



THE COPPERBELT UNIVERSITY

MCS SCHOOL OF MEDICINE

TERM THREE TEST - SEPTEMBER 2022

MBS 210 - PHYSIOLOGY

STUDENT NUMBER: ..... PROGRAMME: .....

TIME ALLOWED: 1 hour

TOTAL MARK: 60 marks

INSTRUCTIONS:

1. Do not write your name, phone number or anything that discloses your identity on any other page apart from this page. Defaulters will have their evaluation nullified.
2. Write your computer number on every other page
3. Answer ALL questions

**SHADE THE SINGLE BEST OPTION ON THE SHEET ABOVE [60 marks]**

1. Alveolar ventilation in a male with a respiratory rate of 10/min and tidal volume of 600 ml is:
  - a) 5500
  - b) 5750
  - c) 6000
  - d) 4500
  - e) 5000
2. A healthy, 45-year-old man is reading the newspaper. Which of the following muscles are used for quiet breathing?
  - a) Diaphragm and external intercostal muscles
  - b) Diaphragm only
  - c) Diaphragm and internal intercostal muscles
  - d) External and internal intercostal muscles
  - e) Internal intercostal muscles only
3. A healthy, 25-year-old medical student participates in a 10-km charity run for the Zambian Heart Association. Which of the following muscles does the student use during expiration?
  - a) Diaphragm and external intercostal muscles
  - b) Diaphragm only
  - c) Diaphragm and internal intercostal muscles
  - d) Internal intercostal and recti abdomini muscles
  - e) Sternocleidomastoid
4. The basic rhythm of respiration is generated by neurons located in the brain stem. Which of the following limits the duration of inspiration and increases respiratory rate?
  - a) Apneustic center
  - b) Dorsal respiratory group
  - c) Afferent vagal fibers
  - d) Ventral respiratory groups
  - e) Nucleus tractus solitarius

5. Which of the following statement is true?

- a) The physiological dead space can be measured by the single breath N<sub>2</sub>
- b) The anatomical dead space be measured by using the Bohr's equation method
- c) Because of the dead space, the alveolar ventilation is much decreased in shallow rapid breathing
- d) Either the diaphragm or external intercostal muscles alone can maintain adequate ventilation during muscular exercise
- e) The diaphragm accounts for about 50% of the change in the intrathoracic volume during quiet inspiration

6. Which of the following statement is wrong?

- a) The transection of the spinal cord above the 3rd cervical segment is fatal without artificial respiration
- b) Transection of the spinal cord below the 5th cervical segment is not fatal
- c) All lung volumes are measured by respirometer except the residual volume
- d) When the diaphragm contracts the anterior posterior diameter increases
- e) The air remaining in the lungs at the resting expiratory levels is the functional residual capacity

7. Which of the following occurs if the blood flow to an alveolus is totally obstructed by a pulmonary thromboembolism?

- a) The V/Q ratio of the alveolus equals zero
- b) The PO<sub>2</sub> of the alveolus will be equal to that in the inspired air
- c) The PO<sub>2</sub> of the alveolus will be equal to the mixed venous PO<sub>2</sub>
- d) There will be an increase in shunting (venous admixture) in the lung
- e) There will be a decrease in alveolar dead space

8. A patient with parotid gland cancer has damage to the glossopharyngeal nerve. As a result, which of the following respiratory reflexes will be impaired?

- a) Hering-Breuer inflation reflex
- b) Juxta pulmonary capillary (J) receptor reflex
- c) Irritant airway reflex
- d) Aortic chemoreceptor reflex
- e) Carotid body chemoreceptor reflex

9. The basic respiratory rhythm is generated in which of the following regions of the brain?
- Cerebral cortex
  - Hypothalamus
  - Reticular activating system
  - Pons
  - Nucleus parabrachialis
10. Which of the following is higher at the apex of the lung than at the base when a person is upright?
- Ventilation
  - Blood flow
  - V/Q ratio
  - PaCO<sub>2</sub>
  - Lung compliance.
11. Peripheral and central chemoreceptors both contribute to the increased ventilation that occurs because of which of the following?
- A decrease in arterial oxygen content
  - A decrease in arterial blood pressure
  - An increase in arterial carbon dioxide tension
  - A decrease in arterial oxygen tension
  - An increase in arterial pH
12. Which of the following will decrease the oxygen consumption of the respiratory muscles?
- A decrease in lung compliance
  - A decrease in airway resistance
  - A decrease in the diffusing capacity of the lung
  - An increase in the rate of respiration
  - An increase in tidal volume
13. An 18-year-old male is thrown from his motorcycle and suffers a complete transection of the brainstem above the pons. As a result, which of the following will most likely occur?
- All breathing movements will cease
  - The Herring-Breuer reflex will be abolished
  - The central chemoreceptors will no longer be able to exert any control over ventilation
  - The peripheral chemoreceptors will no longer be able to exert any control over ventilation
  - The limbic system will no longer be able to exert any control over ventilation

14. When the respiratory muscles are relaxed, the lungs are at which of the following?

- a) Functional residual capacity (FRC)
- b) Expiratory reserve volume (ERV)
- c) Residual volume (RV)
- d) Inspiratory reserve volume (IRV)
- e) Total lung capacity (TLC)

15. A 40-year-old man is admitted to NTH with severe kyphoscoliosis (a thoracic cage deformity). Over time, this anatomical distortion results in respiratory muscle weakness. Which of the following physiological variables will most likely be above normal in this patient?

- a) Total lung capacity
- b) Vital capacity
- c) Chest wall compliance
- d) Arterial carbon dioxide tension
- e) Arterial pH

16. A hospitalized patient is found semicomatose. Arterial blood gases reveal hypercapnia. Which of the following is the most likely cause of the high arterial PCO<sub>2</sub>?

- a) Decreased metabolic activity
- b) Decreased alveolar dead space
- c) Profound hypoxia
- d) Alveolar capillary block
- e) Increased alveolar ventilation

17. Normally, during moderate aerobic exercise, which of the following occurs?

- a) PaO<sub>2</sub> increases
- b) PaCO<sub>2</sub> decreases
- c) Arterial pH decreases
- d) Alveolar ventilation increases
- e) Blood lactate level increases

18. Which of the following will increase because of stimulating cholinergic receptors on the bronchial smooth muscle?

- a) Lung compliance
- b) Airway diameter
- c) Elastic work of breathing
- d) Resistive work of breathing
- e) Anatomic dead space

19. A spirometer can be used to measure directly which of the following?

- a) Total lung capacity
- b) Functional residual capacity
- c) Residual volume
- d) Inspiratory capacity
- e) Physiological dead space It increases phosphate reabsorption in the renal proximal tubular cells

20. Cyanosis

- a) Is caused by low hemoglobin concentration
- b) Is caused by high concentration of carboxyhemoglobin
- c) May be caused by hypoxic or stagnant hypoxia
- d) Its occurrence is related to the proportion and not the absolute concentration of reduced hemoglobin
- e) All the above

21. The rhythmicity center:

- a) Is in the midbrain
- b) Is spontaneously active
- c) Activity causes expiration
- d) Activity is increased by pneumotaxic center
- e) Activity is increased by a rise in blood pressure

22. The partial pressure of oxygen in the alveoli is expected to be least affected by

- a) Fractional concentration of O<sub>2</sub> in inspired air
- b) Respiratory quotient
- c) PCO<sub>2</sub> in alveoli
- d) Hemoglobin concentration
- e) Barometric pressure

23. Central chemoreceptors differ from peripheral chemoreceptors in that they:

23. Central chemoreceptors differ from peripheral chemoreceptors in that they:

- a) Respond to changes in PaCO<sub>2</sub>
- b) Respond to changes in pH
- c) Do not respond to changes in PO<sub>2</sub>
- d) Become more sensitive to CO<sub>2</sub> with chronic exposure
- e) They are less sensitive to changes in PaCO<sub>2</sub> than pH

24. Denervation of carotid and aortic bodies leads to all the following except:

- a) Decreased sensitivity of ventilation to change in PCO<sub>2</sub>
- b) Decreased sensitivity of ventilation to change in pH
- c) Complete absence of response of ventilation to change in PO<sub>2</sub>
- d) Absence response of ventilation to exercise
- e) Decreased sensitivity of ventilation to stagnant hypoxia

25. Minute ventilation is:

- a) The volume of air moved in or out of the alveoli per minute
- b) The volume of air moved in or out of the lung per breath
- c) Alveolar ventilation plus dead space ventilation
- d) Invariably increases if the respiratory rate increases
- e) Is measured using Bohr's equation (CO<sub>2</sub> analysis in expired air)

26. The ventilatory response to hypoxia

- a) Is independent of arterial PCO<sub>2</sub>
- b) Is mediated by the central chemoreceptors
- c) Decreases gradually with time
- d) Is largely mediated by the aortic bodies in humans
- e) None of the above

27. Compared to normal arterial blood, normal mixed venous blood has:

- a) Higher PO<sub>2</sub>, lower PCO<sub>2</sub> and higher pH
- b) Lower PO<sub>2</sub>, higher PCO<sub>2</sub> and higher pH
- c) Lower PO<sub>2</sub>, higher PCO<sub>2</sub> and lower pH
- d) Lower PO<sub>2</sub>, lower PCO<sub>2</sub> and higher pH
- e) Higher PO<sub>2</sub>, lower PCO<sub>2</sub> and lower pH

28. For a normal Hb-O<sub>2</sub> dissociation curve, the most correct relationship is

- a) PO<sub>2</sub> is 40 mmHg, percent saturation 50
- b) PO<sub>2</sub> is 95 mmHg, percent saturation 97
- c) PO<sub>2</sub> is 30 mmHg, percent saturation 50
- d) PO<sub>2</sub> is 60 mmHg, percent saturation 60
- e) PO<sub>2</sub> is 50 mmHg, percent saturation 50

29. In which of the following conditions is the percent saturation of hemoglobin in arterial blood likely to be normal
- a) Arterio-venous shunts
  - b) Pulmonary edema
  - c) Carbon monoxide poisoning
  - d) Anemia
  - e) Methemoglobinemia
30. At the end of expiration at sea level the PO<sub>2</sub> in the anatomic dead space is approximately
- a) 150 mmHg
  - b) 100 mmHg
  - c) 160 mmHg
  - d) 40 mmHg
  - e) 130 mmHg
31. At the end of maximal expiration, the volume of air in the lungs is:
- a) FRC – RV
  - b) IRV + RV
  - c) FRC – TV
  - d) TLC – VC
  - e) VC – ERV – IRV
32. A person whose anatomic dead space is 100 mL breathes 12 times per minute with a tidal volume of 400 ml. His pulmonary ventilation is:
- a) 1.2 liters
  - b) 2.4 liters
  - c) 3.6 liters
  - d) 4.8 liters
  - e) 6.0 liters
33. The residual volume can be calculated by subtracting the expiratory reserve volume from:
- a) Vital Capacity
  - b) Inspiratory capacity
  - c) Functional residual capacity
  - d) Total lung capacity
  - e) Alveolar ventilation

34. Oxygen consumption of an average adult man per minute is about:
- a) 250 ml
  - b) 350 ml
  - c) 400 ml
  - d) 500 ml
  - e) 550 ml

35. Inspiration is initiated by discharge from:
- a) The dorsal inspiratory group of neurons
  - b) The ventral group of neurons
  - c) The pre-Bottzinger complex
  - d) Apneustic center
  - e) Pneumotaxic center

36. The normal diffusing capacity of the respiratory membrane of an average adult male  
for oxygen at rest is about:
- a) 10 ml/minute/mmHg
  - b) 25 ml/minute/mmHg
  - c) 50 ml/minute/mmHg
  - d) 4 ml/minute/mmHg
  - e) 15 ml/minute/mmHg

37. Which type of hypoxia in which there is a greater than normal atrial-mixed venous partial pressure difference and relatively normal arterial oxygen concentration:
- a) Hypoxic hypoxia
  - b) Anemic hypoxia
  - c) Stagnant hypoxia
  - d) Histotoxic hypoxia
  - e) B and C are correct

38. The Herring-Breuer reflexes originate from the:
- a) Chemoreceptors in the lungs
  - b) Hypothalamus
  - c) Baroreceptors
  - d) Mechanoreceptors in the lungs
  - e) Carotid and aortic bodies

39. The oxygen dissociation curve is shifted to the right by:
- Shift of the blood PH towards the alkaline side.
  - Rise of the blood temperature
  - Decreased concentration of 2.3 DPG in the red blood corpuscles
  - CO poisoning
  - Presence of fetal haemoglobin
40. Obstructive lung diseases are best diagnosed by determining the:
- Vital capacity
  - Maximal voluntary ventilation
  - Expiratory reserve volume
  - Respiratory minute volume
  - Timed vital capacity in one second (FEV1)
41. About the metabolic and endocrine functions of the lungs
- The lungs contain active peptides specially VIP
  - Bradykinin is activated in the lungs
  - Angiotensin 1 is synthesized by the alveoli for local use
  - Serotonin is synthesized in the lungs then released into the blood
  - Kallikrein is partially removed from the blood by the lungs
42. The following partial pressures of gases in air are true except:
- The PCO<sub>2</sub> in alveolar air is 40 mmHg
  - The PCO<sub>2</sub> in expired air is 28 mmHg
  - The PH<sub>2</sub>O in both alveolar and expired air is 47 mmHg
  - The PO<sub>2</sub> in alveolar air is 100 mmHg
  - The PO<sub>2</sub> in expired air is 80 mmHg
43. About myoglobin, all the following is true except:
- Its O<sub>2</sub> dissociation curve has the shape of a rectangular hyperbola
  - It is shifted to the left of the Hb O<sub>2</sub> dissociation curve
  - It has a higher affinity to O<sub>2</sub> than blood Hb
  - It is more concentrated in skeletal muscles specialized for sustained contraction
  - It has a low affinity to O<sub>2</sub> at low PO<sub>2</sub>
44. All the following exert non -chemical influence on respiration except
- Hypocapnia
  - Pain sensation through the hypothalamus
  - Proprioceptors
  - Irritation of the air passages in coughing
  - Afferents from the higher centres through the corticospinal tract

45. Anaemic hypoxia is characterized by all the following except:
- a) A lowered Hb content or increased amount of altered Hb
  - b) It is a prominent symptom in CO poisoning
  - c) A normal PO<sub>2</sub> but lowered O<sub>2</sub> content in the arterial blood
  - d) An increased amount of 2,3 DPG
  - e) Lowered p50

46. Concerning the Cheyne -Stokes respiration:
- a) During hyperventilation the PO<sub>2</sub> is lowered and PCO<sub>2</sub> is elevated
  - b) It never occurs normally
  - c) It is a type of periodic (interrupted) breathing
  - d) During apnea, the PCO<sub>2</sub> is decreased and PO<sub>2</sub> is elevated
  - e) The hypoxia resulting from apnea stimulates the central chemoreceptors

47. Concerning the ventilation response to oxygen lack:
- a) Oxygen lack stimulates the respiratory centre via central chemoreceptors
  - b) A decreased in PO<sub>2</sub> in the inspired air decreases the respiratory minute volume
  - c) A decreased arterial PO<sub>2</sub> below 100 mmHg increases the discharge from the carotid and aortic chemoreceptors
  - d) When the alveolar PCO<sub>2</sub> increases 2-3 mmHg and the PO<sub>2</sub> is below 100 mmHg, ventilation is not affected
  - e) When the alveolar PCO<sub>2</sub> is lower than normal and the PO<sub>2</sub> is below 60 mmHg there is no respiratory response

48. Because of severe exercise, all the following occurs except:
- a) The O<sub>2</sub> consumption increases to a maximum of about 4-5 litres/minutes
  - b) The CO<sub>2</sub> production increases up to about 8 litres /minute
  - c) The mean PCO<sub>2</sub> in alveolar air may decrease
  - d) The mean PO<sub>2</sub> in the alveolar air falls
  - e) More than 90% of Hb is oxygenated despite rapid passage of blood through the lungs

49. About O<sub>2</sub> carriage by the blood, all the following is true except:
- a) O<sub>2</sub> flows downhill from air to the alveoli then to the arterial blood then to the intracellular fluid
  - b) In the blood O<sub>2</sub> is present only in chemical combination with Hb
  - c) The PO<sub>2</sub> at the arterial ends of pulmonary capillaries is 40 mmHg
  - d) The PO<sub>2</sub> at the venous ends of pulmonary capillaries is 100mmHg
  - e) O<sub>2</sub> diffuses in the pulmonary capillaries at a gradient of 60 mmHg

50. If the vagi nerves are cut the respiratory rate?
- a) Is increased
  - b) Is decreased
  - c) Remains constant
  - d) Ceases (stops)
  - e) Becomes unresponsive to alterations in blood gases
51. About the respiratory centres, all the following is true except:
- a) The apneustic centre has an inherent activity
  - b) The pneumotaxic centre has a role like that exerted by vagal afferents
  - c) Both the apneustic and pneumotaxic centres are present in the medulla
  - d) Both the apneustic and inspiratory centres are stimulated by a high serum PCO<sub>2</sub>
  - e) Deep and slow breathing occurs after bilateral vagotomy and ablation of the pneumotaxic centre in this case results in apneustic breathing
52. All the following statement are true except:
- a) There is about 21ml O<sub>2</sub> in every 100 ml of atmospheric air
  - b) About 250ml O<sub>2</sub> are utilized in the body per minute at rest
  - c) The water vapour pressure in the alveolar air is about 47 mmHg
  - d) When fully saturated each gm of Hb can combine with 5 ml of O<sub>2</sub>
  - e) There is about 19 ml O<sub>2</sub> in every 100 ml of arterial blood
53. The air volume that can be expelled following maximal inspiration is called the:
- a) Maximal breathing capacity
  - b) Vital capacity
  - c) Tidal volume
  - d) Total lung capacity
  - e) Functional residual capacity
54. The oxygen dissociation curve is shifted to the right by:
- a) Increased CO<sub>2</sub> tension
  - b) Increased N<sub>2</sub> tension
  - c) Increased blood PH
  - d) Decreased body temperature
  - e) CO poisoning
55. The diffusion of CO<sub>2</sub> across the alveolar membrane is much faster than O<sub>2</sub> due to
- a) An active transport of CO<sub>2</sub>
  - b) A larger alveolar area available for CO<sub>2</sub>
  - c) A larger CO<sub>2</sub> pressure gradient
  - d) More solubility of CO<sub>2</sub> in water
  - e) All the above

56. Most of the venous CO<sub>2</sub> is in the form of:

- a) Carbonate
- b) Carbonic acid
- c) Bicarbonate
- d) Dissolved CO<sub>2</sub>
- e) carbaminohemoglobin

57. The most potent stimulant of respiration would be:

- a) A 2-fold increase in the PCO<sub>2</sub> of inspired air
- b) A 2-fold increase in the PO<sub>2</sub> of inspired air
- c) A 50% decrease in the PCO<sub>2</sub> of inspired air
- d) A 50% decrease in the PO<sub>2</sub> of inspired air
- e) Both A and B are equally potent

58. The arterial oxygen tension decreases when:

- a) Ascending to high altitudes
- b) The ventilation perfusion ratio (V/P) is normal
- c) The Hb concentration is decreased
- d) The airway resistance is decreased
- e) There is CO poisoning

59. About carbon dioxide transport, all the following is true except:

- a) It is transported largely in the form of bicarbonate
- b) Some is transported as a carbamino compound with Hb
- c) Its partial pressure in the arterial blood is about 46 mmHg
- d) A little amount is physically dissolved in the blood
- e) Some is transported in association with the plasma protein

60. During rhythmic respiration

- a) Lung inflation leads to activation of the pneumotaxic centre
- b) Inhibition of the apneustic centre by pneumotaxic centre is faster than vagal inhibition
- c) A transection between the pons and medulla oblongata stops respiration
- d) The apneustic centre sends tonic discharge to the inspiratory centre
- e) Section of both vagi renders respiration to be more shallow and rapid

THE END- WISH YOU SUCCESS