Revisions are shown in red.

Question 37, p. 32
The options should read as follows:

- A. \( C_u = 4 \)
  \( C_c = 0.5 \)
- B. \( C_u = 4 \)
  \( C_c = 1.1 \)
- C. \( C_u = 5.5 \)
  \( C_c = 0.5 \)
- D. \( C_u = 5.5 \)
  \( C_c = 1.1 \)

Question 49, p. 38
The options should read as follows:

- A. 2
- B. 7
- C. 9
- D. 36
Question 53, p. 42
The question should read as follows:

A tubular-bowl centrifuge can be used to separate particles by diameter from a liquid feed stream containing particles of various diameters.

Assume the following relationship for particle cut-point diameter as a function of various parameters holds:

\[
D_p = \sqrt{\frac{18 q \mu \ln \left( \frac{r_2}{r_1} \right)}{\omega^2 \pi b (\rho_P - \rho) (r_2^2 - r_1^2)}}
\]

where:
- \(D_p\) = particle cut-point diameter
- \(q\) = volumetric flow rate of fluid
- \(\mu\) = fluid viscosity
- \(r_1\) = radius at time 0
- \(r_2\) = radius at time \(T\)
- \(\omega\) = rotational velocity of bowl
- \(b\) = bowl length
- \(\rho_P\) = particle density
- \(\rho\) = fluid density

Match the change in particle cut-point diameter with each of the given changes in a separation parameter.

<table>
<thead>
<tr>
<th>Separation Parameter Change</th>
<th>Particle Cut-Point Diameter Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid density increases</td>
<td>Increases</td>
</tr>
<tr>
<td>Particle density increases</td>
<td>Decreases</td>
</tr>
<tr>
<td>Atmospheric pressure decreases</td>
<td>Remains the same</td>
</tr>
<tr>
<td>Volumetric flow rate increases</td>
<td></td>
</tr>
</tbody>
</table>
**Question 56, p. 43**
The question should read as follows:

An 80-ft-wide \times 200-ft-long greenhouse with a semicircular (hoop or arch) cross section has a double-polyethylene (IR-inhibited) covering on the top, side, and ends. It also has a heating system with an output of 400,000 Btu/hr. **For the double-polyethylene covering, \( R = 2.0 \text{ hr-ft}^2\text{-°F/Btu} \).** The temperature difference that can be maintained inside to outside in the greenhouse is most nearly:

**Question 69, p. 50**
The options should read as follows:

- **A.** more than 40
- **B.** between 21 and 40
- **C.** between 13 and 20
- **D.** less than 12

**Solution Table, p. 62**
The solution for 69 is **D**.

**Solution 37, p. 78**
The following was added to the solution:

From the graph, \( D_{10} = 1.3, D_{30} = 3.1, D_{60} = 7.0 \)

\[
C_u = \frac{D_{60}}{D_{10}} = \frac{7.0}{1.3} = 5.4
\]

\[
C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = \frac{(3.1)^2}{7.0 \times 1.3} = 1.06
\]
The solution should read as follows:

Reference: General practice knowledge

\[ \Delta T = 30^\circ C \text{ or } 30 \text{ K} \]

\[ Q = UA\Delta T \]

\[ Q = 2,114 \text{ kJ/kg} \times 1,000 \text{ kg/hr} \]

\[ Q = 2.11 \times 10^6 \frac{\text{kJ}}{\text{hr}} \times \frac{\text{W} \cdot \text{sec}}{\text{J}} \times \frac{\text{hr}}{3,600 \text{ sec}} = 586 \text{ kW} \]

\[ Q = 2,700 \frac{\text{W}}{\text{m}^2 \cdot \text{K}} \times 30 \text{ K} \times A \]

586 kW = 2,700 \[ \frac{\text{W}}{\text{m}^2 \cdot \text{K}} \] \times 30 \text{ K} \times A

\[ A = \frac{586 \text{ kW} \cdot \text{m}^2 \cdot \text{K}}{2.7 \text{ kW} \times 30 \text{ K}} \]

\[ A = 7.23 \text{ m}^2 \]

**THE CORRECT ANSWER IS: B**
Solution 52, p. 88
The figure in the solution was modified as shown below:
Solution 53, p. 89
The solution should read as follows:

Changes in parameters present in the numerator (e.g., volumetric flow rate) result in proportional changes in particle cut-point diameter. Changes in parameters present in the denominator (e.g., density difference, which is a function of particle density and fluid density) result in inversely proportional changes in particle cut-point diameter. Changes in parameters absent from the equation (e.g., atmospheric pressure) have no influence on particle cut-point diameter.

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</tr>
</tbody>
</table>
Solution 56, p. 93
The following was added to the solution under “Rearranging”:

Rearranging:

\[ \Delta T = \left( T_o - T_i \right) = \frac{q}{UA} \]

\[ q = 400,000 \text{ Btu/hr} \]

\[ A = \text{area of ends} + \text{area of top} = 2 \times \frac{\pi r^2}{2} + \frac{\pi DL}{2} \]

\[ = 3.14 \times (40 \text{ ft})^2 + \frac{3.14 \times 80 \text{ ft} \times 200 \text{ ft}}{2} = 5,024 \text{ ft}^2 + 25,120 \text{ ft}^2 = 30,144 \text{ ft}^2 \]

\[ U = \frac{1}{R} \]

\[ U = \frac{1}{2.0} = 0.50 \]

\[ U = 0.50 \text{ Btu/hr-ft}^2 \cdot ^\circ\text{F} \]

\[ \Delta T = \frac{400,000 \text{ Btu/hr}}{0.50 \times 30,144 \text{ ft}^2} = 26.5 ^\circ\text{F} \]

Solution 65, p. 95
The variable \( v \) in the last section of the solution was changed to the following:

\[ q_v = Mv \]

\[ v = 0.835 \text{ m}^3/\text{kg at 18} ^\circ\text{C and 60\% (from psychrometric chart)} \]

\[ q_v = 1.3 \text{ kg/s} \times 0.83 \text{ m}^3/\text{kg} \times 60 \text{ s/min} = 66 \text{ m}^3/\text{min} \]
Solution 69, p. 97
The solution should read as follows:

Reference: *ASCE Minimum Design Loads for Buildings and Other Structures*

Assumptions:
- Slippery roof
- Risk Category I
- Heated
- Exposure C

\[ p_s = C_s p_f \]
\[ p_f = 0.7 C_e C_t I_s p_g \]

- \( C_e \), exposure factor Category C that is fully exposed = 0.9 (from Table 7-2)
- \( C_s \), thermal factor for heated structure = 1.0 (from Table 7-3)
- \( I_s \), importance factor for agricultural building with low occupancy = 0.8 (from Table 1.5-2)
- \( C_s \), warm roof slope factor = 1.0 (from Figure 7-2a)

\[ p_f = (0.7)(0.9)(1.0)(0.8)(20) = 10.08 \text{ psf} \]
\[ p_s = (1.0)10.08 \text{ psf} = 10.08 \text{ psf} \]

THE CORRECT ANSWER IS: D
Solution 85, p. 111
The options should read as follows:

Reference: General practice knowledge

\[ r = 1,800 \text{ mm} \]
\[ \text{circumference} = \pi 2r = 11,309 \text{ mm} \]

\[ \begin{align*}
\pm 20 \text{ mm} & \\
11,309 & \times 360^\circ = \pm 0.63^\circ \text{ total target zone}
\end{align*} \]

Need to have sensor \( \pm 0.63^\circ \)

From the options, the minimum resolution that will satisfy the requirements of minimum position accuracy is \( \pm 0.5^\circ \).

Alternatively:

\[ \theta = \sin^{-1} \left( \frac{20 \text{ mm}}{1,800 \text{ mm}} \right) \rightarrow \theta = 0.63^\circ \]