Candidate Number……..

COLLEGE OF HEALTH AGRICULTURE AND NATURAL SCIENCES

DEPARTMENT OF BIOMEDICAL AND LABORATORY SCIENCES

BACHELOR OF MEDICAL LABORATORY SCIENCES HONOURS DEGREE

NSLS 103: CLINICAL PATHOLOGY

END OF SEMESTER II EXAMINATION

APRIL 2024

TIME ALLOWED: THREE (3) HRS

INSTRUCTIONS

- **Write your candidate number on the space provided on top of each page**
- **This paper consists of two sections A and B.**
- **Section A contains 60 Multiple Choice Questions (items). Answer all questions on the question paper.**
- **Section B contains five (5) essay question and you are required to answer any three (3) in the answer booklet provided.**

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SECTION A: MULTIPLE CHOICE ITEMS

Instructions:

This section consists of 60 multiple choice and matching items each with four (4) options, a) to d). Answer all questions.

From question 1 to 46 choose the SINGLE BEST ANSWER for each question by encircling your option.

1. Which of the following statements is MOST characteristic of an exudate?

a) Low protein concentration (< 3 g/dL)

b) High protein concentration (> 3 g/dL)

c) Primarily composed of water and electrolytes

d) Does not clot upon standing

2. Increased permeability of blood vessels is a key factor in the formation of:

a) Transudates only

b) Exudates only

c) Both transudates and exudates

d) Neither transudates nor exudates

3. Which of the following findings would favor the diagnosis of a transudate over an exudate?

a) High cell count (> 1000 WBCs/μL)

b) Low specific gravity (< 1.012)

c) Presence of red blood cells

d) High protein-to-sodium concentration gradient (> 0.1 g/dL per 1 mmol/L)

4. Which protein is MOST commonly found in higher concentrations in exudates compared to transudates?

a) Albumin

b) Globulin

c) Fibrinogen

d) All of the above

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5. Analysis of pleural fluid reveals a protein concentration of 2.5 g/dL and a specific gravity of 1.008. Which of the following is the MOST likely diagnosis?

a) Exudative pleural effusion

b) Transudative pleural effusion

c) Inconclusive without further analysis

d) Blood contamination

6. The presence of _____ in an effusion suggests a high likelihood of a bacterial infection.

a) High glucose concentration

b) Neutrophil predominance (> 50%)

c) Low pH

d) Cholesterol crystals

7. Chylothorax, a milky white effusion, is most commonly caused by:

a) Heart failure

b) Liver cirrhosis

c) Malignant effusion

d) Lymphatic obstruction

8. Which of the following statements about transudates is NOT correct?

a) They are formed due to increased hydrostatic pressure or decreased oncotic pressure.

b) They typically have a low protein concentration and cell count.

c) They can be caused by congestive heart failure or hypoalbuminemia.

d) They are indicative of inflammation within a body cavity.

9. Management of exudative effusions often involves:

a) Dietary sodium restriction

b) Diuretics

c) Underlying cause treatment (e.g., antibiotics for infection)

d) All of the above

10. Analysis of body fluids is a valuable tool in diagnosing various medical conditions. It is important to interpret the results in conjunction with the patient's clinical presentation and other investigations for a comprehensive diagnosis.

a) True

b) False

11. Which of the following enzymes is MOST specific to the liver and shows significant elevation in liver damage?

a) Alkaline phosphatase (ALP)

b) Alanine aminotransferase (ALT)

c) Aspartate aminotransferase (AST)

d) Lactate dehydrogenase (LDH)

12. Bilirubin is a byproduct of red blood cell breakdown. What does elevated bilirubin in the blood (hyperbilirubinemia) suggest?

a) Increased red blood cell production

b) Potential liver dysfunction or bile duct obstruction

c) Dehydration

d) Kidney disease

13. Albumin is a protein produced primarily by the liver. A low serum albumin level in an LFT panel might indicate:

a) Adequate liver function

b) Impaired protein synthesis by the liver

c) Increased protein breakdown in the body

d) All of the above

14. Which of the following statements about prothrombin time (PT) is NOT correct?

a) It is a test that measures the time it takes for blood to clot.

b) An abnormal PT can be a sign of impaired vitamin K absorption or deficiency.

c) Liver disease can prolong PT due to decreased production of clotting factors.

d) PT is not routinely included in a basic LFT panel.

15. An LFT panel reveals elevated ALT levels but normal AST levels. This finding is MOST suggestive of:

a) Alcoholic liver disease

b) Viral hepatitis

c. Severe liver damage

d. Difficulty interpreting without additional tests

16. What percentage of the filtered fluid does the kidney reabsorb?

a) Less than 50%

b) Approximately 75%

c) More than 95%

d) Exactly 100%

17. What is the functional unit of the kidney?

a) Glomerulus

b) Nephron

c) Tubule

d) Bowman's capsule

18. In the kidney, which structure is responsible for filtering blood, and which one handles reabsorption and secretion?

a) Glomerulus; proximal tubules

b) Proximal tubules; glomerulus

c) Distal tubules; collecting ducts

d) Bowman's capsule; loop of Henle

19. Which statement is true concerning the volume of intracellular fluid?

a) All of the water is in the intracellular fluid compartment.

b) Approximately two-thirds of the water is in the intracellular fluid compartment.

c) The intracellular fluid compartment changes, so it is impossible to determine the amount of water at any given time.

d) Approximately one-third of the water is in the intracellular fluid compartment.

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20. Which of the following is NOT a function of the kidneys?

a) Production of bilirubin
b) Excretion of metabolic waste and by-products
c) Endocrine function
d) Regulation of plasma electrolytes, fluid/water balance, and blood pressure

21. Which statement about acids is true?

a) Our bodies have few ways to deal with excess amounts of acids.
b) Most acid is a result of ingestion of acids with food.
c) When acid is high in the body, it causes alkalosis.
d) Weak acids only dissociate partially in solution.

22. Which organ primarily regulates the balance of electrolytes in the body?

a) Liver
b) Kidneys
c) Pancreas
d) Spleen

23. Which buffer system plays a crucial role in maintaining blood pH?

a) Bicarbonate buffer system
b) Phosphate buffer system
c) Protein buffer system
d) Haemoglobin buffer system

24. A blood pH value below 7.30 indicates:

a) Alkalosis
b) Acidosis
c) Neutral blood pH
d) Neither acidosis nor alkalosis

25. The anion gap is calculated as the difference between which ions?

a) {Sodium (Na^+)} - {Chloride (Cl^-) plus bicarbonate (HCO_3^-)}
b) {Chloride (Cl^-)} - {bicarbonate (HCO_3^-) plus Calcium (Ca^{2+})}

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c) {Sodium (Na^+)} - {magnesium (Mg^{2+}) plus bicarbonate (HCO_3^-)}

d) {Sodium (Na^+) and potassium (K^+)} – {Phosphate (PO_4^{3-}) and sulfate (SO_4^{2-})}

26. In the respiratory regulation of acid-base balance:

a) Chemoreceptors in the carotids and aorta are stimulated by a fall in pCO_2

b) Chemoreceptors in the medulla are stimulated by a fall in pH of the CSF

c) The onset of chemoreceptor response is usually slow

d) All the above statements are true

27. Respiratory acidosis occurs due to:

a) Excessive intake of acidic foods.

b) Hyperventilation.

c) Retention of carbon dioxide (CO_2).

d) Increased bicarbonate levels.

28. In clinical chemistry, the term "titratable acidity" refers to which of the following?

a) The amount of excess acid in the body

b) The amount of base required to neutralize acidic substances in urine

c) The amount of acid required to neutralize the urine

d) The amount of CO_2 in the body at any given time.

29. Which of the following is true of iron?

a) It is needed for bone formation

b) It is required for blood clotting

c) It plays a vital role in oxygen transport

d) It is required for muscle contraction

30. Which of these statements is true of urea?

a) It is synthesized in the kidneys

b) It is a high molecular weight polymer

c) Most of the filtered urea is rapidly reabsorbed at the PCT

d) Its synthesis requires NH_3 and CO_2

31. What is the primary function of iron in the human body?

a) Synthesis of hemoglobin

b) Synthesis of vitamin D
c) Regulation of blood pressure
d) Production of thyroid hormones

32. Which of the following is the storage form of iron in the body?

a) Transferrin
b) Ferritin
c) Hemosiderin
d) Hemoglobin

33. What is the main function of the hormone erythropoietin (EPO)?

a) Breaking down excess iron in the spleen
b) Enhancing iron absorption in the intestines
c) Regulating iron storage in the liver
d) Stimulating red blood cell production in the bone marrow

34. In the Fearon's reaction for blood urea estimation, urea reacts with which of the following substances?

a) Diacetyl
b) Diazine
c) Hypochlorite
d) Bromothymol

35. The reference range for plasma sodium concentration is typically:

a) 125-135 mEq/L
b) 135-145 mEq/L
c) 145-155 mEq/L
d) 155-165 mEq/L

36. Which laboratory technique is commonly used to measure plasma sodium concentration?

a) Gas chromatography
b) Enzyme-linked immunosorbent assay (ELISA)
c) Flame photometry
d) Electrophoresis

37. The primary principle behind the operation of an ISE is:

a) Gravimetric analysis
b) Spectroscopic analysis
c) Potentiometric analysis
d) Amperometric analysis

38. In flame photometry, the intensity of the emitted light at specific wavelengths is:

a) Independent of the concentration of the element in the sample
b) Directly proportional to the concentration of the element in the sample
c) Inversely proportional to the concentration of the element in the sample
d) Unrelated to the sample composition

39. In flame photometry, the energy source for exciting electrons in the sample is:

a) Electrical current
b) High-frequency radiation
c) Heat energy from the flame
d) Chemical energy from ATP

40. Anaemia of chronic disease is characterized by:

a) Elevated transferrin saturation
b) Increased iron absorption
c) High serum iron levels
d) Low serum ferritin levels

41. Iron absorption is enhanced by the presence of which nutrient?

a) Vitamin C
b) Vitamin B12
c) Vitamin A
d) Vitamin D

42. Metabolic alkalosis can result from:

a) Excessive vomiting.
b) Diabetic ketoacidosis.
c) Hypoventilation.
d) High levels of carbon dioxide (CO_2).

43. Parathyroid hormone (PTH) primarily regulates:

a) Sodium levels.
b) Calcium levels.
c) Potassium levels.
d) Magnesium levels.

44. Which of the following statements is true of hepcidin?

a) It is produced in the liver
b) It lowers iron absorption from the GIT
c) It decreases iron release from hepatocytes and macrophages
d) All the above statements are correct

45. Uric acid is synthesized from which of the following?

a) Cytosine and guanine
b) Adenosine and guanine
c) Thymine and cytosine
d) Guanine and uracil

46. Which of the following is the PRIMARY function of cerebrospinal fluid (CSF)?

a) Blood pressure regulation
b) Immune response within the CNS
c) Protection and cushioning of the brain and spinal cord
d) Transport of nutrients to the brain

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Matching Questions

Instructions: In questions 47 to 52, match the term in the left column to the most appropriate description in the right column by entering the appropriate alphabet (A – F) **in the space at the extreme right.**

Left Column		**Right Column (options)**	
47	**Alanine aminotransferase (ALT)**	A) Protein produced by the liver low levels suggest impaired protein synthesis	
48	**Albumin**	B) Enzyme found in liver and other tissues, elevated levels can indicate liver or bone disease	
49	**Alkaline phosphatase (ALP)**	C) Enzyme primarily found in the liver elevated levels suggest liver damage	
50	**Aspartate aminotransferase (AST)**	D) Byproduct of red blood cell breakdown, elevated levels indicate potential liver or bile duct problems	
51	**Bilirubin**	E) Test that measures blood clotting time; can be associated with liver disease	
52.	**Prothrombin time (PT)**	F) Enzyme found in the liver and other organs elevated levels suggest liver damage	

Instructions: In questions 53 to 57, match the electrolyte in the left column to the MOST appropriate description or function in the right column.

	Left Column	**Right Column (options)**	
53.	**Sodium (Na+)**	A) Important for muscle contraction and nerve impulse transmission	
54.	**Potassium (K+)**	B) Maintains blood volume and electrical neutrality	
55.	**Chloride (Cl-)**	C) Crucial for bone mineralization and enzyme function	
56.	**Calcium (Ca++)**	D) Plays a role in maintaining acid-base balance	
57.	**Magnesium (Mg++)**	E) Essential for cellular function and protein synthesis	

Instructions: In questions 58 to 60, indicate (by circling), whether the following statements about thyroid function are True or False.

58. The main hormone produced by the thyroid gland is triiodothyronine (T3).
True False

59. Chloride is an essential mineral required for thyroid hormone synthesis.
True False

60. TSH (thyroid-stimulating hormone) is produced by the pituitary gland and stimulates the thyroid gland to produce and secrete thyroid hormones.
True False

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SECTION B: Essay questions

Answer any 3 questions from this section on separate answer sheets provided. Each question carries 20 marks.

1. **a**. Discuss the vital roles of the liver in maintaining overall health and homeostasis.

b. Explain the concept of jaundice and its connection to impaired liver function, exploring the different causes and manifestations of jaundice.

2. **a**. Use an annotated diagram of the nephron to show the sites of i) blood filtration, ii) major sites of sodium and potassium ion reabsorption, and iii) site of aldosterone action

b. A patient's kidney function test (KFT) results show elevated urea levels. Discuss the potential causes of this finding. What are the limitations of blood urea as a kidney function test?

3. **a**. The hypothalamus and pituitary gland function in a complex interplay. Describe the concept of hormonal feedback loops and how they regulate the release of hypothalamic and pituitary hormones.

b. What are the functions of Growth Hormone (GH) and the consequences of GH deficiency?

4. Discuss the roles of the respiratory and renal systems in maintaining acid-base homeostasis. How do these systems work together to compensate for acid-base disturbances?

5. **a**. Discuss the electrolytes typically measured in a serum electrolyte assay. Explain the functions of each of these specific electrolytes and their reference ranges.

b. Explain the functional principle of flame emission spectrophotometry