Chapter 8: Review Answers

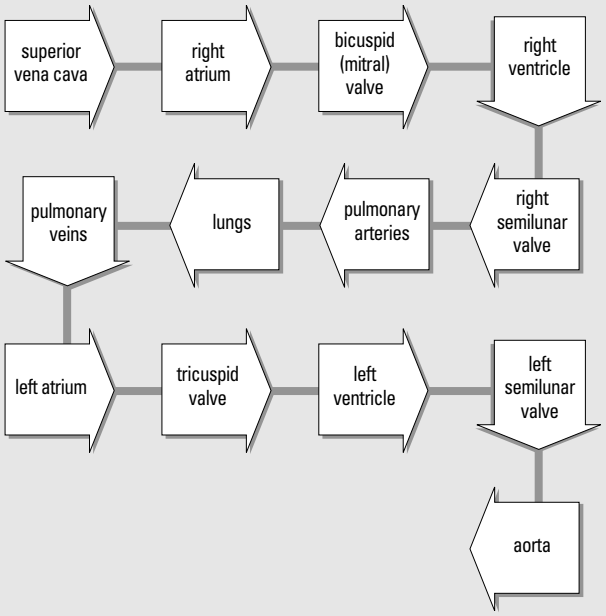
Student Textbook pages 302–303

Answers to Understanding Concepts Questions

1. Three factors that assist blood flow through the veins are: Above the heart, gravity pulls blood back down to the heart; below the heart, muscle contractions push on the veins and force blood back towards the heart; one-way valves also prevent the backflow of blood.

2. Through observations of a mammalian heart, it can be seen that the left ventricle is the largest and strongest chamber. This adaptation is important because the left ventricle pumps blood into the systemic and coronary systems, which together contain the most extensive system of capillary networks in the body.

3. The following flow chart shows the flow of blood through the heart and the lungs:



4. Student flow charts should show the following information:

Electrical signal from the SA node (located in the wall of the right atrium) → the two atria contract simultaneously → signal reaches AV node → AV node transmits signal through the bundle of His → Purkinje fibres initiate simultaneous contraction of the right and left ventricles (starting at the apex) forcing blood towards pulmonary artery and aorta

5. A heart attack is caused when a blood clot or other object obstructs a coronary artery. This cuts off the supply of oxygen and nutrients to the heart muscle.

A stroke occurs when there is blockage or a rupture of an artery in the brain. This disrupts the flow of oxygen and nutrients to the part of the brain behind the damaged artery.

6. Students can select any three of the following functions of the blood:

- transport of oxygen from lungs to cells – red blood cells
- transport of carbon dioxide from cells to lungs – primarily plasma; some in the red blood cells
- fight infection (part of immune system) – white blood cells
- initiate blood clotting (maintaining homeostasis) – platelets
- regulating body temperature (maintaining homeostasis) – plasma (countercurrent heat exchange)

7. The three primary pathways are:

(a) coronary pathway, which is the route taken by blood to the heart muscle itself

(b) pulmonary circulation, which is the route taken by the blood between the heart and the lungs

(c) systemic circulation, which is the route taken by the blood from the heart to the rest of the body

8. Macrophages are phagocytic cells found in the liver, spleen, brain, and lungs; they also circulate in the bloodstream and interstitial fluid. These cells ingest and kill bacteria. Other white cells target body cells that have become cancerous or infected by viruses.

9. Lymph is circulated through a series of glands and vessels that extends throughout the body.

Similarities to blood circulatory system:

- lymph travels in a closed system
- lymphatic vessels have valves to prevent the backflow of lymph (similar to veins)
- depends on the contraction of skeletal muscles outside of the circulatory system (similar to veins)

Differences:

- unlike the circulatory system, the lymphatic system does not have a pump

10. In cellular immunity, a T cell that has a receptor for the particular antigen attaches to the macrophage and then goes through a process of rapid cell division. This produces a number of types of T cells. Helper T cells give off chemicals that stimulate other macrophages, B cells, and other T cells. Cytotoxic (killer) T cells bind to other cells that have been infected and destroy them. Suppressor T cells slow and stop the process of cellular immunity,

while memory T cells remain in the bloodstream to promote faster response if the same antigen appears again.

11. Pathogens can enter the body through the air you breathe, the water you drink, the food you eat, or through breaks in the skin.

Answers to Applying Concepts Questions

12. Students could describe microscopic analysis (counting) of red blood cells similar to the Investigation 8.C on page 285 of the student textbook. Students could also describe a test that involves centrifuging blood until it forms layers and visually analyzing the thickness of the red blood cell layer.

13. During vigorous physical activity, the heart pumps blood more forcefully to meet the higher energy requirements. The systolic blood pressure increases proportionally with exercise effort and energy production.

Nearly opposite of the systolic blood pressure, the diastolic blood pressure typically does not change much during dynamic exercise. The slight decrease in diastolic blood pressure is due primarily to the vasodilation of the arteries from the exercise.

14. When the body's internal environment becomes too warm, the body must be able to rid itself of heat in order to maintain a constant internal temperature. Blood transports heat from where it is formed by cellular respiration and muscular activity, or sitting in a hot tub, to the blood vessels in the skin. Under the control of the nervous system, these vessels dilate to increase the amount of blood flowing and, therefore, to increase the amount of heat that can be lost from the skin. This process is called vasodilation.

15. Students' experiments should include a hypothesis and a logical method of testing the hypothesis. Look for experiments that involve the removal of platelets from the blood, removing calcium ions, or removing one or more of the intermediary proteins required in this process.

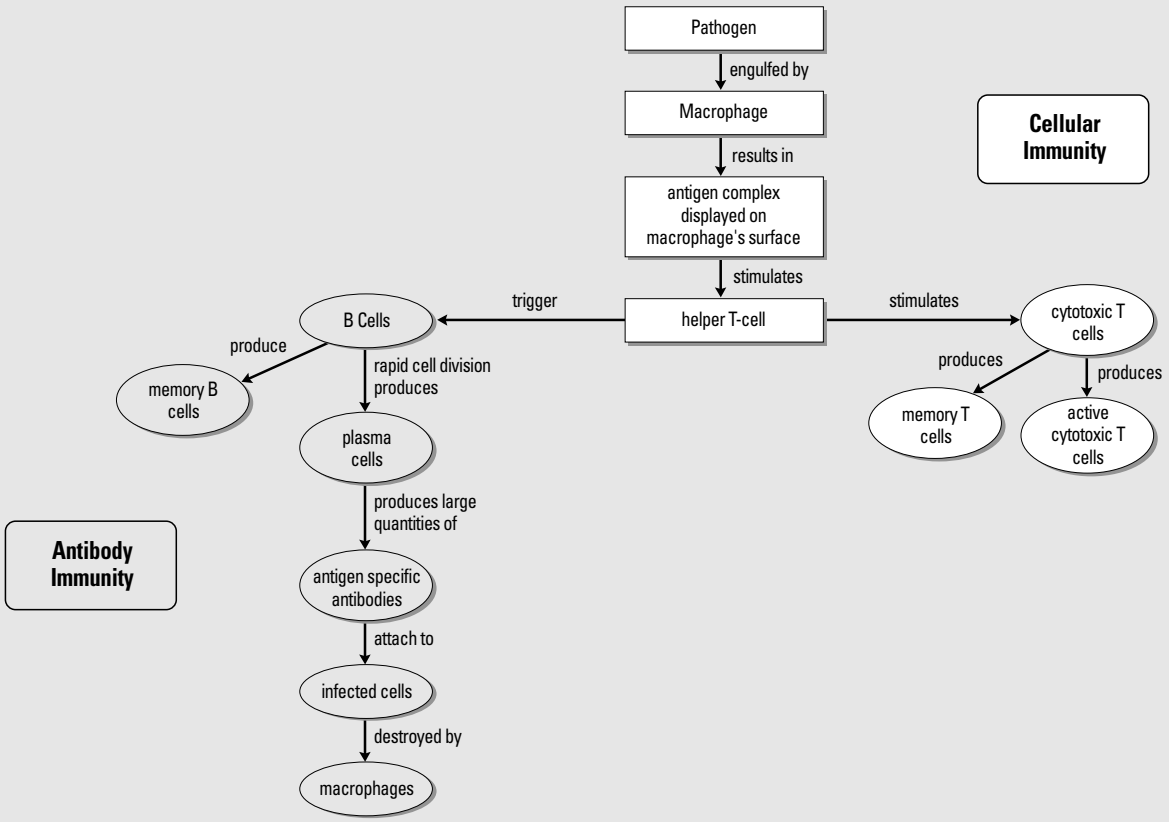
Students might also design an experiment to test the effect of temperature on the time it takes for blood to clot, since temperatures lower than body temperature prolong clotting time.

16. If the artificial blood could not carry carbon dioxide, there would be a build-up of carbon dioxide within the body tissues. The carbon dioxide would only be able to travel dissolved in the plasma. This would not be sufficient to satisfy the needs of the patient to transport carbon dioxide.

17. Students' diagrams should resemble Figure 8.4 on page 271 of the student textbook.

	Artery	Vein	Capillary	Lymph Vessels
Number of layers	3	3	1	lymph capillaries 1 cell thick
Elasticity	very	not very	no	no
Valves	no	yes	no	yes (larger vessels)
Function	transport blood away from the heart	transport blood towards the heart	gas and nutrient exchange	drain excess fluid from tissues and return to cardiovascular system

18. The concept map below is one example of a map that illustrates the relationship among different immune system cells.



19. Transplanted tissue from another individual contains antigens that stimulate an immune response from the host's T lymphocytes. The T lymphocytes would go through rapid cell division, producing helper T cells and cytotoxic T cells that attack the "invading" cells.

20. The following is an example of a possible answer.

Non-specific Immunity	Specific Immunity
Advantage: Always available, ready for immediate response against wide range of antigens—not just to specific antigens or those that were previously encountered by the immune system; thus non-specific immune defences especially important in first exposure to a particular type of foreign organism or substance.	Advantage: With the aid of memory cells, responses to subsequent exposure are faster, targeted, and more powerful than non-specific components of non-specific immune response; specific immune response capable of targeting and attacking cells in a malignant tumour.
Disadvantage: Specific immune response is potentially more effective than non-specific immune response; response to a particular antigen is always the same regardless of the number of times in contact with that antigen.	Disadvantage: Response is slower than non-specific immune response; more time required to reach maximal response to first exposure to a particular type of antigen.

21. (a) If the blood in the container is indeed blood type B as labelled, then the following results will occur when it is mixed with blood types A, AB, and O. If the patient has blood type B as shown on her chart, then the same results would occur when mixing her blood with the three samples.

Blood Type Samples	Results after mixing Blood Type B with Samples
A (anti-B antibodies)	agglutination
AB (no anti-A or anti-B antibodies)	no agglutination
O (anti-A and anti-B antibodies)	agglutination

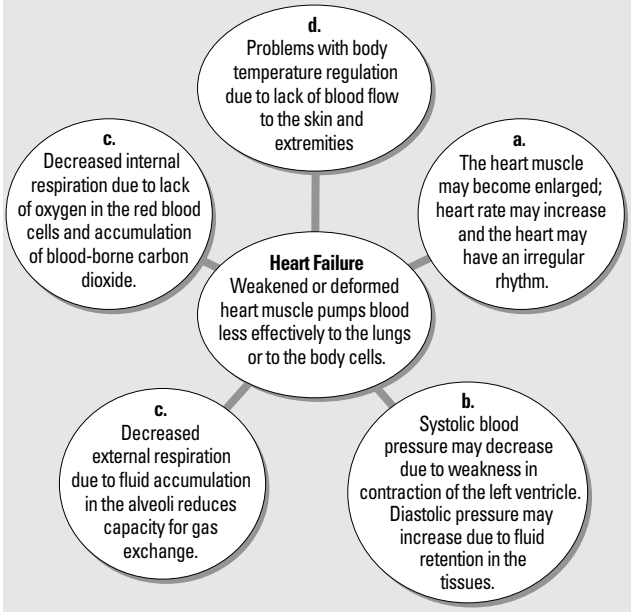
(b) If the patient has blood type B, then blood type O could be used for the transfusion, provided that the Rh factor is also compatible.

22. (a) Damage to the left atrioventricular valve would result in a "whoosh" sound after the lub sound, signifying backflow of blood into the left atrium.

(b) Damage to the aortic semilunar valve would result in a "whoosh" sound after the dub sound, signifying backflow of blood to the left ventricle.

(c) Damage to the AV node may result in an irregular contraction of the ventricles.

23. Student graphic organizers should include the following points:



24.(a) Blood pressure decreases with distance from the left ventricle because there are more arterioles than arteries, which increases the total cross-sectional area of the blood vessels. Blood pressure is highest in the aorta and lowest in the vena cavae.

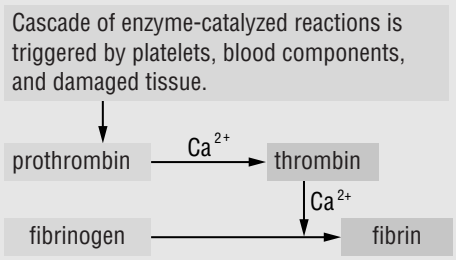
(b) The decrease in blood pressure as blood moves from arteries to capillaries causes the blood velocity to gradually decrease as it flows towards the capillaries.

Because there are more capillaries than arteries, blood moves even more slowly through the capillaries.

Blood velocity increases slightly in the venous vessels.

(c) The increase in the velocity of the blood in the veins is due to a progressive reduction in the cross-sectional area as small venules join to form larger veins.

25. (a) A student flow chart might appear as follows:



The process of blood clotting is complex and involves many steps that are not described in this flow chart. Hemophilia is caused by abnormalities in factors not shown. In classical hemophilia, Factor VIII is not produced. In a less common form of the disease called hemophilia B or Christmas disease (named after the family in which was discovered), Factor IX is not produced.

(b) Joints and other internal areas normally suffer minor injuries through activities such as sports and exercise. We are frequently unaware of small traumas that break internal blood vessels because the blood-clotting mechanism stops this internal bleeding within a few minutes. Bruises may or may not become visible. In hemophiliacs, this internal blood clotting does not occur and bleeding, especially into the joints, is a real danger because it cannot be stopped by applying bandages or pressure. With regular transfusions of the missing clotting factors, much internal bleeding in hemophiliacs can be controlled.

Answers to Making Connections Questions

26. Babies and younger children have not likely been exposed to as many pathogens as adolescents. As a result, their immune system is not prepared to prevent the disease. Some students may include information on vaccinations.

27. Allergies are hypersensitivities to substances, such as pollen or animal hair, which ordinarily would do no harm to the body. Environmental allergens stimulate various immune system responses, such as the production and activation of mast cells. Mast cells release excessive amounts of histamine, causing the cold-like symptoms typically associated with allergies.

28. These include trying to avoid direct contact with people with contagious infections, since contagious diseases, such as cold and flu, are spread by direct contact (shaking hands, handling paper from an infected person) and inhaling droplets in the air (which may contain viruses) that are released into the air when the person sneezes.

A very effective way to limit the spread of pathogens is regular and thorough hand-washing, since many pathogens enter our mouths from our fingers and from food eaten with unwashed hands.

29. Students might suggest a proportional link between body size and heart rate: the larger the body (and, therefore, the larger the heart), the slower the heart rate, and vice versa. Generally speaking, biologists believe this to be the case. Some students might also suggest a relationship between body size and metabolism, whereby smaller animals would tend to have faster metabolic rates and, therefore, faster heart rates. There is less agreement among scientists on this idea, due to the numerous factors that can affect metabolism, but many scientists do support it. Accept all reasoned and reasonable answers.

30. Angioplasty is a procedure in which a surgeon inserts a tube into a clogged artery in the heart. When the tube reaches the site of the clog, a tiny balloon is inflated to force the artery open. Frequently a stent, a tiny mesh tube, is then inserted. The stent is designed to keep the area open after the procedure.