King Saud University
Department of Chemical Engineering
Mass Transfer Operations (CHE 318)
Final Examination

Part 1: Closed Book April 22, 2019 Time Allowed: 30 Min.

Name:	Roll No:

(1) In the absorption process, the transfer of solute takes place

(a) from gas phase to solid phase	(b) from liquid phase to solid phase
(c) from liquid phase to gas phase	(d) from gas phase to liquid phase

(2) To obtain higher separation in an absorption process, one requires

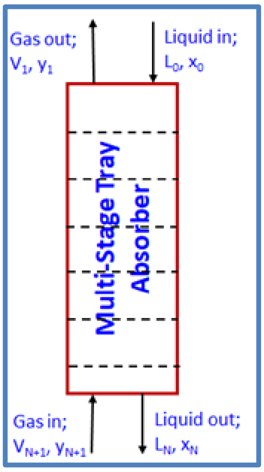
(a) high temperature and low pressure	(b) high temperature and high pressure
(c) low temperature and high pressure	(d) low temperature and low pressure

(3) The separation process of stripping (removal of solute from the liquid) require

(a) high temperature and low pressure	(b) high temperature and high pressure
(c) low temperature and high pressure	(d) low temperature and low pressure

(4) For the separation of sulphur dioxide from a mixture of gases, water is used as solvent at 30 degree C in a multistage absorber. The composition of exit gas is y_1 = 0.02 and exit solvent is x_N = 0.006. Keeping the same flowrate and number of stages, if the temperature of the inlet solvent water is decreased then, you expect

(a) y_1 < 0.02 and x_N < 0.006	(b) y_1 > 0.02 and x_N > 0.006
(c) y_1 > 0.02 and x_N < 0.006	(d) y_1 < 0.02 and x_N > 0.006

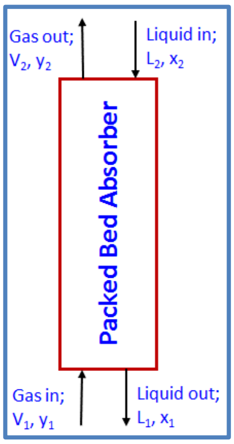


(5) For a given separation in a multistage absorber, increasing the flowrate of the solvent will lead to

(a) increase in stages and decrease in x_N	(b) decrease in stages and increase in x_N
(c) increase in stages and increase in x_N	(d) decrease in stages and decrease in x_N

(6) At the limiting solvent rate (L_{min}), in a packed bed absorber shown in the figure

(a) x_1 and y_2 are in equilibrium	(b) x_1 and y_1 are in equilibrium
(c) x_2 and y_1 are in equilibrium	(d) x_2 and y_2 are in equilibrium



(7) In the design of the absorber, the limiting solvent rate (L_{min}) is affected by

1) temperature and pressure in the absorber
2) composition of the entering gas mixture
3) flowrate of the entering gas mixture

(a) only 1) is correct	(b) both 1) and 2) are correct
(c) all 1), 2) and 3) are correct	(d) both 1) and 3) are correct

(8) When the major resistance is in gas phase, or the "gas phase is controlling", then

1) $K'_y \cong k'_y$
2) $y_{AG} - y^*_A \cong (y_{AG} - y_{Ai})$
3) $m' = (y_{Ai} - y^*_A)/(x_{Ai} - x_{AL})$ is small

(a) only 1) is correct	(b) both 1) and 2) are correct
(c) all 1), 2) and 3) are correct	(d) both 1) and 3) are correct

Subscript 'i' indicate interface condition

K'_y/k'_y: overall/film gas-phase mass-transfer coefficient in $kg\ mol/s \cdot m^2 \cdot mol\ frac$

K'_x/k'_x: overall/film liquid-phase mass-transfer coefficient in $kg\ mol/s \cdot m^2 \cdot mol\ frac$

y^*_A: gas-phase value that would be in equilibrium with x_{AL}

x^*_A: gas-phase value that would be in equilibrium with y_{AG}

(9) For diffusion of A through stagnant B, the flux of solute A, N_A , is given by

(a) $N_A = \frac{k'_y}{(1-y_A)_{iM}}(x_{Ai} - x_{AL}) = \frac{k'_x}{(1-x_A)_{iM}}(y_{AG} - y_{Ai})$	(b) $N_A = \frac{K'_y}{(1-y_A)_{*M}}(y_{AG} - y_A^*) = \frac{K'_x}{(1-x_A)_{*M}}(x_A^* - x_{AL})$
(c) both (a) and (b) are correct	(d) both (a) and (b) are incorrect

(10) In the design of absorbers for concentrated solution, the operating line is usually

(a) a straight line	(b) a curved line
(c) have a small slope	(d) have a large slope

(11) A good packing provides

(a) high interfacial area and high pressure drop	(b) low interfacial area and low pressure drop
(c) high interfacial area and low pressure drop	(d) low interfacial area and high pressure drop

(12) The use of structured packing in packed bed absorbers usually gives

(a) larger diameter and higher pressure drop	(b) smaller diameter and higher pressure drop
(c) larger diameter and lower pressure drop	(d) smaller diameter and lower pressure drop

(13) For a given separation in a counter-current packed bed absorber, if x_1, y_1 are in equilibrium, this means that

(a) absorber design is efficient	(b) absorber design is poor (bad)
(c) solute solubility in solvent is very high	(d) solute solubility in solvent is very low

(14) In the design of the packed bed absorber, if the gas flowrate is decreased keeping solvent flow constant, it will affect (change) the slope of

(a) both operating and equilibrium lines	(b) the equilibrium line only
(c) the operating line only	(d) none of the two lines

(15) In the design of the absorber, if the thermodynamic data is represented as $y = mx$, absorber height (or number of trays) will be highest for

(a) m=0.02	(b) m=0.015
(c) m=0.01	(d) m = 0.05

Answers (marks: 30 2 marks each)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15					
d	c	a	d	d	b	c	c	b	b	c	d	b	c	d					

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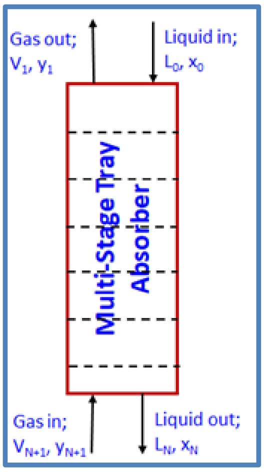

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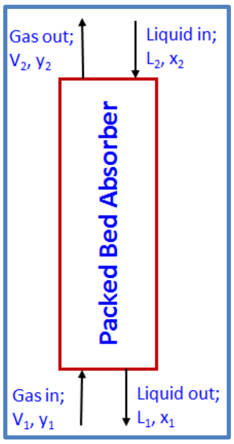

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(a) the equilibrium line only	(b) the operating line only
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(15) In the design of the absorber, if the thermodynamic data is represented as $y = mx$, absorber height (or number of trays) will be highest for

(a) m = 0.05	(b) m=0.015
(c) m=0.01	(d) m=0.02

Answers (marks: 30, 2 marks each)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15					
a	c	d	a	d	a	c	c	a	b	b	b	a	b	a					