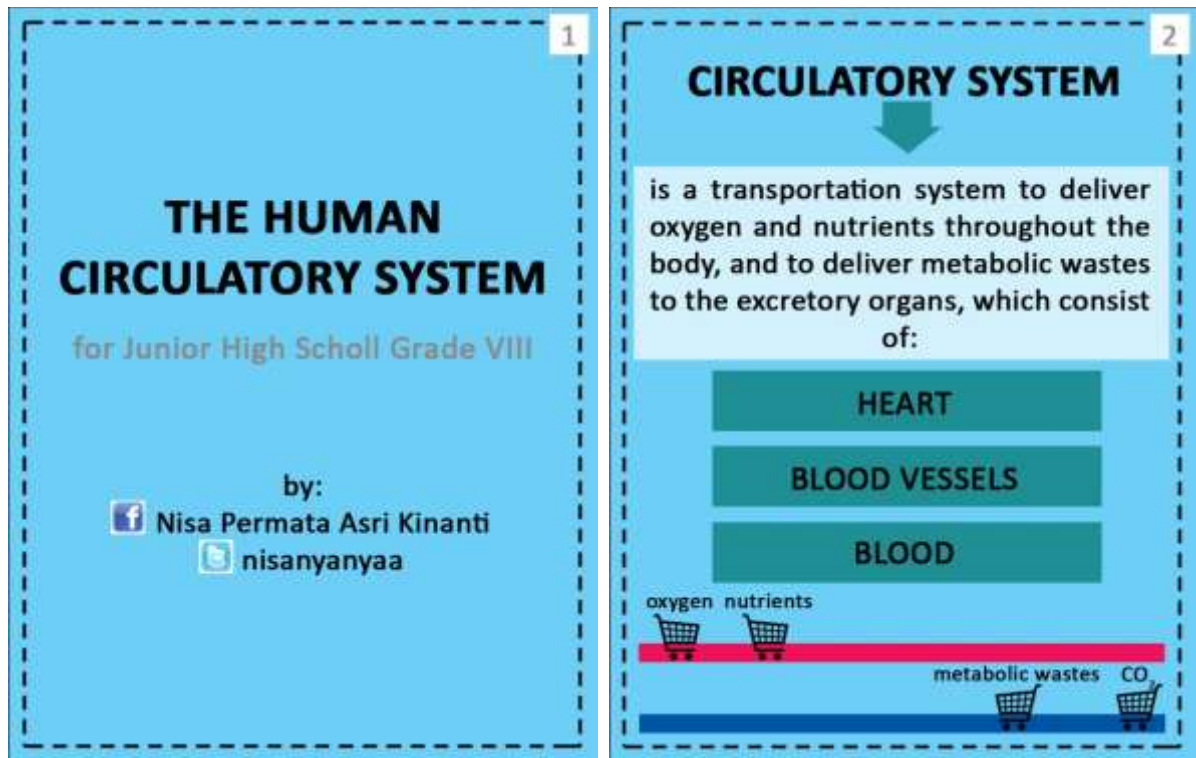



KARTU PEMBELAJARAN BERGAMBAR



3


HEART



Heart is located in the left inside of the chest cavity

The function of heart is to pump blood

Heart is also the center of circulatory system in the body because it carries the blood flow to all parts of the body

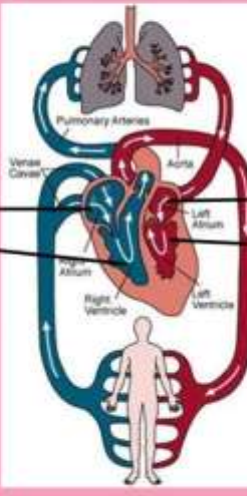


oxygen - nutrients

metabolic wastes CO

4

THE STRUCTURE OF HEART (THE FOUR CHAMBERS OF HEART)



right atrium
receives de-oxygenated blood from the body

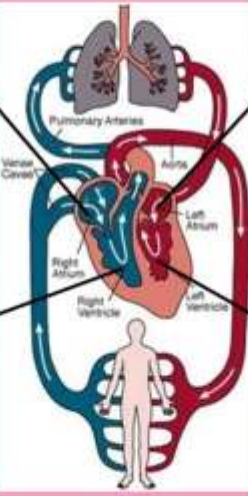
left atrium
receives oxygenated blood from the lungs

right ventricle
pumps blood through the pulmonary artery to the lungs

left ventricle
pumps blood through the main artery (aorta) to all tissues of body

5

THE STRUCTURE OF HEART (HEART CHAMBERS & OXYGEN LEVEL)



poor oxygen

rich oxygen

right atrium
because receives de-oxygenated blood from all tissues of body

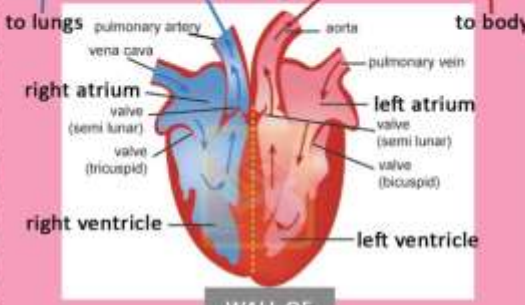
left atrium
because receives oxygenated blood from lungs

right ventricle
because receives de-oxygenated blood from right atrium

left ventricle
because receives oxygenated blood from left atrium

6

THE STRUCTURE OF THE HEART (WALL OF HEART CHAMBERS)



to lungs pulmonary artery vena cava right atrium valve (semi lunar) valve (tricuspid) right ventricle

to body aorta pulmonary vein left atrium valve (semi lunar) valve (bicuspid) left ventricle

WALL OF

right atrium THIN, because it only pump blood to the right ventricle	left atrium THIN, because it only pump blood to the left ventricle
right ventricle THICK, because it has to pump blood through pulmonary artery to the lungs	left ventricle THICKEST, because it has to pump blood through the artery to all tissues of body

7

THE STRUCTURE OF THE HEART (THE HEART'S VALVES)

A	BICUSPID VALVE: two flaps that prevent blood from flowing back from the ventricle to atrium during contraction
B	TRICUSPID VALVE: three flaps that prevent blood from flowing back from the ventricle to atrium during contraction
C	SEMILUNAR VALVE: valve that prevent blood from flowing back into the ventricle when pressure falls during relaxation

8

HEART WORK

FIRST STEP	FIRST STEP the atriums expand, blood enters the atriums
SECOND STEP	SECOND STEP the atriums contract, blood from atriums enters the ventricles
THIRD STEP	THIRD STEP the ventricles contract, blood comes out from the ventricle to arteries

9

HEARTBEAT

a heartbeat occurs if the heart muscle contracts.

Each person has a different heartbeat, it depends on: **AGE, WEIGHT, GENDER, HEALTH, and ACTIVITIES.**

QUIZ 1

Count your heartbeat when you're sitting and when you're standing within 1 minute. You can count it by feel it in artery near the skin surface, such as on the wrist or neck. Send your answer to nisanyanyaa@gmail.com, with subject: **QUIZ 1**, your name, your class. The first one who answer it will get a prize, good luck :)

10

BLOOD PRESSURE


Blood pressure is indicator to measure heart strength in pumping bloods. The blood pressure of a normal adult is 120/80. 120 indicates the blood pressure when the ventricles are contracting, which is called **SYSTOLE**. While the 80 indicates the blood pressure when the ventricles are relaxing, which is called **DIASTOLE**.

QUIZ 2 11

T	R	I	C	U	S	P	I	D	P	R	A	S
P	I	T	C	H	O	E	A	R	S	A	T	
A	R	M	H	E	A	R	T	B	E	A	T	I
R	I	M	A	N	D	E	R	S	S	O	R	C
T	E	A	M	I	N	D	S	E	S	T	I	I
E	V	A	B	E	A	R	D	R	U	M	U	R
R	E	N	E	N	D	R	B	O	R	E	M	C
Y	N	O	R	A	V	A	L	V	E	N	T	U
A	T	R	A	C	T	I	O	N	A	I	L	L
B	R	I	N	G	S	O	O	N	I	T	E	A
B	I	C	U	S	P	I	D	R	E	A	M	T
A	C	R	O	S	O	X	Y	G	E	N	T	O
H	L	I	C	O	N	T	R	A	C	T	I	R
H	E	A	R	T	O	N	B	E	D	T	O	Y
M	A	S	Y	S	T	O	L	E	N	K	A	T

Find at least 10 words that related to circulatory system. Send your answer to nisanyanyaa@gmail.com with subject: QUIZ 2, your name, your class. The first one who answer it correctly will get a prize, good luck :)

BLOOD VESSEL 12



is a part of circulatory system that transport blood

In circulatory system, there are three types of blood vessels:

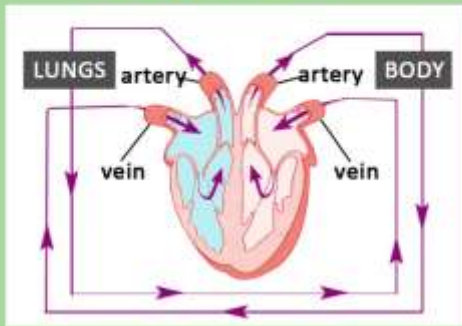
ARTERY

VEIN

CAPILLARY

ARTERY

13



arteries are vessels that carry blood
AWAY from heart

they are hidden inside body

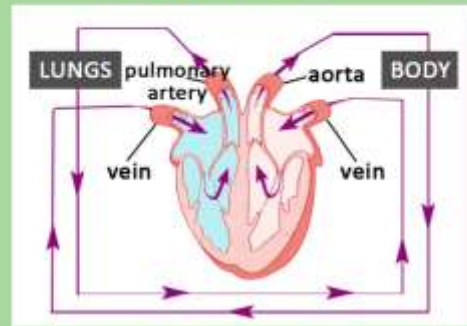
the walls of arteries are thick, strong,
and elastic

the pulse can be felt

arteries have only one valve near the
heart (semilunar valve)

ARTERY

14



AORTA (MAIN ARTERY): starts in left
ventricle of heart, it carries oxygenated
(oxygen-rich) blood throughout the
body

PULMONARY ARTERY: starts in the right
ventricle of the heart. It carries deoxy-
genated blood (oxygen-poor) blood to
the lungs.

VEIN

veins are vessels that carry blood INTO heart

they are located near the skin surface

the walls of veins are thin and not elastic

the pulse can not be felt

veins have valves along their length (to keep blood flowing in one direction)

VEIN

VENA CAVA (MAIN VEIN): carries deoxygenated blood from all parts of body to right atrium of heart

PULMONARY VEIN: carries oxygenated blood from lungs to left atrium of the heart

THE DIFFERENCES BETWEEN ARTERIES AND VEINS

No.	Characteristics	Arteries	Veins
1.	Flowing direction	Away from heart	Toward heart
2.	Wall	Thick & elastic	Thin & not elastic
3.	Pulse	Can be felt	Cannot be felt
4.	Location	Far from skin surface	Near skin surface
5.	Valve	One, near the heart	Many, along the vessels
6.	Pressure	High	Low

CAPILLARY

SMALLEST VESSELS that connect smallest arteries and smallest veins

very delicate

have a very thin walls (consist of one cell layer)

the diameter is only as wide as one red blood cell

directly connected with the body cells

QUIZ 3 19

The crossword puzzle grid consists of 15 numbered starting points for clues:

- 1: Across, 10 letters
- 2: Across, 10 letters
- 3: Down, 10 letters
- 4: Down, 10 letters
- 5: Across, 10 letters
- 6: Down, 10 letters
- 7: Across, 10 letters
- 8: Across, 10 letters
- 9: Down, 10 letters
- 10: Across, 10 letters
- 11: Across, 10 letters
- 12: Down, 10 letters
- 13: Across, 10 letters
- 14: Across, 10 letters
- 15: Across, 10 letters

QUIZ 3 20

ACROSS:

- main vein
- we can feel the ... of arteries
- artery starts from ...
- oxygen-rich
- vessels that carry blood to the heart
- smallest vessel
- vessels that carry blood away from the heart
- system to transport oxygen, nutrients, and metabolism waste in the body

DOWN:

- main artery
- ... artery carries blood from right ventricle to the lungs
- organ to pump blood
- oxygen-poor
- pulmonary vein carry blood from ... to heart
- part of circulatory system to transport blood
- the walls of veins are thin and not ...

Send your answer to nisanyanyaa@gmail.com with subject: QUIZ 3, your name, your class. The first one who answer it correctly will get a prize, good luck :)

BLOOD 21

Human blood consist of blood plasma and blood cells. Take a look at the diagram below!

plasma (55%)
white blood cells & platelets (45%)
red blood cells (45%)

blood

blood plasma

blood cells

red blood cells

white blood cells

platelets

BLOOD PLASMA 22

Blood plasma is a clear yellowish fluid which consist of 90% water and dissolved substances

FUNCTIONS:

Carry dissolved nutrients to all parts of body, such as amino acids, glucose, fatty acids, and vitamins


Carry wastes of metabolic process from tissues or cells to excretion organs

nutrients

metabolic wastes

23

RED BLOOD CELL (ERYTHROCYTE)




SHAPE	FUNCTION
-have no nucleus -flat-round shape -biconcave	to carry oxygen

The red color of erythrocyte is caused by hemoglobin (Hb) which functions to bind oxygen

oxygen
+ hemoglobin

24


RED BLOOD CELL (ERYTHROCYTE)

PICTURE	
SHAPE	Flat, round shape, and biconcave
NUCLEUS	Have no nucleus
FUNCTION	Carry oxygen
AMOUNT/mm ³	± 5.000.000
FORMED IN	Red bone marrow
AGE	120 days

oxygen
+ hemoglobin


25


WHITE BLOOD CELL (LEUKOCYTE)

PICTURE	
SHAPE	Unstable shape
NUCLEUS	Have 1 nucleus or more (nuclei)
FUNCTION	Attack and destroy microbes
AMOUNT/mm ³	4.000-11.000
FORMED IN	Red marrow, spleen, and lymph glands

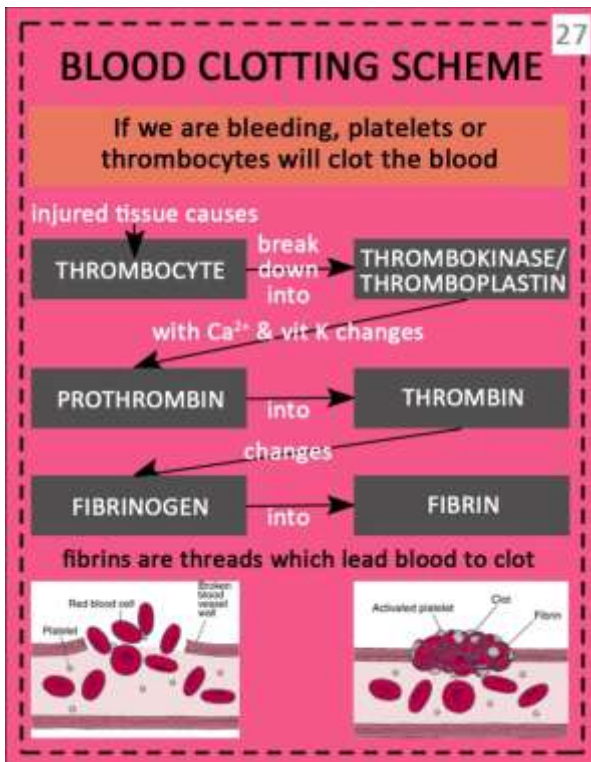
26

PLATELET (THROMBOCYTE)

PICTURE	
SHAPE	Irregular shape
NUCLEUS	Have no nucleus
FUNCTION	Clot the blood
AMOUNT/mm ³	150.000-400.000
FORMED IN	Bone marrow



- red blood cells
- white blood cells
- platelets
- blood plasma



28

QUIZ 4

Match the statements below with the answer in the next page!

1. Human blood consist of blood plasma and
2. Blood which consist of 90% water and dissolved substances is
3. Blood which functions to carry oxygen is
4. The shape of erythrocyte is
5. Substance in erythrocyte which functions to bind oxygen is
6. Red blood cell and platelet are formed in
7. Blood which functions to attack and destroy microbes is
8. Blood which functions to clot the blood is
9. Enzyme that leads prothrombin changes into thrombin is
10. Threads that create an intertwined web and form clots are

29

QUIZ 4

Match the words below with the statements in the page before!

- a. biconcave
- b. white blood cell
- c. hemoglobin
- d. blood plasma
- e. fibrin
- f. trombokininase
- g. platelet
- h. blood cells
- i. red bone marrow
- j. red blood cell

Send your answer to nisanyanyaa@gmail.com with subject: QUIZ 4, your name, your class. The first one who answer it correctly will get a prize, good luck :)

30

BLOOD TYPE

Karl Landsteiner classified blood into 4 types, that are: A, B, AB, and O (zero).

Blood are classified based on the presence of aglutinogen in red blood cell and aglutinin (anti aglutinogen) in blood plasma.

Blood Type/Group	Aglutinogen	Aglutinin/Anti Aglutinogen
A	A	β
B	B	α
AB	A and B	None
O	None	α and β

The presence of aglutinogen and aglutinin in blood

How to read: The person with blood type A has aglutinogen A and aglutinin β (anti B), and so on.

31 BLOOD TRANSFUSION


Blood transfusion is needed by a person who loses lot of blood, for example caused by an accident or surgery.

Person who donates his/her blood is called a **DONOR**

→

Person who receives blood is called a **RECIPIENT**

donates



Blood classification is very useful in transfusion. If the blood of donor is not compatible with recipient, the recipient will refuse the donor's blood. The rejection is indicated by blood coagulation.

32 BLOOD TRANSFUSION

Things that should be noticed in a blood transfusion are: "what aglutinin (antiaglutinogen) does recipient have?" and "what aglutinogen does donor have?" Pay attention to blood transfusion scheme in the table below!

Scheme of transfusion		Blood Group of Donor			
		A <small>Has Aglu A</small>	B <small>Has Aglu B</small>	AB <small>Has Aglu A & B</small>	O <small>Has no Aglu</small>
Blood Group of Recipient	A <small>Has anti B</small>	♥	X	X	♥
	B <small>Has anti A</small>	X	♥	X	♥
	AB <small>Has no anti</small>	♥	♥	♥	♥
	O <small>Has anti A & B</small>	X	X	X	♥

remark: ♥ = not coagulate
X = coagulate

Based on the table, blood group O can donate blood to all blood groups (called an **UNIVERSAL DONOR**), and blood group AB can receive blood from all blood groups (called an **UNIVERSAL RECIPIENT**)

33 QUIZ 5

Answer the question below!

Blood group O can donate its blood to all blood group because blood group O has neither aglutinogen A nor B. Therefore, if it donates to blood groups A, B, and AB which has anti B, anti A, and anti A and B, there will not be any coagulation between aglutinogen and anti aglutinogen/aglutinin.

How about blood group AB? Why can it receive blood from all blood groups?

Send your answer to nisanyanyaa@gmail.com with subject: QUIZ 3, your name, your class. The first one who answer it correctly will get a prize, good luck :)

34 HUMAN BLOOD CIRCULATION

CLOSED CIRCULATORY SYSTEM:

is blood that circulates **INSIDE** blood vessels. Human blood circulation is included in the closed circulatory system.

DOUBLE CIRCULATION:

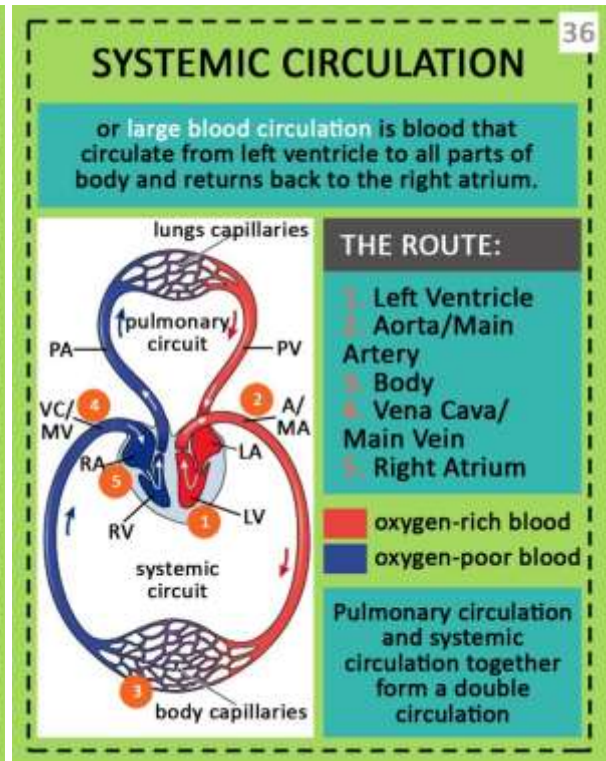
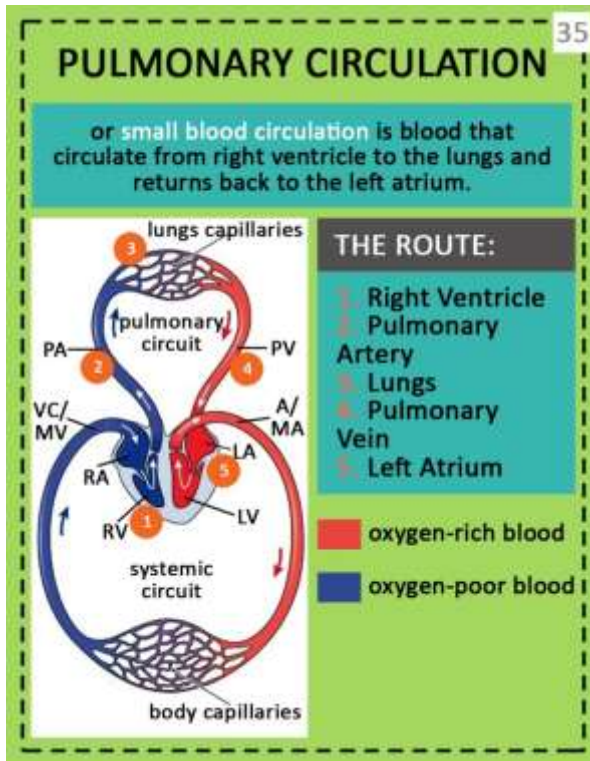
is blood that circulates through the heart **TWICE**. Human blood circulation is included in the double circulation.

Double Circulation

consist of

Pulmonary Circulation

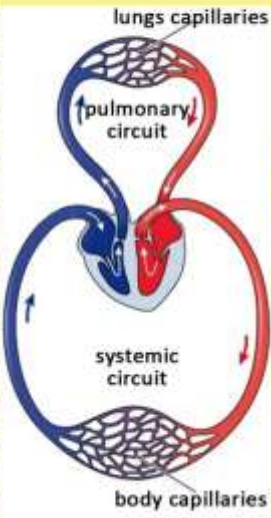
Systemic Circulation



37

QUIZ 6

Answer the question below!



lungs capillaries
pulmonary circuit

systemic circuit
body capillaries

Explain the route of human complete blood circulation!

Send your answer to nisanyanyaa@gmail.com with subject: QUIZ 3, your name, your class. The first one who answer it correctly will get a prize, good luck :)

38

CIRCULATORY SYSTEM DISORDERS

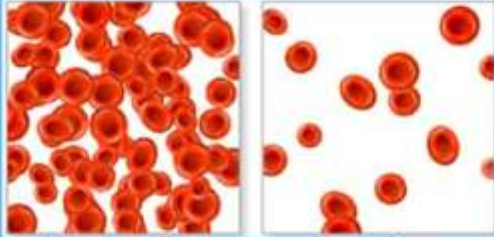
Can be divided into:

Disorders of blood	Disorders of heart & vessel
examples:	examples:
ANEMIA	ATHEROSCLEROSIS
THALASSEMIA	VARICES
LEUKOPENIA	ANGINA
LEUKEMIA	HEART ATTACK
HEMOPHILIA	HEMORRHOIDS
LEUKOCYTOSIS	

39

ANEMIA

is a condition in which blood is unable to carry enough oxygen for body. There are many causes of anemia, some of them are low number of red blood cells and hemoglobin deficiency.




normal anemia

Symptoms that may occur if someone has anemia are: feeling weak or tired more often than usual, headache, concentrating/thinking problem, and light-headedness when stand up.

40

THALASSEMIA

is an inherited blood disease in which body makes an abnormal form of hemoglobin, protein in red blood cells that carries oxygen. Disorder results in excessive destruction of red blood cells, which leads to anemia.




normal thalassemia

41

HEMOPHILIA

is a blood disease in which blood has trouble clotting. The sufferer can lose much blood just because of a minor injury.



Injury Occurs

- 1 Injury to blood vessel results in bleeding.
- 2 Vessel constricts and clotting factors are activated.

Normal

- 3 Along with other substances, clotting factor VIII causes a strong platelet plug to form.
- 4 A stable fibrin clot forms over the platelet plug as a final seal on the injury, and the bleeding stops.

Hemophilia A

- 3 Lack of clotting factor VIII causes a weak platelet plug to form.
- 4 Incomplete and/or delayed fibrin clot allows bleeding to continue.

42

LEUKOPENIA

is a condition in which number of white blood cells is less than normal (below 4.000 cells/mm³ of blood). This condition will decrease the immune system.

LEUKOCYTOSIS

is a condition in which number of white blood cells is far more than normal (above 15.000 cells/mm³ of blood). Leukocytosis commonly happens in someone who suffer from chronic illness.

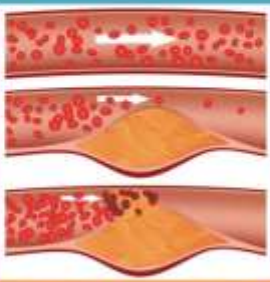
LEUKEMIA

often called blood cancer. White blood cells uncontrollably divide, so that number of white blood cells increase rapidly and engulf red blood cells, other white blood cells, and plasma.

ATHEROSCLEROSIS 43

happens when there is an accumulation of fat and cholesterol on the inner wall of arteries.

This accumulation will form plaque and cause artery constriction which lead to high blood pressure and the disturbance of oxygen and nutrient circulation.



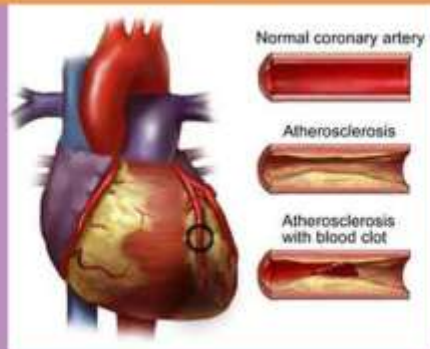
If this constriction happens to the arteries that supply oxygen and nutrition to the heart, it will cause heart attack. If it happens to the arteries that go to the brain, it will cause a stroke.

HEART ATTACK 44

a heart attack is caused by low blood supply to the cardiac (heart) muscle. Usually it is because of atherosclerosis.

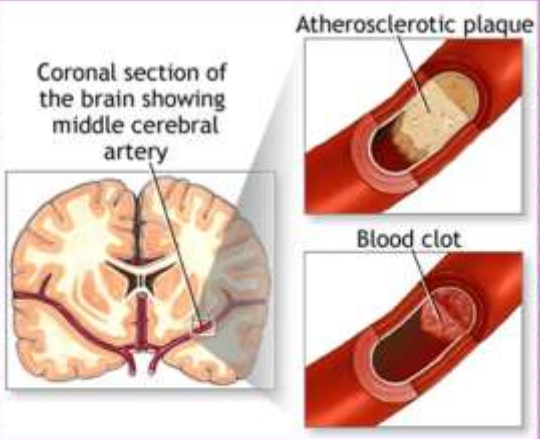
Cardiac muscle will be disrupted and finally die which then leads the heart to stop beating.

A heart attack is marked by pain in the left chest with a cold sweat, dizziness, and nausea.



STROKE 45

happens when blood flow to a part of brain stops. If blood flow is stopped for longer than a few seconds, the brain cannot get blood and oxygen. Brain cells can die, and causing permanent damage.



Coronal section of the brain showing middle cerebral artery


Atherosclerotic plaque

Blood clot

VARICOSE VEINS 46

are widen veins that have filled with an abnormal collection of blood as a consequence of unsmooth blood circulation toward the heart.

In normal veins, valves in vein keep blood moving forward toward the heart. In varicose veins, the valves do not function properly, allowing blood to stay in the vein.



Normal vein

Blood flow

Closed valve

Varicose vein

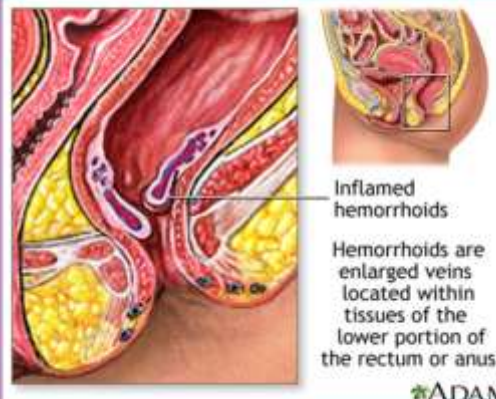
Open valve

ADAM

HEMORRHOIDS

are enlarged veins located within tissues of the lower portion of the rectum or anus.

Hemorrhoids may be caused by:
straining during bowel movements,
constipation,
sitting for long periods of time,
and anal infections.



Inflamed
hemorrhoids

Hemorrhoids are
enlarged veins
located within
tissues of the
lower portion of
the rectum or anus

ADAM