














Appendix A.—Rubric for Engineering Design Process (EDP)

EDP Step	Novice (0)	Apprentice (1)	Journey person (2)	Expert (3)	Score
 Identify the problem (Ask)	Student does not identify the problem	Student incorrectly identifies the problem	Student identifies part of the problem	Student fully and correctly identifies the problem	
 Brainstorm a solution (Imagine)	Student does not brainstorm	Student generates one possible solution	Student provides two solutions	Student provides three or more possible solutions	
 Develop a solution (Plan)	Student does not select or present a solution, or the solution is off-task	Student presents a solution that is incomplete or lacking details	Student selects a solution but does not consider all criteria and constraints	Student selects a solution that considers all criteria and constraints	
 Create a prototype (Create)	Student does not directly contribute to the creation of a prototype	Student creates a prototype that does not meet problem criteria and constraints	Student's prototype meets most problem criteria and constraints	Student creates a prototype that meets all problem criteria and constraints	
 Test a prototype (Test)	Student does not contribute to the testing of the prototype	Student conducts tests that are irrelevant to the problem or do not accurately assess strengths and weaknesses of the prototype	Student conducts carefully performed tests that consider one to two strengths and weaknesses of prototype	Student conducts relevant and carefully performed tests that consider three or more strengths and weaknesses of prototype	
 Redesign based on data and testing (Improve)	Student does not contribute to the redesign	Student does not improve the design or address concerns	Student addresses one concern to improve the design	Student addresses two or more test-based concerns to improve the design	
 Communicate results from testing (Share)	Student does not communicate results	Student shares random results	Student shares organized results but results are incomplete	Student shares detailed, organized results with group	
Total					

Appendix B.—Rubric for Scientific Research Process (SRP)

SRP Step	Novice (0)	Apprentice (1)	Journey person (2)	Expert (3)	Score
 Pose questions	Student does not identify the question	Student incorrectly identifies the question	Student identifies part of the question	Student identifies the question completely	
 Develop hypothesis	Student does not state hypothesis	Student generates a hypothesis that is not clearly stated or well thought out and is not testable	Student generates a hypothesis that is clearly stated and testable	Student generates a hypothesis that is formulated using appropriate terms and is testable	
 Plan the investigation	Student does not plan investigation	Student does plan the investigation, but it is largely incomplete (no testing of hypothesis)	Student does plan the investigation but does not adequately test the hypothesis previously stated	Student does plan the investigation and adequately tests the hypothesis previously stated	
 Assemble data	Student does not present data	Student does present data but uses inappropriate presentation for the type of data	Student does present data and uses the appropriate presentation for the type of data	Student presents data that show trends or patterns (insight) and uses the appropriate presentation for the type of data	
 Document conclusions	Student does not document conclusions	Student does document conclusions, but the conclusions are incomplete or suggests student does not understand the conclusion	Student does document conclusions and shows an understanding of evidence interpretation	Student does document conclusion and shows understanding of evidence interpretations as well as any limitations	
 Present findings	Student does not communicate results	Student shares random results	Student shares organized results, but results are incomplete	Student shares detailed, organized results with group	
Total					

Appendix C.—Glossary of Key Terms

Cargo. Goods carried on a large vehicle

Central crater uplift. A mountain in the center of large (greater than 40 kilometers in diameter) impact craters

Cinder cone. A low, broad, dark, cone-shaped hill formed by an explosive volcanic eruption

Constraint. Limitation or restriction

Crater ejecta. Material thrown out from and deposited around an impact crater

Criteria. Standard for evaluating

Dome. A low, circular, rounded hill suspected to be a volcanic landform

Highlands. Bright areas of the Moon composed of countless overlapping craters (ranging from 1 to over 1,000 meters) that formed when meteorites crashed into the Moon

Illumination. Period during which a lunar South Pole region site receives direct sunlight

Impact crater. A roughly circular hole created when something, such as a meteorite, struck the Moon's surface

Kelvin. The kelvin (K) is the standard international (SI) unit of thermodynamic temperature

Lava flow. A breakout of magma from underground onto the surface

Maria. Areas that formed when lava flows filled in low places. The low places are mostly inside huge basins that were formed by large meteor impacts. The maria cover 16 percent of the Moon's surface.

Multi-ringed basin. Huge impact crater surrounded by circular mountain chains

Optimize. Optimize is making the best or most effective use of a resource

Orbiting lunar habitat. An outpost orbiting the Moon that provides vital support for long-term human return to the lunar surface as well as a staging point for deep space exploration

Polyominoes. Equal-sized squares joined together edge to edge to form a plane geometric figure

Priority. The fact or condition of one thing being regarded as more important than another

Ray. Bright streak of material blasted out from an impact crater

Rille. A channel in the lunar maria formed by an open lava channel or a collapsed lava tube

Slope. The measure of the rise (steepness) or fall (inclination) of a feature relative to the horizontal plane

Terraced crater walls. Steep walls of an impact crater with "stair steps" created by slumping due to gravity and landslides

Topographic map. A detailed, two-dimensional representation of a three-dimensional surface that gives an accurate representation of its features and shape

Volatile. A chemical element or compound that is a gas at room temperature and has been deposited in the top layers of the Moon's surface

Water ice. Frozen water mixed in the regolith (lunar soil) on the Moon in the form of grains

Wrinkle ridge. A long, narrow, wrinkly, hilly section in the maria