### Environmental Issues Assessment Rubric

<table>
<thead>
<tr>
<th>Student: ________________________</th>
<th>Course: ________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reviewer: ________________________</td>
<td>Date: ________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unacceptable=1 Marginal=2 Acceptable=3 Good=4 Exceptional=5</td>
<td>POINTS</td>
</tr>
</tbody>
</table>

- **Demonstrates knowledge of environmental issues.**
  - 1. No knowledge of environmental issues. 10
  - 2. Little knowledge of environmental issues. 20
  - 3. Moderate knowledge of environmental issues. 30
  - 4. Adequate knowledge of environmental issues. 40
  - 5. Complete knowledge of environmental issues. 50

- **Demonstrates knowledge of material impacts on the environment.**
  - 1. No knowledge of material impacts. 5
  - 2. Little knowledge of material impacts. 10
  - 3. Moderate knowledge of material impacts. 15
  - 4. Adequate knowledge of material impacts. 20
  - 5. Complete knowledge of material impacts. 25

- **Demonstrates knowledge of energy impacts on the environment.**
  - 1. No knowledge of energy impacts. 5
  - 2. Little knowledge of energy impacts. 10
  - 3. Moderate knowledge of energy impacts. 15
  - 4. Adequate knowledge of energy impacts. 20
  - 5. Complete knowledge of energy impacts. 25

**Total:** 100

---

**ENVIRONMENTAL ISSUES IN CHEMICAL AND BIOLOGICAL ENGINEERING**

An aqueous waste stream from a pharmaceutical plant is to be treated before final disposal. The stream is a mixture of various streams from across the plant and contains residual cell lysate, salts, and organics (including trace quantities of the product drug). Based on the attached block flow diagram, propose separations technologies at each major junction for the removal of four categories of contaminants: protein fragments (average MW ~ 2,000 g/mol), sodium phosphate (from buffer solutions), ethanol, and a substituted aromatic (pravastatin, MW ~ 425 g/mol). In all cases, the concentration of the contaminant is ≤ 500 mg/L.
Inlet
• Protein
• Salt
• Ethanol
• Statin
• Water
Outlet
• Water

Junction 1:
• Removal of __________________________
• Separation process: __________________________
• Phase of separated contaminant (gas/liquid/solid): __________________________
• Briefly describe why you chose this process: __________________________
• What are the implications for the environment both from a material perspective? ______
• What are the implications for the environment both from an energy perspective? ______
• Identify one safety hazard in this process. __________________________
• How can you minimize the risk associated with this hazard? __________________________

Junction 2:
• Removal of __________________________
• Separation process: __________________________
• Phase of separated contaminant (gas/liquid/solid): __________________________
• Briefly describe why you chose this process: __________________________
• What are the implications for the environment both from a material perspective? ______
• What are the implications for the environment both from an energy perspective? ______
• Identify one safety hazard in this process. __________________________
• How can you minimize the risk associated with this hazard? _______________________

Junction 3:
• Removal of ______________________
• Separation process: ______________________
• Phase of separated contaminant (gas/liquid/solid): ______________________
• Briefly describe why you chose this process: ______________________
• What are the implications for the environment both from a material perspective? ______
• What are the implications for the environment both from an energy perspective? ______
• Identify one safety hazard in this process. ______________________
• How can you minimize the risk associated with this hazard? ______________________

Junction 4:
• Removal of ______________________
• Separation process: ______________________
• Phase of separated contaminant (gas/liquid/solid): ______________________
• Briefly describe why you chose this process: ______________________
• What are the implications for the environment both from a material perspective? ______
• What are the implications for the environment both from an energy perspective? ______
• Identify one safety hazard in this process. ______________________
• How can you minimize the risk associated with this hazard? ______________________