

**UNIVERSITY OF BOLTON**  
**SCHOOL OF ENGINEERING**  
**BIOMEDICAL ENGINEERING**  
**SEMESTER TWO EXAMINATIONS 2021/2022**  
**CLINICAL ANATOMY AND PHYSIOLOGY**  
**MODULE NO: BME4005**

Date: Wednesday 18<sup>th</sup> May 2022

Time: 10:00 – 12:00

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**INSTRUCTIONS TO CANDIDATES:** There are **SIXTY-TWO** questions.

Answer **ALL** questions.

Marks for parts of questions are shown in brackets.

This examination paper carries a total of 100 marks.

All working must be shown. A numerical solution to a question obtained by programming an electronic calculator will not be accepted.

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1. Which of the following is also referred to as voluntary muscle?
- a. skeletal muscle
  - b. smooth muscle
  - c. visceral muscle
  - d. cardiac muscle
- (1 mark)**
2. Which circuit is responsible for re oxygenating blood?
- a. Closed loop system
  - b. Pulmonary circuit
  - c. Systemic circuit
  - d. Aortic arch
- (1 mark)**
3. The connective tissue sheath that surrounds an individual skeletal muscle fibre is called the
- a. perimysium
  - b. sarcolemma
  - c. epimysium
  - d. endomysium
- (1 mark)**
4. Which of these blood vessels feeds blood into the right atrium?
- a. Aorta
  - b. Pulmonary vein
  - c. Hepatic artery
  - d. Superior vena cava
- (1 mark)**
5. During 60 minutes of submaximal exercise, the body temperature reaches a plateau after 35 – 45 minutes. This is an example of
- a. homeostasis
  - b. effector centre
  - c. steady state
  - d. changing internal environment
- (1 mark)**

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6. Calcium ions, responsible for turning on muscle contraction, are stored in the
- sarcolemma
  - T tubules
  - cross bridges
  - sarcoplasmic reticulum
- (1 mark)
7. The thick filaments of a myofibril are composed mainly of
- sarcoplasm
  - tropomyosin
  - actin
  - myosin
- (1 mark)
8. What is the name of the valve that separates the right atrium from the right ventricle?
- Aortic valve
  - Semi lunar valve
  - Bicuspid valve
  - Tricuspid valve
- (1 mark)
9. The precision with which a biological control system maintains homeostasis is termed
- positive feedback
  - negative feedback
  - set point
  - gain
- (1 mark)
10. The smallest functional unit of a muscle is the
- myofilament
  - sarcomere
  - Z disc
  - neuromuscular junction
- (1 mark)

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11. The active binding sites to which myosin cross-bridges attach during muscle contraction are found
- a. on the myosin filaments
  - b. on the actin filaments
  - c. on the Z discs
  - d. on the thick filaments

(1 mark)

12. Where is most of the blood distributed at rest?

- a. Arterial system
- b. The lungs
- c. Venous system
- d. The heart

(1 mark)

13. Which of the following components of a control system detects the stimulus

- a. Integrating centre
- b. Stimulus
- c. Receptor
- d. Effector

(1 mark)

14. On a Monark cycle ergometer a pedalling cadence of 50 revolutions per minute against a resistance of 2kg would result in a work rate of

- a. 60 watts
- b. 90 watts
- c. 120 watts
- d. none of the above

(1 mark)

15. Which blood vessels contain one- way valves to prevent backflow?

- a. Arteries
- b. Veins
- c. Capillaries
- d. Pulmonary arteries

(1 mark)

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16. The A band of a sarcomere contains
- a. actin and myosin filaments
  - b. actin filaments only
  - c. myosin filaments only
  - d. neither actin nor myosin
- (1 mark)**
17. Blood returning to the heart from the lungs enters which chamber?
- a. Left atrium
  - b. Left ventricle
  - c. Right atrium
  - d. Right ventricle
- (1 mark)**
18. What is the name of the small air filled sacks within the lungs?
- a. Pores of Kohn
  - b. Bronchioles
  - c. Alveoli
  - d. Pulmonary capillaries
- (1 mark)**
19. Which muscle fibre type is most predominant in the non-trained population?
- a. Type I.
  - b. Type IIa.
  - c. Type IIx.
  - d. Type IIc.
- (1 mark)**
20. The movement of air in and out of the lungs is called
- a. Pulmonary ventilation
  - b. Pulmonary diffusion
  - c. Capillary diffusion
  - d. Gas exchange
- (1 mark)**

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21. Acetylcholine (Ach) is

- a. one of the major waste products generated by muscle contraction
- b. the neurotransmitter that is released from motor nerves
- c. the chemical energy source for muscle contraction
- d. the enzyme that catalyses the splitting of ATP in a muscle fibre

(1 mark)

22. The volume of air expired on each breath is called

- a. Pulmonary ventilation rate
- b. Maximum voluntary ventilation
- c. Tidal volume
- d. Stroke volume

(1 mark)

23. Most control systems operate via what type of action?

- a. Negative feedback
- b. Thermostatic control
- c. Positive feedback
- d. Stimulus response

(1 mark)

24. The energy required for muscle contraction is supplied by

- a. inorganic phosphate (Pi)
- b. ADP
- c. ATP
- d. ATPase

(1 mark)

25. The respiratory membrane allows the diffusion of oxygen from the alveoli to

- a. pulmonary capillaries
- b. veins
- c. small bronchioles
- d. the heart

(1 mark)

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26. Which of the following is NOT a factor that determines gas exchange rate through the respiratory membrane

- a. surface area
- b. pressure differential
- c. acidity
- d. thickness

(1 mark)

27. What is a typical minute ventilation rate at rest?

- a. 8 litres
- b. 18 litres
- c. 80 litres
- d. 180 litres

(1 mark)

28. Which muscle fibres are best suited for glycolytic energy production?

- a. Type I.
- b. Type IIa.
- c. Type IIx.
- d. Type IIc.

(1 mark)

29. The amount of air left in the lungs after a maximal expiration is called

- a. total lung capacity
- b. residual volume
- c. expiratory volume
- d. forced ratio volume

(1 mark)

30. Muscle contraction is dependant on

- a. the interaction of calcium ions with troponin
- b. the interaction of ATP with myosin
- c. the formation of cross bridges
- d. all of the above.

(1 mark)

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31. As exercise intensity increases there is a shift in metabolism of fuel from
- a. fat to carbohydrate
  - b. carbohydrate to fat
  - c. glucose to glycogen
  - d. protein to amino acids
- (1 mark)**
32. Healthy individuals can exhale approximately how much of their lung volume in 1 second
- a. 30%
  - b. 50%
  - c. 60%
  - d. 85%
- (1 mark)**
33. Which of these is a normal blood pressure at rest
- a. 140/92
  - b. 135/95
  - c. 121/72
  - d. 99/58
- (1 mark)**
34. Low oxidative capacity, high glycolytic capacity, fast contraction speed and a low resistance to fatigue are characteristics of
- a. FTa fibres
  - b. FTx fibres
  - c. FTc fibres
  - d. ST fibres
- (1 mark)**
35. Which of these gives information about blood pressure throughout the cardiac cycle
- a. Systolic blood pressure
  - b. Mean arterial pressure
  - c. Heart rate
  - d. Diastolic blood pressure
- (1 mark)**

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36. An eccentric muscle contraction is one in which
- a. the muscle lengthens as contractile force is generated
  - b. the muscle shortens as contractile force is generated
  - c. the muscle stays the same length as contractile force is generated
  - d. the muscle shortens but no contractile force is generated
- (1 mark)**
37. On each breath approximately how much of the inspired volume is dead space
- a. 50 ml
  - b. 100 ml
  - c. 150 ml
  - d. 500 ml
- (1 mark)**
38. The process of moving gases between the lungs and the blood is called
- a. Pulmonary diffusion
  - b. Pulmonary ventilation
  - c. Capillary diffusion
  - d. Oxygen transport
- (1 mark)**
39. Where is the atrioventricular node located
- a. Right atrium
  - b. Right ventricle
  - c. Left atrium
  - d. Left ventricle
- (1 mark)**

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40. What is the inherent heart rate as established by the SA node

- a. 70 bpm
- b. 80 bpm
- c. 90 bpm
- d. 100 bpm

(1 mark)

41. What is the name of the bundle of fibres connecting the AV node to the left and right bundle branches

- a. bundle of His
- b. Purkinje fibres
- c. interventricular septum
- d. sinoatrial node

(1 mark)

42. What does the large QRS complex on an ECG trace indicate

- a. atrial contraction
- b. atrial relaxation
- c. ventricular contraction
- d. ventricular relaxation

(1 mark)

43. Ventricular systole makes up how much of the cardiac cycle at rest

- a. one half
- b. one third
- c. one quarter
- d. one fifth

(1 mark)

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44. What is the name given to the dilation of muscle arterioles and capillaries to override vasoconstriction

- a. cardiac drift
- b. autoregulation
- c. excitation coupling
- d. Frank Starling mechanism

(1 mark)

45. The P wave on an ECG trace indicates

- a. atrial contraction
- b. atrial relaxation
- c. ventricular contraction
- d. ventricular relaxation

(1 mark)

46. What is a typical breathing frequency at rest

- a. 4 breaths
- b. 12 breaths
- c. 20 breaths
- d. 35 breaths

(1 mark)

47. Which of the following is a typical cardiac output at rest

- a. 2 l/ min
- b. 5 l/ min
- c. 15 l/ min
- d. 75 l/ min

(1 mark)

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48. Parasympathetic nerves innervate which part of the heart

- a. atria
- b. ventricles
- c. atria and ventricles
- d. the coronary arteries

(1 mark)

49. Where is the majority of the blood flow during heavy exercise

- a. skin
- b. skeletal muscles
- c. lungs
- d. heart

(1 mark)

50. What is a typical resting oxygen consumption

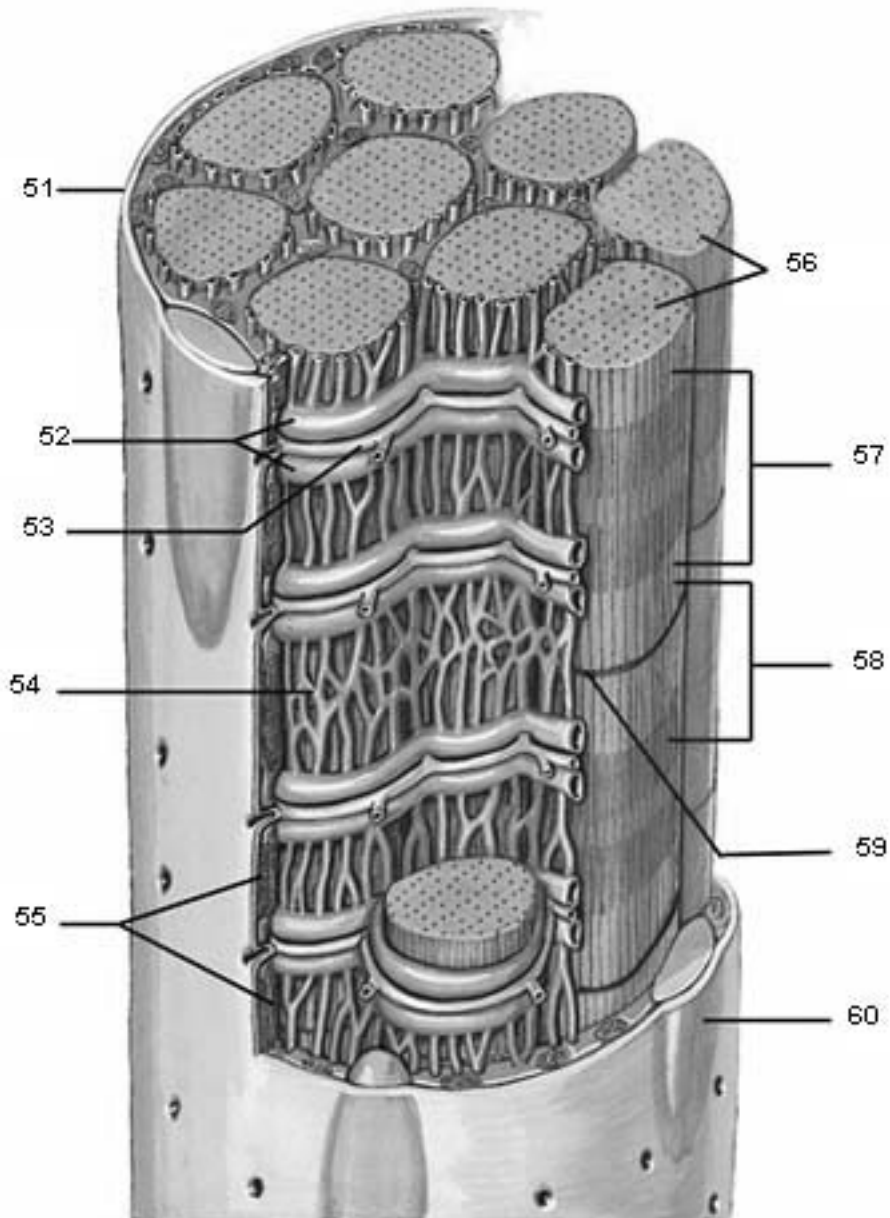
- a. 0.25 l/ min
- b. 1.50 l/ min
- c. 12 l/ mn
- d. 80 l/ min

(1 mark)

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Label the diagram 51- 60



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61. Describe the physiological pathway for systemic and pulmonary circulation of blood flow beginning from the left ventricle. Make reference to the oxygenated status of the blood, structures through which the blood passes and how the blood is moved through the circulatory system.
- (20 marks)**
62. Explain the sliding filament theory of muscle contraction. Make reference to the structure of skeletal muscle and the events that lead to the contractile process.
- (20 marks)**

**END OF QUESTIONS**

PAST EXAMINATION PAPER