ERRATA for

PE Chemical Practice Exam

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Errata posted 11/03/2025

Revisions are shown in red.

Question 7, p. 14:

Methyl mercaptan (CH_3SH) is produced from **stoichiometric** amounts of methanol (CH_3OH) and hydrogen sulfide (H_2S) by the reaction:

CH_3SH yield based on fresh feed of methanol is 90%. Of the feed to the reactor (fresh feed plus recycle), 85% reacts on each pass through the reactor.

Question 16, p. 22:

Latent heat of vaporization of water at its boiling point 2,257.1 kJ/(kg•K)

○ B. 124

Question 28, p. 28:

Sentence 4 should read as follows:

The rate of heat transfer by conduction-convection *Q*/*A* [Btu/(ft^2-hr)] can be assumed to be $0.38\,(\Delta T)^{1.25}$ where ΔT is the temperature difference (°F) between the roof and the air.

Question 32, p. 31:

○ C. 17,800

○ D. 19,100

Question 50, p. 43:

Assumptions:

Inlet to the brine tank is 20 ft above grade.

Solution Table, p. 70:

32: C

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Solution 6, p. 73:

MCB consumed:

All fresh feed is converted to DCB or TCB (from balance around the whole system).

Assume a basis of 1,000 lb mole/hr MCB.

MCB flow to reactor:

Fresh feed and recycle flow (from given ratio)

$$= 1,000 \text{ lb mole MCB/hr} + 0.9 \times 1,000 \text{ lb mole MCB/hr} = 1,900 \text{ lb/hr}$$

$$\text{Conversion} = \frac{\text{MCB consumed}}{\text{MCB flow to reactor}} = \frac{1,000 \text{ lb mole/hr}}{1,900 \text{ lb mole/hr}} \times 100\% = 52.6\%$$

Solution 7, p. 74:

Use yield to calculate methanol feed:

$$\frac{20.79 \text{ lb mole/hr}}{0.90} = 23.1 \text{ lb mole/hr } CH_3OH$$

Solution 9, p. 75:

From the figure, enthalpy of water at 77°F is 42 Btu/lbm ($x_{H_2SO_4} = 0$) and enthalpy of pure H_2SO_4 is 5 Btu/lbm ($x_{H_2SO_4} = 1.00$).

$$\text{Water:} \quad 50 \text{ lb} \times \frac{42 \text{ Btu}}{\text{lbm}} = 2,100 \text{ Btu}$$

$$\text{Total} = 2,600 \text{ Btu}$$

Heat evolved:

$$Q = Q_{\text{product}} - Q_{\text{feed}} = -18,750 - 2,600 = -21,350 \text{ Btu}$$

Solution 13, p. 78:

The equations following paragraphs two and three should read as follows:

$$\Delta h_{\text{sensible}} = h_{\text{L},440°\text{F}} - h_{\text{L},120°\text{F}} = 419 \text{ Btu/lb} - 89 \text{ Btu/lb} = 330 \text{ Btu/lb}$$

$$\Delta h_{\text{total}} = h_{\text{vap},440°\text{F}} - h_{\text{L},120°\text{F}} = 1,205 \text{ Btu/lb} - 89 \text{ Btu/lb} = 1,116 \text{ Btu/lb}$$

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Solution 16, p. 81:

Enthalpy of evaporation:

$$H_{\text{vap}} = \frac{1{,}000 \text{ kg DA}}{\text{s}} \times \frac{7 \text{ g water}}{\text{kg DA}} \times \frac{1 \text{ kg}}{1{,}000 \text{ g}} \times \frac{2{,}257.1 \text{ kJ}}{\text{kg}} = 15{,}800 \text{ kJ/s}$$

Sensible heat:

$$H_{\text{liquid water}} = \frac{1{,}000 \text{ kg DA}}{\text{s}} \times \frac{7 \text{ g water}}{\text{kg DA}} \times \frac{1 \text{ kg}}{1{,}000 \text{ g}} \times \frac{4.186 \text{ kJ}}{\text{kg}\bullet\text{k}} \times (373 - 298)\text{K} = 2{,}202 \text{ kJ/s}$$

$$H_{\text{water}\bullet\text{vapor}} = \frac{1{,}000 \text{ kg DA}}{\text{s}} \times \frac{7 \text{ g water}}{\text{kg DA}} \times \frac{1 \text{ kg}}{1{,}000 \text{ g}} \times \frac{2.01 \text{ kJ}}{\text{kg}\bullet\text{k}} \times (405 - 373)\text{K} = 448 \text{ kJ/s}$$

Total:

$$H = 105{,}930 \text{ kJ/s} + 15{,}800 \text{ kJ/s} + 2{,}202 \text{ kJ/s} + 448 \text{ kJ/s} = 124{,}380 \text{ kJ/s} = 124.4 \text{ MJ/s}$$

Solution 20, p. 83:

The total concentration of dissolved mercury is the sum of the concentrations of $\left(Hg^{2+}\right)$ and $\left(RSHg^{4-}\right)$.

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Solution 32, p. 91:

To calculate the steam flow rate to the jacket, we need to know how much energy is needed to evaporate the water. With the information given in the question statement, the heat duty can be calculated from the heat-transfer equation:

$$m_{\text{steam}}\Delta h_{\text{vap(20 psig)}} = Q = U_o A\Delta T$$

The temperature in the jacket is the saturation temperature of 20-psig steam. The temperature in the evaporator is the saturation temperature of 0-psig (1-atm) steam. From the steam table:

$$T_{\text{sat(0 psig)}} = 212°\text{F}$$

At 20 psig = 34.696 psia: interpolate between 30 psia and 40 psia

$$T_{\text{sat}} = 250.34°\text{F} + \frac{(34.696-30)}{(40-30)}\times(267.25-250.34)°\text{F} = 258.28°\text{F}$$

$$h_{\text{liq}} = 218.9\,\frac{\text{Btu}}{\text{lbm}} + \frac{(34.696-30)}{(40-30)}\times(236.1-218.9)\,\frac{\text{Btu}}{\text{lbm}} = 226.98\,\frac{\text{Btu}}{\text{lbm}}$$

$$h_{\text{vap}} = 1{,}164.1\,\frac{\text{Btu}}{\text{lbm}} + \frac{(34.696-30)}{(40-30)}\times(1{,}169.8-1{,}164.1)\,\frac{\text{Btu}}{\text{lbm}} = 1{,}166.78\,\frac{\text{Btu}}{\text{lbm}}$$

$$\Delta h_{\text{vap}} = h_{\text{vap}} - h_{\text{liq}} = 939.80 \text{ Btu/lbm}$$

The heat transferred in the evaporator is:

$$Q = U_o A\Delta T = \left[400 \text{ Btu/(hr-ft}^2\text{-°F)}\right](900 \text{ ft}^2)(258.3°\text{F} - 212°\text{F}) = 16.776\times10^6 \text{ Btu/hr}$$

The amount of steam necessary to supply this heat is:

$$m_{\text{steam}} = \frac{Q}{\Delta h_{\text{vap (20 psig)}}} = \frac{16{,}776{,}000 \text{ Btu/hr}}{939.8 \text{ Btu/lb}} = 17{,}850.6 \text{ lb/hr}$$

THE CORRECT ANSWER IS: C

Solution 34, p. 93:

Line 12 should read as follows:

$$\frac{1}{h_{\text{foul}}} = \frac{1}{U_{\text{o}}} - \frac{\delta_{\text{brick}}}{k_{\text{brick}}} - \frac{\delta_{\text{shell}}}{k_{\text{shell}}} - \frac{1}{h_o}$$

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Solution 50, p. 105:
Use the Bernoulli equation for pressure basis. Take Point 2 as the inlet of the brine tank, which is assumed to be at atmospheric pressure. Take Point 1 as the pump discharge.

The velocity terms can be neglected, since these will likely cancel each other (velocities in the inner pipe and the annulus are similar).

Solution 52, p. 107:

$$= 2\rho f \frac{L_1}{D}\frac{v_1^2}{g}$$ from head loss relation, where f is the Fanning friction factor

Solution 61, p. 114:
The last five lines of the solution should read as follows:

The ratio of liquid densities ψ equals 1 since the absorbing fluid is water.

$$G^2 = \frac{(0.085)(0.0909)(62.4)(32.2)}{(32)(1)(1.11)^{0.2}} = 0.475$$

$$G = 0.6893 \text{ lb/(ft}^2\text{-sec)}$$

$$\text{Area} = \frac{G'}{G} = \frac{8.34}{0.6983} = 12.10 \text{ ft}^2 = \frac{\pi D^2}{4}$$

$$D = \sqrt{\frac{(12.10)(4)}{\pi}} = 3.90 \text{ ft}$$