

Level	Design [SO2,8]	Design [SO2,8]	CHEMCAD [SO2,8]	CHEMCAD [SO2,8]	Control [SO2,8]
10	Cadets modify design to achieve optimization and energy integration.	Cadets produce working design that meets or exceeds all design constraints and specific production needs.	Cadets produce rigorous column design that include design of condensers reflux drums, and reboilers.	Cadets produce rigorous flowsheet design that includes all required ancillary equipment and piping.	Major control points and relief devices in the process identified and described. Control strategies are safe.
5	Cadet design works and cadets have incorporated realistic features but design is not fully optimized.	Cadets incorporate design constraints into a plausible design scheme but the degree to which the constraints are satisfied is weak or unclear. Constraints are listed.	Cadets developed a flowsheet model that incorporates rigorous column design to include tray number, feed location and diameter for each column.	Process flow sheet models process but one or more minor features are missing.	Control points in the process have been identified and described but minor detail is missing, leading to potential safety issues.
1	Cadet design works but is primitive and demonstrates minimal engineering creativity.	Understanding of design constraints is weak or leads to poorly designed equipment or processes. See Note 1.	Cadets developed a <i>working</i> flowsheet model to accomplish design. Crude oil feed stream is <i>correctly</i> specified.	Process flow sheet is working, but one or more major features of the design are missing.	At least one control point has been described for each major portion of the process.

Rubric notes:

1. Cadets must develop realistic constraints for allowed sulfur and water content.
2. All levels and quality of performance are determined by the instructor.
3. Cadets may ask for clarification at any time during the grading process.
4. Instructor will provide cadets with periodic updates of the rubric scores during the IPRs.
5. The number of columns in this rubric does not indicate weighting in final grade.
6. SO stands for Student Outcomes for the chemical engineering program.

Cadets:

Date:

Level	Communication [SO3]	Communication [SO3]	Context [SO4]	Economics [SO4]	Environmental [SO4]
10	Report is well-written and clear; all sections are included.	Graphical data is presented in a clear and professional style.	Cadets have analyzed political context and economic impact on sustainability.	Cadets have calculated economic measures and have assessed them against appropriate benchmarks.	Assessment is complete and comprehensive. Major important sources and tools have been employed and interpreted.
5	All major sections are included, but factual or grammatical errors detract significantly from the meaning, or one or more minor sections are missing.	All required information is present, but plots or flow diagrams are missing features or information, or plots or diagrams are not neatly embedded into the text.	Cadets include an analysis of the political and economic details of the geographic regions where they draw raw materials.	Cadets have calculated economic measures and presented the results in the main body of the report, but have minor errors or unrealistic results.	Environmental issues have been identified, valid sources of information have been employed, but interpretation is weak or needs additional work.
1	Report is missing major sections. Writing and grammar errors detract significantly from the meaning of the content.	Important plots or flow diagram are missing from the report, or visual presentation detracts significantly from the content.	Cadets include description of geographic region supplying their raw materials.	Important economic measures (PBP, ROI, NPW, and DCFR) are missing or incomplete.	Assessment submitted but is minimal or is missing major sections or important sources of information.

Rubric notes:

1. Cadets must develop realistic constraints for allowed sulfur and water content.
2. All levels and quality of performance are determined by the instructor.
3. Cadets may ask for clarification at any time during the grading process.
4. Instructor will provide cadets with periodic updates of the rubric scores during the IPRs.
5. The number of columns in this rubric does not indicate weighting in final grade.
6. SO stands for Student Outcomes for the chemical engineering program.

Cadets:

Date:

Level	Safety [SO4]	Health [SO4]	Problem Solving [SO1]	Technical [SO1]	Research [SO7]
10	Safety audit is complete. Assessment is comprehensive.	Identification and discussion of human exposure factors is comprehensive and summarized in a concise fashion.	Identification, formulation, and solution of problems is creative and efficient.	Level of understanding of key theoretical concepts results in a working design.	Areas requiring research are apparent or clearly explained in the final report, and student research is thorough, carefully presented, and correctly documented.
5	Safety audit is complete. Assessment is comprehensive but contains one or more minor omissions or errors in interpretation.	Students have identified human exposure risk factors and summarized them adequately, but analysis lacks rigor or is missing information.	Students identify problems that must be solved to produce a working design and develop creative formulations and solutions.	Level of understanding of key theoretical concepts is limited and produces minor design inconsistencies, or key theoretical information is lacking or incomplete.	Students identify information gaps or areas where research is needed to address the design problem and find enough information to proceed with project.
1	Assessment was submitted but is missing major sections.	Human exposure factors are mentioned but analysis is minimal or lacking.	Students identify problems that must be solved to produce working design.	Understanding of underlying principles limits ability to achieve working design.	Students are unable to identify information needed to address the design problem.

Rubric notes:

1. Cadets must develop realistic constraints for allowed sulfur and water content.
2. All levels and quality of performance are determined by the instructor.
3. Cadets may ask for clarification at any time during the grading process.
4. Instructor will provide cadets with periodic updates of the rubric scores during the IPRs.
5. The number of columns in this rubric does not indicate weighting in final grade.
6. SO stands for Student Outcomes for the chemical engineering program.

Cadets:

Date: