5E Integrated STEM Lesson Plan – Template

Lesson Title: Space Shuttle Reentry (Modified Egg Drop Challenge)

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Topic: This engineering challenge will span a number of units with a number of different content areas. Students will be asked to engineer the safe reentry of a spacecraft to Earth by using an egg as a substitute. Students will be asked to provide justification of their design using energy analysis, momentum analysis, force diagrams, and kinematic equations. Here is a summary of the challenge:

Your 7 mission will have five phases, following the standard Engineering Design Process procedures:

1) Design Phase: Draft several blueprints of the re-entry capsule given the available materials. Its design should be made with some constraints in mind, but most importantly, this is a matter of life and death! Utilize your knowledge of *gravity, forces, Newton's laws, terminal velocity* and the physics of *momentum conservation (inelastic and elastic collisions, impulse)* and *energy conservation* (*potential and kinetic energy*) to minimize the *force* on our pilot during landing. **Provide force diagrams and calculations to ensure our pilot will survive**. **Also Provide kinematic equations to provide the final velocity the device will reach.**
2) Building Phase: Construct the re-entry capsule prototype.
3) Testing & Data Collection Phase: Gather and analyze impact data using a test dummy and offer some recommendations to improve on the design of the re-entry capsule. **Base your suggestions on calculations using data you collect and the physics of collision.**
4) Revising Phase: Refine the constructed re-entry capsule based on recommendations from the test phase.
5) Implementation Phase: The day of launch is _____

Targeted Grade Level: *Introductory High School Physics (9th - 12th grade)*

Subject Integration: Visual Arts (As Mentioned Below!)

Standards:

- Anchor Standard 1: Generate and conceptualize artistic ideas and work
    - HS Proficient - Use multiple approaches to begin creative endeavors

- Anchor Standard 3: Refine and complete artistic work.
    - HS Accomplished (MA:Cr3.1.II)
        - a. Consolidate production processes to demonstrate deliberate choices in organizing and integrating content and stylistic conventions in media arts production, demonstrating understanding of associated principles, such as continuity and juxtaposition.
        - b. Refine and elaborate aesthetic elements and technical components to intentionally form impactful expressions in media artworks for specific purposes, intentions, audiences and contexts.

- Anchor Standard 10: Synthesize and relate knowledge and personal experiences to make art.
    - HS Accomplished - Utilize inquiry methods of observation, research, and experimentation to explore unfamiliar subjects through artmaking

In their engineering design, students will incorporate aspects of Anchor Standard 1, 3, and 10. Students will be meeting Anchor Standard One through their initial design iterations and their drafting of multiple blueprints. They will then be engaging with Anchor Standard Three in the revisions phase based on scientific principles. Here, students will be demonstrating “demonstrate deliberate choices in organizing and integrating content and stylistic conventions” in their design. Furthermore, students will engage in Anchor Standard 10 by adding their own personal flair and identify as part of the piece. In one of the discussion comments, Yishan suggested having students engage in Logo design, which would be welcomes warmly by many of my students

NGSS Performance Expectations *If you state does not use NGSS, use your state standards. Identify the state and link to the standards page. You are encouraged to list both the NGSS and your state standards.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:

If applicable	*If applicable*	*If applicable*
Common Core State Standards: *Use your state standards if Common Core is not applicable in your state. You are encouraged to list the CCSS and your state standards.* Math: *If applicable* ELA: *If applicable*		
ITEEA Standards *(If applicable)*		
Other Standards *(as needed)*		

Measurable Student Learning Objectives: *Write the learning objectives as "students will be able to" statements. Be sure that your objectives are measurable and connect to the standards listed above.*

You are encouraged to use Webb's Depth of Knowledge to create action oriented objectives.

Nature of STEM: *Summarize how your lesson addresses the "nature of" science, technology, engineering, math, etc. as discussed in the Methods of STEM course.*

Engaging Context/Phenomena: *What are your engaging phenomena or your "hook" for the lesson? Be sure whatever you choose is appropriate for the subject area and grade level you are addressing.* Several example phenomena are shared in course. Consider how observations of the natural world serve as phenomena to engage students in the content. *You must utilize a NASA resource in your lesson (please discuss with your instructors if you need assistance).*

Data Integration: *What data is being used in this lesson? Are students analyzing or collecting data? What are they doing with the data? This would be a great place to include all the different NASA data made available to you. If NASA data is not appropriate for your lesson, speak to your course instructor to identify another source of data that is appropriate. It may be publicly available, collected by students, or accessible to you with permission through other projects.*

Differentiation of Instruction: *How can you adjust this lesson to meet the unique needs of students in your classes? What needs should be addressed? Think about and make these modifications PRIOR to the lesson so all students have the greatest ability to participate.*

Real-life Connection: *Is there a real-life connection to this lesson? If so, what is it? How have you considered culturally responsive teaching practices? How will students connect to the lesson in their everyday lives?*

Possible Misconceptions: *Are there any previous ideas or thoughts you anticipate students having about this concept? List them here as it will help you consider ideas to include in your lesson.*

Lesson Procedure: *This is where you include each phase of the 5E. They should be extremely clear, well organized, and ready to be used by another educator. Be sure that each learning experience meets the guidelines for each "E". The template below will help you.*

5E Model	5E Objectives

Engage *Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as appropriate. Learn about what students already know and want to know.*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*
Explore *Plan for students to engage in hands-on activities that are designed to facilitate*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*

conceptual change.	
Explain *Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts.*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*
Elaborate *Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*

understanding and skills.	
Evaluate *Assess students knowledge, skills and abilities.*	**Procedure:** *(What happens during this phase? What is the teacher doing? What is the student doing?)* **Modifications** *(What student needs must be addressed? How can you make each experience accessible for ALL learners?)* **Standards Addressed** *(Which standards are being explicitly taught in this section?)* **Formative/Summative Assessments** *(How will you assess in each phase?)* **Resources** *(List all resources and materials used in this part of the lesson.)*

Teacher Background: *What background information does the teacher need to effectively teach this lesson? If you can provide links to resources, please do so.*