Science Lesson Planning Template

Context Issues of the Lesson

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| **Unit or Lesson Title:** | Physics—Force and Motion |
| **Grade Level** | 9th grade |
| **Topic/Theme/Nature of the Investigation:** | Students will learn the different components regarding Force and Motion. They will design a car powered by a balloon to determine the fastest and most accurate vehicle. |
| **NGSS Performance Expectation(s)** | |  |  | | --- | --- | | **HS-PS2-3.** | Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.\* [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [*Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.*] | |
| **NGSS Dimension 1 component** | Developing and Using Models  Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.  Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4) |
| **NGSS Dimension 2 component** | [**Structure and Function**](http://www.nap.edu/openbook.php?record_id=13165&page=96)   * Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-PS2-6) |
| **NGSS Dimension 3 component** | [**ETS1.A: Defining and Delimiting an Engineering Problem**](http://www.nap.edu/openbook.php?record_id=13165&page=173)   * Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. *(secondary to HS-PS2-3)* |
| **Duration:**  1 class period for introduction video along with background knowledge regarding acceleration, velocity, friction.  1 class period for group brainstorming and designing of vehicle.  1 class period for in school vehicle development and testing.  1 class period for class competition  1 class period for theoretical design  2 class period for the evaluation assessment |  |

Planning Stages Within the 5-E Inquiry Model

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| **Engage** | | |
| PURPOSE:   * To get the students excited for the project and to inform them of the problem they will be solving. | | |
| **What is the teacher doing? What are the students doing?**  The teacher will be displaying different possible vehicle pictures and showing video clip from previous years races. Students will be informed that they will be racing their cars for Pink slips.  The problem: What is the best design of a vehicle that will demonstrate the fastest, most accurate, and safest vehicle and will cover the most distance using a balloon as the power source?  The student’s will be observing the pictures and brain storming possible ideas. | | |
| **Explore** | | |
| PURPOSE:   * To allow the students the opportunity to develop their racecar design. | | |
| **Activities (list)** | | **Driving Question** |
| 1. Balloon Racer Lab 2. Students will research different vehicle shapes 3. Students will work with a partner to design their best racecar. They will compete for speed and distance. 4. Students will build car out of the classroom 5. Students will race car. While racing they will measure the distance travel, the time travel and they will calculate velocity and acceleration for each of the three trials. 6. If they have to modify their design it must be documented and retested. 7. Students will find the average of all three trials. | | What design of car will make it travel the fastest?  What design of car will make it travel the furthest? |
| **Student Communication Product:** (written report, oral presentation, poster, etc.)   * Students will report their average velocity and acceleration to the class and then they will then graph the class data, making sure all parts of a graph are label. | | |
| **Explain** | | |
| PURPOSE:   * For the students to justify their design. | | |
| **Content Media: (written material, video, teacher lecture, technology)**   * Keynote or PowerPoint presentations * Can also use a poster board to display information.   **Student Communication Product (assessment):** (unit test, written report, oral presentation, poster, etc.)   * Student will compose a presentation about their findings. They will include the materials used in their design, why they decided to use those materials. What they could have done to improve their vehicle, how and why that improvement helped or hindered their design and any trends they saw through the class. They must also relate their design to the real world, regarding any safety issues that might have occurred as they were conducting their trials. Ex. Weak axels or poor infrastructure. This will be presented to the class. | | |
| **Elaborate** | | |
| PURPOSE:   * For the students to understand the collaboration that goes into making a vehicle safe, accurate and efficient. | | |
| **Activities:**  Student will look at each racecar developed in the class and combine the successful designs into an ultimate car. They will draw this ultimate car on a sheet of paper. They have to give credit to each original designer for the components that they are utilizing. They must then explain why they picked those traits/ designs.  **Content Media: (written material, video, teacher lecture, technology)**  Written material for the designer credits and the explanation of why they picked that trait/ design. Written material also for drawing.  **Extending/Application Questions for Whole/Small Group Discourse:**  Analyzing the data from the trials students will talk about the following questions in their small groups.   1. Which car was the fastest? 2. Which car went the furthest? 3. Which car had the least safety issues? 4. What traits would they like to utilize in their new design.   **Student Communication Product (assessment):** (unit test, written report, oral presentation, poster, etc.)   * Groups will use all of the designs and data presented by their classmates to create a theoretical ultimate balloon racecar. * They will show their picture and explain in an oral presentation what and why they created this theoretical balloon racecar design. | | |
| **Evaluate** | | |
| PURPOSE:   * To determine if the students have gained the knowledge of acceleration and velocity relating to a vehicle design. | | |
| **Skill/Reasoning Learning Objectives** | **Assessment Instrument** | |
| Students will show their understanding of velocity, acceleration, and forces | The students will show their understanding of velocity, acceleration, and forces by designing, evaluating and redesigning a balloon car. | |
| **Knowledge Learning Objectives**  Students can create, evaluate and improve their car designs using concepts of velocity, acceleration and forces. | **Assessment Instrument**  Using a Rubric to grade the presentation of the original and redesigned car. | |
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