

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Level : B.Sc.
Year : III
Time : 2 hrs. 30mins.

28 JUL 2024

Course : BIOT 301
Semester : I
F. M. : 55

SECTION "C"

[3 Q. × 8 = 24 marks]

Attempt ANY THREE questions.

1. Explain the role of chaotropic and anti-chaotropic salts in the purification of proteins with an example each.
2. Explain the principle of rotary drum vacuum filters with a suitable diagram.
3. Explain how biological molecules can be separated based on the following properties:
 - a. Size
 - b. Sedimentation coefficient
4. Bacterial cells were centrifuged using 5 cm long centrifuge tubes in a laboratory centrifuge having an angled rotor which held the tubes at 60-degree angle with the axis of rotation. The top of the tubes was 5 cm away from the axis and it took 10 minutes at a rotation speed of 10,000 rpm to completely sediment the cells. Calculate the sedimentation coefficient of the cells.

SECTION "D"

[31 marks]

Attempt ANY SIX questions. (Q.N. 6 is compulsory)

5. Write short notes on [3+3=6]
 - a. Salting out effect
 - b. Ultrafiltration
6. Explain the principle of cell disruption in downstream processing using detergent and enzymes [5]
7. Explain briefly the different steps involved in an extraction process. [5]
8. Define ion exchange adsorption. List the various types of ion exchange adsorption ligands used in bio separation. [5]
9. Explain the principle of precipitation using organic solvents. [5]
10. How biological molecules can be separated based on their molecular weight? [5]
11. Explain the role of fixed angled and swing out centrifuges in downstream processing of biomolecules. [5]

10. Which of the following is commonly used to precipitate proteins by reducing the dielectric constant of the solution?
 Water Sodium chloride
 Ethanol Hydrogen peroxide
11. Which salt is commonly used as an anti-chaotropic agent in protein precipitation?
 Sodium chloride Potassium chloride
 Ammonium sulfate Urea
12. Which type of rotor is preferred for centrifuging cells and coarse particles?
 Horizontal rotor Fixed angle rotor
 Swing out rotor Vertical rotor
13. In the context of a centrifuge, what does the sigma factor (Σ) represent?
 Rotation speed Equipment properties
 Material Properties Particle size
14. Which of the following is NOT a method to improve filtration efficiency?
 Pre-treatment of the fermentation broth
 Use of filter aids
 Increasing the pressure drop
 Optimizing the duration of the fermentation
15. Which of the following is NOT a typical application of extraction in bioprocessing?
 Purification of antibiotics Purification of alkaloids
 Separation of enantiomers Purification of lipids.
16. What is the primary application of **ultrafiltration** in biotechnology?
 Removal of salts from solutions Separation of gases
 Concentration of macromolecules Sterilization of products
17. Which of the following method of bio separation is of low resolution but high throughput
 Filtration Ultracentrifugation
 Chromatography Electrophoresis
18. The rotating speed of a rotary drum vacuum filters is in the range
 0.1- 2 rpm 0.5- 10 rpm 5- 50 rpm 20-100 rpm
19. DEAE group in adsorption is a
 Weak cation exchange adsorbents Strong cation adsorption adsorbents
 Weak anion exchange adsorbents Strong anion exchange adsorbents
20. The membrane filtration used for sterilization of fermentation medium is
 Ultrafiltration Microfiltration
 Nanofiltration Dialysis

SECTION "B"
[10 Q. × 1 = 10 marks]

Fill in the blanks

21. The k factor can be calculated using the empirical correlation _____.
22. The minimum solubility of protein is observed at its _____.
23. The membrane filtration that can be used for buffer exchange is _____.
24. The purification of the protein lysozyme using S-adsorbent is an example of _____ exchange adsorption.
25. The precipitation by using anti chaotropic salt is governed by _____ equation.
26. Most commonly used filter aid in bio separation is _____.
27. Protein A and Protein G are specific ligands which recognize and bind _____ type antibodies.
28. According to the _____ law of grinding, the amount of energy needed for size reduction is proportional to the change in surface area.
29. The amino acid _____ is used for binding ribosomal-RNA.
30. A polymer-polymer two phase system can be obtained by mixing _____.

