CHAPTER 25 READING QUESTIONS

These reading questions are designed to help you focus your reading on the most important points in the chapter. They are arranged using chapter section headers so that the file can be easily edited to reflect the material covered in class.

25.1 METABOLISM AND EXERCISE

1. Muscles require ATP for contraction. What are the sources of this ATP? (Figs. 25.1, 25.2)

2. Without new ATP production, a muscle has enough ATP and phosphocreatine to supply energy for about _____ seconds of intense exercise.

3. What macromolecules are the primary substrates for energy production?

4. Discuss the advantages and disadvantages of anaerobic muscle metabolism versus aerobic metabolism. (Figs. 25.1, 25.2)

5. Where does muscle obtain glucose for ATP production? (Fig. 25.1)

6. True or false: Aerobic exercise first uses glucose for ATP production, then turns to fatty acid metabolism. (Fig. 25.3) Defend your answer.

7. Beta-oxidation is _____ (faster or slower?) than glucose metabolism through glycolysis.

8. What are the metabolic results of aerobic training and endurance training?

Hormones Regulate Metabolism during Exercise

9. List hormones that affect glucose and fat metabolism during exercise and briefly describe their actions.

10. What happens to insulin secretion during exercise? Give the physiological mechanism and the adaptive significance for this pattern of insulin secretion.

Oxygen Consumption Is Related to Exercise Intensity

11. Exercise intensity is quantified by measuring oxygen consumption (V_{O2}). Define oxygen consumption. In what units is oxygen consumption measured?
12. What is indicated by the maximal rate of oxygen consumption (V_{O2max})?
13. Increased O_2 consumption persists even after activity ceases. (Fig. 25.4) Why?

Several Factors Limit Exercise

14. When determining maximum oxygen consumption during aerobic exercise, cardiac efficiency is a _____ (more or less?) important determining factor than ventilation.
15. Identify other factors that can limit exercise.

25.2 Ventilatory Responses to Exercise

16. How do total pulmonary ventilation, alveolar ventilation, and rate and depth of breathing change in response to exercise?
17. Fill the gaps in the following pathways. (Fig. 25.5)
    a. Exercise begins → _____ (receptors) send signals to motor cortex.
    b. Motor cortex signals respiratory control center in the _____ to increase ventilation.
    c. As exercise continues, which sensory receptors send sensory feedback to the respiratory control center to ensure that O_2 use and ventilation are matched? What information is being reported by these receptors?
18. How does exercise hyperventilation maintain nearly normal P_{O2} and P_{CO2}? (Figs. 25.5, 25.6)

25.3 Cardiovascular Responses to Exercise

19. The cardiovascular control center (CVCC) responds to exercise with _____ (sympathetic or parasympathetic?) discharge. What effect does this have on cardiac output? Peripheral arterioles?

Cardiac Output Increases during Exercise

20. Cardiac output increases dramatically with strenuous exercise. What factors influence cardiac output? Which one of these factors has the greatest effect on cardiac output during exercise?
21. Describe how the autonomic nervous system influences heart function during exercise. Why are these changes necessary and important?

Muscle Blood Flow Increases during Exercise

22. During exercise, 88% of cardiac output is diverted to exercising muscles. (Fig. 25.7) Compare this to the cardiac output that goes to muscles during times of rest.
23. Describe the local and reflex processes that influence how the body redistributes blood flow during exercise.

Blood Pressure Rises Slightly during Exercise

24. What factors contribute to mean arterial blood pressure? How does each of these factors change during exercise? (Fig. 25.8a)
25. What is the net result of the changes in cardiac output and peripheral resistance during exercise? (Fig. 25.8)

The Baroreceptor Reflex Adjusts to Exercise

26. Normally, increased blood pressure triggers a homeostatic effort to return blood pressure to normal. During exercise, though, BP increases without activating homeostatic compensation. Why is this? Outline the possible mechanisms behind the exercise-related changes to the baroreceptor reflex.

25.4 Feedforward Responses to Exercise

27. Feedforward responses play a significant role in exercise physiology. For example, ventilation _____ (increases or decreases?) upon beginning exercise, despite normal P_{CO2} and P_{O2}. (Figs. 25.5, 25.6)
28. Describe one possible mechanism explaining the feedforward response to exercise.

25.5 Temperature Regulation During Exercise

29. What happens to most of the energy released during exercise metabolism?
30. Endurance exercise events can create core body temperatures of _____ °C.
31. Both homeostatic responses to increased temperature can disrupt other homeostatic conditions. Describe the body's responses and the homeostatic challenges of:
    a. sweating
    b. increased cutaneous blood flow
32. Faced with maintaining either blood pressure or body temperature, which will the body select? What would cause the body to choose the other parameter? Why?
33. Describe the changes that take place with acclimatization to exercise in hot environments.

25.6 Exercise and Health

34. Exercise can improve several pathological conditions. List some of these conditions.

Exercise Lowers the Risk of Cardiovascular Disease

35. Exercise lowers your risk of cardiovascular disease. How does exercise affect:
    a. BP
    b. plasma triglycerides
    c. HDL levels

Type 2 Diabetes Mellitus May Improve with Exercise

36. Regular exercise can improve type 2 diabetes mellitus. Briefly describe how this is so. (Fig. 25.9)

Stress and the Immune System May Be Influenced by Exercise

37. Few rigidly controlled studies support that exercise boosts immunity, prevents cancer, or helps HIV-positive people fight AIDS. In fact, strenuous exercise can be detrimental. What is the physiology behind the potentially detrimental effects of strenuous exercise? (Fig. 25.10)
38. What does research indicate about the relationship of exercise and depression? Is this relationship proved by the evidence or overstated?