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University Examinations 2024/2025

SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF MEDICAL LABORATORY

HML 3213: LABORATORY ANALYTICAL TECHNIQUES

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS:
Answer ***All*** *questions*
Ensure that all your answers are properly numbered
Part I multiple Choice Questions (MCQ): Write the correct answer on the space provided in the answer booklet. Each MCQ is one mark
Part II: Short Answer Questions – Answer questions following each other on the answer booklet
Part III: Long Answer Questions – Answer each question on the answer booklet

SECTION A: MULTIPLE CHOICE QUESTIONS (20 marks)

1. The following are true about stationary phase in chromatography EXCEPT

   a) The type of adsorbent material used as the stationary phase is vital for efficient separation of components in a mixture.

   b) Adsorbent material can be chosen based on particle size and activity of the solid.

   c) The activity of the adsorbent is represented by its activity grade, which is a measure of an adsorbent's attraction for solutes in the sample solution.

d) The solids with the lowest activity grading are those that are completely anhydrous.

e) Silica gel and alumina are among the most popular adsorbents used.

2. The following statements are true about size exclusion chromatography EXCEPT ONE:

a) Size exclusion chromatography separates molecules by their size.

b) This is done by having the stationary phase be packed with small particles of silica or polymer to form uniform pores.

c) The smaller molecules will get trapped in the silica particles and will elude from the column at a rate that is not greater than that of larger molecules.

d) The retention time depends on the size of the molecules.

e) Larger molecules will be swept away in the mobile phase and therefore having a smaller retention time.

f) Also notice that in this type of chromatography there isn't any interaction, being physical or chemical, between the analyte and the stationary phase.

3. The following statements are not true about affinity chromatography EXCEPT ONE:

a) This type of chromatography involves binding a reagent to the analyte molecules in a sample.

b) The stationary phase is usually agarose or a porous glass bead that is able to immobilize the unbonded molecule.

c) It is not possible to change the elution conditions by manipulating the pH or the ionic strength of the binding ligand.

d) This method is often used in biochemistry in the purification of vitamins.

e) The ligand tag is unbonded and after separation the tag is then removed and the and the pure protein is obtained.

4. The following statements are true about electrophoresis EXCEPT ONE:

a) Separates DNA, RNA or protein molecules based on size and electrical charge.

b) Charged macromolecules are placed in the electric field move towards the negative or positive pole based on their charge.

c) Nucleic acid has a negative charge and therefore it migrates towards the anode.

d) Slab electrophoresis include zone electrophoresis and Isoelectrofocusing

e) Capillary electrophoresis gel electrophoresis and Immunoelecirophoresis

5. The following statements are true about immunochemical reactions and techniques EXCEPT ONE:

a) Immunochemical techniques are based on a reaction of antigen with antibody, or more exactly, on a reaction of an antigenic determinants with the binding site of the antibody.

b) The antibodies used are produced by various ways.

c) Immuno-techniques are methods used to study the immune system and produce antibodies that can detect specific proteins in biological samples.

d) They are used for inducing, measuring, and characterizing immune responses.

e) Antibodies are generally macromolecules (proteins, glycoproteins, or polysaccharides) that can express many different epitopes.

6. The following statements are true about Sandwich ELISA EXCEPT ONE:

a) Sandwich ELISA helps to detect the presence of antibody in a sample.

b) The sample containing the antigen is added to the well and washed to remove free antigens.

c) Then an enzyme-linked secondary antibody, which binds to another epitope on the antigen is added.

d) The microtitre well is coated by the antibody and is washed to remove any free secondary antibodies.

e) The enzyme-specific substrate is added to the plate to form a colored product, which can be measured.

7. The following are diseases that Can Be Diagnosed Using ELISA EXCEPT ONE:

a) Ebola

b) Tuberculosis

c) Pernicious anaemia

d) Rotavirus

e) Lyme disease

8. The following are some of the advantages of the ELISA technique EXCEPT ONE:

a) Results fetched from ELISA gives an accurate diagnosis of a particular disease since two antibodies are used.

b) Can be carried out for complex samples as the antibody is not required to get purified to detect.

c) It is highly responsive since direct and indirect analysis methods can be carried out and it is a rapid test that yields results quickly.

d) Possible detection for ELISA ranges from the quantitative, semi-quantitative, standard curve, qualitative, calibration curve models etc.

e) Easier to perform and uncomplicated process as compared to other assays which require the presence of radioactive materials.

9. The following statements are true about Immunoblotting EXCEPT ONE:

a) Immunoblotting is a semiquantitative method that uses gel electrophoresis to detect proteins in a sample based on their size and electric charge.

b) Immunoblotting is also called Western Blotting

c) Immunoblotting is a technique used for analysis of individual antibodies in a protein mixture e.g., a cell lysate

d) Immunoblotting techniques use antibodies (or other specific ligands in related techniques) to identify target proteins among a number of unrelated protein species.

e) They involve identification of protein target via antigen-antibody (or protein-ligand) specific reactions.

10. The following statements are methods of agglutination reactions EXCEPT ONE:

    a) Latex agglutination

    b) Precipitin test

    c) Flocculation tests

    d) Direct bacterial agglutination

    e) Hemagglutination.

11. The following are electrochemical methods EXCEPT ONE:

    a) Cytometry

    b) Potentiometry

    c) Voltammetry

    d) Amperometry

    e) Coulometry

12. The following statements are true about amperometry EXCEPT ONE:

    a) Amperometry in chemistry is the detection of ions in a solution based on electric current or changes in electric current.

    b) Amperometry is used in electrophysiology to study vesicle release events using a carbon fiber electrode.

    c) Amperometry is conducted in a three-electrode system and every analyte has a fixedpotential for undergoing a redox activity.

    d) The potential required is applied, and the resultant current is measured.

e) AmoerometTic titration is done in different manner.

13. The following statements are true about conductometry EXCEPT ONE:

a) Conductometry is a measurement of electrolytic conductivity to end a process of chemical reaction.

b) Conductometry has notable application in analytical chemistry, where conductometric titration is a standard technique.

c) Conductometry is the measurement of the electrical conductivity of a solution.

d) The conductance is defined as the current flow through the conductor.

e) The unit for the conductance is Seimens (S) which is the reciprocal of Ohm's (Q —1).

14. The following are the basic components of an automated system EXCEPT ONE:

a) Action element

b) Optical mechanism

c) Sensing mechanism

d) Control element

e) Decision element

15. Inferential statistics can be divided into four categories EXCEPT ONE:

a) Parametric

b) Non-parametric

c) Verbaric

d) Predictive correlation

e) Predictive regression

16. The following statements are true about qualitative or categorical data EXCEPT ONE:

a) Qualitative known as the categorical data, describes the data that fits into the categories.

b) Qualitative data are not numerical.

c) The categorical information involves categorical variables that describe the features e.g., person's gender, home town etc.

d) Categorical measures are defined in terms of natural language specifications, but not in terms of numbers.

e) Sometimes categorical data can hold numerical values (quantitative value) that have a mathematical sense.

17. The following statements are true about summative evaluation EXCEPT ONE:

a) Summative evaluation is a type of evaluation that occurs at the middle of a learning period or program.

b) It assesses students' learning and whether they have met the established learning goals.

c) It evaluates the effectiveness of a learning program or to provide a final grade for a student's performance.

d) Formative evaluation is a process of regularly assessing the progress of a project, program, or product while it is still in development.

e) It aims to increase efficiency, effectiveness, and success by identifying and addressing early challenges or issues.

18. The following statements are true about isotopes EXCEPT ONE:

a) Isotopes are elements with the same atomic number but a different mass number

b) Isotopic forms of Fluorine are fluorine 17, fluorine 18 and fluorine 19

c) Isotopic forms of Oxygen are Oxygen -16, Oxygen -17 and Oxygen -18

d) Isotopic forms of Uranium are U-235 and U-239

e) Isotopic forms of Chlorine are Chlorine- 35 and Chlorine — 37

19. The following statements are true about properties of isotopes EXCEPT ONE:

a) Generally, the chemical properties of isotopes of any element are almost identical.

b) The numbers of neutrons in Hydrogen isotopes do not have a major effect on the size of the nucleus of a hydrogen atom.

c) The physical properties of isotopes in a particular element vary from each other.

d) The physical properties of any isotope depend on the mass.

e) The physical properties shows that mass of each isotope of a single element varies from one another.

20. There following are the types of kidney stones EXCEPT ONE:

a) Calcium oxalate

b) Uric acid

c) Magnesium ammonium phosphate

d) Hydrochloric acid

e) Cystine

SECTION B: SHORT ANSWER QUESTIONS (ANSWER ALL) (40 MARKS)

QUESTION ONE

Define the following as applied in laboratory analytical techniques (5 Marks)

a) Chromatography

b) Isotopes in clinical chemistry

c) Electrophoresis

d) Spectroscopy

e) Spectra

QUESTION TWO:

Define Quality Assurance and outline the four types of Quality Assurance as in the medical laboratory (5 Marks)

QUESTION THREE:

Describe PH and outline four ways of measuring PH in medical laboratory (5 Marks)

QUESTION FOUR:

Describe forensic toxicology and outline four methods used in toxicological analysis

(5 Marks)

OUESTION FIVE:

Outline the five steps in gas chromatography procedure (5 Marks)

OUESTION SIX:

What is formative evaluation and list any four data collection methods that can be used in formative evaluation? (5 Marks)

OUESTION SEVEN:

List any five methods of analysis of protein in a laboratory? (5 Marks)

QUESTION EIGHT:

With examples highlight on in a medical laboratory (5 Marks)

SECTION C: LONG ANSWER (20 MARKS)

SECTION ONE:

a) Briefly state the principle of Enzyme-linked immunosorbent assay(ELISA) as a laboratory analytical technique (4 Marks)
b) Write on the three types of enzyme-linked immunosorbent assay as a laboratory analytical technique (12 Marks)
c) List any eight disease that can be diagnosed using enzyme-linked immunosorbent assay (4 Marks)

OUESTION TWO:

a) Write on nine elements of Standard infection control precautions (SICPs) in the laboratory? (18 Marks)
b) Briefly outline on specimen collection by swabbing from a patient? (2 Marks)

OUESTION THREE:

a) Briefly write on amino acids? (2 Marks)

b) Briefly state the principle of Ninhydrin Test for analysis of amino acids in a sample in the laboratory? (4 Marks)

c) Outline the procedure for Ninhydrin Test for analysis of amino acids in a sample in thelaboratory? (8 Marks)

d) Briefly write on the application of Ninhydrin Test for analysis of amino acids (6 marks)