



AMREF INTERNATIONAL UNIVERSITY
SCHOOL OF MEDICAL SCIENCES
DEPARTMENT OF REHABILITATIVE MEDICINE
BACHELOR OF SCIENCE IN PHYSIOTHERAPY
END OF JAN-APRIL 2024 SEMESTER EXAMINATIONS

UNIT CODE: PHT 215

UNIT NAME: EXERCISE PHYSIOLOGY

DATE: 17TH APRIL 2024

TIME: TWO HOURS

START: 9:00 AM STOP: 11:00AM

INSTRUCTIONS

- 1. Attempt all questions as per the instructions in each section**
- 2. This exam is marked out of 70 marks**
- 3. This Examination comprises of Sections A, B and C**
- 4. It is the student's responsibility to report any page and number missing in this paper.**
- 5. Total number of pages are 8 including the cover page.**
- 6. Read through the instructions carefully before starting.**
- 7. Any aspect of cheating detected during and or after the exam administration will lead to nullification of your exam.**
- 8. Do not write on this question paper, use the provided booklet to write your answers**

SECTION A

Answer all the questions

1. Which of the following statements is TRUE about gas exchange in the alveoli?
 - (a) Oxygen diffuses from the alveoli into the blood
 - (b) Carbon dioxide diffuses from the alveoli into the blood.
 - (c) The alveoli are filled with fluid, hindering gas exchange.
 - (d) The diaphragm actively pumps gases across the alveolar membrane.
2. What is the approximate surface area of the alveoli in a human lung?
 - (a) 1 square meter
 - (b) 10 square meters
 - (c) 40 square meters
 - (d) 80 square meters
3. During incremental exercise, the initial increase in minute ventilation is primarily due to:
 - (a) Increased tidal volume
 - (b) Increased respiratory rate
 - (c) A combination of both (a) and (b)
 - (d) Activation of the sympathetic nervous system
4. Which of the following statement is NOT TRUE about the respiratory system as a system of energy delivery
 - (a) Pulmonary ventilation increases during exercise are indirect proportional to the intensity of exercise and the increased need for oxygen.
 - (b) Contraction and relaxation of these respiratory muscles are directly controlled by somatic motor neurons in the spinal cord.
 - (c) The respiratory system has a pacemaker and a control system that increases breathing to match ventilation to the metabolic rate.
 - (d) The major muscle of inspiration, the diaphragm, is a highly oxidative muscle that resists fatigue.
5. During exercise, cardiac output increases primarily due to:
 - (a) Increased heart rate (HR) only.
 - (b) Increased stroke volume (SV) only.
 - (c) A combined increase in both HR and SV.
 - (d) A decrease in both HR and SV.
6. As exercise intensity increases, stroke volume eventually reaches a plateau in the untrained and moderate trained persons due to:
 - (a) Increased blood flow to the heart muscle
 - (b) Limited filling time of the ventricles
 - (c) Decreased oxygen availability
 - (d) Exhaustion of the heart muscle

7. During exercise, blood flow is redistributed away from the following organ systems. Which organ system is MOST affected by this redistribution?
- (a) Skeletal muscles
 - (b) Digestive system
 - (c) Cardiovascular system
 - (d) Brain
8. Which of the following mechanisms contributes to the increased blood flow to working muscles during exercise?
- (a) Vasodilation of blood vessels in active muscles
 - (b) Increased blood pressure
 - (c) Decreased activity of the sympathetic nervous system
 - (d) Both (a) and (b)
9. Why is the redistribution of blood flow crucial during exercise?
- (a) To maintain blood pressure within a normal range
 - (b) To deliver oxygen and nutrients to working muscles
 - (c) To regulate body temperature
 - (d) All of the above
10. What is the term for the rate at which your body burns calories at rest?
- (a) Basal Metabolic Rate (BMR)
 - (b) Daily Energy Expenditure (DEE)
 - (c) Physical Activity Energy Expenditure (PAEE)
 - (d) Thermic Effect of Food (TEF)
11. Which type of calorimetry measures the heat change by monitoring the temperature change of a substance?
- (a) Direct Calorimetry
 - (b) Indirect Calorimetry
 - (c) Differential Scanning Calorimetry
 - (d) Bomb Calorimetry
12. Indirect calorimetry relies on measuring which of the following to estimate heat production?
- (a) Temperature change
 - (b) Heat transfer rate
 - (c) Oxygen consumption and carbon dioxide production
 - (d) Specific heat of the system

13. Bomb calorimeters are a type of: _____ calorimetry.
- (a) Direct
 - (b) Indirect
 - (c) Isothermal
 - (d) Differential Scanning
14. Which of the following statements is NOT TRUE about the direct calorimeters
- (a) It is the gold standard measurement for estimating calories
 - (b) Bomb calorimeters are device designed to measure the amount of heat liberated
When combusting food
 - (c) It is the most cost effect method of calculating energy expenditure
 - (d) It is the method best suited to exercise physiology.
15. You eat a grilled chicken breast (30g protein) and steamed vegetables (10g carbs).
What's the total calorie intake? (1 gram of protein = 4 calories, 1 gram of carbs = 4
calories)
- (a) 160 calories
 - (b) 180 calories
 - (c) 200 calories
 - (d) 220 calories
16. A restaurant dish lists its ingredients: 100g rice (77 calories per 100g), 50g grilled fish
(180 calories per 100g), and 60g vegetables (30 calories per 100g). What's the total
calorie content?
- (a) 467 calories
 - (b) 547 calories
 - (c) 627 calories
 - (d) 707 calories
17. Which of the following is NOT a common symptom of peripheral fatigue?
- (a) Tingling or numbness in the hands and feet
 - (b) Muscle cramps
 - (c) Difficulty in maintaining cognitive alertness
 - (d) A weak grip

18. If you are experiencing persistent peripheral fatigue, it is advisable to:
- (a) Self-diagnose and treat the condition
 - (b) Consult a healthcare professional for proper diagnosis and treatment
 - (c) Ignore the symptoms and hope they go away on their own
 - (d) Increase your intake of sugary drinks
19. Why is it difficult to definitively describe the growth hormone response to exercise?
- (a) Growth hormone levels are not affected by exercise.
 - (b) The response varies greatly depending on the type, intensity, and duration of exercise.
 - (c) There is no reliable method to measure growth hormone accurately.
 - (d) Both b and c
20. What type of exercise is most effective in mitigating the negative effects of microgravity on the human body?
- (a) Cardiovascular exercise
 - (b) Resistance training
 - (c) Flexibility exercises
 - (d) All the above
21. Beta-blockers are medications that target which hormone system?
- (a) Epinephrine-norepinephrine system
 - (b) Insulin-glucagon system
 - (c) Thyroid hormone system
 - (d) Testosterone-estrogen system
22. You a physiotherapist of a local hockey team and you have received a communication from your coach about a camp training which will take place on a higher altitude for 2 weeks. Which of the following exercises will you give the players to prepare them altitude camp training?
- (a) Strengthening exercises
 - (b) High intensity interval training
 - (c) Endurance exercises/activities
 - (d) All the above

23. How does cortisol's action on carbohydrate metabolism oppose the effects of growth hormone?
- (a) Cortisol stimulates glycogenolysis (breakdown of glycogen), while growth hormone promotes glycogen synthesis.
 - (b) Cortisol increases glucose uptake by cells, while growth hormone reduces it.
 - (c) Cortisol promotes gluconeogenesis (glucose production), while growth hormone inhibits it.
 - (e) All of the above
23. Your exercise partner feels well motivated to go for some high intensity outdoor exercise this afternoon. However, the local weather news channel reports increased level of air quality index (AQI) to high due to smog. What advice should you give your partner?
- (a) Advice that you abandon the exercise session until the smog clears since its not good for your respiratory system
 - (b) Agree to join your partner and continue with the exercise plan as suggested
 - (c) Agree to join your partner and advice to engage in low intensity work-outs instead
 - (d) Advice that you go for the high intensity exercise but on condition that you wear face mask to reduce the effect of the increased level of AQI
25. What is the most important aspect of proper skinfold measurement technique?
- (a) Using calipers with strong pressure
 - (b) Pinching the skin at random locations
 - (c) Following standardized protocols and landmarks
 - (d) Taking multiple measurements without averaging
26. Which of the following anatomical sites is NOT considered for girth measurement?
- (a) Abdomen: 1 inch above the umbilicus
 - (b) Calf: widest girth midway between the ankle and knee
 - (c) Upper arm: midpoint between the shoulder and the elbow
 - (d) Pelvis: Anterior superior iliac spine
27. As a physiotherapist of a soccer team, you have discovered that the next soccer match in two days will be played in 5 degrees above the normal temperature. Which of following will you advice your players

- (a) Take water only when feeling thirsty
- (b) Sip water regularly throughout the match
- (c) Take energy drinks during the several breaks in the match
- (d) Wear tight fitting clothes to maintain core temperature of the body

28. An athlete with exercise-induced asthma finds that their symptoms worsen during intense training sessions. Which of the following modification is NOT advisable for them to avoid in order to minimize the risk of an asthma attack?

- (a) Consider medical consultation
- (b) Quit exercises all together
- (c) Adjust the intensity and duration of the exercise
- (d) Consider learning controlled breathing techniques

29. A patient undergoes an indirect calorimetry test. During the test data collected reveals, $\dot{V}_i = 80$ L/min, $F_{iO_2} = 20.93\%$, $\dot{V}_e = 78.6$ L and $F_{eO_2} = 18.6\%$

Using this formula, calculate the $\dot{V}O_2$?

$$\dot{V}O_2 = (\dot{V}_i \times F_{iO_2}) - (\dot{V}_e \times F_{eO_2})$$

- (a) 2.12L/Min
- (b) 2000ml/Min
- (c) 1.12L/Min
- (d) 2L/Min

30. In which part of the cell does the Krebs cycle occur?

- (a) Cytoplasm
- (b) Nucleus
- (c) Mitochondrial matrix
- (d) Endoplasmic reticulum

31. 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

SECTION B

1. Bruno is 1.75M tall and weighs 68.04 Kg.

a) What is his BMI? (2 Marks)

b) Using the BMI classification system, categorize his BMI (1Mark)

BMI	Weight status
Below 18.5	Underweight
18.5- 24.9	Healthy weight (normal)
25.0 -29.9	Overweight
30 and above	Obesity

2. Describe respiratory ration (2 Marks)

3. Patient X has a Stroke Volume (SV) of 120ml and has an End Diastolic Volume (EDV) of 140ml. Calculate the ejection fraction of patient X (3 marks).

4. Briefly describe the Krebs cycle which is one of the stages of cellular respiration. (4 Marks)

5. Explain the difference between the systemic gas exchange and the alveolar gas exchange (4 Marks)

6. Explain the auto-regulation phenomenon as a cardiovascular response to exercise. (4 Marks)

Section C Attempt one of the following questions

1. a. You are a developer working on a new fitness app that helps users track their calorie intake and expenditure. As part of the app's features, you want to incorporate an estimation of the user's Basal Metabolic Rate (BMR). Identify and discuss 3 factors explaining how they influence the calories burnt at rest (10 Marks).

b. Discuss 5 factors that affect the Thermic Effect of Food (TEF) (10 Marks)

2. Discuss the effects of the following environmental factors on the human body during submaximal exercise workouts (20 Marks)
- i. Temperature: How does hot and cold weather influence performance
 - ii. Altitude:
 - iii. Depth and microgravity
 - iv. Air quality

AMMU