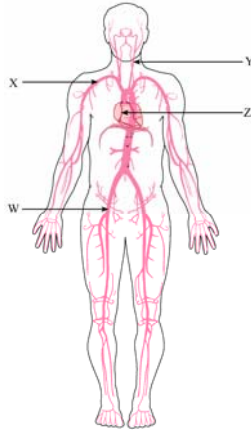


Circulatory System and Blood

1.



Identify the arteries in the diagram and give one function for each.

- Y: Common carotid artery:** sends oxygenated blood to the brain, provide nutrients.
- X: Subclavian artery:** sends oxygenated blood to the arms; receives lymph from lymphatic system
- Z: Coronary artery:** provides the heart nutrients and oxygen.
- W: Iliac artery:** sends oxygenated blood to the legs.

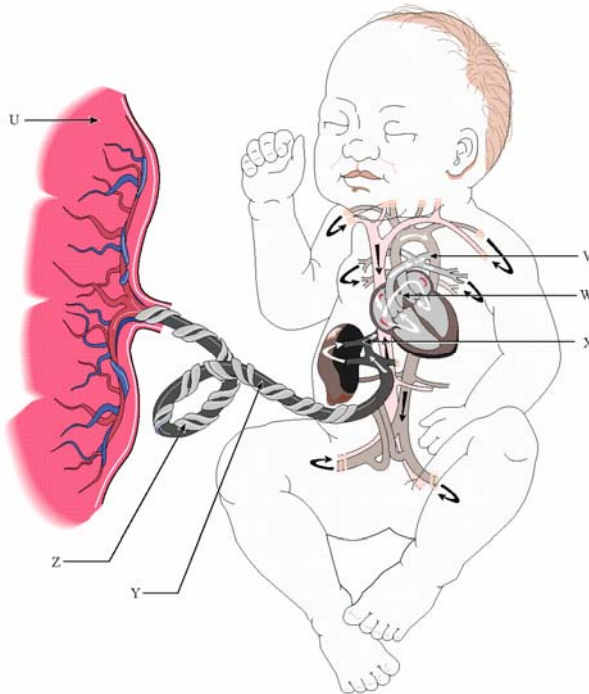
2.



The heart shown is in the process of **(D)**
Ventricles are pumping blood to the aorta and pulmonary trunk; atria are relaxing.

- A.** atrial and ventricular systole. **B.** atrial and ventricular diastole. **C.** atrial systole and ventricular diastole. **D.** atrial diastole and ventricular systole.

3.



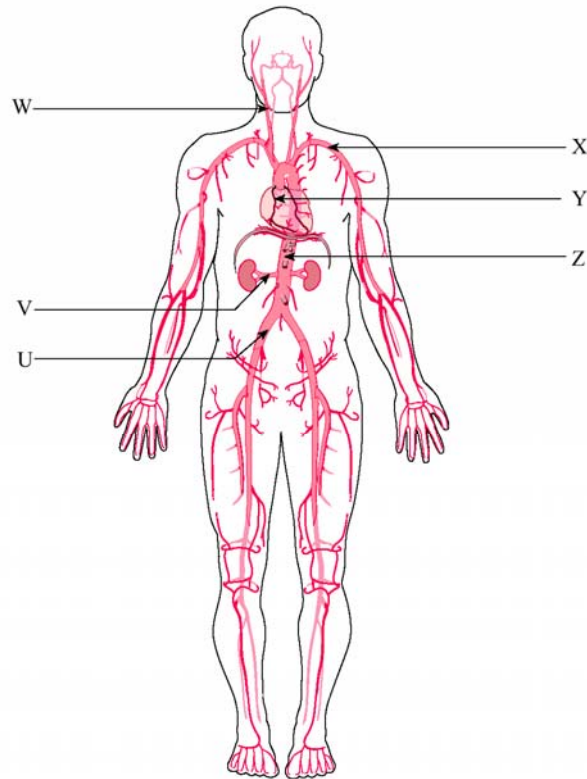
Identify the structures in the diagram below and describe one function for each. (12 marks).

- V: Arterial duct** – bypass lungs, connects to the aorta
- W: Oval opening** – bypass lungs, connects right and left atria.
- X: Venous duct:** connects umbilical vein to the inferior vena cava.
- Z: Umbilical artery** – sends deoxygenated blood and wastes to the placenta.
- Y: Umbilical vein** – sends oxygenated blood and nutrients back to the fetus.
- U: Placenta:** place where wastes and nutrients exchange between the mother and the fetus.

The blood vessel found in adults that contains oxygen levels similar to the blood vessel labelled Y is the **(B)**
Pulmonary vein carries oxygenated blood from lungs back to the left atrium.

- A.** renal vein. **B.** pulmonary vein. **C.** pulmonary artery. **D.** hepatic portal vein.

4.



- a) For each blood vessel listed in the table below, write the letter from the diagram which indicates the vessel's location. (2 marks: $\frac{1}{2}$ mark each)

X: Subclavian artery
W: Carotid artery
Y: Coronary artery
Z: Aorta
V: Renal artery
U: Iliac artery

-
5. In the table, contrast the structure and/or function of the hepatic vein versus the hepatic portal vein (4 marks).

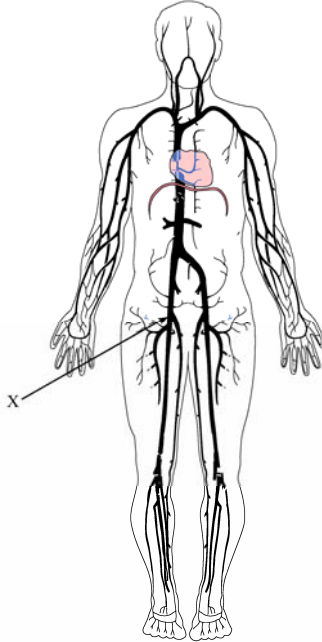
Hepatic Vein:

1. Brings deoxygenated blood from liver to inferior vena cava.
2. Compared to hepatic portal vein, it has less oxygen and nutrients, because liver also consumes oxygen and nutrients.

Hepatic Portal Vein:

1. Connect digestive tract to the liver.
 2. Compared to the hepatic vein, it has more nutrients and wastes, because the blood has not been filtered at the liver yet.
-

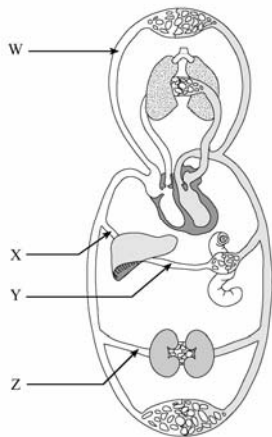
6.



The structure labelled X is the **(A)** iliac vein leads blood to the legs.

- A. iliac vein.
- B. renal vein.
- C. subclavian vein.
- D. posterior vena cava.

7.



Identify the blood vessels in the diagram above (4 marks), give a function for each (4 marks), and list 3 differences in the composition of blood in blood vessels X and Y (3 marks)

- W: Superior Vena Cava:** It brings deoxygenated blood from the upper part of the body back to the right atrium.
- X: Hepatic Vein:** It brings deoxygenated blood from the liver back to the inferior vena cava.
- Y: Hepatic Portal Vein:** It connects the digestive tract to the liver.
- Z: Renal Vein:** It brings deoxygenated blood (filtered) from the kidney back to the inferior vena cava.

Difference in the Composition of Blood in X and Y.

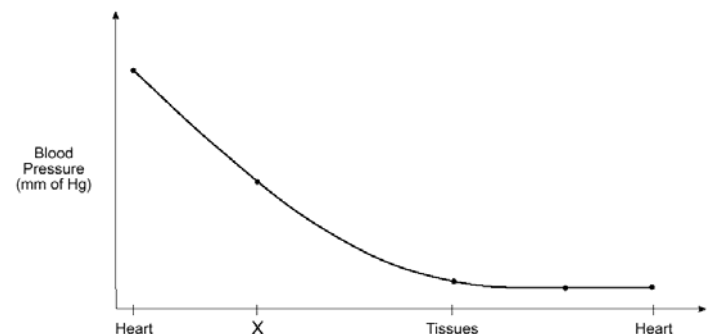
1. At X (Hepatic Vein), there is lower level of oxygen than at Y (Hepatic Portal Vein), because liver needs oxygen to supports its cells.
2. At Y, there is more nutrients than in X, because digestive tract (small intestine) absorbs nutrients, such as amino acid and glucose, to the blood stream.
3. At X, the blood is filtered. At Y, there are more wastes in the blood, because blood has to go through the liver to be filtered.

8.

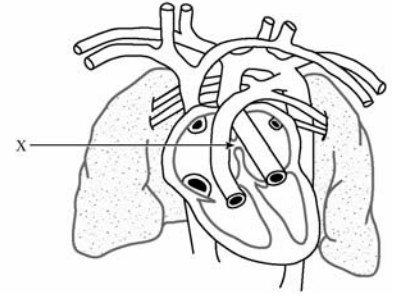
The reading taken at X would be at the a) renal artery b) pulmonary vein c) posterior vena cava d) peritubular capillaries **(A)**

The graph shows that the blood pressure at X is quite high compared to at the tissues. Therefore, renal artery is the artery that branches off from the aorta, and its blood pressure is high, because it is not that far from the heart.

A person's blood pressure was measured at five blood vessels and plotted on the graph below.



9. In the fetus, the function of the structure labelled X is to **(D)**
X is the oval opening; it connects the two atria and let blood go to the left atrium from the right atrium. Therefore, it bypass the lungs.

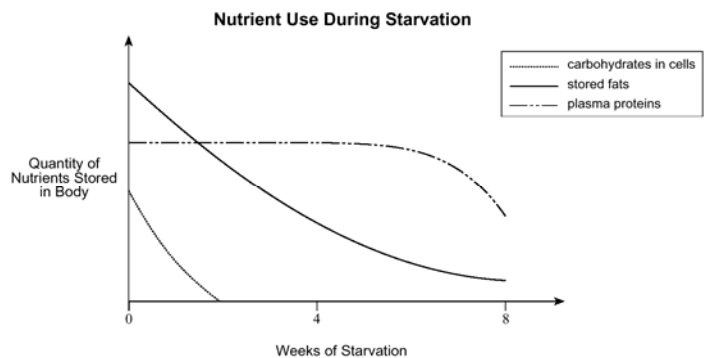


A. take blood to the lungs. B. ensure adequate blood flow to the brain. C. return blood from the placenta to the heart. D. direct some of the blood away from the lungs. (1 mark)

What would be the consequences of this structure persisting after childbirth. (2 marks)

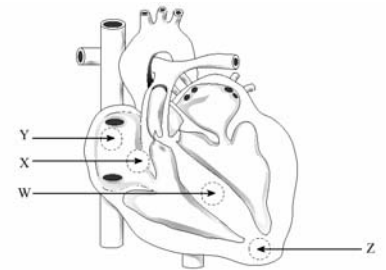
If oval opening does not close off after the childbirth, the baby's oxygenated blood and deoxygenated blood will be mixed, so that the organs will not get enough nutrients as they should get in healthy person. Mixed blood carries less oxygen than the oxygenated blood, and so, it gives the organs less oxygen.

10. The graph illustrates how the body consumes stored nutrients during a prolonged period of starvation. After eight weeks **(B)**
During starvation, the solids in the blood will go down, such as plasma protein, because body will use them as food. Therefore, if the solids in blood decrease, the concentration of water will increase. Water will diffuse into the tissue, and causing fluids accumulating in the tissues.



A. Blood pressure will increase. B. Fluids will accumulate in tissues. C. Glycogen production will increase. D. Hemoglobin will not release oxygen.

11. Which area indicated in the diagram is the location of the AV node? **(B)**
AV node is located at the lower back of the atria.



A. W B. X C. Y D. Z

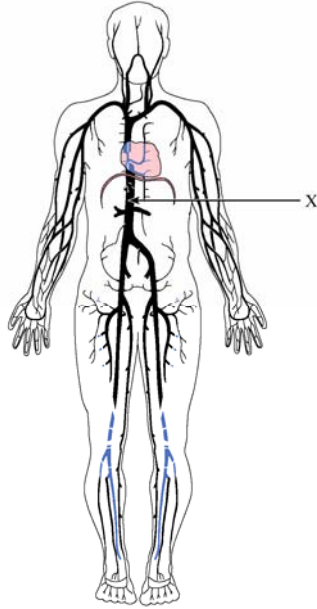
12. Describe how the structure of each of the following aids in its function (3 marks)

a) Artery: Artery has 3 layers, contains smooth muscle, which aids the artery to contract to control the blood pressure and blood flow.

b) Semi-lunar valve: Semilunar valve has two flaps, so that they can open and close during ventricle systole, allowing blood to pass through, preventing blood back flow.

c) Capillary: Capillary's wall is one-cell thick, allowing for exchange of nutrients and wastes between the blood and the tissues.

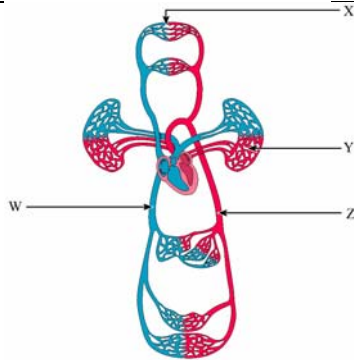
13.



The structure labelled X is the **(D)**
Posterior vena cava is the inferior vena cava; it brings deoxygenated blood from the lower part of the body back to the right atrium.

- A. iliac artery.
- B. hepatic vein.
- C. carotid artery.
- D. posterior vena cava.

14.



In the diagram above, the blood pressure is highest at **(D)**
Z is the aorta; it receives the pumped blood from the left ventricle, and thus the blood pressure is the highest.

- A. W B. X C. Y D. Z

15. Which of the following blood vessels is represented by the diagram?

(C)
Veins have less smooth muscle and they have valves.

- A. Lymph vessel. B. Carotid artery. C. Hepatic portal vein. D. Peritubular capillary.

Blood capillaries and lymph capillaries both **(D)**
Capillaries' walls are one-cell thick, allowing the exchange between the blood and the tissues, and the entering of the tissues fluid into the lymphatic system.

- A. Filter bacteria. B. Have one-way valves. C. Contain red blood cells. D. Have walls which are one-cell thick.

- one-way valves
- thin elastic layer
- near skeletal muscle

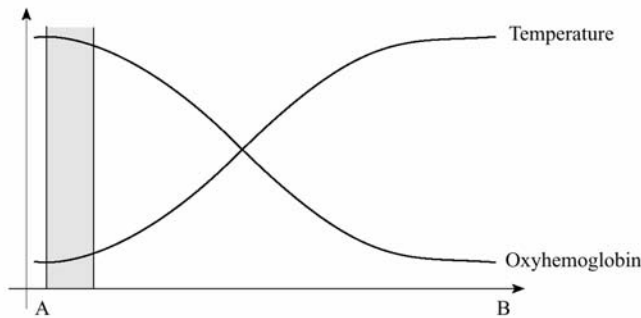
The characteristics above describe which type of vessel? **(A)**

They are characteristics of the vein, preventing the backflow of the blood (valves) and movement of the blood (muscles).

- A. vein B. artery C. arteriole D. capillary



16.



The graph above shows the temperature and level of oxyhemoglobin in the blood as it moves from point A to point B in the body. The shaded area on the graph would represent the **(D)** In alveolar capillaries, the body temperature is the lowest, while oxygen diffusing into the bloodstream from the lungs and bind with hemoglobin, causing the amount of the oxyhemoglobin is the highest.

A. trachea. B. body tissues. C. pulmonary arteries. D. alveolar capillaries.

17. Blood vessel U is a(n) **(D)**

The blood in capillaries moves very slow (2cm/sec), in order to allow the exchange of oxygen and wastes between the blood and the tissue fluid.

A. vein. B. artery. C. venule. D. capillary.

BLOOD VESSEL	PRESSURE (mm of mercury)	VELOCITY (cm/sec.)
S	less than 5	15
T	20	80
U	10	2
V	40	100

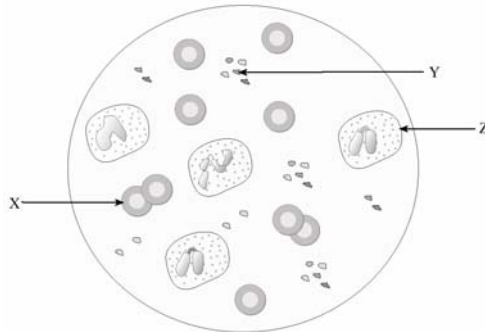
18. a) Describe one function of each of the following. (3 marks)

- Red blood cells: contains hemoglobin, carrying oxygen.
- White blood cells: defend the body from diseases, fight infection
- Platelets: clotting

b) Where are red blood cells produced?

Red blood cells are produced in the red bone marrow.

19.



Name structures X, Y and Z and provide a function of each.

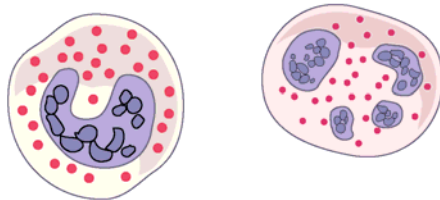
(6 marks: 1 mark for each name; 1 mark for each function)

X: Red blood cell: contains hemoglobin, carrying oxygen.

Y: Platelets: clotting

Z: White blood cell: defend body from diseases, fight infection

20.

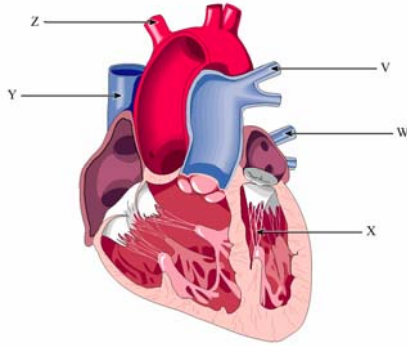


The blood cells shown in the diagram above function to **(B)**

The diagram shows the white blood cell, which is used to defend the body from diseases and fights infection.

A. clot the blood. B. fight infection. C. buffer the blood. D. transport oxygen.

21.



The function of the structure labelled X is to **(D)**
D is the chordae tendineae, which is used to prevent the valves from inverting when the blood is passing through.

A. initiate heartbeat. B. channel blood to the ventricles. C. carry blood to the heart muscle. D. prevent the valves from inverting.

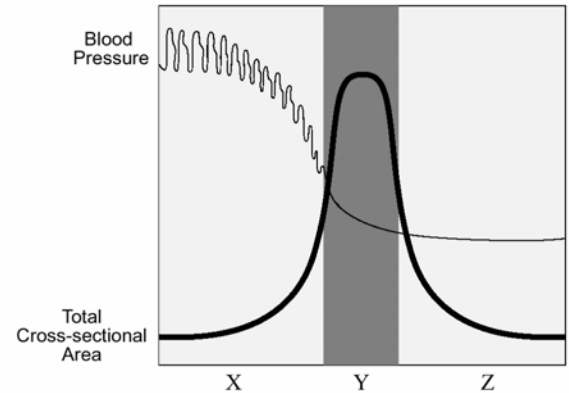
The anterior (superior) vena cava is labeled **(C)**
 A. V B. W C. Y D. Z

22.

The graph shows blood pressure and cross-sectional area of vessels in various parts of the circulatory system. What kind of blood vessel would have the characteristics found in area Z?

(A)
 At Z (Vein) the blood pressure is the lowest, because it is the farthest from the heart pump. Also, the total cross-sectional area is smaller than Y (capillary bed).

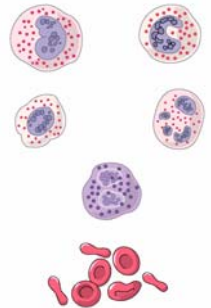
A. Vein. B. Artery. C. Arteriole. D. Capillary.



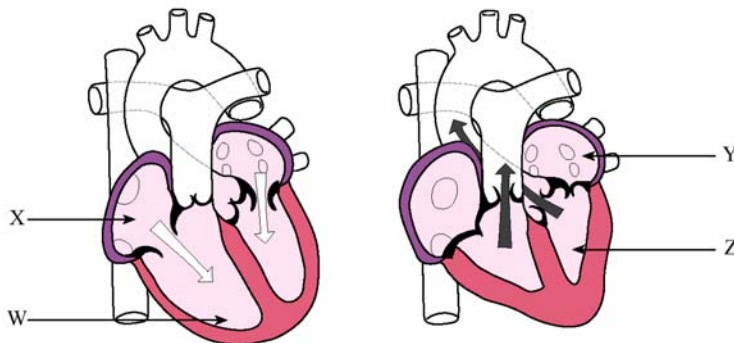
23.

The blood cells shown in the diagram would not be able to **(C)**
 The diagram shows the red blood cell and white blood cell, which cannot initiate a blood clot. Platelets can initiate a blood clot.

A. carry oxygen.
 B. fight infection.
 C. initiate a blood clot.
 D. carry carbon dioxide.



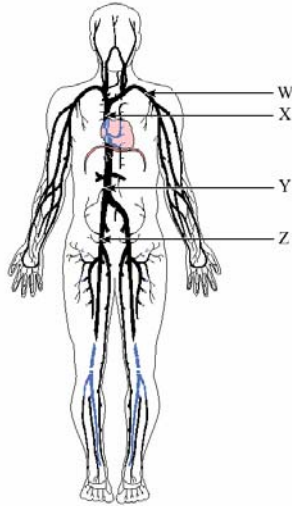
24.



Systole of the ventricles is occurring at **(D)**
 At Z: ventricles are contracting.

A. W B. X C. Y D. Z

25.

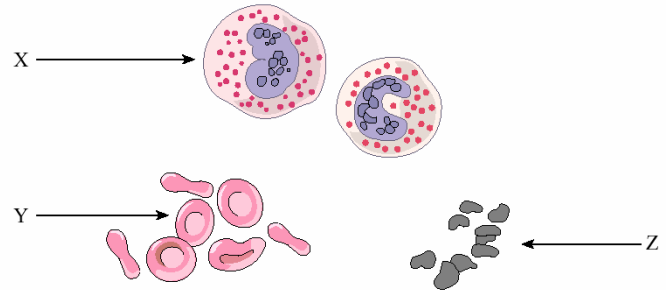


Lymph fluid is returned to the circulatory system in the vessel labeled **(A)**
 Lymph fluid is returned to the circulatory system in the subclavian veins (W).

- A. W B. X C. Y D. Z

26. Identify each blood component indicated in the diagram below and give one function of each.
 (6 marks: 1 mark each for name and 1 mark each for function)

X: White blood cell: fight infection
 Y: Red blood cell: carrying oxygen by hemoglobin
 Z: Platelets: clotting

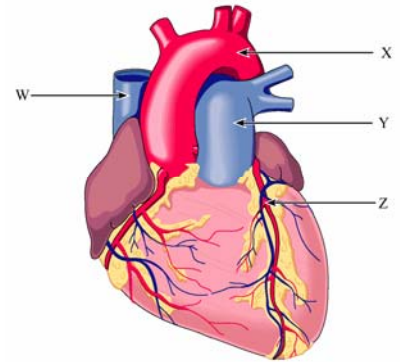


27. a) Which blood vessel in the diagram above directly supplies the heart tissue with oxygen and nutrients? **(Z)**
 Coronary artery (Z) directly supplies the heart tissue with oxygen and nutrients.

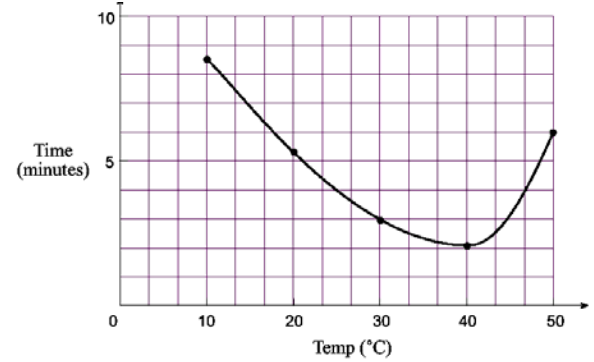
- A. W B. X C. Y D. Z

b) The sequence of structures through which the nerve impulse passes to cause contraction of the heart is **(D)**
 SA node initiates the heart beat every 0.85sec, causing atria to contract. The impulse travels to the AV node, then to the Purkinje fibers, causing the ventricles to contract.

- A. AV node – SA node – Purkinje fibres.
 B. Purkinje fibres – AV node – SA node.
 C. Purkinje fibres – SA node – AV node.
 D. SA node – AV node – Purkinje fibres.

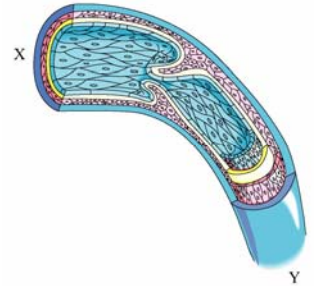


28. An experiment was performed to determine the effect of changing temperature on the speed of blood clotting. Whole blood was placed in labeled test tubes. The tubes were then placed in water baths of various temperatures. Time required for a clot to form was then measured. The results are graphed below. (6 marks: 2 marks each)



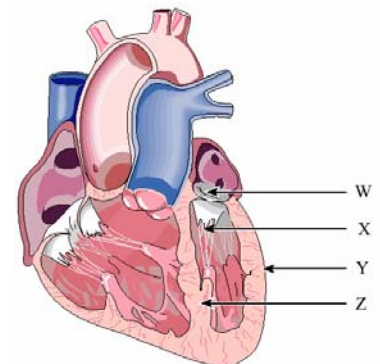
Give the clotting times observed at 10°C, 40°C and 50°C and explain why these Clotting times occur.

- a) 10°C: At 10 C, the time required to form the clot is long, about 8.5 minutes. The reason is that thrombin (enzyme) which participates in the blood clotting does not function properly because the temperature is not thrombin's optimal temperature. Low temperature causes the substrates moving too slow, so that the rate of the reaction between the enzyme and the substrates is slow.
- b) 40°C: At 40 C, the time required to form the clot is the shortest, about 2 minutes. The reason is that 40 C is thrombin's optimal temperature to function well.
- c) 50°C: At 50 C, the time required to form the clot is long, about 6 minutes. The reason is that the temperature is too high for thrombin, so thrombin denatures and cannot bind to the substrates.
29. The blood vessel shown carries blood between organs at locations X and Y. Blood flow through the vessel would be from the (B) The diagram shows the image of vein, which contains one-way valves. Hepatic portal vein leads the blood from the intestine to the liver, and the valves should lean towards the way of blood flow.
- A. heart at X to the kidneys at Y. B. intestine at Y to the liver at X. C. heart at Y to the kidneys at X. D. intestine at X to the liver at Y.



















30. The chordae tendineae are indicated by the letter (B) Chordae tendineae connects the tricuspid/bicuspid valves in the heart.

A. W B. X C. Y D. Z





31. Each of four Biology 12 students carries out the following procedures to determine his/her blood type. Each student is provided with a prepared card with four squares:
- Square W is prepared with anti-A solution which causes agglutination in blood containing the A antigen.
 - Square X is prepared with anti-B solution which causes agglutination in blood containing the B antigen.
 - Square Y is prepared with anti-Rh solution which causes agglutination in blood containing the Rh antigen. Blood which contains the Rh antigen is said to be Rh⁺, while blood without the Rh antigen is said to be Rh⁻.
 - Square Z is a control (no solutions added).

Each student adds a drop of his/her own blood to each square on his/her card. The results are shown below:

	W anti-A	X anti-B	Y anti-Rh	Z control
Student 1				
Student 2				
Student 3				
Student 4				

LEGEND

 non agglutinated

 agglutinated

a) What is the blood type of Student 2? (1 mark)

The student 2 has blood type A, because antigen A agglutinates with antibody A.

b) Which student(s) may receive a transfusion of A₊ blood (A-type blood that is Rh⁺) with no ill effect? (1 mark)

Student 4 can receive blood A with Rh⁺. The data shows that the student's blood agglutinates with W, inferring that the student has blood type A. Also, the data shows that anti-Rh agglutinates with the blood, inferring that the student has positive Rh. Therefore, student 4 can receive blood A with positive Rh.

c) Which student has made an error in his/her exercise? Explain how you know an error was made. (2 marks)

Student 3 has made an error, because the control (Z) should not have any agglutination occurring, because there is no solutions added.

d) If Student 1 is a female, what condition should her doctor alert her to if she becomes pregnant? (1 mark)

Student 1's Rh is negative, because there is no agglutination happening in Y. Therefore, if she has a baby with a man who has positive Rh, she will begin produce anti-Rh after the first childbirth. Therefore, the second child's blood will be attacked by the mother's antibodies, causing erythroblastosis.

32. State one function of each of the following heart structures.

a) SA node: (1 mark): The SA node initiates the heart beat and automatically sends out an impulse.

b) Coronary arteries: (1 mark): Serve the heart muscle itself, brings oxygen and nutrients.

c) Atrioventricular valves: (1 mark): Directs the bloodflow and prevents the backward movement.

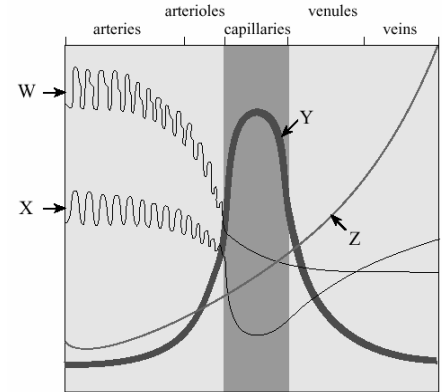
d) Right ventricle: (1 mark): Pumps the blood into pulmonary trunk

33. a) Explain why people with “O” type blood are termed universal donors, yet are limited in the blood they can receive. (2 marks)
 Type O blood does not have antigen but has both antibody A&B. Therefore, people with blood type O can donate their blood to all other people without agglutination, while they can only receive type O blood.
- b) If an Rh negative mother has a second Rh positive child, there may be fetal erythroblastosis.
 i) Explain the cause of erythroblastosis. (2 marks)
 If the mother with negative Rh has a baby with a father with positive Rh. After the first childbirth, the mother will make Rh antibodies if the child has a positive Rh. If the second child also has positive Rh, mother’s antibodies will attack the antigen of positive Rh blood of the fetus.
- ii) State one way that erythroblastosis could be prevented. (1 mark)
 Doctors can provide the medicine that prevent the production of Rh antibodies.

34. In the table below, state one function of each vessel and describe the vessel’s structure that facilitates this function. (6 marks: 1 mark for function, 1 mark for structure)
- a) Arteries: The thick layer and consists of smooth muscle that can contract to regulate blood to flow and blood pressure; carry blood away from the heart.
- b) Veins: have valves that direct the blood flow and prevent backflow, carry the blood to the heart.
- c) Capillaries: Narrow, microscope tube with one-cell- thick walls for exchange the substance.

35. Which letter represents a graph indicating the total cross-sectional area of the body’s blood vessels? (Y)
 Capillaries have the highest cross-sectional area. Both arteries and veins have lower cross-sectional area.

A. W B. X C. Y D. Z

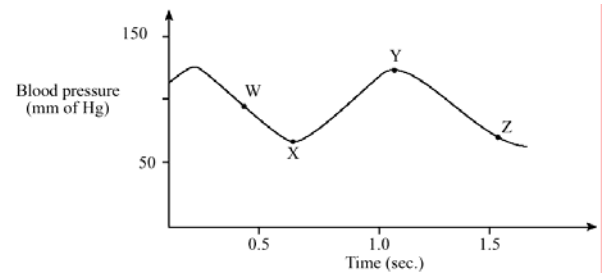


36. a) The graph above shows changes in arterial blood pressure over time. Which letter would indicate ventricular systole? (C)
 Blood pressure is high when ventricles are contracting and pumping and blood.

A. W B. X C. Y D. Z

- b) Which of the following is a characteristic of systemic circulation?

(A)
 In systemic circuit, arteries contain oxygenated blood from left ventricle, that the blood has gone through lungs to pick up oxygen.

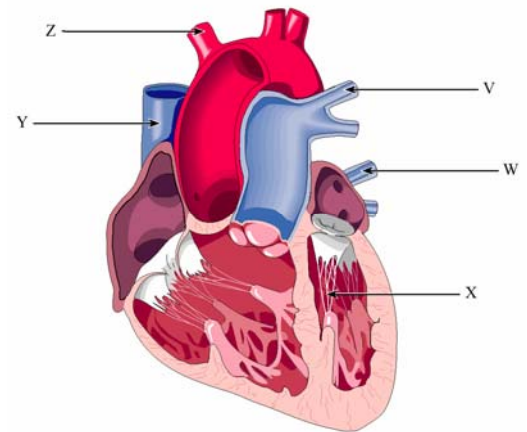


A. Highly oxygenated arterial blood. B. Increased blood pressure in the veins. C. Low carbon dioxide concentration in the veins. D. Increased concentration of reduced hemoglobin (HHb) in the arterial blood.

37. Under what conditions would:
- a) more blood sugar be found in the hepatic portal vein than in the hepatic vein? (2 marks)
 Full and eat well. Hepatic portal vein contains nutrients absorbed from villi.
- b) More blood sugar is found in the hepatic vein than in the hepatic portal vein? (2 marks)
 Starvation. Liver changes glycogen to glucose during starvation, because body needs energy.
- c) Blood sugar levels decrease below normal levels? (1 mark)
 Really starve. No more glucose to support the body.

38. Trace the flow of red blood cells through the heart of a mature human, naming all the valves, vessels and chambers, starting with venous blood entering the heart and arterial oxygenated blood leaving the heart. (7 marks: 1/2 mark for each item, 1/2 mark for proper sequence)
 Superior/Inferior vena cava—right atrium –tricuspid valve—right ventricle—pulmonary semilunar valve—pulmonary trunk---pulmonary artery--- lungs---pulmonary veins---left atrium--- bicuspid valve---left ventricle ---aortic semilunar valve---aorta
39. a) Name two structures that exist in the human fetal circulation system that are non-functional in the adult. Outline their function in the fetal circulatory system and explain why they are unnecessary in the adult. (5 marks)
 Oval opening—drives blood away from lungs,bypass the lungs.
 Arterial duct: bypass the lungs.
 Adults need both pulmonary and systemic circuits because oxygenated and deoxygenated blood cannot be mixed. Otherwise, tissues may not receive enough nutrients and oxygen from the mixed blood. Fetus has only systemic circuit functioning, because nutrients and oxygen are gotten from the mother.
 b) What effect will the foramen ovale (oval opening) not closing after birth have on the normal body functions in humans? (2 marks)
 Oxygenated and deoxygenated blood will mix, and thus, tissue cells may not receive enough nutrients. Also, the lungs may not function well because blood is bypassed by the oval opening.
40. Describe the structure of each one of the following blood vessels and explain how it is related to its function:
 a) Arteries: The thick layer and consists of smooth muscle that can contract to regulate blood to flow and blood pressure; carry blood away from the heart.
 b) Veins: have valves that direct the blood flow and prevent backflow, carry the blood to the heart.
 c) Capillaries: Narrow, microscope tube with one-cell- thick walls for exchange the substance.
41. Hypoxia refers to the condition in which the availability or utilization of oxygen is depressed. The data in the chart was obtained from 5 different subjects: one with normal condition and four having different types of hypoxia caused by various problems.
- | Subject | Haemoglobin (g Hb/100 mL of blood) | O ₂ content of arterial blood | O ₂ content of venous blood | Cardiac output (L/min) |
|-----------|------------------------------------|--|--|------------------------|
| Normal | 15 | 19 | 15 | 5.0 |
| Hypoxia A | 15 | 15 | 12 | 6.6 |
| Hypoxia B | 8 | 9.5 | 6.5 | 7.0 |
| Hypoxia C | 15 | 19 | 10 | 3.0 |
| Hypoxia D | 15 | 19 | 18 | no info |
- a) Which subject may be suffering from an iron deficiency? Support your answer with a reason. (2 marks)
 Subject B is suffering from an iron deficiency, because the level of hemoglobin is low with low level of iron.
- b) Which subject may be suffering from heart failure and poor circulation? Why? (2 marks)
 Subject D is suffering from heart failure, because there is no info for the cardiac output.
- c) Which subject may have been recently exposed to carbon monoxide gas? Why? (2 marks)
 Subject A has been exposed to carbon monoxide gas, because monoxide blocks oxygen from binding to the hemoglobin, and thus the level of oxygen is low.
- d) Which subject may be suffering from poisoning which prevents the cells from taking up oxygen? Why? (2 marks)
 Subject D is suffering from poisoning, because cells no longer take up oxygen, and thus the oxygen level in veins is abnormally high.
- e) Subject B has an increased breathing rate. Suggest a possible physiological reason for this. (2 marks)
 Subject B does not have enough hemoglobin, so tissues cannot get enough oxygen. Breathing rate will increase to allow more oxygen to go into tissues.

42. a) Explain why there is a sharp drop in pressure as blood moves from arteries to capillaries. (1 mark)
 Increase the total cross-sectional area of blood vessels, farther from the heart.
 b) Give an advantage of having low pressure in capillaries. (1 mark)
 Low pressure in capillaries to allow the exchange of substances between the blood in capillaries and surrounding tissues. Capillaries' walls are thin, may not withstand high blood pressure. In addition, if blood pressure is too high, osmotic pressure may not overcome blood pressure at venule side.
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43. Certain tissues of the heart are responsible for its rhythmic contraction. Name these tissues and explain how they work to regulate and co-ordinate a rhythmic contraction of the heart. (4 marks)
 SA and AV nodes are responsible for the contraction of the heart, in which SA node initiates the heartbeat, causing atria contraction, and AV node receives the impulse from SA node, causing ventricles contraction by sending impulse through Purkinje fibers. SA node is regulated by medulla oblongata, in which sympathetic system will speed up heartbeat, and parasympathetic system will slow down the heartbeat.
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44. A blood pressure reading 120/80 mm of Hg is considered normal.
 a) Explain what could cause an individual to have a resting systolic pressure reading 160 mm of Hg (2 marks)
 The individual will have high blood pressure if the reading is 160mm of Hg. The reason may be that blood vessels are blocked, so that ventricles need to pump harder in order to let the blood flow through the blockage.
 b) Is it possible to have a blood pressure reading 120/140 mm of Hg? Explain. (2 marks)
 No, because blood pressure of ventricular diastole never higher than the blood pressure of ventricular systole.
-
45. Give one function of each of the following in the circulatory system: (7 marks)
 a) Red blood cells: carry oxygen, helps to carry carbon dioxide.
 b) Platelets: clotting
 c) Pulmonary artery: carries deoxygenated blood from the heart to the lungs.
 d) Hepatic portal vein: connects the digestive track to the liver
 e) S-A node: initiates the heartbeat, causing atria contraction
 f) Arterial duct: bypass the lungs
 g) Hemoglobin: carries oxygen, carbon dioxide and hydrogen ion.
-
46. Name and give one function for each of the indicated parts: (10 marks)
 Z: aorta: carries oxygenated blood to the rest of the body
 Y: Superior vena cava: brings deoxygenated blood from the upper part of the body to the heart.
 V: Pulmonary arteries: bring deoxygenated blood from the pulmonary trunk to the lungs.
 W: Pulmonary veins: bring oxygenated blood from the lungs to the left atrium.
 X: Chordae Tendineae: prevents the valves from inverting.



48. Outline the physiological responses, which occur in a human during the first hours following an accident which caused severe bleeding. (10 marks)
Heart rate will increase to send more nutrients and oxygen to the tissues. Breathing rate will increase because more oxygen is needed to support cell metabolism. Blood pressure will decrease due to the severe bleeding. Capillary beds will shrink due to severe bleeding. Clotting begins, blood pressure gets normal

49.

BODY PARTS	AT REST mL ³ /min	LIGHT EXERCISE mL ³ /min	FAIRLY STRENUOUS EXERCISE mL ³ /min	MAXIMUM EXERTION mL ³ /min
Heart muscles	250	350	750	1000
skeletal muscles	1200	4500	12500	22000
kidneys	1100	900	600	250
gut	1400	1100	600	300
skin	500	1500	1900	600
brain	750	750	750	750
all other regions	600	400	400	100
TOTAL	5800	9500	17500	25000

The table above shows the blood flow for different parts of the human body, at rest during different levels of physical activity. Explain and give reasons for the figures for each of the following:

- a) Kidneys (2 marks): Blood flow through kidney decreases during exercising period, because more blood is needed to be sent to the muscle cells to produce more energy.
b) Brain (1 mark): Blood flow through the brain has no change at resting and exercising states, because no matter what body does, it is controlled by the brain. Therefore, brain never rest and needs certain amounts of nutrients and oxygen.
c) Skin (2 marks): More blood goes through skin at exercising state, because skin is close to the muscle, which needs more blood to deliver more nutrients and oxygen. In addition, sweat also comes out during exercising period.

Compare and contrast the blood flow to the heart and skeletal muscles. (3 marks)

Blood flow to the heart and skeletal muscles both increase during exercising period, because skeletal muscles need more oxygen to produce energy for the movement, and thus heart muscles also need more oxygen to pump faster and stronger to send more blood to the skeletal muscles.

However, there is much more blood flow to the skeletal muscles than to the heart, because there are lots of skeletal muscle in the body, but only a small amount of heart tissues. Therefore, when skeletal muscles are doing the work, more blood is needed to be sent to support the metabolism.

50. a) Name two structures that exist in the human fetal circulation system that are non-functional in the adult. Outline their function in the fetal circulatory system and explain why they are unnecessary in the adult. (5 marks)
Oval opening—drives blood away from lungs, bypass the lungs.
Arterial duct: bypass the lungs.
Adults need both pulmonary and systemic circuits because oxygenated and deoxygenated blood cannot be mixed. Otherwise, tissues may not receive enough nutrients and oxygen from the mixed blood. Fetus has only systemic circuit functioning, because nutrients and oxygen are gotten from the mother.
b) What effect will the foramen ovale (oval opening) not closing after birth have on the normal body functions in humans? (2 marks)
Oxygenated and deoxygenated blood will mix, and thus, tissue cells may not receive enough nutrients. Also, the lungs may not function well because blood is bypassed by the oval opening.

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51. Describe the structure of each one of the following blood vessels and explain how it is related to its function:
- a) **Arteries:** The thick layer and consists of smooth muscle that can contract to regulate blood to flow and blood pressure; carry blood away from the heart.
 - b) **Veins:** have valves that direct the blood flow and prevent backflow, carry the blood to the heart.
 - c) **Capillaries:** Narrow, microscope tube with one-cell- thick walls for exchange the substance.
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52. a) Explain why there is a sharp drop in pressure as blood moves from arteries to capillaries. (1 mark)
Increase the total cross-sectional area of blood vessels, farther from the heart.
- b) Give an advantage of having low pressure in capillaries. (1 mark)
Low pressure in capillaries to allow the exchange of substances between the blood in capillaries and surrounding tissues. Capillaries' walls are thin, may not withstand high blood pressure. In addition, if blood pressure is too high, osmotic pressure may not overcome blood pressure at venule side.
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53. Certain tissues of the heart are responsible for its rhythmic contraction. Name these tissues and explain how they work to regulate and co-ordinate a rhythmic contraction of the heart. (4 marks)
- SA and AV nodes are responsible for the contraction of the heart, in which SA node initiates the heartbeat, causing atria contraction, and AV node receives the impulse from SA node, causing ventricles contraction by sending impulse though Purkinje fibers. SA node is regulated by medulla oblongata, in which sympathetic system will speed up heartbeat, and parasympathetic system will slow down the heartbeat.
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54. A blood pressure reading 120/80 mm of Hg is considered normal.
- a) Explain what could cause an individual to have a resting systolic pressure reading 160 mm of Hg (2 marks)
The individual will have high blood pressure if the reading is 160mm of Hg. The reason may be that blood vessels are blocked, so that ventricles need to pump harder in order to let the blood flow through the blockage.
- b) Is it possible to have a blood pressure reading 120/140 mm of Hg? Explain. (2 marks)
No, because blood pressure of ventricular diastole never higher than the blood pressure of ventricular systole.
-
55. Give one function of each of the following in the circulatory system: (7 marks)
- a) **Red blood cells:** carry oxygen, helps to carry carbon dioxide.
 - b) **Platelets:** clotting
 - c) **Pulmonary artery:** carries deoxygenated blood from the heart to the lungs.
 - d) **Hepatic portal vein:** connects the digestive track to the liver
 - e) **S-A node:** initiates the heartbeat, causing atria contraction
 - f) **Arterial duct:** bypass the lungs
 - g) **Hemoglobin:** carries oxygen, carbon dioxide and hydrogen ion.
-

56.

Subject with initial atrioventricular valve (A-V) damage.



Heart at the end of ventricular systole.

Same subject one year later.



Heart at the end of ventricular systole.

Both diagrams are drawn to the same scale and represent the heart at the end of the ventricular systole.

a) Explain two physiological problems this subject will immediately face as result of the damage to the A-V valves. (2 marks)

Blood will flow back into the atria, so the tissues may not get enough nutrients and oxygen.

b) Explain two major changes that will occur to the heart during the year to help it re-establish homeostasis. (2 marks)

Fix the AV valves to let normal amount of blood go to the tissues; decreases the blood pressure.

c) Explain two further changes that are likely to have occurred in the rest of the circulatory system to help it re-establish homeostasis. (2 marks)

Thyroxin will be released to cause cells taking in more oxygen.