GUJARAT TECHNOLOGICAL UNIVERSITY

BE-6 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:

MASS TRANSFER OPERATIONS II (3160501)

Unit 1: Distillation

Repeated Questions:

1. **A feed of 60 mole% hexane and 40 mole% octane is fed to a pipe still through a pressure reducing valve into a flash disengaging chamber. The vapour and liquid leaving the chamber are assumed to be in equilibrium. If 50 mole% of feed is vaporized, find the composition of the top and bottom products.**
   (W24 - Q2(c) OR, 07 marks) [Table given]
   (W23 - Q1(c) OR, 07 marks) [Table given]
   (W22 - Q3(c), 07 marks) [Table given]
2. **A mixture of benzene and toluene containing 60 mole% benzene is to be separated to give a product of 95 mole% benzene and bottom product containing 10 mole% benzene. The feed enters a column at its bubble point. It is proposed to operate the column with reflux ratio of 2.5. Calculate number of theoretical plates needed by McCabe-Thiele method and position of feed plate.**
   (W24 - Q1(c), 07 marks) [VLE Table given]
   (W23 - Q2(c), 07 marks) [VLE Table given]
3. **Prove that 'Relative Volatility (α) is the ratio of vapor pressure of the components'.**
   (W25 - Q1(b), 04 marks)
   (W24 - Q2(a), 03 marks)
   (S22 - Q2(a), 03 marks)
4. **Differentiate between extractive and azeotropic distillation and discuss their selection criteria.**
   (W24 - Q2(c) OR, 07 marks)
   (S23 - Q1(c), 07 marks)
5. **Write a short note on azeotropic distillation (with suitable example).**
   (S22 - Q1(c), 07 marks)
   (S25 - Q3(b), 04 marks)

Other Important Questions (Newest to Oldest):

1. **Q.3 (a) Define quantity 'q'. Derive equation for q- line.** (S22 - Q3(a), 03 marks)
2. **Q.1 (a) Explain briefly optimum reflux ratio.** (S22 - Q1(a), 03 marks)
3. **Q.2 (c) 1000 kmol/hr of an ethanol-propanol mixture containing 65 mole percent ethanol is to be separated...** (S22 - Q2(c) OR, 07 marks) [Numerical Problem]
4. **Q.5 (a) Brief about optimum reflux ratio.** (W22 - Q5(a), 03 marks)
5. **Q.4 (a) Define: 1) Total reflux ratio 2) Minimum reflux ratio 3) Quantity 'q'.** (W23 - Q4(a) OR, 03 marks)
6. **Q.2 (b) Explain q line for distillation. Also derive equation for q- line.** (W22 - Q2(b), 04 marks)
7. **Q.5 (b) Define the quantity 'q'. Discuss the different types of feed to a distillation column and their 'q' values using relevant diagram.** (W24 - Q5(b) OR, 04 marks)
8. **Q.1 (a) Define: 1) Minimum reflux ratio 2) Quantity 'q' 3) Boil up ratio.** (W24 - Q2(a), 03 marks)
9. **Q.2 (c) A fractional column separates a liquid mixture entering at 5000 kmol/h containing 50 mole % A...** (W22 - Q2(c), 07 marks) [VLE Table given]

10. **Q.2 (c) It is desired to separate a mixture of 50% vapor and 50% liquid in a plate type distillation column...** (W22 - Q2(c) OR, 07 marks) [VLE Table given]
11. **Q.1 (c) A bubble cap fractionating column consisting of 12 plates working at an average efficiency of 75% is being used...** (W24 - Q1(c), 07 marks) [VLE Table given]
12. **Q.1 (c) A continuous distillation column is used to separate a feed mixture at its boiling point, containing 24 mole % acetone and rest methanol...** (S23 - Q2(c), 07 marks) [VLE Table given]
13. **Q.2 (c) A mixture of benzene and toluene having 40 % benzene is to be separated at 200 kmol/h...** (S23 - Q2(c) OR, 07 marks) [Numerical Problem]
14. **Q.3 (c) Discuss differential distillation and derive Rayleigh equation for a binary mixture.** (S22 - Q3(c), 07 marks)
15. **Q.2 (c) A liquid mixture containing 40 mole% methanol and 60 mole% water is fed to the differential distillation...** (W23 - Q2(c), 07 marks) [VLE Table given]
16. **Q.2 (c) OR A liquid mixture containing 60 mole% acetone (1), 40 mole% water (2) at 1 atm pressure in differentially distilled...** (W23 - Q2(c) OR, 07 marks) [VLE Table given]
17. **Q.3 (c) 100 moles of mixture of components A and B containing 60 mole % of A is subjected to a differential distillation...** (W24 - Q3(c) OR, 07 marks) [Numerical Problem]
18. **Q.3 (b) Distillation tower can not be operated at minimum reflux or total reflux. Justify.** (W22 - Q3(b) OR, 04 marks)
19. **Q.3 (a) At higher pressure, distillation is difficult. True or false? Justify.** (S23 - Q3(a), 03 marks)
20. **Q.1 (b) Explain the effect of increasing pressure on separation of components in binary distillation column? Justify with appropriate T-x,y and y vs x diagram.** (W24 - Q1(b), 04 marks)
21. **Q.2 (b) Explain the effect of increasing pressure on vapour liquid equilibrium for a binary mixture. Justify using T-xy, P-xy and xy diagrams.** (W24 - Q2(b), 07 marks)
22. **Q.4 (a) List characteristics of ideal solutions and explain Raoult's law.** (S23 - Q4(a), 03 marks)
23. **Q.1 (c) Discuss positive deviations from ideality with neat sketch.** (S25 - Q1(c), 07 marks)
24. **Q.1 (a) Describe the concept of Flash Distillation.** (S25 - Q1(a), 03 marks)
25. **Q.1 (b) Discuss importance of vacuum distillation.** (S25 - Q1(b), 04 marks)
26. **Q.3 (a) Explain Extractive distillation.** (S25 - Q3(a), 03 marks)
27. **Q.1 (a) Define Reflux Ratio.** (S25 - Q2(a), 03 marks)
28. **Q.5 (a) Draw schematic diagram of conventional fractionating column.** (W23 - Q5(a) OR, 03 marks)
29. **Q.1 (b) List out various types of reboiler used in industry. Explain any one in detail.** (S22 - Q1(b), 04 marks)
30. **Q.4 (a) List out the various types of reboilers used in industry. Explain any one in detail.** (W24 - Q4(a), 03 marks)
31. **Q.2 (b) Explain feed tray location in distillation operation.** (W23 - Q2(b), 04 marks)
32. **Q.4 (a) List assumptions of McCabe-Thiele method and its limitations.** (W23 - Q4(a), 03 marks)
33. **Q.2 (b) Enlist the assumptions of McCabe-Thiele method for determination of number of stages in a distillation column.** (W24 - Q5(b), 04 marks)
34. **Q.2 (b) List assumptions of McCabe-Thiele method and its limitations.** (S25 - Q2(b), 04 marks)
35. **Q.3 (a) Steam distillation takes place at reduced temperature. Justify. Also explain the reason behind the same.** (W22 - Q3(a), 03 marks)
36. **Q.3 (a) In perfumery industries, steam distillation is preferable. True or false? Justify the statement. Also cite few examples of steam distillation.** (S23 - Q3(a) OR, 03 marks)
37. **Q.3 (b) Explain principle and applications of steam distillation.** (W23 - Q3(b), 04 marks)
38. **Q.3 (a) Briefly explain steam distillation by stating proper example.** (W22 - Q3(a) OR, 03 marks)
39. **Q.1 (c) Enlist various types of distillation in brief and explain azeotropic distillation in detail.** (W22 - Q1(c), 07 marks)

40. **Q.3 (b) Explain Azeotropic distillation.** (W23 - Q3(b) OR, 04 marks)
41. **Q.1 (a) Define: 1) Azeotrope 2) Reflux Ratio 3) Total reflux.** (W25 - Q2(a), 03 marks)
42. **Q.1 (a) Define relative volatility. Discuss its importance.** (W24 - Q1(a), 03 marks)
43. **Q.1 (b) Define volatility. Prove that: $y = \alpha x / (1 + (\alpha - 1)x)$.** (S23 - Q1(b), 04 marks)
44. **Q.2 (b) Compute the equilibrium data from following data at 760 mmHg pressure and relative volatility.** (S22 - Q3(b), 04 marks) [Table given]

Unit 2: Humidification Operations

Repeated Questions:

1. **In a mixture of benzene (A) vapor and nitrogen (B) gas at a total pressure of 800 mmHg and temperature of 60°C, the partial pressure of benzene is 100 mmHg calculate the (i) Mole fraction of benzene, (ii) Molal absolute humidity and (iii) Absolute humidity.**
   (W24 - Q3(a), 03 marks)
   (S22 - Q4(a) OR, 03 marks)
2. **Define: 1) Absolute Humidity 2) Dew point 3) ...** (This definition cluster appears frequently with varying third terms)
   (W25 - Q3(a), 03 marks) [Defines: Absolute Humidity, Lewis relation, Humid heat]
   (W22 - Q4(a) OR, 03 marks) [Defines: Relative humidity, Humid heat, Dew point]
   (W23 - Q3(a), 03 marks) [Defines: Relative saturation, Percentage saturation, Dew point]
   (W24 - Q3(a) OR, 03 marks) [Defines: Wet bulb temperature, Dew point, Humid volume]
3. **A gas (B)-benzene (A) mixture is saturated at 1 std atm, 50°C. Calculate the absolute humidity if B is (a) nitrogen and (b) carbon dioxide.**
   (W24 - Q3(b), 04 marks) [Vapor pressure of benzene given]
   (S25 - Q3(c), 07 marks) [Vapor pressure of nitrogen given]
4. **Explain the theory of adiabatic saturation temperature and derive the equation for adiabatic saturation temperature (determination/curve).**
   (W22 - Q4(c), 07 marks)
   (W24 - Q3(c) OR, 07 marks)
   (W23 - Q3(c), 07 marks)
5. **Explain the concept of wet bulb temperature (and adiabatic saturation curve).**
   (W24 - Q4(b), 04 marks) [Wet bulb temperature concept]
   (S22 - Q4(c), 07 marks) [Wet-bulb temperature curve and adiabatic saturation curve]

Other Important Questions (Newest to Oldest):

1. **Q.4 (c) Explain the concept of wet-bulb temperature curve and adiabatic saturation curve. Explain Lewis relation.** (S22 - Q4(c), 07 marks)
2. **Q.3 (c) Derive the expression for wet bulb depression.** (W25 - Q3(c), 07 marks)
3. **Q.3 (c) Derive the equation of adiabatic saturation curve.** (W25 - Q3(c) OR, 07 marks)
4. **Q.3 (a) Define: 1) Grosvenor Humidity 2) Critical Moisture 3) Bound Moisture.** (S23 - Q1(a), 03 marks)
5. **Q.1 (a) Define: 1) Absolute Humidity 2) Unbound Moisture 3) Humid Volume.** (W22 - Q1(a), 03 marks)
6. **Q.1 (a) Define: 1) Humid Volume 2) Humid heat 3) Lewis Relation.** (W23 - Q1(a), 03 marks)
7. **Q.1 (b) Define: (i) Humid volume (ii) Wet bulb temperature (iii) Bound moisture (iv) Unbound Moisture.** (S22 - Q2(b), 04 marks)
8. **Q.3 (a) Define the following terms 1) Free moisture 2) Reflux ratio 3) Wet bulb temperature.** (W24 - Q2(a), 03 marks)
9. **Q.3 (a) Define the following terms 1) Dew point 2) Adiabatic Saturation temperature 3) Absolute Humidity.** (W24 - Q3(a) OR, 03 marks)
10. **Q.3 (c) Define: (1) Absolute humidity (2) Relative humidity (3) Dry-bulb temperature (4) Wet-bulb temperature (5) Humid volume (6) Humid Heat (7) Lewis relation.** (S25 - Q3(c), 07 marks)
11. **Q.4 (b) A mixture of nitrogen and acetone vapor at 800mmHg total pressure and 25°C temperature has 80% saturation. Calculate molal and absolute humidity, partial pressure of acetone. Also determine relative humidity if vapor pressure of acetone is 190mmHg.** (S23 - Q4(b) OR, 03 marks)
12. **Q.3 (a) Wet bulb temperature is generally less than dry bulb temperature. True or False? Justify. Also define Humid Heat and Humid Volume.** (S23 - Q3(b) OR, 04 marks)
13. **Q.4 (a) Explain range and Approach with reference to cooling towers. Determine range and approach of cooling tower if its inlet temperature is 41°C and outlet water temperature is 31°C. Wet bulb temperature is 24°C.** (S23 - Q4(a), 03 marks)

14. **Q.5 (b) Explain range and approach with reference to cooling tower. Also explain losses taking place in cooling tower.** (W22 - Q5(b) OR, 04 marks)
15. **Q.3 (a) Explain range and approach with reference to cooling tower.** (W23 - Q3(a) OR, 03 marks)
16. **Q.3 (a) Discuss range and approach with reference to cooling tower.** (W24 - Q3(a), 03 marks)
17. **Q.1 (c) Explain the various types of cooling towers and discuss their selection criteria.** (W24 - Q1(c), 07 marks)
18. **Q.3 (c) Explain the various types of cooling towers and discuss their selection criteria.** (W23 - Q3(c) OR, 07 marks)
19. **Q.3 (b) Classify cooling towers in detail.** (W22 - Q3(b), 04 marks)
20. **Q.4 (b) Classify various types of cooling towers with neat sketches.** (S22 - Q4(b), 04 marks)
21. **Q.3 (c) Explain classification of cooling tower and brief induced draft cooling tower with neat sketch.** (W24 - Q3(c), 07 marks)
22. **Q.3 (b) Explain natural draft cooling tower.** (W25 - Q3(b), 04 marks)
23. **Q.4 (a) Explain various losses in cooling towers and explain why make up water is required in cooling towers.** (S22 - Q4(a), 03 marks)
24. **Q.3 (b) Explain various losses in cooling towers and explain need of make-up water in cooling towers.** (S23 - Q3(b), 04 marks)
25. **Q.4 (c) Why cooling towers are used in chemical process industries, give the classification and explain in detailed about cooling tower used in power plants.** (S25 - Q4(c), 07 marks)
26. **Q.4 (c) Explain mechanism of cooling in upper part and lower part of a cooling tower operating counter currently.** (S22 - Q4(c) OR, 07 marks)

Unit 3: Adsorption and Ion Exchange

Repeated Questions:

1. **Explain principles of ion exchange in brief. Also list its applications.**
   (W25 - Q4(c) OR, 07 marks)
   (W24 - Q2(b), 04 marks)
   (S23 - Q5(b), 04 marks)
   (W22 - Q4(b) OR, 04 marks)
   (S22 - Q3(c), 07 marks)
2. **Explain Freundlich equation. Derive the relation for single stage adsorption using the Freundlich equation.**
   (W25 - Q4(c), 07 marks)
   (W24 - Q4(c), 07 marks)
   (W23 - Q4(c) OR, 07 marks)
   (S23 - Q5(c), 07 marks)
3. **Explain Pressure Swing Adsorption (PSA). (With neat diagram, industrial applications and advantages).**
   (W24 - Q4(c), 07 marks) [Includes diagram and advantages]
   (W22 - Q5(c) OR, 07 marks) [Includes industrial examples]
   (S25 - Q5(c), 07 marks) [Write brief note]
   (W23 - Q4(b) OR, 04 marks) [Explain in brief]
   (W24 - Q4(b), 04 marks) [Explain and discuss applications]
4. **Compare and contrast physisorption and chemisorption (physical adsorption and chemisorption).**
   (W24 - Q3(b) OR, 04 marks)
   (W23 - Q4(b), 04 marks)
   (S22 - Q4(b) OR, 04 marks)
5. **State the various industrial applications of adsorption.**
   (W25 - Q4(a) OR, 03 marks)
   (W24 - Q3(b), 04 marks)
   (S22 - Q3(a), 03 marks)

Other Important Questions (Newest to Oldest):

1. **Q.5 (c) What do you mean by Ion Exchange? Describe techniques and application of ion exchange and list out the factors on which rate of ion exchange is dependent.** (S25 - Q5(c), 07 marks)
2. **Q.4 (c) Explain Ion Exchange and describe techniques and applications of ion exchange and list out the factors on which rate of ion exchange is dependent.** (W23 - Q4(c), 07 marks)
3. **Q.4 (c) Define Ion Exchange? Describe techniques and applications of ion exchange and list out the factors on which rate of ion exchange is dependent.** (W24 - Q4(c) OR, 07 marks)
4. **Q.1 (b) Explain the effect of temperature on the adsorption operation.** (W24 - Q1(b), 04 marks)
5. **Q.1 (b) Explain effect of temperature on adsorption with one example.** (W23 - Q1(b), 04 marks)
6. **Q.5 (a) Discuss the effect of temperature and pressure on adsorption.** (S23 - Q5(a), 03 marks)
7. **Q.1 (b) Generally, adsorption is preferable at low temperature and high pressure. True or false. Justify.** (W22 - Q1(b), 04 marks)
8. **Q.4 (a) State any four commercial adsorbents.** (W25 - Q4(a), 03 marks)
9. **Q.5 (a) Enlist the principal adsorbents generally used in adsorption.** (W24 - Q5(a), 03 marks)
10. **Q.4 (a) List the principal adsorbents which is generally used in adsorption.** (W24 - Q4(a) OR, 03 marks)

11. **Q.1 (a) Explain adsorption with example by citing proper industrial examples and also enlist commonly used adsorbents and their characteristics.** (S23 - Q2(a), 03 marks)
12. **Q.5 (a) Explain nature of adsorbents.** (S25 - Q5(a), 03 marks)
13. **Q.4 (b) Explain selection criteria of adsorbents and adsorption process.** (W25 - Q4(b), 04 marks)
14. **Q.4 (b) Explain equilibrium with reference to adsorption. State characteristics of adsorbent as well.** (W22 - Q4(b), 07 marks)
15. **Q.5 (b) Explain equilibrium with reference to adsorption. Also discuss hysteresis.** (S23 - Q5(b) OR, 04 marks)
16. **Q.4 (a) Define: 1) Adsorption hysteresis 2) Azeotrope 3) Total Reflux.** (W24 - Q4(a), 03 marks)
17. **Q.2 (c) Explain Adsorption hysteresis with figure.** (S25 - Q2(c) OR, 07 marks)
18. **Q.4 (b) Explain Adsorption hysteresis.** (W25 - Q4(b) OR, 04 marks)
19. **Q.5 (a) Explain the adsorption wave in adsorption operation.** (W24 - Q5(a) OR, 03 marks)
20. **Q.4 (b) Explain the adsorption wave in adsorption operation.** (W24 - Q4(b) OR, 04 marks)
21. **Q.5 (a) Brief about elution and chromatography.** (W22 - Q5(a) OR, 03 marks)
22. **Q.4 (c) Using Freundlich equation, derive the expression for a two-stage counter current adsorption operation.** (W24 - Q4(c), 07 marks)
23. **Q.5 (c) Explain Freundlich equation. Derive the relation for two stage counter current adsorption using the Freundlich equation.** (W22 - Q5(c), 07 marks)
24. **Q.4 (c) Write Freundlich equation. How is it applied to two-stage cross current adsorption?** (S25 - Q4(c), 07 marks)
25. **Q.3 (a) Explain physical adsorption.** (S25 - Q3(a) OR, 03 marks)
26. **Q.5 (b) Explain cross current adsorption.** (S25 - Q5(b), 04 marks)
27. **Q.5 (a) At 30°C the amount of acetone adsorbs at partial pressure of 10 and 100 mmHg are 0.1 and 0.4 kg Acetone per kg activated carbon respectively. Assume Langmuir isotherm describe the adsorption... Determine the amount adsorbed at 50 mmHg.** (S23 - Q5(a) OR, 03 marks) [Numerical Problem]
28. **Q.3 (b) State the significance of Freundlich equation applicable to adsorption.** (S22 - Q3(b), 04 marks)

Unit 4: Drying

Repeated Questions:

1. **A wet solid is to be dried from X% to Y% moisture under constant drying conditions... (All moisture contents are on dry basis).** (This is a common problem type with varying numbers)
   a) From 35% to 10% in 5 hours. Equilibrium moisture 4%, Critical moisture 14%. How long to dry to 6%? (W24 - Q5(c), 07 marks)
   b) From 40% to 10% in 5 hours. Equilibrium 5%, Critical 15%. Estimate excess time to dry to 8%. (S23 - Q4(c), 07 marks)
   c) From 100% to 10% (dry basis). Equilibrium 6%, Critical 55%. Estimate reduction in time to dry to 16%. (W22 - Q4(c), 07 marks)
2. **A 50 kg batch of granular solid containing 25% moisture is to be dried in a tray dryer to 12% moisture... constant rate of drying is 0.0008 kg/m²s, critical moisture content is 10%. Calculate the drying time. Surface area = 1 m².**
   (W25 - Q5(c), 07 marks)
   (W23 - Q5(c) OR, 07 marks)
3. **Explain Freundlich equation. Derive the relation for single stage adsorption using the Freundlich equation.**
   *Note: This question is fundamentally about **Adsorption** but is frequently asked in Drying unit papers under OR sections. It is listed here as it appears in Drying unit question papers.*
   (W25 - Q4(c), 07 marks)
   (W24 - Q4(c), 07 marks)
   (W23 - Q4(c) OR, 07 marks)
   (S23 - Q5(c), 07 marks)
4. **Explain rate of drying curve with neat diagram.**
   (W23 - Q5(b), 04 marks)
   (S25 - Q5(b), 04 marks)
5. **Define/Categorize types of moisture: Bound, Unbound, Free, Equilibrium, Critical.**
   (W24 - Q5(a), 03 marks) [Defines: Bound, Unbound, Free]
   (S25 - Q4(b), 04 marks) [Explains: Bound, Free, Equilibrium, Critical]
   (W22 - Q1(a), 03 marks) [Defines: Absolute Humidity, Unbound Moisture, Humid Volume - partial match]
   (S23 - Q1(a), 03 marks) [Defines: Grosvenor Humidity, Critical Moisture, Bound Moisture]

Other Important Questions (Newest to Oldest):

1. **Q.5 (c) What is critical moisture content? Derive the equations for time of drying for (i) Initial and final moisture content greater than critical (ii) ... less than critical (iii) Initial > critical and final < critical.** (S22 - Q5(c), 07 marks)
2. **Q.5 (c) A granular solid with dry bulk density of 1600 kg/m³ being dried in a batch drier...** (S22 - Q5(c) OR, 07 marks) [Detailed Numerical Problem with Psychrometric data]
3. **Q.5 (c) A slab of paper pulp 1.5 m * 1.5 m having 5 mm thickness is to be dried under constant drying condition from 18% to 8% on dry basis... calculate the drying time.** (W24 - Q5(c), 07 marks) [Numerical Problem]
4. **Q.5 (c) Slabs of paper pulp 100cm x 100cm x 1.5cm is to be dried under constant drying conditions from 67% to 30% moisture... calculate the drying time.** (W25 - Q5(c) OR, 07 marks) [Numerical Problem]
5. **Q.5 (c) A 100kg batch of granular solid containing 30% moisture is to be dried in a tray dryer to 16% moisture... calculate the drying time.** (W23 - Q5(c), 07 marks) [Numerical Problem]
6. **Q.5 (c) A wet solid of 28% moisture is to be dried to 0.5% moisture in a tray dryer. A laboratory test shows... Calculate the drying time.** (W24 - Q5(c) OR, 07 marks) [Numerical Problem]
7. **Q.5 (b) Derive expression of time of drying in the constant rate period in drying operation.** (W24 - Q5(b) OR, 04 marks)

8. **Q.5 (c) Find out the rate of drying and moisture content from the following data...** (W24 - Q5(c) OR, 07 marks) [Table given]
9. **Q.3 (c) Derive equation for retention time in continuous dryer at low temperature.** (W22 - Q3(c) OR, 07 marks)
10. **Q.3 (c) Describe the different zones in continuous drying operation and derive equation for retention time in continuous dryer at low temperature.** (S23 - Q3(c) OR, 07 marks)
11. **Q.4 (a) Derive equation for falling rate period if rate is proportional to square of moisture content.** (S23 - Q4(a) OR, 03 marks)
12. **Q.5 (a) Classify dryers and discuss selection criteria for dryers.** (W25 - Q5(a), 03 marks)
13. **Q.2 (a) Classify drying equipment in depth.** (W22 - Q2(a), 03 marks)
14. **Q.5 (b) Classify drying equipments.** (S22 - Q5(b), 04 marks)
15. **Q.5 (a) Write a short note on sublimation drying.** (S22 - Q5(a), 03 marks)
16. **Q.5 (a) Write a short note on vacuum drum drier.** (S22 - Q5(a) OR, 03 marks)
17. **Q.4 (a) Explain Freeze Drying with application.** (S25 - Q4(a) OR, 03 marks)
18. **Q.5 (a) Explain Vacuum drying with example.** (S25 - Q5(a) OR, 03 marks)
19. **Q.4 (b) With neat sketch, explain drum dryer.** (S25 - Q4(b), 04 marks)
20. **Q.4 (b) Write a short note on Rotary Dryer.** (W24 - Q4(b), 04 marks)
21. **Q.3 (b) Explain principle and working of rotary dryer with neat sketch.** (S23 - Q3(c), 07 marks)
22. **Q.3 (b) Classify rotary dryer and explain any one in brief.** (S25 - Q3(b) OR, 04 marks)
23. **Q.5 (b) Explain hold up in Rotary Dryer.** (S22 - Q5(b) OR, 04 marks)
24. **Q.3 (b) Write a short note on Tray Dryer.** (W24 - Q3(b), 04 marks)
25. **Q.5 (b) Explain Tray dryer and give its applications.** (W24 - Q5(b), 04 marks)
26. **Q.3 (c) Explain principle and working of fluidized bed dryer with neat sketch.** (W22 - Q3(c), 07 marks)
27. **Q.5 (b) Explain principle and working of fluidized bed drier with neat sketch.** (W23 - Q5(b) OR, 04 marks)
28. **Q.4 (a) Discuss about the different factors affecting drying operation.** (W22 - Q4(a), 03 marks)
29. **Q.5 (a) Describe the factors affecting on rate of drying.** (W25 - Q5(a) OR, 03 marks)
30. **Q.5 (b) Explain moisture movement mechanism within solid for drying.** (W22 - Q5(b), 04 marks)
31. **Q.4 (a) Define Moisture content on wet basis and dry basis.** (S25 - Q4(a), 03 marks)
32. **Q.5 (a) Define: 1) Critical moisture content 2) moisture content on wet basis 3) moisture content on dry basis.** (W24 - Q5(a) OR, 03 marks)
33. **Q.1 (a) Define: 1) Lewis Relation 2) Chemisorption 3) Equilibrium moisture.** (W24 - Q1(a), 03 marks)

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