THE COPPERBELT UNIVERSITY

MICHAEL C. SATA SCHOOL OF MEDICINE

2016/2017 END OF TERM 2 EXAMINATION: MBS 210 (HUMAN PHYSIOLOGY)

BDS, BSc CM AND MBChB (312 STUDENTS)

Venue: MCS Date: Wednesday 01st March, 2017

TIME: 09.00 – 11.00 (3 hours).

STUDENT NO.:…… PROGRAMME……..

INSTRUCTIONS TO CANDIDATES

THERE ARE TWO (2) PAPERS; I and II. Paper I constitutes MCQs with True or False whereas Paper II contains applied Physiology questions.

1. Answer Paper I questions on the question sheet as instructed and Paper II questions to be answered in the provided spaces in question paper too.
2. Write your student number and programme of study as indicated above.
3. Indicate your student number on all answer scripts used.
4. DO NOT WRITE YOUR NAME.

Examiners: Dr. Festus Mushabati and Mrs Charity K. Muselema

PAPER I; MULTIPLE CHOICE QUESTIONS (60%)

SECTION B: TRUE OR FALSE

In questions 1 – 47, write down "T or F" if the statement is TRUE or FALSE respectively against options A, B, C, D and E with respect to the corresponding stem question. Each correct marking/answer in this section carries one (1) mark; 0.5 will be deducted from each wrong marking/answer. No penalty for not attempting an option.

1. The carotid bodies:
   A. Have, per unit mass, a blood flow rate similar to brain tissue
   B. Are more influenced by arterial Po2 than by arterial oxygen content
   C. Are stimulated by a rise in blood hydrogen ion concentration
   D. And the aortic bodies are entirely responsible for stimulation of ventilation in response to hypoxia
2. The surfactant material lining the lung alveoli:
   A. Decreases the surface tension of the alveolar fluid
   B. Increases the compliance of the lungs
   C. Has progressively less effect, the more the lungs are inflated
   D. Is decreased when pulmonary blood flow is interrupted
3. Comparing a healthy person of 70 with a healthy person of 20 (of the same sex and height), the older person would tend to show:
   A. A smaller ratio of residue capacity: vital capacity
   B. Lung airways which collapse and close at an earlier stage of expiration
   C. A smaller ratio of forced expiratory volume in one second: vital capacity
   D. A reduction in arterial oxygen saturation nearer 10% than 5%.
4. Carbon dioxide:
   A. Is carried on the haemoglobin molecule as carboxyhaemoglobin
   B. In the blood increases the oxygen binding power of haemoglobin
   C. When breathed at a concentration of 20% in oxygen is a powerful respiratory stimulant
   D. In free plus combined form is present in arterial blood in greater amount than is oxygen in free plus combined form
5. In normal lungs:
   A. The volume of air ventilating the alveoli per minute is greater than the volume of blood perfusing the lung capillaries per minute.
   B. In the erect posture the ventilation/perfusion ratio increases from base to apex
   C. Oxygen transfer can always be explained by passive diffusion
   D. Dead space volume can increase buy more than half during a maximal inspiration

6. The rate of ventilation of the alveoli will be altered when a person changes from breathing room air to breathing:
   A. 21% oxygen and 79% nitrogen
   B. 17% oxygen and 83% nitrogen
   C. 2% carbon dioxide and 98% oxygen
   D. A gas mixture which causes alveolar Pco2 to rise by 10%
7. contraction of the smooth muscle in the respiratory tract occurs in response to:
   A. Irritation of the bronchial mucosa
   B. Stimulation of local beta adrenoceptors
   C. A decrease in the Pco2 in the bronchial air
   D. A cold stimulus to the bronchial mucosa
8. During the initial part of inspiration:
   A. Intrapulmonary pressure falls
   B. Intrathoracic pressure rises
   C. Intra-abdominal pressure rises
   D. The partial pressure of oxygen in the dead space rises
9. Compliance of the lungs is greater:
   A. In the tidal volume range, than in the inspiratory reserve volume range of ventilation
   B. At age 30 than at age 10
   C. Than compliance of the lungs and thorax
   D. When filled with normal saline than when filled with air
10. An individual who ascends from sea level to 6000 (where the atmospheric pressure is halved) is likely to develop:
   A. An increase in pulmonary ventilation
   B. A fall in arterial Po2
   C. A rise in arterial pH
   D. A rise in cerebral blood flow
11. Inspiration:
   A. Increases the venous return to the blood
   B. Is assisted with tension forces in the alveoli
   C. Requires less muscular effort than expiration during quiet breathing
   D. Begins when intrapleural pressure falls below atmospheric pressure
12. Contraction of the diaphragm:
   A. Is essential to provide enough pulmonary ventilation to support life
   B. Leads to protrusion of the anterior abdominal wall
   C. Causes an increase in the pressure gradient between the inside of the lungs and the intrapleural space
   D. Ceases if the spinal cord is severed at the seventh cervical segment

13. The diffusion capacity of gas transfer factor of the lungs:
    A. May be expressed as volume per unit time per unit pressure gradient
    B. Is greater for oxygen than carbon dioxide
    C. Increases in exercise
    D. Is unaffected if one lung is excised
14. Tidal air in a resting subject:
    A. Has an average volume of around three times the dead space
    B. Has a reciprocal relationship with the respiratory rate
    C. Has a similar volume to alveolar air volume
    D. Leaves the body saturated with water vapor
15. The residue volume:
    A. Is the gas that remains in the lungs after a full expiration
    B. Average 3-5 litres in an adult
    C. May be measured by an indicator dilution technique
    D. Decreases with age
16. A rise in arterial carbon dioxide tension:
    A. Occurs during moderate exercise
    B. Stimulates respiration via peripheral chemoreceptors
    C. Stimulates respiration via central chemoreceptors
    D. Causes a reflex fall in blood pressure
17. An increase in ventilation occurs when the:
    A. Plasma bicarbonate levels fall
    B. Subject goes to sleep
    C. pH of the CSF falls
    D. blood adrenaline level rises
18. when a person hyperventilates voluntarily so that his minute volume is trebled, the:
    A. magnitude of the negative change on the plasma proteins decreases
    B. level of ionized calcium in the blood rises
    C. alveolar Po2 trebles
    D. oxygen saturation of arterial blood rises by about 10%
19. If peripheral chemoreceptor function is lost:
    A. A 75% fall in arterial Po2 will not appreciably alter ventilation
    B. A 10% rise in Pco2 will not appreciably alter ventilation
    C. Ventilation will not increase in exercise
    D. The subject is less able to adapt to life at high attitude

20. In emphysema:
    A. Narrowing of airways is typically due to loss of pulmonary elastic tissue rather than smooth muscle spasm
    B. Hypoxia may occur due to the fall in the overall ventilation perfusion ratio
    C. The vital capacity is increased
    D. The ratio of the forced expiratory volume in one second to the vital capacity is abnormally low
21. The heart:
    a. is symmetrical about a plane along the ventricular septum
    b. converts chemical energy to mechanical energy
    c. contains cells which demonstrate spontaneous electrical activity
    d. contains cells which do not usually demonstrate spontaneous electrical activity
    e. receives most of its myocardial blood supply during diastole
22. cardiac muscle cells
    a. are highly depended on glucose as nutrients
    b. ae highly depended on aerobic metabolism
    c. have prolonged action potentials partly because they demonstrate a voltage –activated Ca^{2+} current
    d. are electrically insulated from one another
    e. are striated
23. the cardiac action potential
    a. acts as the physiological stimulus for cell contraction
    b. is generated by voltage-sensitive ion channels all of which tend to open when the membrane is depolarised
    c. is conducted more slowly though through the atrium than through the atrioventricular node
    d. is conducted throughout the atria by Purkinje fibres
    e. varies in length in different regions of the heart
24. the electrocardiogram
    a. changes in shape when recorded from different sites on the body
    b. is generated by the conduction on the action potential across the heart
    c. has a QRS complex generated by the spread of repolarization across the atria
    d. should demonstrate a longer than normal gap between the P and QRS waves when conducting between the atria and ventricles is delayed
    e. has a peak amplitude of 100 mV

25. in the cardiac circle:
    a. the T wave of the ECG overlaps the decline in ventricle pressure
    b. the 'a' wave in atrial pressure coincides with the arterial pulse
    c. ventricular ejection reduces ventricular volume by more than 90% at the rest
    d. the first heart sound immediately precedes the arterial pulse
    e. the aortic valve is close whenever ventricular pressure exceeds aortic pressure
26. cardiac output
    a. can be determined from the heart rate
    b. decreases on standing upright from a sitting position
    c. can be accurately estimated using measurements of O_2 consumption, and the O_2 concentrations in the radial artery and vein
    d. increases when parasympathetic nerves to the heart are stimulated
    e. increases when sympathetic nerves to the veins are stimulated
27. cardiac preload
    a. increases during exercise
    b. is mainly depended on venous return
    c. tends to reduce the force of cardiac contraction as preload increases under normal conditions
    d. is more important in determining cardiac output than is afterload
    e. would be reduced following removal of 500 ml of blood from patient
28. arterial blood pressure
    a. is affected by the amount of elastin in the arterial walls
    b. is normally regulated solely though changes in the peripheral resistance
    c. is the sole determinant of the rate on blood flow through an organ
    d. may be increased by increases in venous return
    e. can be measured using an auscultatory method
29. arterioles
    a. have muscular walls
    b. are the most compliant type of blood vessel
    c. are important in the control of local blood flow
    d. control peripheral resistance
    e. can constrict leading to rises in arterial and capillary pressures
30. baroreceptors
    a. are a type of stretch receptors
    b. are located in the aortic and carotid bodies
    c. control the mean arterial pressure to week to week
    d. produce sensory signals which stimulate the vasomotor center and cardiac parasympathetic nucleus in the medulla oblongata
    e. are stimulated by a sudden fall in blood pressure

31. the renin-angiotensin system:
    a. is stimulated following blood loss
    b. relies on angiotensinogen secretion from the juxtaglomerular apparatus
    c. promotes aldosterone secretion from the adrenal cortex
    d. can stimulate vasoconstriction
    e. is active even under nomal conditions
32. in the systemic circulation, tissue blood flow:
    a. increases linearly with arterial pressure over the range 20 to 200 mmHg
    b. may increase as a result of passive vasodilatation following inhibition of sympathetic nerves
    c. may increase as a result of active vasodilation following stimulation of sympathetic nerves
    d. is increased following a period of reversible ischaemia
    e. may be increased by locally produced metabolites
33. pulmonary
    a. blood flow equals systemic blood flow
    b. vascular resistance is similar to systemic peripheral resistance
    c. blood flow decreases in areas of increased alveolar CO_2 tension
    d. hypertension can lead to left ventricular hypertrophy
    e. veins drain into the left atrium
34. during exercise:
    a. blood flow is reduced in the gastrointestinal tract
    b. parasympathetic nerves dilate muscle arterioles
    c. cardiac output increases mainly because of an increase in stroke volume
    d. cardiac β-adrenoceptors are stimulated
    e. systolic blood pressure tends to rise more that diastolic pressure
35. resistance to blood flow:
    a. in skin is normally regulated from control centres in the hypothalamus
    b. in coronary blood vessels is increased during exercise
    c. in the brain may be increased by sympathetic nerves during hypotension (reduced arterial pressure)
    d. increases as blood haematocrit increases
    e. decreases dramatically as the diameter of a blood vessel decreases
36. net capillary filtration
    a. peripheral resistance increases
    b. arterial pressure as measured in a vessel at heart level tends to fall
    c. neck veins collapse
    d. cerebral blood vessels dilate
    e. the effective circulating blood volume decreases

PAPER II: APPLIED PHYSIOLOGY QUESTIONS (40%)

Answer any two of the questions in provided spaces below. Each question carries 20 marks.

1. **Matching item questions.**

   Theme: Cardiovascular control

   Options

   A. aldosterone
   B. antidiuretic hormone
   C. sympathetic nerves
   D. parasympathetic nerves
   E. angiotensin II
   F. local metabolites
   G. length-tension relationship
   H. atrial natriuretic peptide (hormone)

   For each of the descriptions below choose the most appropriate option from the list above. Each option may be used once, more than once or not at all.

   1. Explain (s) why cardiac output equals venous return
   2. Regulate (s) cutaneous blood flow in line with thermoregulatory needs
   3. Expand(s) plasma volume and raise(s) BP by increasing renal Na^+ absorption
   4. Adjust (s) vascular resistance to match blood flow to workload
   5. Stimulates (s) an increase in heart rate during exercise.

2. Describe compensatory mechanisms you would expect to be activated following serious blood loss?

3. A. A patient has obstructive airways disease and looks very cyanosed. What abnormalities would you expect to find in the arterial blood gases?

B. Draw an O_2 dissociation curve. How do you think it would be changed by changes in the P_{CO_2} and temperature changes? Explain.

'Nothing succeeds like success'

....Shebby....