THE COPPERBELT UNIVERSITY

MCS SCHOOL OF MEDICINE

END OF TERM TWO TEST – JUNE 2022

MBS 210 - PHYSIOLOGY

STUDENT NUMBER [redacted] PROGRAMME: MBCHB

TIME ALLOWED: 2 hours

TOTAL MARK: 100 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 questions in all SECTIONS (A, B & C)

08
28
34.5
2/70.5

SECTION A: CHOOSE THE SINGLE BEST OPTION [16 marks]

EACH QUESTION CARRIES 1 MARK. ANSWER IN THIS SAME PAGE

1. The principal determinants of mean arterial pressure are:
   A. Cardiac output and peripheral resistance
   B. Arterial and venous capacitance
   C. Cardiac output and arterial capacitance
   D. Peripheral resistance and arterial capacitance
   E. Cardiac output and venous capacitance

2. The increase in the arterial pulse pressure usually observed in an elderly hypertensive person is produced mainly by:
   A. An increase stroke volume
   B. An increased heart rate
   C. A decreased cardiac output
   D. An increase vagal activity
   E. A decreased arterial compliance

3. The formula for MCV is :
   A. Hct*10/WBC
   B. Hct*12/RBC
   C. Hct*10/RBC
   D. Hct*20/WBC
   E. Printed on calculator keys

4. The circulatory variable that is maintained relative constant by the baro receptor reflex is:
   A. Heart rate
   B. Stroke volume
   C. Peripheral resistance
   D. Velocity of blood flow
   E. Arterial blood pressure

5. The medullary vasomotor centre is stimulated most effectively by:
   A. Decreased arterial blood oxygen tension
   B. Decreased arterial blood hydrogen ion concentration
   C. Increased arterial blood adenosine concentration
   D. Increased arterial blood carbon dioxide tension
   E. Increase/decrease in arterial blood pressure

6. _____ lymph Node is the lymph node where the lymph of the organ or part of the body drained to at first place.
   A. Thorasic
   B. Abdominal

C. Regional
D. Anatomical
E. Pelvic

7. Fluid flow through the circulatory system is in many respects similar to fluid flow through a tube, in that:
A. Flow rate is faster near the centre of flow
B. It is directly proportional to the square of the diameter of the tube
C. It is always characterized by laminar flow
D. Flow rate is directly proportional to length of the tube
E. A and C are correct

8. All the following statements related to blood volume are correct EXCEPT for:
A. Blood volume is about 5 litres
B. Plasma volume is about 3 litres
C. Veins contain about 40% of blood volume
D. Arteries and arterioles contain about 15% of blood volume
E. Heart contains about 7% of blood volume

9. A young male aged 18 has been diagnosed with MONKEY POX at a hospital in Switzerland and is lying down flat. All of the following statements are correct EXCEPT:
A. Systolic blood pressure declines during systole
B. The pressure during systole is DBP
C. The pressure during diastole is SBP
D. The pressure in the left ventricle is 120/80 mm Hg
E. The pressure in the right atrium is 120/80 mm Hg

10. A pulse generator is a small metal case that contains electronic circuitry with a small computer and a battery that regulate the impulses sent to the heart. Propagation of an action potential through the heart is fastest in the
A. SA node
B. Atrial muscle
C. AV node
D. Purkinje fibres
E. Ventricular muscle

11. At birth, changes that occur in the foetal (Rh) blood circulation due to Rh incompatibility can be corrected by
A. Increased systemic arterial pressure
B. Increased pulmonary vascular resistance
C. Increased pulmonary arterial pressure
D. Exchange blood transfusion with Rh -ve
E. Exchange blood transfusion with Rh +ve

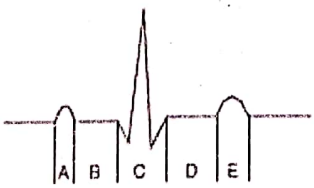
12. An increased preload on left ventricle can be caused by;
A. Decreased venous return
B. Decreased blood pressure
C. Increased venous return
D. Atherosclerosis
E. Arteriosclerosis

13. Conduction of impulses between the atria and the ventricles is channeled through (responsible for delay);
A. AV node
B. Annulus fibrosus
C. SA node
D. Bundle of His
E. Hirkens fibres

14. The prevalence of congestive heart failure based on clinical criteria is 2%. These estimates suggest that between 1 and 2 million adults are affected. In congestive heart failure, the following is correct
A. The ventricular tissue is dead
B. The atrial tissue is dead
C. The pericardium is dead
D. Heart chambers are not pumping efficiently
E. None of the above are true

15. Human heart is unique structure that can create its own voltage signals. The cardiac excitation –conduction system shows the following characteristics;
A. The AV node is the auto rhythmic discharger of the upper portion of the heart
B. The nodal delay allow the ventricle to contract before the atria
C. The purkinje fibres show the slowest rate of transmission
D. The SA node is the pacemaker
E. All the above are true

16. Which of the following parts on the ECG has the mitral valve close?



A. A

B. B
C. C
D. D and E

Multiple TRUE/FALSE – Mention T or F on this same paper
Each question carries 4 Marks. Total marks = 32

1. The cardiac muscles are less striated and are noted to have

T **A.** Branches

T B. More gap junctions
T C. Have plateau type of action potential
F D. Have tetanus

2. About the atrialventricular junctional area, the following is true

F A. The transitional cell zone is not present
T B. The penetrating part of the AV bundle is known as the His bundle
F C. The transitional cells donot differ histologically from atrial myocardium
F D. The compact portion of the AV node is a superficial structure lying just beneath the right atrial endocardium, 5 mm long and wide.

3. About delay time

F A. From point of origin in the SA node through the intermodal pathways to A-V node, impulse takes about 0.03.
F B. 3 second delay in the A-V node itself
F C. Impulse enters the penetrating portion of the A-V bundle where it is delayed another 0.04 seconds
F D. Impulse enters the penetrating portion of the A-V bundle where it is delayed another 0.4 seconds

4. The following are true about the ECG

T A. To get readings of an ECG, electrodes that are positive and negative are placed on the surface of the body
F B. It is possible to get readings as due to fluids being bad conductors and having the ability to bring the electrical activity to the body surface
T C. Applying a positive electrode to the left lower limb will pick activities as though the electrode is at the apex of the heart

T D. If electrode is placed on the right arm, it will be as though this electrode is placed on the right atrium of the heart

5. Reason for AV nodal delay is
F A. Desmosomes
F B. More gap junctions
T C. Less gap junctions
F D. Hemidesmosomes

6. Right axis deviation is seen in the following:

T A. Right ventricular hypertrophy
F B. Left Posterior Fascicular Block
T C. Lateral Myocardial Infarction
T D. Inferior myocardial infarction

7. These size categories are used to classify anemia.

T A.Normocytic anemia have normal size cells and a normal MCV.
T B. Microcytic anemia have small cells and a decreased MCV.
T C. Microcytic anemia have large cells and a increased MCV.
F D. Pernicious anemia is due to Iron loss from blood

8. Macrocytic anemia can be caused by:

T A. Vitamin B-12 deficiency
T B. Folate deficiency
F C. Chemotherapy
F D. Preleukemias

SECTION B: STRUCTURED AND SHORT ANSWER QUESTIONS [32 marks]
Answer all the questions in the provided spaces within the question paper

1. Specify two functional differences between Basophils and Eosinophils [2 marks]

- Basophils release chemical mediators which trigger cellular response to infection
- Eosinophils fight ~~against~~ of infection like viruses.
- Eosinophils are responsible for fighting allergic reactions in the body.
- Basophils work as alarms that signal for foreign material invasion.

1.5

2. Discuss succinctly your understanding on phenomenon of Rh incompatibility with emphasis on Erythroblastosis foetalis? How to prevent it? [6 marks]

A person with the Rh antigen is said to be Rh positive while a person without the antigen is said to be Rh negative. Rh incompatibility is a disorder that results when blood from the mother who is Rh negative crosses the placenta and enters the blood of the embryo. The mothers body develops antibodies against the Rh antigen. The effect is seen on the second baby as it does not affect the first child. Rh incompatibility can be prevented by using anti-D Rh drugs or it can also be done by changing the neonates blood. The attack of antibodies on the second child child is what we call Hemolytic Disease of the new born also called Erythroblastosis foetalis.

4

3. Explain the physio pharmacological basis for action of Epinephrine and Norepinephrine in the cardiac muscle [4 marks]

Epinephrine and Norepinephrine are chemicals that are released by the sympathetic nervous system. These chemicals are released in conditions that require the heart to pump blood at a faster rate. Epinephrine and Norepinephrine will cause an increase in heart rate, the increase in heart rate will lead to increased cardiac output. The increase in cardiac output ensures that blood is supplied to vital organs of the body.

3

4. Describe the physiological significance of cytometric classification of Anemia? Specify with EXAMPLES [4 marks]

Cytometric Classification of Anemia helps with the diagnosis of different kinds of Anemia. The cytometric Classification divides the types of Anemias in the following categories:

(a) Normochromic Normocytic anemia, Normal MCHC and normal MCV, caused due to hemmorherge.

(b) Hypochromic Microcytic anemia, low MCHC and low MCV, due to iron deficiency.

(c) Normochromic Macrocytic anemia, Normal MCHC and High MCV, B12 deficiency and folate.

5. Discuss succinctly the concept of Hemostasis and its clinical application [4 marks]

Hemostasis is the sequency of events involved in the maintenance of blood levels in the body. The clinical application is that it helps to maintain blood levels by overcoming events that lead to blood Clotting:

(a) Vascular Spasm: Smooth muscles will contract in order to reduce the rate of flow of blood to damaged site.

(b) Platelet Plug formation: The platelets will stick to the endothelial walls forming a Plug.

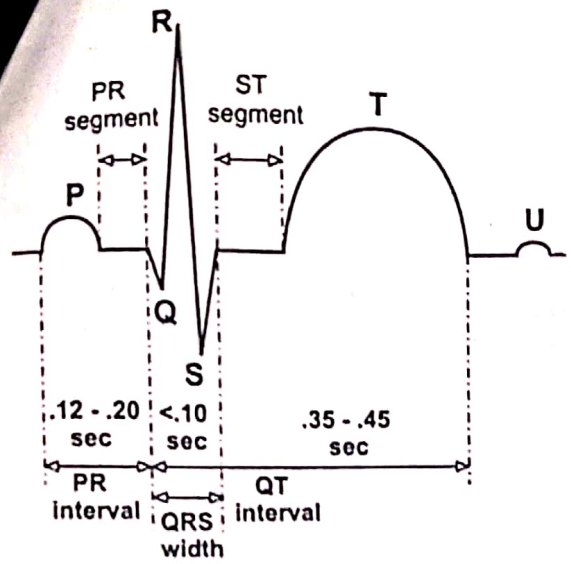
(c) Coagulation: Fibrin will be converted to fibrinogen and a clot will be formed.

This helps to prevent further bleeding and loss of blood.

6. Explain briefly the intracellular mechanism underlying the therapeutic application of Digitalis in the management of congestive heart failure [2 marks]

Digitalis in the management of congestive heart failure

2



7.

a. For the labels P,Q,R,S and T in the diagram, specify the significance for each with REASONS [3 marks]

(a) P-wave indicates atrial depolarization due to contraction of the atrias

(b) Q-wave indictive of intraventricular septum depolarization due to electrical impulses from A.V nodal system

(c) R-wave represents Ventricular depolarization due to the Contraction of the Ventricles as the ~~pump~~ blood is pumped out.

(S) S-wave - indictive of proboal depolarization

(T) T-wave is indictive of repolarization which is rapid compared to depolarization

2

b. How can you make a possible diagnosis of MYOCARDIAL INFARCTION based on ECG wave changes? Give EXAMPLES with reasons. [2 Marks]

Myocardial infarction diagnosis based on ECG can be made by looking at various Segments of the ECG: Example in a case where a person has an infarct in the heart the QRS complex will diminish due to failure of the heart to conduct enough electrical signals

1.5

8. Discuss succinctly the concept of Baro receptor reflex and its application (orthostatic hypotension) while measuring standing blood pressure using sphygmomanometer in clinical physiology lab. [5 marks]

Baro receptor reflex is a mechanism that helps to regulate blood pressure. When either a decrease or increase in the blood pressure the nerves in the aortic arch will send signals to the brain those signals inturn will either release further signals that tells the heart to slow down or beat fast depending on the situation.

In the case where we have a decrease in the blood pressure the nerves in the aortic arch will detect this decrease and send impulse to the brain, the brain will send signals to the kindney to activate the Renin angiotensin aldestarone system which will lead to the normal fuctioning of the heart.

Standing blood pressure is the blood pressure that is measure when a person is standing. A sphymomanometer is used to detect the blood pressure levels of the patient. The sphygmomanometer Cuff is responsible for the generation of the korotkoff sounds.

3

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SECTION C: SCENARIO QUESTION

Answer all the questions in the spaces provided within the question paper

Integrated Essay - 20 marks

1. Ms Chilufya Marvellous is a 87 year old retired coiffeur from FINLAND, who arrives at the Emergency Department complaining of severe fatigue. She recently has been experiencing occasional chest pain and shortness of breath, particularly on exertion while climbing staircase at ZEE MART. Her blood pressure is 120/85. After admitted to the ROMA Medical center for further management, her stroke volume was 40 ml/beat and pulse rate was 90/minute. History revealed poor dental hygiene.

A. What is meant by cardiac output? Calculate for Ms C. Marvellous. [3 Marks]

Cardiac output is the amount of blood that is pumped by each ventricle per minute.

CO = SV x HR

~~CO = 3600 ml/min~~

2.5

CO = 40 ml/beat x 90/beat
CO = 3,600 ml/min

B. Specify various factors that affect her stroke volume and cardiac output, with special EMPHASIS on "Frank starling's law". [5 Marks]

The Frank Starling's law stated the greater the stretch the greater the contraction force. Stroke volume is the amount of blood that is pumped out in one heart beat. A change in stroke volume will affect cardiac output. i.e an increase in stroke volume will result in an increase in cardiac out put and a decrease in stroke volume will result in a decrease in cardiac output. Therefore any factor that has an impact on the stroke volume has an impact on the cardiac output. The following are factors that affect Stroke volume and Cardiac output with emphasis on the frank steerling law.

* venous return - the rate at which blood comes back to the heart will determine the rate at which it is pumped out.
* Valve resistance -
* Blood viscosity - how thick the blood is
* Heart rate
* Vascular resistance

3

C. How can dental hygiene affect cardiovascular health? Give EXAMPLE with REASONS. [2 Marks]

Dental hygiene can affect Cardiovascular health in that poor dental hygiene will lead to the production and growth of bacteria in the mouth. Once that bacteria enters the blood stream it will have a negative impact on the heart leading to cardiovascular events. Example: Dental caries (bacteria) that develops in between teeth will distroy the teeth and get to the vessels in the mouth.

1

D. What volume of her resting cardiac output is being supplied to the skeletal muscles? Specify REASONS. [2 Marks]

60% of the total cardiac out put is being supplied to the skeletal muscles which is approximately 2160 ml/min this is so because at rest the body or the heart does not pump a lot of blood.

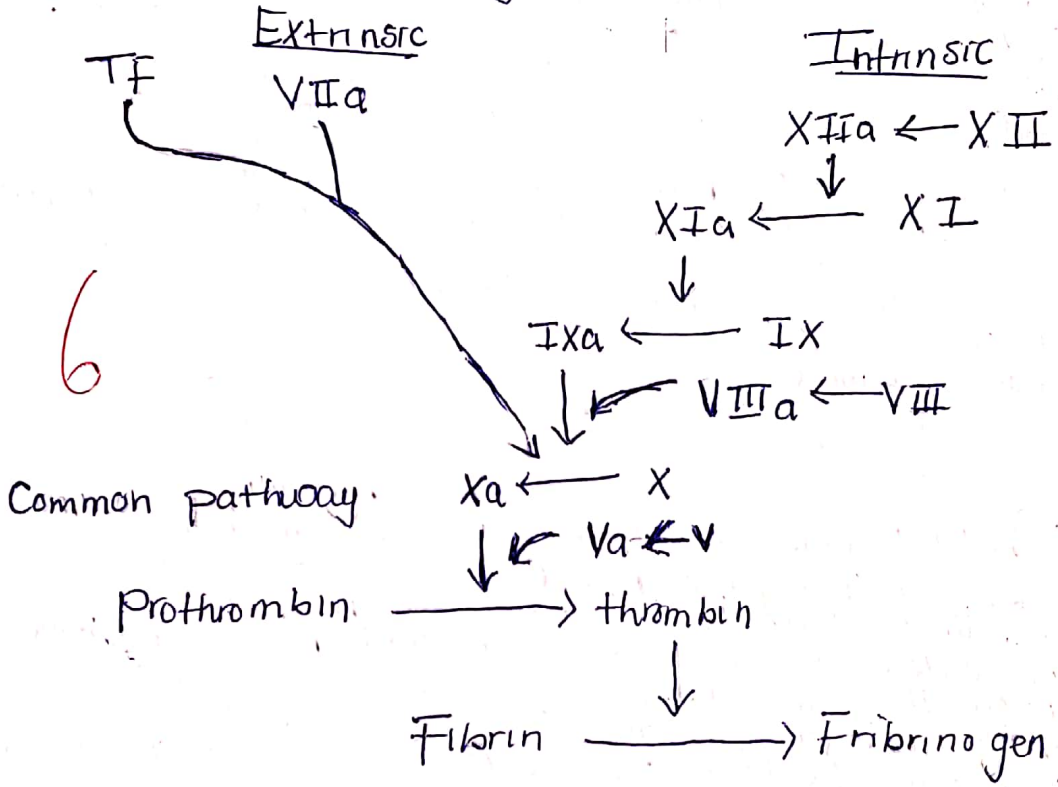
0.5

The volume of blood supplied to the skeletal muscles is less as compared when a person is exercising.

2. Mr PP came to dental clinic in Hillcrest with swollen gums in the left jaw since a year. After examination, the dentist operated surgical procedure. Later, he started bleeding through the gums that subsided with usage of coagulant medications.

Draw a labelled flow chart of extrinsic and intrinsic pathway of clotting mechanisms. Mention various catalysts involved in the process. [8 Marks]

Coagulation Cascade



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* Calcium (Ca^{2+}) is involved in the acceleration of the clotting mechanisms. it helps in speeding up the process.

THE END