antibodies to the mother's blood b) develops antigens to the mother's blood c) may have its red cells attacked by antibodies made by the mother d) may have its red cells attacked by antigens made by the mother **C**
27. The agglutination of red blood cells occurs whenever a) appropriate antibodies bind with antigens on red cells b) a person receives a blood transfusion from someone with an incompatible blood type c) complementary antibodies combine d) blood cells are destroyed by leukocytes e) a and b **E**

Critical Thinking Questions

1. A person's arm was scraped. Within a few minutes, the region became inflamed. The area became reddish in colour (not due to bleeding), slightly swollen, and warm to the touch. Explain the physiological cause of each symptom.
   i) Reddish Colour: ***Broken blood vessel and tissue cells release bradykinin causing mast cells to release histamines. Bradykinin and histamines cause capillary to enlarge resulting in the reddening of skin.***
   ii) Swelling: ***Bradykinin and histamines also increase the permeability of the blood vessel allowing fluids and proteins to escape. This leads to swelling.***
   iii) Warmth: ***Increased blood flow brings warmer blood from the interior of the body to the site of injury which is typically near the relatively cooler surface of the body. Results in a feeling of warmth at injury site.***

2. A student is injured and loses 800 ml of blood. Explain how the following would respond to maintain blood pressure:
   i) Heart rate: ***increases to make up for the lowered blood pressure due to lost blood volume.***
   ii) Diameter of Arterioles: ***decreases in order to bring blood pressure back up.***
   iii) Capillary Beds: ***sphinctors close to capillary beds of peripheral structures (fingers, toes, etc.) inorder to keep high enough blood pressure in arteries to deliver blood to vital organs.***

3. Why would you expect edema when blood pressure rises but not when it decreases? ***As B.P. increases and the difference between it and osmotic pressure becomes larger, more fluids will leave blood and enter tissues at the arteriole end than will be recouped back into the blood at the venule end. Excess fluids in the tissues results in edema.***