



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE

SBC 402: LABORATORY TECHNIQUES IV

DATE: Thursday 5th April, 2012

TIME: 2.00 p.m. – 4.00 p.m.

SECTION A: Answer ALL questions (20 marks each)

1. Capillary electrophoresis – mass spectrometry (CE – MS) is commonly used in protein analysis because:

- (a) It is relatively easy to couple capillary electrophoresis to mass spectrometry.
- (b) CE – MS can be used to analyze samples with molecular weight less than 1,000.
- (c) CE – MS is compatible with protein analysis.
- (d) None of the above.

2. While performing mass spectrometry the purpose of derivatizing a sample analyte is to make it

- (a) More water soluble
- (b) Less nonpolar
- (c) More volatile
- (d) None of the above

3. The ions that are used in selected ion monitoring to confirm the presence of say a drug are called

- (a) Peak qualifiers
- (b) Quantitation ions
- (c) Base peaks
- (d) Molecular ions

4. The base peak in a mass spectrum is the ion that

- (a) Has the highest m/z ratio
- (b) Has the greatest abundance
- (c) Has the lowest m/z ratio
- (d) Has the lowest abundance.

5. Common types of mass analyzers used in biochemistry laboratories include

- (a) Quadrupoles and ion traps
- (b) Magnetic sector instruments

- (c) Double focusing instruments
(d) None of the above
6. Which of the following processes do not occur in the ion source of mass spectrometer
- (a) Fragmentation
(b) Rearrangement
(c) Formulation of negative ions
(d) Ion-photon conversion
7. Which of the following statements is not true about IgG immunoglobulin
- (a) It is a pentamer
(b) It has two antigen-binding sites
(c) It has a molecular weight of 150KD
(d) It is the major immunoglobulin in blood processes.
8. Which of the following statements is an exception regarding the general principles of immunoassay measurements
- (a) The analyte of interest may be either an antigen or an antibody
(b) Haptens are highly antigenic in vivo and hence are often incorporated into in vitro analyses.
(c) The term ligand refers to the analyte measured
(d) A tracer is chemically bonded to a ligand to help monitor the reaction.
9. Which of the following is not a major drawback of radioimmunoassay
- (a) Poor sensitivity
(b) Handling of radioactive waste
(c) Difficult to automate
(d) Very labor-intensive.
10. An important application of the immunoblotting assay is
- (a) Measurement of DNA concentration

- (b) Measurement of RNA concentration
- (c) Study of body-antigen reactions
- (d) Confirmation of viral antigens in human blood or tissues.

11. Varying antibody-antigen ratios brings immune-precipitating. This occurs at the equivalence point characterized by the following

- (a) Antibody excess
- (b) Antigen excess
- (c) Antibody and antigen concentrations balance each other
- (d) None of the above.

12. Enzyme commonly used for labeling antibodies for immunoassay is

- (a) Glucose 6-phosphate dehydrogenase
- (b) Acidic phosphate
- (c) Alkaline phosphate
- (d) Hexokinase

13. Which of the following immunoassay technique is competitive in nature

- (a) Enzyme-linked immunosorbent assay
- (b) Radioimmunoassay
- (c) Fluorescence-polarization immunoassay
- (d) None of the above.

14. Which of the following techniques requires a labeled antibody

- (a) Rocket immunoelectrophoresis
- (b) Single radial immunodiffusion
- (c) Immunoelectrophoresis
- (d) Immunoblotting

15. Which of the following techniques is quantitative

- (a) Single radial immune diffusion (SRID)
- (b) Immunohistochemistry
- (c) Immunoblotting

(d) None of the above.

Answer true (T) or false (F)

16. Combined gas chromatography – mass spectrometer (GC-MS) and liquid chromatography (LC-MS) are widely used for biochemical analysis BECAUSE they cannot identify minor components in complex mixtures.
17. HPLC – mass spectrometry is preferable to GC-MS BECAUSE sample derivatization of sample analytes is usually not required.
18. Electrospray ionization is of great value in protein analyses because it cannot be easily coupled to HPLC
19. Matrix assisted laser desorption ionization (MALDI) coupled to time of flight (TOF) is commonly used in proteomic analysis BECAUSE it is possible to obtain accurate values of molecular weights.
20. An advantage of fast atom bombardment – mass spectrometry (FAB-MS) is that it can be used for protein sequencing studies.

SECTION B: Answer ALL Questions (30 Marks)

Fill the missing information

1. Newly developed techniques for studying (i)_____ molecular dynamics utilizes (ii)_____ a naturally occurring (iii)_____ protein by a certain jelly fish. Using recombinant DNA techniques researchers can (iv)_____ DNA encoding (v)_____ to a gene coding for a particular cellular protein. The resulting (vi)_____ can

then be introduced into cells where it is expressed to a (vii)_____ version of the normal cellular protein. In many cases, (viii)_____ functions like the ordinary protein and (ix)_____ used to analyse (x)_____ as it functions in a living cell.

- (i)
- (ii)
- (iii)
- (iv)
- (v)
- (vi)
- (vii)
- (viii)
- (ix)
- (x)

2. Fluorescence microscopy is useful not only for observing movements of (i)_____ but also for measuring their (ii)_____. When two (iii)_____ whose fluorescence properties are matched are brought very close together, it is possible for them to experience (iv)_____. In this technique, illuminating a cell at (v)_____ of the (vi)_____ results in energy transfer to the (vii)_____. This process itself does not involve (viii)_____ but once it occurs, it causes the (ix)_____ to emit light at its characteristic (x)_____.

- (i)
- (ii)
- (iii)
- (iv)
- (v)
- (vi)
- (vii)
- (viii)

(ix)

(x)

3. An important property of many (i)_____ is their ability to precipitate. (ii)_____ from solution. Antibodies are divalent (iii)_____ or multivalent (iv)_____ and if the antigen is also multivalent (v)_____ give rise to (vi)_____ that is too large to remain in solution so that (vii)_____ occurs. The formation of an insoluble (viii)_____ is very dependent on antigen and antibody concentrations. It occurs within a narrow concentration range known as (ix)_____. This represents the conditions under which macromolecular (x)_____ are formed that are sufficiently large to be precipitated.

(i)

(ii)

(iii)

(iv)

(v)

(vi)

(vii)

(viii)

(ix)

(x)

4. Although SDS-PAGE is a powerful technique for (i)_____ of complex protein mixtures, it does not give (ii)_____ of a protein. If (iii)_____ are available the technique of (iv)_____ can achieve this. The key step is the (v)_____ of proteins to (vi)_____.

Blotting can be achieved by the use of (vii)_____ where the gel is placed on a wet pad of buffer-soaked filter paper and (viii)_____ placed on the gel. (ix)_____ is then drawn through the gel by placing a pad of dry absorbent material followed by a heavy weight on the blotting paper sheets. Passage of buffer by (x)_____ through the gel carries the separated protein on to nitrocellulose sheet.

- (i)
- (ii)
- (iii)
- (iv)
- (v)
- (vi)
- (vii)
- (viii)
- (ix)
- (x)

5. Cells and sub- cellular particles can be separated from one another on the basis of differences on the (i)_____ between two (ii)_____ in the technique called (iii)_____. If the cells are to be separated without undue damage, the media chosen must be compatible with cells with respect to (iv)_____ (v)_____ (vi)_____ (vii)_____. This greatly restricts the selection of (viii)_____ usable of cells especially in comparison with the wide range of choices available when counter current distribution is applied for separation of (x)_____.

- (i)
- (ii)
- (iii)
- (iv)
- (v)
- (vi)

- (vii)
- (viii)
- (ix)
- (x)

6. Fill in the missing information in the table

	TECHNIQUE	PRINCIPLE	ADVANTAGE
(i)	EI		
(ii)	CI		
(iii)	FAB		
(iv)	ESI/APCI		
(v)	MALDI/ TOF		

SECTION C: Answer ANY TWO questions (20 Marks)

1. Explain the principles and applications of solid - phase enzyme immunoassays.
2. Describe the principles and applications of isotope-ratio mass spectrometry (IR-MS).
3. Describe the principle and applications of Fluorescence Activated Cell Sorting (FACS) machine.