



**AMREF INTERNATIONAL UNIVERSITY
SCHOOL OF MEDICAL SCIENCE
DEPARTMENT OF REHABILITATION MEDICINE
BACHELOR OF SCIENCE IN PHYSIOTHERAPY
END OF SEPT-DECEMBER 2024 TRIMESTER EXAMINATIONS**

UNIT CODE: PHT 215 UNIT NAME: EXERCISE PHYSIOLOGY
DATE: Tuesday / 3rd/ AUGUST
TIME: TWO HOURS
START: 11:15AM STOP : 1:15PM

INSTRUCTIONS (physical exams)

Do not write on this question paper

(Marks and questions distribution as per program curriculum.)

1. This exam is marked out of 70 marks
2. This Examination comprises 3 Sections
3. This exam shall take 2 Hours

1. What is the main function of the link reaction between glycolysis and the Krebs cycle?
 - A. To break down glucose further
 - B. To transport pyruvate into the mitochondria
 - C. To generate a significant amount of ATP
 - D. To release carbon dioxide as a waste product
2. Which of the following statements is NOT true about the electron transport chain?
 - A. It utilizes the high-energy electrons from NADH and FADH₂.
 - B. It pumps protons across the inner mitochondrial membrane.
 - C. It directly produces ATP through substrate-level phosphorylation.
 - D. It contributes to the creation of a proton gradient for chemiosmosis.
3. A marathon runner's heart rate increases to 180 beats per minute and stroke volume increases to 120 milliliters per beat during a race. Calculate their cardiac output.
 - A. 18,000 ml/min
 - B. 21,600 ml/min
 - C. 24,000 ml/min
 - D. 27,000 ml/min
4. Why is ATP considered the "ground zero" of human energy?
 - A. It is the only source of energy for cells
 - B. It is the most abundant molecule in the body
 - C. It is the immediate energy currency for cellular processes
 - D. It is synthesized exclusively in the mitochondria
5. Which of the following best describes the role of the Z line in a sarcomere?
 - A. It serves as a point of attachment for the actin filaments.
 - B. It regulates the release of calcium ions.
 - C. It is the site of the neuromuscular junction.
 - D. It prevents the overstretching of muscle fibers.
6. Which of the following best describes the role of ATP in the sliding filament theory of muscle contraction?
 - A. It prevents muscle relaxation.
 - B. It increases the length of the sarcomere.
 - C. It provides the energy for the myosin heads to bind to actin and move.
 - D. It regulates the release of calcium ions.
7. What is the primary role of acetylcholine in the process of muscle contraction?
 - A. To initiate the depolarization of the sarcolemma.
 - B. To stimulate the release of calcium from the sarcoplasmic reticulum.
 - C. To bind to troponin and expose the myosin binding sites on the actin filaments.
 - D. To increase the sensitivity of the muscle fiber to electrical stimulation.

8. Based on your knowledge about types of muscle fibers, which of the following muscles is most likely to contain a high proportion of type I fibers?
- The quadriceps femoris
 - The gastrocnemius
 - The soleus
 - The pectoralis major
9. Which of the following statements accurately describes the relationship between muscle fiber V_{max} and myosin ATPase activity?
- Higher myosin ATPase activity is associated with lower V_{max} .
 - Myosin ATPase activity has no effect on V_{max} .
 - Higher myosin ATPase activity is associated with higher V_{max} .
 - Myosin ATPase activity is inversely related to V_{max} .
10. Which of the following statements accurately compares the efficiency of type I and type IIx muscle fibers?
- Type I fibers are less efficient than type IIx fibers due to their higher myosin ATPase activity.
 - Type IIx fibers are more efficient than type I fibers due to their greater anaerobic capacity.
 - Type I fibers are more efficient than type IIx fibers due to their lower rate of ATP turnover.
 - Both type I and type IIx fibers have similar efficiency.
11. Compared to moderate-intensity exercise, the total Excess Post-Exercise Oxygen Consumption (EPOC) is greater following heavy or very heavy exercise primarily due to.
- Higher levels of circulating hormones.
 - Increased heart rate and breathing rate.
 - Greater depletion of ATP and PC.
 - Increased oxidative conversion of lactate to glucose.
12. Which of the following is the most accurate definition of Excess Post-Exercise Oxygen Consumption (EPOC)?
- The oxygen deficit incurred at the onset of exercise.
 - The elevated oxygen uptake above resting levels during exercise.
 - The excess post-exercise oxygen consumption required to replenish energy stores and restore homeostasis.
 - The repayment of the oxygen debt incurred during exercise.

13. Which of the following statements best compares the metabolic characteristics of cardiac and skeletal muscle?
- A. Both cardiac and skeletal muscle primarily rely on anaerobic glycolysis for energy production.
 - B. Cardiac muscle is highly aerobic and relies on oxidative metabolism, while skeletal muscle is more glycolytic.
 - C. Skeletal muscle is highly aerobic and relies on oxidative metabolism, while cardiac muscle is more glycolytic.
 - D. Both cardiac and skeletal muscle are highly aerobic and rely on oxidative metabolism.
14. Which of the following statements accurately describes the role of the autonomic nervous system in heart rate regulation during exercise?
- A. The autonomic nervous system primarily influences heart rate during exercise through changes in parasympathetic activity.
 - B. Sympathetic activity is solely responsible for increasing heart rate during exercise, while parasympathetic activity remains constant.
 - C. The initial increase in heart rate during exercise is primarily due to a withdrawal of parasympathetic activity, followed by a gradual increase in sympathetic activity.
 - D. Parasympathetic activity remains dominant throughout exercise, ensuring a steady increase in heart rate.
15. The concept of the "heart rate threshold" suggests that:
- A. Heart rate increases linearly with exercise intensity throughout the entire exercise bout.
 - B. There is a point at which the rate of increase in heart rate begins to slow down, even though exercise intensity continues to increase.
 - C. Heart rate remains relatively constant at a plateau during submaximal exercise.
 - D. Heart rate increases rapidly at the beginning of exercise but then plateaus quickly.
16. Which of the following statements is true regarding cardiac output in untrained individuals during exercise?
- A. Cardiac output increases solely due to increases in heart rate at work rates greater than 40-60% $\dot{V}O_2$ max.
 - B. Stroke volume increases significantly at work rates greater than 40-60% $\dot{V}O_2$ max.
 - C. Cardiac output increases primarily due to increases in stroke volume at work rates greater than 40-60% $\dot{V}O_2$ max.
 - C. Cardiac output remains constant at work rates greater than 40-60% $\dot{V}O_2$ max.

17. Which of the following statements is true regarding the $a-\bar{v}O_2$ difference during exercise?
- A. It remains constant as exercise intensity increases.
 - B. It decreases as exercise intensity increases.
 - C. It increases as exercise intensity increases due to increased oxygen extraction by tissues.
 - D. It increases as exercise intensity increases due to increased cardiac output.
18. Which of the following statements accurately describes the relationship between exercise intensity and blood flow distribution during exercise?
- A. As exercise intensity increases, blood flow to skeletal muscles remains constant while blood flow to the splanchnic circulation decreases linearly.
 - B. As exercise intensity increases, blood flow to both skeletal muscles and the splanchnic circulation increases linearly.
 - C. As exercise intensity increases, blood flow to skeletal muscles increases linearly while blood flow to the splanchnic circulation decreases linearly.
 - D. As exercise intensity increases, blood flow to skeletal muscles increases exponentially while blood flow to the splanchnic circulation decreases linearly.
19. Which of the following statements accurately describes the relationship between heart rate, blood pressure, and exercise type?
- A. During arm work, both heart rate and blood pressure increase significantly compared to leg work, even at the same oxygen consumption level.
 - B. Leg work leads to a higher heart rate and blood pressure response than arm work, regardless of the oxygen consumption.
 - C. Heart rate and blood pressure remain relatively unchanged during both arm and leg work as long as oxygen consumption is maintained.
 - D. The type of exercise (arm vs. leg) does not influence heart rate or blood pressure response.
20. Compare and contrast the effects of hot and humid environments on athletic performance, focusing on the mechanisms of heat dissipation.
- A) Both hot and humid environments pose similar challenges to athletes, primarily due to increased core temperature.
 - B) Humid environments are more detrimental to athletic performance than hot environments due to their ability to inhibit sweat evaporation.
 - C) Hot environments are more detrimental to athletic performance than humid environments due to their potential for dehydration.
 - D) The effects of hot and humid environments on athletic performance are largely dependent on the intensity of the exercise.

21. A professional soccer player is preparing for a crucial match in a tropical country with high temperatures and humidity. The player has been training diligently but is concerned about their ability to maintain focus and make quick decisions during the game. Given the athlete's concerns, which of the following statements best describes the potential impact of environmental temperature on their cognitive function?
- A. Environmental temperature has no significant effect on cognitive function during athletic performance.
 - B. Cold environments can enhance cognitive function during athletic performance by increasing blood flow to the brain.
 - C. Warm environments can impair cognitive function during athletic performance by altering catecholamine levels and affecting decision-making.
 - D. The impact of environmental temperature on cognitive function is solely determined by individual differences in heat tolerance.
22. Which of the following air pollutants would likely have the most immediate and significant impact on athletic performance during a high-intensity workout?
- A. Carbon dioxide
 - B. Particulate matter (PM10)
 - C. Carbon monoxide
 - D. Nitrogen oxides (NO_x)
23. A professional athlete is training in a city with high levels of air pollution. The athlete has been experiencing symptoms such as coughing, shortness of breath, and decreased endurance during workouts. What advice would you give the athlete regarding their training regimen in this polluted environment?
- A. Increase the intensity of workouts to improve lung capacity and tolerance to pollution.
 - B. Train indoors in an air-conditioned environment as much as possible.
 - C. Supplement with antioxidants to counteract the harmful effects of pollution.
 - D. Reduce the duration and intensity of workouts to minimize exposure to pollution.
24. Acclimatization to high altitude involves several physiological adaptations. Which of the following is NOT a key component of this process?
- A. Increased red blood cell production
 - B. Decreased heart rate
 - C. Elevated hemoglobin levels
 - D. Enhanced oxygen-carrying capacity
25. During ball flight the aerodynamic properties of a ball can be influenced by altitude. Which of the following is a potential consequence of this phenomenon on athletic performance?
- A. Increased ball speed
 - B. Reduced ball spin
 - C. Decreased ball trajectory
 - D. Increased ball weight

26. DOMS is primarily associated with:
- A. Isometric contractions
 - B. Concentric contractions
 - C. Eccentric contractions
 - D. Static stretching
27. Which of the following conditions is NOT commonly associated with central fatigue?
- A. Muscles appear to stop listening when fatigue sets in
 - B. No pain sensation or discomfort associated with the fatigue
 - C. Difficulty in maintaining cognitive vigilance
 - D. Individuals have sleep disturbances
28. You're planning a recreational scuba diving trip to a tropical island. While researching the location, you discover that the average depth of the dive sites is 30 meters. You usually dive at local sites with depths of 10-15 meters. Which of the following type of exercises will you NOT include in your preparation for the deeper dives, considering the potential effects of pressure on your body?
- A. Endurance and cardio exercise
 - B. Flexibility exercise
 - C. Resistance exercises
 - D. Deep breathing exercises
29. During periods of stress or "fight-or-flight" response, which hormone would be expected to cause a rapid rise in blood glucose levels?
- A. Insulin
 - B. Glucagon
 - C. Epinephrine
 - D. Thyroid hormone
30. A person weighs 70 kg and is 1.8 meters tall. What is their BMI (rounded to the nearest whole number)?
- A. 17
 - B. 20
 - C. 23
 - D. 26

Section B Answer all the question

1. Define VO₂ Max (1 Mark)
2. Distinguish between conducting zone and respiratory zones in the respiratory system (4 Marks)
3. Epinephrine and norepinephrine hormones are termed as fast acting hormones. List three of their functions (3 Marks)
4. Explain how insulin and glucagon hormones work in the body (6 Marks)
5. Discuss the procedure of measurement of the waist hip ratio (6 Marks)

Section C: Choose one of the following questions

1. The liver plays a crucial role in energy generation and substrate interconversion, particularly during fasting or exercise. Discuss in details its role during exercises. (20 Marks)
2. A 25-year-old male athlete, previously sedentary, begins a rigorous training program. The program involves alternating short bursts of intense exercise which occasions of low intensity long duration conditioning exercises with brief periods of rest. Discuss the effect of anaerobic and aerobic exercise on the Heart rate, blood pressure and stroke volume/cardiac output (20 Marks)