CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN NURSING

NURS 112: MEDICAL PHYSIOLOGY I

STREAMS: Y1S1 **TIME: 3 HOURS**

DAY/DATE: WEDNESDAY 16/12/2020 **8.30 A.M. – 11.30 A.M.**

INSTRUCTIONS:

- Do not write anything on the question paper.
- Mobile phones and any other reference materials are NOT allowed in the examination room.
- The paper has three sections. Answer ALL questions.
- All your answers for Section I (MCQs) should be on one page.
- Number ALL your answers and indicate the order of appearance in the space provided in the cover page of the examination answer booklet.
- Write your answers legibly and use your time wisely

Section A: Multiple Choice Questions (20 Marks)

1. In the plasma membrane, carbohydrates and glycoproteins are oriented:
    a) Towards inside
    b) Towards outside
    c) Towards inside and outside
    d) Randomly distributed

2. The following transport process induces conformational change in protein:
    a) Primary active transport
    b) Secondary active transport
    c) Simple diffusion
    d) Facilitated diffusion

3. The following cellular component is the sorting and packaging centre of the cell:
    a) Golgi apparatus
    b) Lysosome

c) Nucleus
d) Rough endoplasmic reticulum

4. An increases in one of the following variables tends to decrease resistance to blood flow:
    a) Radius of the blood vessel
    b) Viscosity of the blood
    c) Length of the blood vessel
    d) Hematocrit level

5. The primary chemical stimulus for breathing is the concentration of:
    a) Carbon monoxide in the blood
    b) Carbon dioxide in the blood
    c) Oxygen in the blood
    d) Carbonic acid in the blood

6. Cardiac activity can be modulated by the autonomic nervous system. The following statement is true:
    a) The sympathetic system increases the heart rate and stroke volume
    b) The parasympathetic system increases the heart rate and stroke volume
    c) The sympathetic system decreases the conduction across the atrioventricular node
    d) The parasympathetic system increases the conduction across the atrioventricular node

7. The oxygen-hemoglobin dissociation curve is shifted to the left by:
    a) Increase in arterial PCO_2
    b) Decrease in pH
    c) Decrease in arterial PO_2
    d) A fall in temperature

8. Which of the following will increase stroke volume?
    a) Decreased activity of cardiac sympathetic nerves
    b) Increased arterial pressure
    c) Increased ventricular filling pressure
    d) Reduced end-diastolic volume

9. The volume of air that can be exhaled after normal exhalation is the
    a) Tidal volume
    b) Residual volume
    c) Inspiratory reserve volume
    d) Expiratory reserve volume

10. An increase in systemic blood pressure from 100 to 120 mm Hg would be expected to have what effect on the renal circulation of a normal individual?
    a) Increased vascular resistance and little change in blood flow.
    b) Increased vascular resistance and modestly decreased blood flow.
    c) Decreased vascular resistance and modestly increased blood flow.
    d) Decreased vascular resistance and modestly decreased blood flow.

11. The following is true concerning the plasma membrane:
    a) It is selectively permeable to substances in the body
    b) It is made up entirely of proteins
    c) It does not contain lipids
    d) It is made up entirely of carbohydrates

12. Pulmonary surfactant increases:
    a) The surface tension of the fluid lining alveolar walls
    b) Lung compliance
    c) In effectiveness as the lungs are inflated
    d) In amount when the pulmonary blood flow is interrupted

13. What would be the cardiac output of a person having 72 heart beats per minute and a stroke volume of 50 ml?
    a) 360 mL
    b) 3600 mL
    c) 7200 mL
    d) 5000 mL

14. According to Starling's Law of the heart, an increase in end diastolic volume (EDV):
    a) Decreases stroke volume
    b) Results in greater shortening of the ventricular muscle
    c) Is proportional to the increase in the initial length of myocardial fibers in the left ventricle
    d) Increases the net external work done by the heart

15. In the lungs, the following statement is true:
    a) PCO2 in the alveoli is the same as that in the capillaries
    b) PO2 in the alveoli is the same as that in the capillaries
    c) PCO2 in the alveoli is higher than that in the capillaries
    d) PCO2 in the alveoli is lower than that in the capillaries

16. Repolarization of ventricular myocytes (Phase 3) occurs mainly due to
    a) Influx of Na^+
    b) Efflux of Na^+
    c) Influx of K^+
    d) Efflux of K^+

17. Which of the following cause a rightward shift in the oxygen-hemoglobin dissociation curve?
    a) Decreased pH
    b) Decreased PCO_2
    c) Hypothermia
    d) Increased PO_2

18. In most vascular beds, sympathetic nerves elicit vasoconstriction of blood vessels by:
    a) Lowering blood pressure
    b) Release of norepinephrine from post-ganglionic fibers and binding to α-adrenergic receptors
    c) Release of acetylcholine and activation of muscarinic receptors
    d) Activating pain receptors which stimulates release of tissue metabolites

19. The following transport process will be affected directly if the mitochondria in a cell are not functioning properly:
    a) The movement of glucose into a cell
    b) The movement of water into and out of the cell
    c) The movement of oxygen across the cell membrane
    d) The movement of sodium out of the cell

20. Which of the following will result in a transfusion reaction? Assume that the patient has never had a transfusion.
    a) Type O Rh− packed cells to an AB Rh+ patient
    b) Type A Rh+ packed cells to an A Rh+ patient
    c) Type AB Rh+ packed cells to an AB Rh+ patient
    d) Type A Rh+ packed cells to an O Rh+ patient

Short Answer Questions (40 Marks)

1. Briefly describe how the following transport processes occur across the plasma membrane:
    a) Facilitated diffusion (3 marks)
    b) Secondary active transport (3 marks)
2. Explain how the body water is distributed in an adult human. (6 marks)
3. State five (5) properties of graded potentials. (5 marks)
4. State two (2) functions of each of the following cytoskeleton components:
    a) Microfilaments (2 marks)
    b) Microtubules (2 marks)
5. State six (6) roles of the proteins in the plasma membrane. (6 marks)
5. Describe three (3) hematopoietic growth factors specifying their contributions in hematopoiesis. (6 marks)
6. Define stroke volume and explain how the preload and afterload pressures affect it. (7 marks)

Long Answer Questions (40 Marks)

1. Transport and exchange of respiratory gases sustains cellular life:
    a) Describe the process of pulmonary gas exchange (4 marks)
    b) Explain how the following factors affect the rate of pulmonary gas exchange:
        i. Partial pressure difference of gases (3 marks)
        ii. Distance of diffusion (3 marks)
    c) Describe how carbon dioxide is transported in blood (6 marks)
    d) Explain how the pH of body fluids affects the affinity of hemoglobin for oxygen (4 marks)

2. The heart is a pump tasked with distribution of essential substances to body tissues. Action potentials from contractile cardiac cells lead to contraction and generation of force responsible for the pumping activity:
    a) Describe the ionic changes that occur during the following phases of the cardiac action potential:
        i. Phase 0 (3 marks)
        ii. Phase 2 (3 marks)
    b) Describe the hormonal regulation of blood pressure. (14 marks)
