Lesson/Title and Product Number: Lunar Biosphere (EG-1997-10-116-HQ)	**Grade:** Middle School
Description This activity challenges students to create a working model of a lunar biosphere that is a balanced, self-enclosed living system able to run efficiently over a long period of time.	
Objective To build a biosphere that is a balanced, self-enclosed living system able to run efficiently over a long period of time.	**Standards** ETS1; LS2
ALIGNMENT TO STANDARDS: NGSS	
A. Integrates grade appropriate elements of the three dimensions of the NGSS Framework.	Meaningfully and adequately addressed.
B. Lessons fit together	Criterion is absent in the task/lesson. Not a multi-lesson sequence.
C. Disciplinary core ideas	Meaningfully and adequately addressed.
D. Crosscutting concepts are used in the explanation	Meaningfully and adequately addressed.
E. Provides grade appropriate connection(s) to the Common Core	Criterion is absent in the task/lesson. Math connections were not included. All elements of this lesson should be reviewed in light of opportunities to highlight math concepts that would appropriated for subgroups within the fairly wide range of graded for which this lesson is suggested as being suitable.
ALIGNMENT TO STANDARDS: Common Core State Standards in Mathematics	
A. Lesson is aligned with the eight Standards for Mathematical Practice	Criterion is absent in the task/lesson.
B. Lessons are aligned to Mathematical Content	Criterion is absent in the task/lesson.
C. Connects the Standards for Mathematical Practices to the Standards for Mathematical Content	Criterion is absent in the task/lesson. This lesson should be carefully reviewed in light of opportunities to include this element of the Mathematical Practice Standard
INSTRUCTIONAL SUPPORT: Learning Environment	
A. Differentiates and individualize learning. (Sotomayor, K., 2013)	Criterion is present in the lesson/task but not adequately or in a superficial manner. A careful review of all component of the lesson should be reviewed so that opportunities to consider mixed modalities can be considered.
B. Lesson includes elements of collaboration / cooperation	Meaningfully and adequately addressed. The lesson might be improved by providing the students an opportunity to design their own biosphere model and/or to choose a model type when given several choices. They [learners] might also been asked to

	critique s the design of the model that was given to them. This would involve their using the engineering design process.
C. Lesson design / teacher materials includes affective domain considerations.	Criterion is present in the lesson/task but not adequately or in a superficial manner. A greater contribution to the affective domain if more socially-oriented types of questions were asked.
INSTRUCTIONAL SUPPORT: Best Practices in Science and Engineering Teaching	
A. Students are actively constructing meaning	Meaningfully and adequately addressed. The possibility of adding a Project-Based theme could be accomplished if there was an option for the learners to create a prototype for an environmental model that would be suitable for demonstrating how a closed-
B. Lesson plan incorporates learning progressions and connections	Criterion is present in the lesson/task but not adequately or in a superficial manner. A moderately comprehensive pre and posttests might help to know with more confidence what was learned.
C. Emphasizes scientific argumentation	Meaningfully and adequately addressed. Possible, for the older learners, there might be a component where the teams would first critique each other and they would critique what was done by the other teams. This would be within the spirit of scientific argumentation and not that of a debate where rebuttals are aimed at defeating the ideas and positions held by others.
D. Lesson makes learning and content relevant and contextual	Meaningfully and adequately addressed. Frankly included questions that will force all learners to consider relevance and the larger context of purpose for this lesson.
INSTRUCTIONAL SUPPORT: Mathematics Teaching Practices	
A. Establishes mathematics goals to focus learning.	Criterion is absent in the task/lesson. Carefully review all aspects of the lesson and try to identify where mathematical foci might be added in a complementary manner.
B. Implements tasks that promote reasoning and problem solving.	Meaningfully and adequately addressed.
C. Uses and connects mathematical representations.	Criterion is present in the lesson/task but not adequately or in a superficial manner. Carefully review all aspects of the lesson and try to identify where opportunities for use of mathematical representations might be included.
D. Facilitates meaningful mathematical discourse.	Criterion is absent in the task/lesson.
E. Poses purposeful questions.	Meaningfully and adequately addressed.

F. Builds procedural fluency from conceptual understanding.	Meaningfully and adequately addressed.
G. Supports productive struggle in learning mathematics.	Criterion is absent in the task/lesson. Carefully review all aspects of the lesson such that there will be support for a productive struggle in learning mathematics.
H. Elicit and use evidence of student thinking.	Meaningfully and adequately addressed.
Cultural Responsive Teaching	
A. Academic Language support for ELLs:	Meaningfully and adequately addressed. All parts of this lesson should be reviewed relative to means of incorporating this metric in a manner that does not detract from the science objectives.
B. Cognitive Demand: The task or majority of the lesson includes task(s) that require close analysis of procedures and concepts, involves complex mathematical/scientific thinking, utilizes multiple representations AND requires explanation/justification.	Meaningfully and adequately addressed.
C. Power and Participation: The development of mathematical / scientific knowledge (see NGSS, CCSS) is seen as a collaborative effort between teacher and student.	Meaningfully and adequately addressed.
D. Incorporating students' identities and funds of knowledge/culture/community: The creation and maintenance of collective understandings about mathematics that involves intricate connections to personal/community/cultural knowledge and permeates the entire lesson. This would include hook/intro, main activities, assessment, closure and homework.	Meaningfully and adequately addressed. Carefully review this lesson in light of opportunities to apply lessons learned in their experiment to new and different problems in the lives of the learners.
E. Use of critical knowledge/social justice: Mathematics/science is viewed as an analytical tool to understand an issue/context, formulate mathematically/scientifically-based arguments to address community/societal the issues, and provide substantive pathways to change/transform the issue.	Criterion is absent in the task/lesson. This lesson, as presented, does not address this metric. Carefully review this lesson in light of the use of critical knowledge/social justice and make modifications as are reasonable.

Materials
Cardboard or heavy-weight paper Clear Cinder, gravel, sand silt, clay Data and Observation Sheets Fertilizer Lamp Markers or crayons Measuring cups & spoons String Something to use as the frame: wooden chopsticks, other kinds of sticks, Permiculite Plastic tape Plastic drinking straws, hangers Plastic 2-liter bottle Seedlings and animals Team Member Information Sheets Vermiculite Water

5E Lesson/Description	
1. Engage	**Present.** The nature of the abiotic and biotic component should resonate with nearly all learners because they are items that are frequently encountered in one's daily comings and goings. Student made to designing hanging mobile "Biosphere" to assess prior knowledge will promote curiosity and elicit prior knowledge of students. Question posed to students in one area of the activity the student or learner finds answers that is related to a different core idea. Brain storming the before design helps engage students.
2. Explore	**Present.** This metric allows all core ideas to be introduced and explored to varying depths as related to the grades exploring this lesson. Every element of protocol provides opportunities to explore the practices, thus allowing the learners to gain a very good understanding of how scientists and engineers carryout their respective missions for such a venture as creating an artificial environment. Team dialogue also helps student to explore ideas to solve problems.
3. Explain	**Present.** Lesson/activity allows for provision of qualitative descriptions that attempt to explain why their lunar model presented the way that it does.
4. Expand/ Enhance	**Present.** Learners are challenged to create their own model which challenges them to think critically, and come up with an idea to solve the problem. Learners develop new skills when a conceptual understanding is gained in solving the task.
5. Evaluate	**Not present.** Students understanding of the model can be assessed on how they collect to aid their progress in the creation of the lunar model. How students fill their data and observation sheet helps assess understanding of the lunar model.