KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.Sc.
Year : III

Course : BIOT 301
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 20 DEC 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and mark [X] in the most appropriate option from each set of choices

1. The first step in the recovery process of intracellular products is typically
   [ ] Cell disruption
   [ ] Product purification
   [ ] Cell separation from culture medium
   [ ] Membrane filtration

2. What does the Stokes-Einstein diameter represent?
   [ ] Molecular weight
   [ ] Diffusivity of a spherical molecule
   [ ] Equivalent radius of particles
   [ ] Sedimentation Coefficient

3. Non-ionic detergents are preferred for cell lysis because
   [ ] They are less toxic to humans
   [ ] They preserve biological molecules better
   [ ] They are cheaper than ionic detergents
   [ ] They enhance enzymatic activity

4. During osmotic shock, rapid cell rupture is caused by
   [ ] Dehydration of the cytoplasm
   [ ] Rapid influx of water
   [ ] Cavitation bubbles
   [ ] Enzymatic reactions

5. What method is commonly used to concentrate cell suspensions
   [ ] Distillation
   [ ] Ultrasonication
   [ ] Microfiltration
   [ ] Osmotic shock

6. At the isoelectric point, proteins have
   [ ] Net positive charge
   [ ] Net negative charge
   [ ] Neutral charge
   [ ] Maximum charge

7. Kick's coefficient depends on
   [ ] Size
   [ ] Viscosity
   [ ] rigidity
   [ ] Operating condition

8. Chaotropic salts are used for the purification of
   [ ] Nucleic acids
   [ ] Proteins
   [ ] Lipids
   [ ] Carbohydrates

9. Ultrasonic disruption of cells is commonly performed at frequency
   [ ] 25 kHz
   [ ] 20kHz
   [ ] 30kHz
   [ ] 35kHz

10. Swing-out rotors are preferred for
    [ ] Macromolecules
    [ ] Cells and coarse particles
    [ ] Proteins
    [ ] Nucleic acid

11. Which of the following statement is true?
[ ] K factor of fixed angled rotor is smaller than swing out rotors.
[ ] Svedberg coefficient is independent of sedimentation coefficient.
[ ] G value of a centrifuge is constant for a particular rotor.
[ ] Rotating speeds for preparative centrifuges range from 5000 - 20000 rpm.

12. The partition coefficient is used in
[ ] Gel electrophoresis
[ ] Liquid -Liquid extraction
[ ] Light absorption analysis
[ ] Sedimentation

13. What is the main advantage of rotary-drum vacuum filters?
[ ] High labor cost
[ ] Compact design
[ ] Continuous operation
[ ] High driving force

14. What are filter aids like diatomaceous earth used for in filtration?
[ ] To reduce the temperature of the mixture
[ ] To act as a filter medium themselves
[ ] To improve the porosity of the filter cake
[ ] To slow down the filtration process

15. Which of the following is a weak cation exchange group
[ ] Quaternary aminoethyl
[ ] Carboxymethyl
[ ] Sulphopropyl
[ ] DEAE

16. The "sigma factor" ($\sum$) in centrifugation equations represents
[ ] Particle density
[ ] Feed flow rate
[ ] Centrifuge capacity
[ ] Sedimentation velocity

17. In cation exchange adsorption, the adsorbent is
[ ] Negatively charged
[ ] Positively charged
[ ] Neutral
[ ] Amphoteric

18. Which of the following salt is not used for downstream processing of enzymes?
[ ] Ammonium sulphate
[ ] Sodium choride
[ ] Sodium sulphate
[ ] Guanidine hydrochloride

19. Which of the following materials has the highest density?
[ ] DNA [ ] RNA [ ] Proteins [ ] Microbial cells

20. The friction factor is independent of
[ ] Shape of the molecule
[ ] The degree of hydration
[ ] Temperature
[ ] P^h

SECTION "B"

[10 Q. × 1 = 10 marks]

Fill in the blanks

21. In the extraction of penicillin, at _____ pH, the antibiotic partitions favorably in an organic solvent.

22. Precipitation by using additives is governed by the thermodynamic equation _____.

23. Nucleic acid precipitation processes are carried out at very low temperatures, typically at _____ degrees centigrade

24. The k factor can be calculated using the empirical correlation _____.

25. The Stokes-Einstein radius {rSE) of a macromolecule can be estimate from its diffusivity using the equation: _____.

26. Reverse phase adsorption uses hydrophobic, low polarity substances such as _____ aliphatic hydrocarbon chains for solute binding.

27. According to thermodynamic equation, Precipitants act by increasing _____.

28. Kick's law of grinding states that energy required is proportional to _____

29. Most commonly used filter aid in bio separation is _____.

30. The minimum solubility of protein is observed at its _____.

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SECTION "C"
[3 Q. × 8 = 24 marks]

Attempt ANY THREE questions.

1. List the various properties of biological molecules based on bio separation. Explain any two properties.

2. Explain the principle of cell disruption using enzymes and detergent. Explain Rittinger's law of grinding.

3. Explain the principle of protein precipitation using anti chaotropic salts.

4. Explain the principle of disc stack centrifuge with a diagram.

SECTION "D"
[31 marks]

Attempt ANY SIX questions. ***(Q.N. 5 is compulsory)***

5. Write short notes on. [3+3=6]
   a. Filter aid
   b. Ultrafiltration

6. Explain the principle of rotary drum vacuum filtration. [5]

7. Explain the filtration theory with the general filtration rate equation. [5]

8. Explain in brief the steps involved in extraction process [5]

9. Explain briefly the principle of ion exchange adsorption. [5]

10. Explain how penicillin is extracted from fermentation broth. [5]

11. Explain the principle of cell disruption using bead mill. [5]