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Conditioning for Strength and Human Performance, Third Edition

Chapter 2: The Cardiorespiratory System

Multiple Choice

1. The difference between end-diastolic volume and end-systolic volume is known as:
   A) cardiac output
   B) ejection fraction
   C) stroke volume
   D) cardiac cycle

Answer: B

2. Decreases in heart rate as a result of training is likely the result of:
   A) increased parasympathetic activity
   B) increased sympathetic activity
   C) decreased sympathetic activity
   D) a combination of answers a and c

Answer: D

3. Increases in stroke volume during the early phases of exercise are the result of an increase in left ventricular end-diastolic volume. This is a result of:
   A) Frank-Starling mechanism
   B) Law of LaPlace
   C) Fick principle
   D) Bohr effect

Answer: A

4. Which statement is not correct relating to cardiovascular changes during an acute exercise bout?
   A) blood is diverted from the kidneys to exercising muscle
   B) heart rate increases linearly with increases in work load

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C) diastolic blood pressure will increase at the beginning of exercise and then level off

D) as exercise duration becomes prolonged, heart rate has a tendency to gradually increase

Answer: C

5. Oxygen dissociates from hemoglobin more rapidly when:

A) hemoglobin concentrations are reduced

B) pH levels are reduced

C) lactate concentrations are reduced

D) carbon dioxide levels are lowered to 20 mmHg

Answer: B

6. Maximal aerobic capacity is determined by:

A) cardiac output and $(a-v)O_2$ difference

B) cardiac output and heart rate

C) heart rate and $(a-v)O_2$ difference

D) stroke volume and heart rate

Answer: A

7. Concentric hypertrophy of the left ventricle is best described as:

A) cardiac morphological adaptation resulting from endurance training

B) increased wall thickness with a decrease in the internal diameter of the left ventricle

C) increased wall thickness with no change in the internal diameter of the left ventricle

D) increased internal diameter of the left ventricle

Answer: C

8. Which statement concerning cardiovascular changes to endurance training is *not* correct?

A) decreases in hematocrit are a result of plasma volume expansion

B) maximal heart rate will increase, but only after years of training

C) left ventricular mass is approximately 45% greater in highly trained athletes

D) resting bradycardia is often seen after prolonged endurance training

Answer: B

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9. Which statement is most accurate concerning cardiovascular adaptations in a resistance-trained athlete?
   A) increases in cardiac output are generally seen after 8–10 weeks of training
   B) walls of the left ventricle increase in size at the expense of internal diameter
   C) walls of the left ventricle increase in size with no change in internal diameter
   D) resting blood pressure become elevated

Answer: C

10. Which of the following is not part of the conduction system in the heart?
   A) mitral valve
   B) sinoatrial node
   C) atrioventricular node
   D) bundle of His

Answer: A

11. Which answer is most correct concerning capillary microcirculation and oxygen diffusion?
   A) the combination of small surface area, fast rate of blood flow and thick layer of endothelial cells makes this an ideal place for gas exchange
   B) the combination of large surface area, slow rate of blood flow and thin layer of endothelial cells makes this an ideal place for gas exchange
   C) the combination of small surface area, slow rate of blood flow and thick layer of endothelial cells makes this an ideal place for gas exchange
   D) the combination of large surface area, fast rate of blood flow and thick layer of endothelial cells makes this an ideal place for gas exchange

Answer: B

12. Adaptations to the morphology of the heart are governed by:
   A) Frank-Starling mechanism
   B) law of LaPlace
   C) Fick principle

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D) Bohr effect

Answer: B

13. When exercise is prolonged or performed in a hot environment an increase in heart rate may be seen with a concomitant decrease in stroke volume. This phenomenon is known as:

A) law of LaPlace

B) Bohr Effect

C) Cardiac Drift

D) Valsalva Effect

Answer: C

14. Which statement concerning exercising in the heat is not correct?

A) an increase in blood pooling in the periphery is typically seen

B) heart rate will increase to compensate for the reduction in blood volume

C) cardiac output will remain the same despite the increase in heart rate

D) the evaporative cooling provided by increasing sweat rate serves to restore blood volume

Answer: D

15. Which of the following would be expected to occur during prolonged exposure to altitude?

A) lung volumes tend to decrease

B) red blood cell production tends to increase

C) hemoglobin concentrations tend to decrease

D) partial pressure of oxygen tends to increase

Answer: B

True/False

16. True or False? Maximal heart rate can be elevated through prolonged, high intensity endurance training.

Answer: False

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17. True or False? The sinoatrial node is also known as the pacemaker of the heart.

Answer: True

18. True or False? A reduction in resting heart rate is likely the result of increased sympathetic stimulation.

Answer: False

19. True or False? The primary mechanism controlling oxygen diffusion from the capillaries to the tissues is pressure gradients created by the partial pressure of oxygen in each area.

Answer: True

20. True or False? Systolic blood pressure will increase linearly during dynamic exercise.

Answer: True

21. True or False? The primary mechanism causing hypervolemia is an increase in red blood cell number.

Answer: False

22. True or False? During exercise blood flow is diverted away from essential organs to exercising muscles.

Answer: False

23. True or False? An elevation in heart rate is a common response to exercise in the heat.

Answer: True

Fill in the Blanks

24. During initial exposure at altitude (at elevations above 3,000 m) decreases in plasma volume appear to be a result of both a _____ and _____.

Answer: diuresis and natiuresis

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25. Cardiac output is the product of _____ and _____.

Answer: Stroke volume and Heart rate

26. Parasympathetic stimulation of the vagus nerves has a _____ effect on SA node activity.

Answer: depressant

27. During rest the heart spends about _____% of its time in diastole.

Answer: 60

28. The _____ is a thick solid muscular wall that separates the right and left ventricles.

Answer: interventricular septum

29. The rapid augmentation of stroke volume during exercise is due to the _____.

Answer: Frank-Starling mechanism.

30. Prolonged endurance training appears to _____ blood volume and _____ red blood cell number.

Answer: Increase and increase

Essay

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31. Describe the different physiological adaptations that are seen in cardiac morphology between prolonged endurance training and resistance training.

    Answer: The answer should include description of both eccentric and concentric hypertrophy of the left ventricle as a result of volume and pressure overloads, respectively.

32. Describe the Frank-Starling mechanism and how it impacts exercise performance.

    Answer: The answer should describe the greater volume of blood returning to the heart during exercise that results in a stretching of the ventricles to a greater extent than normal. This will result in a more forceful contraction causing a greater volume of blood to be ejected from the heart. This greater stroke volume will enhance blood flow to the exercising muscles.

33. When exercising in the heat at the same intensity a runner notices that her heart rate is gradually increasing. Can you describe what is happening to this athlete?

    Answer: The answer should include that this phenomenon is known as cardiovascular drift and is often seen during prolonged exercise in the heat when intensity of the exercise remains the same. It reflects a decrease in stroke volume that occurs as blood is diverted to the periphery to help in the cooling process. To compensate for the decrease in stroke volume, sympathetic stimulation causes the heart rate to elevate.

34. Why is hyperventilation often seen as an individual begins to ascend above sea level?

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Answer: The answer should include discussion of changes in the partial pressure of oxygen as one gains altitude. As a result the gradient between oxygen in the tissues and the vasculature will drop causing a significant reduction in the speed at which oxygen moves between the capillaries and the tissues. To compensate for the reduced PO_2 breathing rate is increased.

35. Compare the resting cardiovascular adaptations that are associated with endurance training and resistance training.

Answer: The answer should include discussion of heart rate (decrease during endurance training, while a decrease or no change may be seen during resistance training), blood pressure (dependent upon initial levels – if slightly elevated it may decrease from both modes of training, however, if BP was normal no change is likely regardless of the mode of exercise), stroke volume (increase in endurance training no change during resistance training), and cardiac output (no change from either endurance or resistance training).

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