Unit 11 - Week 9

Assignment 9

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-11-18, 23:59 IST.

1) *1 point*

Select the correct option about Heuristics for distillation sequencing.

I. We should favour direct sequence and perform most difficult separation first.
II. Qualitative heuristics may lead to conflicting results.

(a) Only statement – I is true
(b) Only statement-II is true
(c) Both the statements are true
(d) Both the statements are false

a)
b)
c)
d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b)

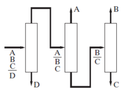
2) *1 point*

The relative volatility of component A is 6.25 and that for component B is 5.00. The relative volatility of the more volatile component with respect to the less volatile component is _____.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 1.20,1.30

3) *1 point*

Consider the separation of a four-component (A, B, C, D) mixture bythe following distillation sequence.



The following data are available about vapour flow rates in columns.

Separation	Vapour Flow Rate (kmol/h)
A/B	1564
B/C	675
C/D	2654
ABC/D	3295
A/BC	1825

The sum of column Marginal Vapour Rate (kmol/h) is _____.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 902

4) *1 point*

Select the correct option.

I. A sidestream distillation column can be used to separate any four-component non-azeotropic mixture into three products.

II. Sidestream distillation columns are broadly used in petroleum refineries.

(a) Only statement – I is true
(b) Only statement-II is true
(c) Both the statements are true
(d) Both the statements are false

a)
b)
c)
d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
d)

5) *1 point*

Select the correct option.

I. Both the side-rectifier and side-stripper arrangements reduce the energy consumption compared to simple two-column arrangements.

II. Thermal coupling of distillation columns reduces the heat load compared to the conventional arrangement, but the utilities are required at extreme temperatures.

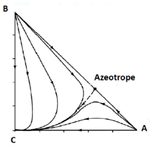
a) Only statement – I is true
b) Only statement-II is true
c) Both the statements are true
d) Both the statements are false

a)
b)
c)
d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
d)

6) *1 point*

Select the correct option about the following Residue Curve Map.



I. There is no distillation boundary for this system.

II. There are four fixed points and the fixed points A and B are unstable.

III. The binary azeotrope represents a saddle here.

(a) Only statement – I and statement-II are true
(b) Only statement-II and statement-III are true
(c) Only statement-I and statement-III are true
(d) Only statement-III is true

a)
b)
c)
d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b)

7) *1 point*

Select the correct option.

I. Both minimum-boiling and maximum boiling azeotropic mixture can be separated by pressure swing distillation.

II. In pressure swing distillation, the recycle from low-pressure column to high-pressure column increases if the azeotrope is more sensitive to change in pressure.

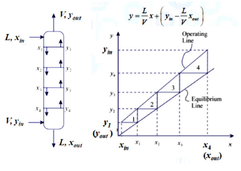
III. In case of extractive distillation, the added solvent (entrainer) forms a low-boiling azeotrope with one of the components in column.

(a) Only statement – I and statement-II are true
(b) Only statement-II and statement-III are true
(c) Only statement-I and statement-III are true
(d) Only statement-I is true

a)
b)
c)
d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
d)

8) Consider the absorption of benzene vapour from a hydrocarbon gas stream by a heavy liquid hydrocarbon stream in a counter current absorber as shown in the figure. The gas stream is available at 40 kmol/h, 16.0 psi, and 25 °C. The concentration (mol fraction) of benzene in the gas stream is $y_{in} = 0.02$ and 95% removal of benzene is required. The concentration (mol fraction) of benzene in the liquid stream is $x_{in} = 0.006$. At the temperature of the separation, the saturated liquid vapour pressure of benzene can be considered as 2.0 psi and it may be assumed that the vapour–liquid equilibrium obeys Raoult's Law. Assuming an Absorption factor (A) of 1.4, estimate the number of theoretical trays required using Kremser equation. The liquid and vapour flow rates do not change due to absorption.



The number of theoretical trays required is (nearest integer) _____.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 8,10

9) *1 point*

A multistage stripping column is used to remove 99% of benzene and ethyl benzene from a waste water stream using dry air as stripping gas. The dry air is available at a flow rate of 25 m^3/s, a temperature of 18 °C, and a pressure of 1.2 atm. The vapour pressure and solubility data for both the volatile organic components are given in the following table:

Volatile organic component	Vapor pressure at 20°C , kPa	Solubility at 20°C(mol fraction)
Benzene	10.55	4.1×10^{-4}
Ethyl benzene	1.03	3.5×10^{-5}

Stripping is to be carried out at 20°C and 1.2 atm. The flow rate of the waste-water system is 0.5 m^3/sec.Assume air to be an ideal gas. The molecular weight of water is 18.02 gm/mol, and the density of water 1000kg/m^3. The values of stripping factor(S) for benzene and ethyl benzene will be _____ and _____.

[Hint: vapour/liquid equilibrium ratio $(K_i) = \frac{p_i^s}{(x_i^*)(p)}$; x_i^* denotes mole fraction under equilibrium condition, p denotes pressure of gas , p^s denotes vapour pressure of solute.]

(a) 9.67, 11.03
(b) 9.07, 10.38
(c) 10.05, 11.67
(d) 10.38, 9.07

a)
b)
c)
d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b)

10) 70mol of a binary mixture containing equimolar amounts of component A and component B is undergoing a batch distillation process. The distillation is allowed to proceed until the amount of residue left in still pot is equal to 25 moles. The relative volatility of A with respect to B is 2 and the equilibrium relation is given by:

$$y_A = \frac{(\alpha_{AB})(x_A)}{1 + (\alpha_{AB} - 1)(x_A)}$$

Here, y_A→ Mol fraction of component A in the distillate at any instant.
x_A→ Mol fraction of component A in the in the still pot at any instant.
and, α_{AB} →Relative volatility of Component A with respect to Component B.

Find out the average mole fraction of ComponentA in the distillate.

Hint

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.50,0.65

1 point