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Course: B. Tech in Petrochemical Engineering **Sem: IV**
Subject Name: Petrochemical Engineering-II **Subject Code: BTPCC404**

Question Bank (For reference only)

<table>
<tr><td>Q.1.</td><td>Write critically on : Pressure - An important design variable</td><td>6M</td></tr>
<tr><td>Q.2.</td><td>Outline the method for calculation of number of stages for multicomponent distillation by Fenske–Underwood-Gilliland correlation.</td><td>6M</td></tr>
<tr><td>Q.3.</td><td>With appropriate example explain how understanding of concentration profile can be useful in design of distillation column</td><td>6M</td></tr>
<tr><td>Q.4.</td><td>Why post treatment of different fractions is necessary? Briefly elaborate on chemical impurities.</td><td>4M</td></tr>
<tr><td>Q.5.</td><td>Draw a neat flow diagram amine sweetening process for LPG</td><td>4M</td></tr>
<tr><td>Q.6.</td><td>Write informative account on Kerosene treatment.</td><td>4M</td></tr>
<tr><td>Q.7.</td><td>A multicomponent hydrocarbon mixture has the following composition on mole basis.
i-butane: 0.20, n-pentane: 0.25 and n-hexane: 0.55.
Calculate dew point temperature and bubble point temperature for this mixture at 100 psia.</td><td>6M</td></tr>
<tr><td>Q.8.</td><td>Define bubble point pressure, dew point pressure, bubble point temperature and dew point temperature. Derive an expression which allows calculation of fractional composition of component in vapor phase for flash distillation.</td><td>6M</td></tr>
<tr><td>Q.9.</td><td>Outline Van-winkle method for inter-conversion of ASTM data at 760mm Hg. to EFV data at 10mm Hg.</td><td>6M</td></tr>
<tr><td>Q.10.</td><td>For a particular stock, atmospheric ASTM-D158 distillation data is as follows:
<table>
<tr><td>Volume % distilled</td><td>0</td><td>10</td><td>30</td><td>50</td><td>70</td><td>90</td><td>100</td></tr>
<tr><td>Temp 0F</td><td>90</td><td>140</td><td>245</td><td>342</td><td>408</td><td>514</td><td>597</td></tr>
</table>
Obtain the atmospheric EFV data by using Van winkle method.</td><td>8M</td></tr>
<tr><td>Q.11.</td><td>Draw schematic representation of fractional distillation process.</td><td>2M</td></tr>
<tr><td>Q.12.</td><td>State the minimum essentials for the fractionation process.</td><td>3M</td></tr>
<tr><td>Q.13.</td><td>Write an informative account on : Limits of operability of distillation column based on reflux ratio.</td><td>6M</td></tr>
<tr><td>Q.14.</td><td>With appropriate example explain how understanding of concentration profile can be useful in design of distillation column.</td><td>6M</td></tr>
<tr><td>Q.15.</td><td>Why post treatment of different fractions is necessary? Briefly elaborate on physical or mechanical impurities.</td><td>6M</td></tr>
<tr><td>Q.16.</td><td>Define the following: relative volatility, k value, vapour pressure etc.</td><td>1M each</td></tr>
<tr><td>Q.17.</td><td>Apply phase rule to a ten component flash vaporization system and find out degree of freedom.</td><td>2M</td></tr>
<tr><td>Q.18.</td><td>Draw a neat and completely labelled equilibrium curve.</td><td>2M</td></tr>
</table>

Q.19. Define the following: dew point pressure, dew point temperature, bubble point temperature, bubble point pressure — **1M each**

Q.20. A ternary system composed of 20% Ethanol, 50% 1-Propanol and 30% 2-Propanol can be classified essentially an ideal system at 4 atmosphere pressure. Find out the average temperature of the mixture. — **3M**

Antoine constants for components are:

Component	A	B	C
Ethanol	16.8958	3795.17	230.918
1-Propanol	16.1154	3483.67	205.807
2-Propanol	16.6796	3640.20	219.610

Q.21. Draw a neat & completely labelled diagram of conventional fractionating column. — **2M**

Q.22. Draw a graph showing schematic relationship between reflux ratio and number of stages and explain it. — **2M**

Q.23. Write down Fenske equation. What we find out from it and when do we use it? — **2M**

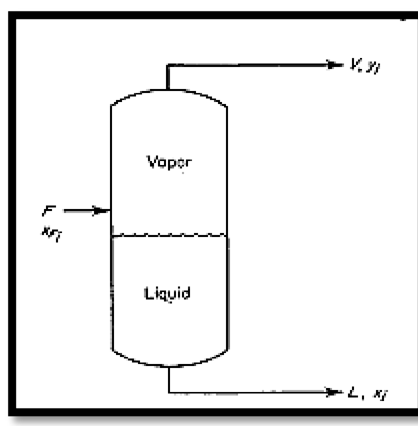
Q.24. Enlist the minimum essentials for a fractionating process (any 4). — **2M**

Q.25. Which methods are available to study vaporization characteristics of complex mixture? (any 2) — **1 M**

Q.26. A ternary mixture at its bubble point composed of components a, b, and c is to be fractionated to produce the products indicated. The system is desired to be essentially ideal. Calculate the minimum reflux by the Underwood method. The reflux is a bubble point liquid. — **4M**

Component	x_F	α	x_D	x_B
a	0.047	4.20	0.1263	0.000
b	0.072	1.57	0.1913	0.001
c	0.881	1.00	0.6824	0.999

Q.27. Write down the overall material balance equation and component material balance equation for flash system provided in adjacent figure. — **2M**



Q.28. A multicomponent hydrocarbon mixture is composed as follows: — **3M**
CH_4 = 0.02, C_2H_6 = 0.08, C_3H_8 = 0.25, i-C_4H_{10} = 0.05, n-C_4H_{10} = 0.30, n-C_5H_{12} = 0.30.
The mixture is flashed at 100 psia. Find out its bubble point temperature.
(Hint: Bubble point temperature lies between 0 to 60 ^{0}F)

	K value chart will be provided	
Q.29.	**A multicomponent hydrocarbon mixture is composed as follows:** **CH_4 = 0.02, C_2H_6 = 0.08, C_3H_8 = 0.25, i-C_4H_{10} = 0.05, n-C_4H_{10} = 0.30, n-C_5H_{12} = 0.30.** **The mixture is flashed at 100 psia. Find out its dew point temperature.** **(Hint: Bubble point temperature lies between 0 to 60 ^{0}F)** **K value chart will be provided**	**3M**
Q.30.	**What is preflashing? When and how it is performed?**	**2M**
Q.31.	**Explain the disadvantages of top tray reflux.**	**1M**
Q.32.	**Give Nelson's equation for correcting curvature.**	**1M**
Q.33.	**Draw the properly labelled schematics of crude oil distillation process.**	**2M**
Q.34.	**Define ASTM gap & TBP overlap with the help of suitable diagrams.**	**4M**
Q.35.	**For a petroleum stock, EFV 760 mmHg data is given in table below. Find the EFV data at 200 mmHg. Given: EFV 50% temperature at 200 mmHg is 412 ^{o}F.**	**2M**

% Distilled	EFV 760 mmHg t, ^{o}F
0	315
10	370
30	460
50	515
70	567
90	652
100	712

Q.36.	**With neat sketches , explain the necessity of different types of reflux in distillation**	**6M**
Q.37.	**With neat sketches explain various arrangement of towers.**	**6M**
Q.37.	**With neat diagram , explain Merox Sweetening process.**	**6M**
Q.38.	**Why dehydration of natural gas or light petroleum fraction is necessary? State different methods used in refinery**	**6M**
Q.39.	**Discuss with a neat flow diagram amine sweetening process for LPG.**	**6M**
Q.40.	**Write a note on equilibrium distillation.**	**2M**
Q.41.	**Give the mathematical equations for bubble point and dew point.**	**2M**
Q.42.	**Give the classification of distillation according to various criteria's.**	**4M**
Q.43.	**Write a note on number of equilibrium stages in a distillation column.**	**3M**
Q.44.	**Write a note on relation of reflux and number of plates. Explain with suitable diagram.**	**4M**
Q.45.	**With the help of suitable equations, explain Underwood method to determine minimum reflux ratio for a system with adjacent light and heavy key.**	**4M**

Q.46. **6M**

A multicomponent mixture of the composition below and consisting of 66% vapor is to be fractionated to produce the products shown. Determine the minimum reflux by the Underwood method. The reflux is a bubble-point liquid.

Component	x_F	x_D	x_B	α
a	0.26	0.434	—	100
b	0.09	0.150	—	24.6
(LK) c	0.25	0.411	0.010	10.0
(HK) d	0.17	0.005	0.417	4.85
e	0.11	—	0.274	2.08
f	0.12	—	0.299	1.00

Q.47. **Differentiate between multicomponent and complex distillation.** **2M**

Q.48. **Give some examples of complex system.** **2M**

Q.49. **Draw and explain true boiling point curve for binary system, multicomponent system and complex system.** **6M**

Q.50. **A Petroleum stock (API=61.0) to be processed for jet fuel has the following ASTM D158 760mmHg distillation data:** **6M**

Volume % Distilled	**0**	**10**	**30**	**50**	**70**	**90**	**End point**
Temperature, ^{o}F	**95**	**150**	**255**	**330**	**410**	**510**	**597**

Determine the atmospheric EFV curve by Edmister-Pollock method.

Q.51. **A Petroleum stock (API=61.0) to be processed for jet fuel has the following ASTM D158 760mmHg distillation data:** **8M**

Volume % Distilled	**0**	**10**	**30**	**50**	**70**	**90**	**End point**
Temperature, ^{o}F	**95**	**150**	**255**	**330**	**410**	**510**	**597**

Determine the EFV curve at 100 psia by Edmister-Pollock method.

Q.52. **A Petroleum stock (API=61.0) to be processed for jet fuel has the following ASTM D158 760mmHg distillation data:** **6M**

Volume % Distilled	**0**	**10**	**30**	**50**	**70**	**90**	**End point**
Temperature, ^{o}F	**95**	**150**	**255**	**330**	**410**	**510**	**597**

Determine the EFV curve at 400 mmHg by Edmister-Okamoto method.

Q.53. **A Petroleum stock (API=61.0) to be processed for jet fuel has the following ASTM D158 760mmHg distillation data:** **4M**

Volume % Distilled	**0**	**10**	**30**	**50**	**70**	**90**	**End point**
Temperature, ^{o}F	**95**	**150**	**255**	**330**	**410**	**510**	**597**

Determine the atmospheric EFV curve by Van Winkle method.

<table>
<tr><td>Q.54.</td><td>A Petroleum stock (API=61.0) to be processed for jet fuel has the following ASTM D158 760mmHg distillation data:
<table>
<tr><td>Volume % Distilled</td><td>0</td><td>10</td><td>30</td><td>50</td><td>70</td><td>90</td><td>End point</td></tr>
<tr><td>Temperature, ^oF</td><td>95</td><td>150</td><td>255</td><td>330</td><td>410</td><td>510</td><td>597</td></tr>
</table>
Determine the EFV curve at 100 mmHg by Van Winkle method.</td><td>6M</td></tr>
<tr><td>Q.55.</td><td>The following data result from an ASTM-D1160 10 mm Hg distillation. Determine the EFV at 100 mm Hg.
<table>
<tr><th>% Distilled</th><th>t, °F</th></tr>
<tr><td>0</td><td>174</td></tr>
<tr><td>10</td><td>337</td></tr>
<tr><td>30</td><td>393</td></tr>
<tr><td>50</td><td>434</td></tr>
<tr><td>70</td><td>483</td></tr>
<tr><td>90</td><td>542</td></tr>
</table></td><td>8M</td></tr>
<tr><td>Q.56.</td><td>Describe atmospheric distillation of crude oil with representative diagram.</td><td>6M</td></tr>
<tr><td>Q.57.</td><td>Explain the reasons why atmospheric distillation of crude oil is carried out at pressures slightly above atmospheric pressure.</td><td>2M</td></tr>
<tr><td>Q.58.</td><td>What is flash zone? Explain its significance.</td><td>6M</td></tr>
<tr><td>Q.59.</td><td>What is separation capability?</td><td>1M</td></tr>
<tr><td>Q.60.</td><td>What is degree of separation & degree of difficulty of separation?</td><td>2M</td></tr>
<tr><td>Q.61.</td><td>Mention the ASTM gaps followed in common practice for any 2 successive cuts.</td><td>2M</td></tr>
<tr><td>Q.62.</td><td>What is sweetening? What are the different principles for sweetening?</td><td>6M</td></tr>
<tr><td>Q.63.</td><td>Write a note on catalytic desulfurization.</td><td>3M</td></tr>
<tr><td>Q.64.</td><td>What are the different methods for production of LPG?</td><td>2M</td></tr>
<tr><td>Q.65.</td><td>Explain LPG production by absorption technique with the help of flowsheet.</td><td>6M</td></tr>
<tr><td>Q.66.</td><td>Explain natural gas liquefaction process with suitable diagram.</td><td>6M</td></tr>
<tr><td>Q.67</td><td>What are the different sweetening techniques for gases?</td><td>2M</td></tr>
<tr><td>Q.68.</td><td>Explain Stretford process for sweetening of gases with the help of suitable flowsheet.</td><td>4M</td></tr>
<tr><td>Q.69.</td><td>What are the different sweetening techniques for gasoline?</td><td>3M</td></tr>
<tr><td>Q.70.</td><td>Explain copper chloride process for gasoline sweetening with flowsheet.</td><td>4M</td></tr>
<tr><td>Q.71.</td><td>Explain Unisol process for gasoline sweetening with flowsheet.</td><td>6M</td></tr>
<tr><td>Q.72.</td><td>Explain Dualayer process for gasoline sweetening with flowsheet.</td><td>6M</td></tr>
<tr><td>Q.73.</td><td>Explain lead doctoring of gasoline with flowsheet.</td><td>6M</td></tr>
<tr><td>Q.74.</td><td>Explain sulfuric acid treatment for gasoline sweetening with flowsheet.</td><td>6M</td></tr>
<tr><td>Q.75.</td><td>Explain catalytic desulfurization process for gasoline sweetening with flowsheet.</td><td>4M</td></tr>
<tr><td>Q.76.</td><td>Write a note on treatment of kerosene.</td><td>4M</td></tr>
<tr><td>Q.77.</td><td>Explain liquid sulfur dioxide extraction process with flowsheet.</td><td>6M</td></tr>
<tr><td>Q.78.</td><td>Explain flash distillation process.</td><td>3M</td></tr>
<tr><td>Q.79.</td><td>Draw neat and labelled T-xy and P-xy diagram for binary system.</td><td>4M</td></tr>
<tr><td>Q.80.</td><td>Explain the method of oxidizing mercaptans to disulfides with suitable reactions.</td><td>4M</td></tr>
</table>