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(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN EXAMINATIONS

UNIVERSITY EXAMINATIONS 2021/2022 ACADEMIC YEAR

END OF SEMESTER ONE YEAR THREE EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF MEDICINE AND BACHELOR OF SURGERY

COURSE CODE: MPS 312

COURSE TITLE: CHEMICAL PATHOLOGY

DATE:22ND APRIL 2022 **TIME: 3 HOURS**

INSTRUCTIONS TO CANDIDATES

Answer ALL questions in sections A, B and C

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 8 Printed Pages. Please Turn Over.

SECTION A; MULTIPLE CHOICE QUESTIONS (30MARKS)

1. Venipuncture should NOT be carried out in which of the following patients?
   a. Prone
   b. Sitting for less than 10 minutes
   c. Sitting for more than one hour
   d. Standing
   e. Supine
2. Stainless-steel needle is required for the collection of which of the following specimens?
   a. Amino acids
   b. Arterial blood gases
   c. Clotting factors
   d. Cortisol
   e. Trace elements
3. The type of error that occurs when an analytical method is nonspecific for an analyte and is actually considered to be a type of bias is:
   a. Systematic error.
   b. Nonsystematic error.
   c. Random error.
   d. True error.
   e. Type1 error
4. In a method comparison analysis, the lowest value of an analyte that significantly exceeds the measurement of a blank sample is referred to as the;
   a. Limit of detection of a method.
   b. Analytical sensitivity.
   c. Analytical specificity.
   d. Basic error of a method.
   e. Predictive value of a method
5. In the selection of a new method, the first step in selecting a candidate method is the determination of:
   a. Reliability.
   b. Total allowable error.
   c. Specifics of the assay including reagent stability.
   d. What is necessary clinically from a laboratory test
   e. Turnaround time
6. Absorbance of light is:
   a) Difference between incident and transmitted light
   b) Light absorbed in a solution after striking it
   c) Negative log of transmitted and incident light
   d) Molar absorption of light by the solution
   e) Ratio of incident and transmitted light
7. According to Beer-Lambert Law absorbance of a solution increases with:
   a) Intensity of the light source
   b) Length of the light path
   c) Number of light scattering particles
   d) Percentage transmittance of the light
   e) Reflectance of light

8. An autoanalyser has rejected the blank cuvettes before the start of analysis with the message "Cuvette Check Fail" (Dirty Cuvettes). Which of the following phenomena is mainly prevented by this function of autoanalyser:
    a) Absorbance of light
    b) Emission of light
    c) Reflectance of light
    d) Scattering of light
    e) Transmission of light
9. Immunoassays have passed through an evolutionary process of development with decreasing 'Limits of Detection' (Increasing 'Analytical Sensitivity') and ease of automation. Following is a list of labelled immunoassays in a random order. Which of the immunoassay techniques has the highest Analytical Sensitivity?
    a) Chemiluminescence Immunoassay (CMIA)
    b) Enzyme Linked ImmunoSorbent Assay (ELISA)
    c) Fluorescent Polarized Immunoassay (FPIA)
    d) Immunoradiometric Assay (IRMA)
    e) Radioimmunoassay RIA)
10. In an Ion-Selective Electrode (ISE) the most important part determining the selectivity of the cell is:
    a) External reference electrode
    b) Inner electrolyte
    c) Internal reference electrode
    d) Membrane
    e) The frit
11. The discrete auto-analyser are most commonly used these days, which can carry out multiple tests on one specimen or one test on multiple specimens. They are also called:
    a. Batch analyser
    b. Centrifugal analyser
    c. Continuous flow analyser
    d. Discrete analyser
    e. Random access analyser
12. Specimen having analyte of interest is incubated with suitable reagent, reaction takes place and coloured complex thus formed is read for absorbance at specific wavelength. Which type of analytical reaction it is:
    a. Continuous monitored
    b. End-point
    c. End-point kinetic
    d. Two point enzymatic
    e. Two point kinetic
13. Highly purified chemicals that are directly weighed or measured to produce a solution whose concentration is exactly known. Such Reference Material is known as:
    a. Certified Reference Material
    b. Crystalline Reference Material
    c. NIST Traceable Reference Material
    d. Secondary Reference Material
    e. Standard Reference Material

14. A clinical laboratory manager is working on the measures like reducing turnaround time, improvement for specimen and patient identification, and test utility. Which of the following term best describes the processes:
    a. Quality Assurance
    b. Quality Control
    c. Quality Improvement
    d. Quality Laboratory Processes
    e. Quality Planning
15. Which of the following is most common cause of a random error?
    a. Change in reagent or calibrator lot numbers
    b. Deterioration of reagents or calibrators
    c. Fluctuation in power supply
    d. Improperly prepared reagents
    e. Wrong calibrator values
16. You are working in a state of the art hospital laboratory in Middle East. There is no issue of funds and proper storage of reagents. Which of the following control material you will select for use in your laboratory for most precise test?
    a. Liquid, bovine and assayed controls
    b. Liquid, human, and assayed controls
    c. Lyophilized, bovine, assayed controls
    d. Lyophilized, bovine, un-assayed controls
    e. Lyophilized, human and assayed controls
17. Basic statistics is essential for running a quality control programme in a laboratory. In statistical terms, normal data means:
    a. Labs own generated values
    b. Result of disease free subjects
    c. Result of healthy individuals
    d. Symmetrical distribution
    e. Values within reference values
18. True positives /(true positives + False positives) is the Formula used to determine the:
    a. predictive value of a positive test.
    b. predictive value of a negative test
    c. prevalence.
    d. odds ratio
    e. risk ratio
19. In relation to healthcare, the word quality is defined as:
    a. the most expensive care that can be provided to a patient.
    b. the use of the best analyzers an equipment available or diagnostics to improve outcomes.
    c. the increase probability of desired outcomes and the decrease probability of un desired outcomes.
    d. an improved outcome
    e. none of the above
20. Which one of the following aspects best describes an External Quality Assessment Scheme (EQAS)?
    a. Detection of imprecision

b. Detection of random error
c. Inter-laboratory comparison
d. Prevention of post-analytical errors
e. Prevention of pre-analytical errors

21. The normal anion gap is:
    a. < 7
    b. < 12
    c. < 17
    d. <22
    e. < 30
22. A low concentration of sodium in the blood stimulates the production of:
    a. Potassium ions from potassium hydroxide
    b. Hydrogen ions from strong acids
    c. Renin from the nephron of the kidney
    d. Lymph from the lymphatic channels
    e. None of the above
23. Excessive amount of potassium in the body may lead to:
    a. Arrhythmia of the heart
    b. Poor muscle contration
    c. Accumulation of acid in the body
    d. Fibrillations of the heart
    e. Strong muscle contraction
24. Hypoproteinemia is a condition of unusually low levels of plasma proteins. This problem is often characterized by:
    a. Tissue edema
    b. Extreme weight loss
    c. Extreme weight gain
    d. Nerve damage
    e. Cardiac arrest
25. Respiratory acidosis can occur when:
    a. A person consumes excessive amount of antiacids
    b. A persons breathing is shallow due to obstruction
    c. A runner has a completed a very long marathon
    d. The kidneys secrete hydrogen ions
    e. Liver failure
26. The following laboratory parameter is high in blood sample in cases of dehydration, bronchitis, cushing's disease, diabetes insipidus and insufficient water intake:
    a. Sodium
    b. Hematocrit
    c. Erythrocyte sedimentation rate (ESR)
    d. Platelet count
    e. Hemoglobin
27. What disorder results when the acid – base balance of the blood is thrown off, causing it to become more acidic?
    a. Hypomagnesaemia
    b. Hypermagnesaemia

c. Hyperkalemia
d. Hypokalemia
e. Metabolic acidosis

28. Which disorder can be caused by excess intake of calcium (supplements or antacids) or altered excretion of calcium by either renal failure or administration of diuretics?
    a. Hypocalcaemia
    b. Hypokalemia
    c. Hypocalcemia
    d. Hyponatremia
    e. Hypernatremia
29. Which disorder has the following signs and symptoms; hypotension, nausea, diarrhea, increased bowel sounds, malaise, muscle weakness, decreased deep tendon reflexes, personality changes, altered level of consciousness, and possibly seizures?
    a. Hypercalcemia
    b. Hypernatremia
    c. Hypocalcemia
    d. Hyponatremia
    e. Hypokalemia
30. Which disorder may be caused by insufficient sodium excretion due to hormone imbalance, renal failure, corticosteroids, increased water loss due to fever, hyperventilation, increased metabolism and dehydration due to sweating, vomiting or diarrhea?
    a. Hypocalcemia
    b. Hypernatremia
    c. Hyponatremia
    d. Hypokalemia
    e. Hypercalcemia
31. A patient was diagnosed with hyperparathyroidism after a work-up to determine the cause of her elevated calcium levels. The greatest concern in a patient with hypocalcaemia would be:
    a. Constipation
    b. Dehydration
    c. Kidney stones and muscle weakness
    d. Cardiac arrhythmia and sinus arrest
    e. Nausea and vomiting
32. You are monitoring intravenous fluids for a patient who is currently being treated for metabolic acidosis. What are some of the signs and symptoms that you will monitor?
    a. Hypotension, altered heart rate, elevated respiratory rate, and muscle weakness
    b. Hypertension, tachycardia, slowed repiratory rate and muscle spasms
    c. Elevated blood pressure, bradycardia, elevated respiratory rate and muscle twitching
    d. Hypotension, hypoxia, irritability and parenthesis
    e. Hypoxia, hypernatremia and cachexia
33. After a physical examination. An elderly patient is diagnosed with dehydration. What assessment findings would you expect to see from the above mentioned patient?
    a. Rales, peripheral edema, palpitations and diaphoresis
    b. Tachypnea, tachycardia, hypotension, poor skin turgor and decreased urinary output

c. Bradycardia, slowed respirations, low body temperature, and weight gain
d. Malaise, lymphadenopathy, and nausea
e. Fever, shortness of breath and nausea.

34. Which disorder can be caused by fluid losses due to diuretics or diarrhea, endocrine disorders, insufficient intake of potassium, and low magnesium levels?
    a. Hypernatremia
    b. Hypocalcemia
    c. Hyponatremia
    d. Hypokalemia
    e. Hypocalcemia
35. For which disorder will water restriction help to prevent further dilution of the plasma concentration of sodium?
    a. Hypercalcemia
    b. Hypocalcemia
    c. Hypokalemia
    d. Hypernatremia
    e. Hyponatremia
36. Which disorder has the following signs and symptoms: irritability; parenthesis of lips and extremities; muscle spasm and cramping; intermittent painful tonic spasms; abdominal pain due to muscle cell cramping; seizures due to irritation of nervous system tissue; and cardiac arrhythmias?
    a. Hypernatremia
    b. Hypocalcemia
    c. Hyponatremia
    d. Hypercalcemia
    e. Hypokalemia
37. For which disorder would you advise the patient to avoid salt substitutes and foods such as bananas, tomatoes and orange juice?
    a. Hyperkalemia
    b. Hypomagnesemia
    c. Metabolic acidosis
    d. Hypokalemia
    e. Metabolic alkalosis
38. Which disorder may develop as a result of increased phosphate levels due to renal insufficiency, increase in phosphate intake, hyperparathyroidism, rhabdomylosis, or as a result of cell destruction from chemotherapy?
    a. Hypophosphatemia
    b. Metabolic alkalosis
    c. Hyperphosphatemia
    d. Dehydration
    e. Metabolic acidosis

39. Which disorder has the following signs and symptoms; lethargy due to increased hydrogen ion concentration in the blood; bilateral muscle weakness; tachycardia; hypotension and hyperventilation as the body attempts to compensate?
    a. Metabolic alkalosis
    b. Hypermagnesemia
    c. Hypomagnesemia
    d. Hyperkalemia
    e. Metabolic acidosis
40. Which disorder can be caused by increased excretion or abnormal excretion of sodium, water imbalance, hormonal imbalance, ecstasy use, hypothyroidism, renal failure, diuretics, diarrhea, vomiting and wound drainage?
    a. Hyponatremia
    b. Hypercalcemia
    c. Hypocalcemia
    d. Hypernatremia
    e. Hypokalemia

SECTION B; SHORT ANSWER QUESTIONS (30 MARKS)

1. State FIVE steps of evaluation of a new analytical method in the laboratory (5mks)
2. Outline THREE patient related and TWO cyclic sources of biological variation of laboratory results in chemical pathology (5mks)
3. State the differences of the following techniques as used in chemical pathology (5mks)
    a) Atomic absorption spectrometry and flame emission spectrometry
    b) Nephelometry and turbidimetry
4. Briefly describe the biochemical pathology of acute and chronic complications associated with diabetes mellitus (5 marks).
5. Explain biochemical pathophysiology of porphyria or porphyrinurias associated with lead toxicity (5 marks).
6. Explain the pathological condition associated with iron metabolism and its management (5 marks).

SECTION C; LONG ASSAY QUESTIONS (30MARKS)

1. Describe reference ranges and Outline the steps involved in their establishment from a reference population (15 Marks)
2. Discuss six (6) pathological variations of water and electrolyte imbalances (15 marks)