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$\doteq 49\%$

THE COPPERBELT UNIVERSITY

MCS SCHOOL OF MEDICINE

END OF TERM III TEST – SEPTEMBER, 2019

MBS 210

PHYSIOLOGY

NAME: GILBERT SAMUCCUA

STUDENT ID NUMBER: 17109485 ***PROGRAMME:*** BDS ***TIME ALLOWED:*** 2 HOU

INSTRUCTIONS:

1. *Write your number on every page of the answer sheet.*
2. *Answer ALL questions*

SECTION – A

Instructions: Unless otherwise specified, choose the single best answer. Answer ALL questions.

1. The most abundant protein in blood is:
A. albumin
B. hemoglobin
C. fibrinogen
D. beta-1 globulin
E. All of the above

2. Macrocytes have a mean corpuscular volume greater than:
A. 70 fL
B. 80 fL
C. 90 fL
D. 100 fL
E. 150 fL

3. The amount of hemoglobin contained in normocytes is approximately:
A. 20 pg
B. 25 pg
C. 30 pg
D. 35 pg
E. 50 pg

4. The amount of hemoglobin present in 100 ml of red blood cells is defined as:
A. MCH
B. MCHC
C. hemoglobin index
D. RDW
E. MCV

5. In an individual with a blood hemoglobin concentration of 10 g/dL and a hematocrit of 40, MCHC is approximately:
A. 20 g/dL
B. 25 g/dL
C. 30 g/dL
D. 35 g/dL
E. 50 g/dL

6. A lab technician determines RBC count by manual hemocytometry, blood hemoglobin concentration by Sahli's acid hematin method, and hematocrit using a microcentrifuge. He follows all procedures correctly. Which of the following RBC indices calculated from these measurements would likely be the **most reliable**?

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A. Mean corpuscular volume
B. Mean corpuscular hemoglobin
C. Mean corpuscular hemoglobin concentration
D. Mean cell diameter
E. Mean erythrocyte hemoglobin

7. Primary hemostasis refers to cessation of bleeding due to:
A. Formation of a definitive clot
B. Clot retraction
C. Formation of a temporary platelet plug.
D. Vasoconstriction
E. None of the above

8. *Select all correct answers.* Platelet aggregation is stimulated by:
A. thromboxane A_2
B. ADP
C. thrombin
D. serotonin
E. Prostaglandin I_2

9. The adhesion of platelets to subendothelial collagen is impaired in the absence of:
A. von Willebrand factor
B. plasmin
C. heparin
D. antithrombin III
E. All of the above

10. Which of the following clotting factors is **not** vitamin K dependent?
A. Factor II
B. Factor V
C. Factor VII
D. Factor IX
E. Factor X

11. The extrinsic pathway is triggered by the release of:
A. Factor VII
B. Tissue factor
C. Tissue factor pathway inhibitor
D. Contact factor
E. Von Willibrand factor

12. The extrinsic pathway is inhibited by:
A. Tissue factor
B. Thromboplastin

C. Tissue factor pathway inhibitor (TFPI)
D. Contact factor
E. Fibrin stabilizing factor

13. The test that screens the extrinsic pathway is:
A. Prothrombin time (PT)
B. Activated partial thromboplastin time (aPTT)
C. Thrombin time
D. Urea solubility test
E. Clot lysis time

14. The enzyme that ultimately lyses fibrin is:
A. Plasminogen
B. TPA
C. Urokinase
D. Plasmin
E. Tyrpsin

15. Prolongation of prothrombin time does **not** occur when there is a deficiency of only:
A. Factor VIII
B. Factor IX
C. Factor X
D. Vitamin K
E. Protein S

16. *Select all correct answers.* Mutations in which of the following have been implicated in the pathogenesis of hypercoagulable states?
A. Protein C
B. Protein S
C. Factor V
D. Antithrombin III
E. None of the above

17. Factor V Leiden:
A. Is a mutated form of factor IX
B. Is inactivated by protein C
C. Is present in a large subset of patients with venous thromboembolism
D. All of the above
E. None of the above

18. *Select all correct answers.* Which condition(s) is / are characterized by an increase in both bleeding time and clotting time?
A. Afibrinogenemia
B. Hypoprothrombinemia
C. Hemophilia A
D. von Willebrand's disease

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E. Hypoalbuminemia

19. Red cell antigens A and B are chemically:
A. Phospholipids
B. Glycosphingolipids
C. Glycopeptides
D. Polypeptides
E. Glycocalyx

20. *Select all correct answers.* Red blood cell antigens A and B are also present in:
A. Saliva
B. Semen
C. Amniotic fluid
D. Pancreas
E. Liver

21. The red blood cells of a person with the Bombay blood group do **not** have:
A. GLUT
B. H substance
C. Spectrin
D. Ankyrin
E. None of the above

22. Most of the iron in the body is present in:
A. Hemoglobin
B. Myoglobin
C. Ferritin
D. Transferring
E. Liver

23. In an Rh-negative mother not previously sensitized by the Rh antigen, Rh incompatibility does not usually have a serious consequence during the first pregnancy **because:**
A. Antibodies are not able to cross placenta
B. The titer of IgG is low during the primary immune response
C. IgG is ineffective against fetal red cells
D. Massive hemolysis in the fetus is compensated by increased erythropoiesis
E. None of the above

24. In the context of blood transfusions, ABO compatibility is important because:
A. There are 3 antigens in this system
B. The A and B antigens are present in all cells
C. When an individual's RBC lacks the A or B antigen, the corresponding

antibody is invariably present in serum.

D. O is a strong antigen

25. A 55-year-old male accident victim in the ED urgently requires a transfusion. His blood group could not be determined as his red cell group and plasma group did not match. Emergency transfusion should be done with:

A. RBC corresponding to his red cell group and colloids and crystalloids
B. Whole blood corresponding to his plasma group.
C. O positive RBC, colloids and crystalloids
D. AB negative blood
E. All of the above

26. In the adult, most of the circulating erythropoietin originates from:

A. Interstitial cells (fibroblasts) surrounding peritubular capillaries in the renal cortex
B. Perivenous hepatocytes
C. Kupffer cells of liver
D. Osteoblastic cells of the bone marrow
E. Macrophages

27. Osmotic fragility of red blood cells is **decreased** in:

A. Sickle cell anemia
B. Hereditary spherocytosis
C. Microcytic hypochromic anemia
D. Macrocytic anemia
E. All of the above

28. Hereditary spherocytosis occurs due to mutations in genes coding for:

A. Spectrin and ankyrin
B. Na-K ATPase
C. Glucose-6-phosphate dehydrogenase
D. Pyruvate kinase
E. Glutathione

29. CO_2 is formed as an end product of:

A. heme metabolism
B. arginine metabolism
C. oxidation of acetoacetate
D. Bilirubin reduction
E. All of the above

30. Heme is converted to bilirubin mainly in the:

A. kidneys

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B. liver
C. spleen
D. bone marrow
E. Muscle

31. The protein that binds extracorpuscular hemoglobin is:
A. hemin
B. haptoglobin
C. hemopexin
D. haptopexin
E. All of the above

32. When a serum sample is electrophoresed, which of the following bands is normally **absent?**
A. Albumin
B. α_1 globulin
C. α_2 globulin
D. Fibrinogen
E. γ-globulin

33. Which of the following is **not** synthesized in the liver?
A. IgG
B. α_2 macroglobulin
C. Albumin
D. Angiotensinogen
E. All of the above

34. Which of the following plasma proteins are protease inhibitors?
A. α_1 antitrypsin
B. Transferrin
C. C-reactive protein
D. Antithrombin III
E. All of the above

35. Which of the following is a 'negative' acute phase reactant?
A. Albumin
B. C-reactive protein
C. α_2 macroglobulin
D. Transferrin
E. All of the above

36. ESR is increased in:
A. anemia
B. hypofibrinogenemia
C. spherocytosis
D. polycythemia

E. Hypertension

37. The average half-life of neutrophils in the circulation is:
A. 6 hours
B. 5 days
C. 2 weeks
D. 1 month
E. 120 days

38. The protein content of lymph draining from the_____is highest.
A. Choroid plexus
B. Skeletal muscle
C. Liver
D. Gastrointestinal tract
E. Lungs

39. Which of the following is **incorrect** about fetal hemoglobin (HbF)?
A. In comparison to HbA, HbF has greater affinity for 2,3–BPG
B. The oxygen dissociation curve of HbF is shifted to the left relative to HbA.
C. At low PO_2, HbF gives up more oxygen to tissues than HbA.
D. All are correct
E. None of the above

40. Problems of massive transfusion most commonly include:
A. Metabolic alkalosis
B. Hyperkalaemia
C. Coagulopathy
D. None of the above
E. All of the above

41. Which immunoglobulin would exist as a monomer in tears, saliva & mucus secretions
A. IgA
B. IgG
C. IgM
D. IgE
E. IgD

42. Erythropoietin is a glycoprotein which:
A. Stimulates red and white cell production
B. Is broken down in the kidney
C. Has a half life of days
D. None of the above
E. All of the above

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43. Erythropoietin:
A. Red cell maturation 24 to 72 hours
B. Inactivated by Kupffer cells
C. Metabolised in liver
D. Half-life is 5 mins
E. None of the above

44. Antithrombin III inactivates which coagulation factor?
A. XIa
B. IIIa
C. Ia
D. IXa
E. All of the above

45. Vitamin K neutralizes:
A. Factor 5
B. Heparin
C. Antithrombin 3
D. Plasminogen
E. None of the above

46. Platelet activation will NOT occur without:
A. Ca^{+2}
B. Vessel wall damage
C. Von Willebrand factor
D. Serotonin
E. All of the above

47. Glycoprotein CD_4 is expressed on:
A. Cytotoxic T cells
B. Suppressor T cells
C. Helper T cells
D. Plasma cells
E. Complement Determinant cells

48. HLA antigens are found on:
A. All leucocytes
B. B cells
C. T cells
D. All nucleated cells
E. All cells

49. Which of the following is *not* primarily a function of blood plasma?
A. Transport of hormones
B. Maintenance of red cell size
C. Transport of chylomicrons

D. Transport of antibodies
E. Transport of O_2

50. A hematocrit of 41% means that in the sample of blood analyzed
A. 41% of the hemoglobin is in the plasma
B. 41% of the total blood volume is made up of blood plasma
C. 41% of the total blood volume is made up of red and white blood cells and platelets
D. 41% of the hemoglobin is in red blood cells
E. 41% of the formed elements in blood are red blood cells

51. In normal human blood
A. the eosinophil is the most common type of white blood cell
B. there are more lymphocytes than neutrophils
C. the iron is mostly in hemoglobin
D. there are more white cells than red cells
E. there are more platelets than red cells

52. Lymphocytes
A. all originate from the bone marrow after birth
B. are unaffected by hormones
C. convert to monocytes in response to antigens
D. interact with eosinophils to produce platelets
E. are part of the body's defense against cancer

53. In which of the following diseases is the structure of the hemoglobins that are produced normal but their amount reduced?
A. Chronic blood loss
B. Sickle cell anemia
C. Hemolytic anemia
D. Thalassemia
E. Transfusion reactions

54. Plasma
A. Contains about 50% water.
B. Contains about 40% plasma proteins.
C. Volume changes considerably from moment to moment.
D. Is a colloidal solution.
E. All of these

55. The liquid portion of the blood with fibrinogen and some of the clotting proteins removed is;
A. Plasma
B. Platelets.
C. Plasma proteins.
D. Formed elements.
E. Serum

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56. Cells in the red bone marrow that give rise to all the formed elements of the blood are called
A. Fibrinogen.
B. Globulins
C. Megakaryoblasts
D. Proerythroblasts
E. Stem cells

57. Which of these areas does NOT contain red marrow in the adult?
A. Sternum
B. Ribs
C. Pelvis
D. distal femur
E. vertebrae

58. Each hemoglobin molecule has _____ heme group(s) and _____ globin molecule(s).
A. 1, 2
B. 1, 4
C. 2, 4
D. 4, 2
E. 4, 4

59. The form of hemoglobin that has carbon dioxide attached is called:
A. Oxyhemoglobin.
B. Deoxyhemoglobin.
C. Carboxyhemoglobin.
D. Carbaminohemoglobin.
E. All of the above

60. Pernicious anemia is an example of:
A. Hypochromic anemia.
B. Nutritional anemia.
C. Hemorrhagic anemia.
D. Hemolytic anemia.
E. Polycythemia.

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SECTION B: ANSWER ALL QUESTIONS

1. Explain the mechanism by which aspirin prevents intravascular clotting (5 marks)

Aspirin's mechanism of action is that it prevents the Synthesis of prostaglandin H2 by inhibiting the Cyclooxygenase enzyme. This inhibition prevents the Synthesis of thromboxan A2 (which promote) and prostacyclin (which inhibits) blood clotting from the platelet and endothelium respectively. Now, the endothelium is able to produce its own prostaglandin H2 and so it's Synthesis is Continued.

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2. State the causes and consequences of hypoproteinemia (10 marks)

hypoproteinemia is a Condition in which there is low protein in blood. it is Caused by

i) low protein diet
ii) renal impairment (leads to excretion of urine)
iii) liver impairment (the protein are Synthesized by the liver)
iv) problems in the ~~intestine~~ intestines where there are absorbed
v) problems in the ~~rate~~ pancreas which prevents their digestion into absorbable material

the Consequences of hypoproteinemia include

i) edema (due to reduced Colloid osmotic pressure)
ii) reduced transportation of drug and other Substances
iii) reduced Synthesis of enzyme hence slowed metabolism
iv) reduced Synthesis of hemoglobin which leads to anemia
v) muscle Contraction problems

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3. What are the components of the Prothrombin activation complex? (4 marks)

pro-thrombin activation Complex Consist of factor X (which activate prothrombin both in intrinsic & extrinsic path), factor V (which promote its activation.

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4. How is the intrinsic system inhibited? (2 marks)

i) In vitro by reduction of the plasma Ca^{2+} levels
ii) In vivo by administration with heparin.

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5. Name two factors that activate factor VIII and Name two functions of vWF (4 marks)

a) i) prothrombin ii) Platelet factor 3 (PL)

b) i) it facilitates platelet adhension

ii) it promotes platelet aggregation

6. How does thrombin enhance the clotting process? (3 marks)

Thrombin enhances clotting process by autoactivation as itself to ensure more thrombin is available, it promotes platelet aggregation and it acts as an activators of other clotting factors.

7. What is the importance of Vitamin K in blood clotting and mention the clotting factors that depend of Vitamin K for their activation? (7 marks)

Vitamin K is important in the Conversion of glutamic acid to gamma Carboxyglutamic acid. 6 clotting factor needs this Conversion for their release. the factors are

i) proteins C and II(prothrombin, VII(proConvertin) IX(Christmas factor) and

ii) Clotting factor ~~II, VII, IX and X~~ X(stuart prower factor)

8. Mention the clotting factors that form the prothrombin group and those that are not synthesized in the liver (8 marks)

The prothrombin group factors; I(fibrinogen), V(proaccelerin), VIII(anti-hemophwe globulin and III(thromboplastin, tissue factor).

i) ~~I, V, VIII and III~~

The clotting factors not synthesized by the liver

ii) ~~III~~ IV i) III (tissue thromboplastin), IV (Calcium) XIII(fibrin Stabilising factor, Platelet factor 3, von willebrand factor

9. List the various types of hemoglobin and their polypeptide configurations (4marks)

i) hemoglobin A (2α, 2β)

ii) hemoglobin F (2α, 2γ)

iii) hemoglobin A_2 (2α, 2 delta)

10. Mention the functions of Protein C and S (3 marks)

protein S is the Co-factor of protein C, protein C has an anticoagulate effect that regulates blood clotting similar to the actions of prostacyclin.

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11. List the receptors present of the platelet cell membrane (5 marks)

- Collagen
- ADP
- Thrombopoietin
- von Willebrand Factor
- Fibrinogen

12. State the natural anticlotting mechanisms of the body (7 marks)

The body's anticlotting mechanism is through the following;

i) The balance of action between thromboxane A_2 and prostacyclin

ii) The fast moving blood which prevents stagnance

iii) The secretion of clotting factors in inactive forms

iv) The action of anti-thrombin III

v) The actions of the fibrinolytic system

vi) The actions of heparin

vii) Pro-thrombin is inactive form.

13. Without the benefits of mitochondria and ribosomes for synthesizing protein, how is the erythrocyte able to survive for more than 4 months in the face of repeated oxidant stress from high O_2 concentration and repeated mechanical stress? (5 marks)

The erythrocytes are able to survive for so long by the production of energy which is used in three main processes

i) in the maintenance of cell volume

ii) in the reduction of or prevention of oxidation

iii) In the reduction of the hemoglobin's affinity for Oxygen.