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Multiple Choice Questions

- Decide which of the choices best completes the statement or answers the question.
 - Locate that question number on the separate answer sheet provided.
 - Use the procedure described by your teacher to answer each question. For example, “fill in the circle that corresponds to your choice” or “make an X over the letter corresponding to your choice.”
1. What are the three major components of the human circulatory system?
 - a. heart, blood vessels, and blood
 - b. lymphocytes, lymphatic vessels, and lymph
 - c. erythrocytes, leucocytes, and platelets
 - d. killer T cells, helper T cells, and B cells
 2. Blood leaving the right ventricle will move through pulmonary arteries, then to the lungs for gas exchange, and then back to the left atrium. Which blood vessel(s) was omitted?
 - a. coronary arteries
 - b. aorta
 - c. pulmonary veins
 - d. superior vena cava
 3. One semilunar valve in the heart is found between the
 - a. left atrium and left ventricle.
 - b. aorta and right ventricle.
 - c. right atrium and right ventricle.
 - d. aorta and left ventricle.
 4. Which of the following is NOT a function of the elasticity of the artery walls?
 - a. helps blood flow in the right direction
 - b. provides an additional pumping motion to help force the blood through the blood vessels
 - c. allows the artery to expand as a wave of blood surges through it during the contraction of the ventricles
 - d. provides increased surface area for nutrient and gas exchange between the blood and body cells
 5. The maximum blood pressure that occurs in arteries during a single ventricular contraction is referred to as the _____ pressure.
 - a. diastolic
 - b. systolic
 - c. QRS
 - d. SA node

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6. Which of these does NOT correctly contrast the pulmonary circuit and the systemic circuit?

Row	Pulmonary Circuit	Systemic Circuit
a.	veins carry O_2^- poor blood	veins carry O_2^- rich blood
b.	carries blood to and from the lungs	carries blood to and from the body tissues
c.	has a limited number of blood vessels	has a large number of blood vessels
d.	goes between the right ventricle and the left atrium	goes between the left ventricle and the right atrium

7. Which artery supplies oxygen and nutrients directly to the muscle cells of the heart?

- aorta
- pulmonary
- coronary
- superior vena cava

8. The first heart sound, the “lub” of the “lub-dub” sound, is caused by

- the closing of the semilunar valves in the aorta and pulmonary artery.
- the contraction of the ventricles.
- the closing of the atrioventricular valves between the atria and ventricles.
- a faulty heart valve (heart murmur).

9. The best explanation for the slow movement of blood in capillaries is

- skeletal muscles press on veins, not capillaries.
- capillaries have a much greater cross-sectional area than the small arteries that provide them with blood.
- blood capillaries have much thinner walls than arteries.
- small veins have a much greater cross-sectional area than capillaries that provide them with blood.

10. Which of the following does NOT assist in the return of venous blood to the heart?

- veins have one-way valves
- the contraction of skeletal muscles squeeze the vein
- reduction in cross-sectional area as blood moves into the veins
- the contraction of muscle layers in the veins keeps the blood flowing in the right direction

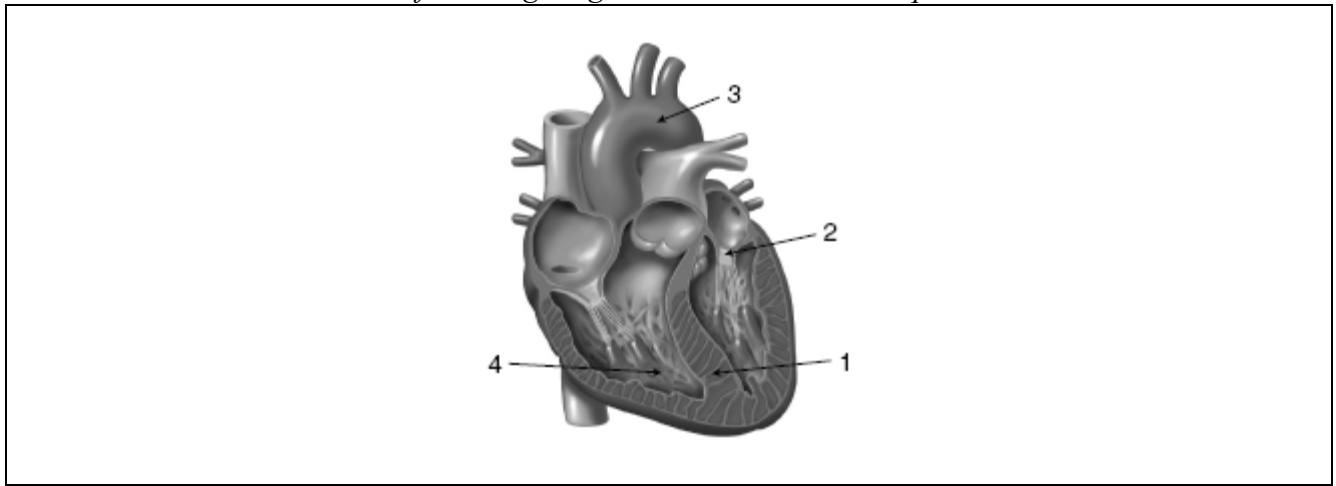
11. Which association is incorrect?

Row	Component	Association
a.	white blood cells	fighting infection
b.	red blood cells	initiating blood clotting
c.	plasma	transporting nutrients, carbon dioxide
d.	platelets	initiating blood clotting

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12. Which of the following would be an option for treating arteriosclerosis in a coronary artery?
- common cold medications
 - vasoconstricting drugs
 - angioplasty
 - bone marrow transplant

Use the following diagram to answer the next question.



13. Which of the following does NOT match the number on the diagram above to the actual structure of the heart?

Row	Number	Structure
a.	1	septum
b.	2	left AV valve (bicuspid valve)
c.	3	pulmonary artery
d.	4	right ventricle

14. Which statement best describes how the circulatory system responds when the external environment is cold and body heat needs to be conserved?
- Vasoconstriction of the blood vessels near the surface of the skin reduces the amount of heat that is dissipated from the skin.
 - Vasoconstriction of the blood vessels near the surface of the skin increases the amount of heat that is dissipated from the skin.
 - Vasodilation of blood vessels near the surface of the skin reduces the amount of heat that is dissipated from the skin.
 - Vasodilation of blood vessels near the surface of the skin increases the amount of heat dissipated from the skin.

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Use the following information to answer the next two questions.

It is estimated that about 20 percent of North Americans have hypertension, which is high blood pressure. Included in this group are individuals with atherosclerosis. Hypertension is present when systolic blood pressure is 140 mmHg or greater or the diastolic blood pressure is 90 mmHg or greater. While both systolic and diastolic pressures are considered important, the diastolic pressure is emphasized when medical treatment is being considered.

15. Which of the following lifestyle changes can help reduce the risk of developing high blood pressure?
- eating foods that are high in monosaturated fats and low in saturated fats
 - maintaining a regular exercise program and replacing saturated fats in the diet with trans fatty acids from natural sources
 - maintaining a regular exercise program and replacing saturated fats in diet with unsaturated fats
 - maintaining weight at 20 percent above the recommended weight for one's height
16. Identify a health risk from the list below that is NOT associated with hypertension.
- stroke
 - heart attack
 - kidney problems
 - leukemia
17. Identify the statement that explains what happens to the nutrients (glucose and oxygen) and waste products (carbon dioxide and urea) in the middle of a capillary bed associated with a skeletal muscle.

Row	Nutrients	Waste Products
a.	diffuse out of the capillary into the tissues	diffuse out of the capillary and into the tissues
b.	diffuse out of the capillary into the tissues	diffuse out of the tissues and into the capillary
c.	diffuse out of the tissues into the capillary	diffuse out of the tissues and into the capillary
d.	diffuse out of the tissues into the capillary	diffuse out of the capillary and into the tissues

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Use the following information to answer the next two questions.

Complete Blood Count

A complete blood count (CBC) test measures the following:

- The number of red blood cells (RBCs)
- The number of white blood cells (WBCs)
- The total amount of hemoglobin in the blood
- The fraction of the blood composed of red blood cells (hematocrit)

Normal Values

Red Blood Cells (varies with altitude):

- Male: 4.7 to 6.1 million cells/ μ L
- Female: 4.2 to 5.4 million cells/ μ L

White Blood Cells

- 4,500 to 10,000 cells/ μ L

Hematocrit (The hematocrit is the percent of whole blood that is composed of red blood cells. The hematocrit is a measure of both the number of red blood cells and the size of red blood cells. It varies with altitude.):

- Male: 40.7 to 50.3 %
- Female: 36.1 to 44.3 %

Hemoglobin (varies with altitude):

- Male: 13.8 to 17.2 g/dL
- Female: 12.1 to 15.1 g/dL

(Units: cells/ μ L = cells per microliter; g/dL = grams per deciliter)

Source: <http://www.nlm.nih.gov/medlineplus>

18. A person with a higher than normal number of leucocytes in the blood may be diagnosed with
 - a. anemia.
 - b. hypertension.
 - c. arteriosclerosis.
 - d. leukemia.

19. A person with a lower than normal hematocrit might be suffering from
 - a. anemia.
 - b. hypertension.
 - c. arteriosclerosis.
 - d. leukemia.

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20. Which of the following is NOT a function of the lymphatic system?

- production of red blood cells
- return of excess tissue fluid to the blood
- transport of fats and lipids from the small intestine
- defend the body against pathogens

21. Which of the following is a non-specific defence of the body?

- B lymphocytes (B cells)
- T lymphocytes (T cells)
- antibody production by B cells
- macrophages (neutrophils and monocytes)

Use the following information to answer the next two questions.

ABO Blood Type System and The RH System

Individual	Antigen on Red Blood Cells	Antibodies in Plasma	Rh factor
A	A and B	none	Rh ⁺
B	none	A and B	Rh ⁻
C	A	anti-B	Rh ⁺
D	B	anti-A	Rh ⁻

22. Which individual in the chart above would have Type O negative blood?

- Individual A
- Individual B
- Individual C
- Individual D

23. All of the individuals identified in the chart above are females, all had previous pregnancies with men who are Rh⁺, and all become pregnant a second time. Which individuals in the chart would have to be concerned about hemolytic disease of the newborn (HDN)?

- Individuals A and C
- Individuals A and B
- Individuals B and D
- Individuals C and D

24. Which disease or disorder would be treated by triple-bypass surgery?

- cardiovascular disease
- hemophilia
- autoimmune disorder
- HIV/AIDS

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25. Which row below does NOT correctly match the T cell to its specific function?

Row	T Cell	Function
a.	helper T cell	recognizes the antigen; gives off chemical signals that stimulate action of macrophages
b.	killer T cell	binds with infected cells and destroys them by puncturing a hole in their cell membrane
c.	suppressor T cell	slows and suppresses the process of cellular immunity to ensure that normal tissue does not get destroyed
d.	memory T cells	these cells remain in the bloodstream and are able to act quickly if the antibody is encountered again

Numerical Response Question

- Record your answer on the answer sheet provided.
- If an answer is a value between 0 and 1 (e.g., 0.25), be sure to record the 0 before the decimal place.

Use the following information to answer the next question.

Some of the steps of the cardiac cycle are listed below.

- 1 muscles of the ventricles contract
- 2 SA node sends out an electrical stimulus
- 3 muscles of the atria contract
- 4 AV node transmits an electrical impulse

1. The order in which the events listed above occur during the cardiac cycle is _____, _____, _____, and _____. Record your **four-digit answer** in the numerical response section on the answer sheet.

Use the following information to answer the next question.

Some of the steps in the production of antibodies are listed below.

- 1 B cell enlarges and divides to produce memory B cells and plasma cells.
- 2 Plasma cells produce large quantities of antibodies.
- 3 T-cells bind to the B cell antibody-antigen complex, activating the B cell.
- 4 Memory B cells remain in the blood, ready to trigger another response.

2. The order in which the events listed above occur during antibody-mediated immunity is _____, _____, _____, and _____. Record your **four-digit answer** in the numerical response section on the answer sheet.

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Use the following information to answer the next question.

Cardiac Output

Individual	Resting Heart Beat (beats per minute)	Stroke Volume (mL/beat)	Cardiac Output (mL/min)
A	70	70	?
B	98	50	?
C	35	140	?

3. Calculate the cardiac output for Individual “C” on the chart above. Record your **four-digit answer** in mL the numerical-response section on the answer sheet.

Answer: _____

Use the following information to answer the next question.

A person goes in to see her doctor. The doctor indicates that her blood pressure is 140 mmHg over 100 mmHg.

4. Identify the diastolic and systolic pressure, respectively, of this individual. Record all **six digits** of your answer in the numerical-response section on the answer sheet.

Answer: _____ mmHg _____ mmHg
diastolic **systolic**

Written Response Questions

Use the following information to answer the following questions:

An Artificial Heart That Doesn’t Beat

Earlier this month, the first fully implantable artificial heart was approved by the U.S. Food and Drug Administration. Artificial hearts work by pumping deoxygenated blood from the body to the lungs. The device then pumps oxygenated blood through the body. The newly approved device, called AbioCor, made by Massachusetts-based Abiomed, uses an implanted hydraulic pumping system to simulate a natural heartbeat. It brings hope to patients who are near death from heart failure, yet some major problems remain with it—namely, its large size and relatively short lifespan. It can only be implanted in people with large chest cavities, making it inappropriate for most women.

A new concept for an artificial heart could solve some of those issues. But its innovative, pulse-free architecture might also raise problems of its own. The alternative design, conceived by O.H. “Bud” Frazier, a prominent heart surgeon and pioneer in the development of cardiac devices at the Texas Heart Institute in Houston, pumps blood through the body continuously, rather than with the periodic beat of the normal heart.

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Pumps that work on this principle, known as continuous flow pumps, are already in clinical use as part of “ventricular assist devices,” which are implanted into patients with some remaining heart function to help circulate blood through the body. (Artificial hearts replace the heart entirely.)

With Frazier’s continuous flow design for an entirely artificial heart, a severely damaged heart is removed and replaced with two rotor-based pumps that continually cycle blood through the body, completely taking over the function of the heart. The biggest advantage of the rotor-style pumps is that they are small and relatively simple.

Frazier also says continuous flow pumps are better able to respond to the body’s changing needs for blood. “If you’re walking, more blood is pumped back to the heart and the heart will automatically pump more,” he says. If pressure on one side of the pump increases, flow through the device automatically increases, allowing the pump to respond like a native heart, Frazier says.

Source: Emily Singer, <http://www.technologyreview.com/Biotech/17523/>
Thursday, September 21, 2006

1. a) **Draw** a cross-sectional sketch of the human heart in the space provided. **Label** all of the chambers, valves, and major blood vessels that take blood into and away from the heart. (10 marks)

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b) Use a flow chart to **trace** the flow of blood through the heart. Start with the blood in the inferior vena cava and end with blood entering the aorta. Include all of the chambers, valves, and major blood vessels that take blood into and away from the heart. (6 marks)

c) **Describe** how you would use a stethoscope to determine damage to the aortic semilunar valve and damage to the left atrioventricular valve. Provide details including what you would expect to hear and when in the cardiac cycle you would hear this particular sound. (4 marks)

d) **Explain** what is meant by the term “pulse.” **Why** would a person with this type of artificial heart not have a pulse? (4 marks)

e) **List** four questions (one for each category) that you think should be asked regarding the individual, cultural, ethical, and economic impact of artificial heart transplants. (4 marks)
