**TITLE:** Momentum, Impulse and its application to vehicles in a crash by Thomas procopio

**Grade** 9-12

**Driving question:** Should safety devices be required for passengers in a back seat of a vehicle?

**Standards:**

**HS-PS2-1**. Analyze data to support the claim that Newton’s Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. [Clarification Statement: Examples of data could include tables, graphs, or diagrams (vector diagrams) for objects subject to a net unbalanced force, for objects in equilibrium (Newton’s First Law), or for forces describing the interaction between two objects (Newton’s Third Law).][Assessment Boundary: Assessment is limited to macroscopic objects moving at non-relativistic speeds whose measured quantities can be classified as either vector or scalar.]

**HS-PS2-2.** Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. [Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.] [Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.]

**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.]

**Project ideas with major products:**

1. **Presentations** 
   1. **Multimedia (Video/ power point/ posters choose 2 of the 3) report on how seatbelts saving lives (two groups of three report to class)** 
      1. **Conservation of momentum**
      2. **Newton 3 laws included**
   2. **Multimedia (Video/ power point/ posters choose 2 of the 3) report on seatbelts usage in back seat** 
      1. **Examples of wearing a seat belt as opposed to not wearing one in back seat**
      2. **Use newtons 3 laws included**
   3. **Multimedia report report on safety of airbags**
      1. **Pros of air bags**
      2. **Cons of airbags (dangers ?)**
   4. **Class discussion, based on evidence, on merits of airbags in the back seat**
   5. **How could air bags become more safe in the back seat**

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| Milestone #1  **1 days** | Milestone # 2  **(4 days)** | Milestone # 3  **(3 days)** | Milestone # 4  **( 1 day )** | Milestone # 5  **Public product** |
| **Show accidents with passengers in back seat and what happened**  [**https://youtu.be/\_lhibYD39Gs**](https://youtu.be/_lhibYD39Gs)  [**https://youtu.be/y3InF19dzlM**](https://youtu.be/y3InF19dzlM)  [**https://youtu.be/crUUr7FnBMI**](https://youtu.be/crUUr7FnBMI)  [**https://youtu.be/3YF34gzwiaQ**](https://youtu.be/3YF34gzwiaQ) | **Research implications of seatbelt restraints in the back seat and /or airbags in back seat** | **Class presentations to rest of class**  **and revisions** | **Feedback from physics teachers** | **Raise awareness on usage air bags and seatbelts for passengers in back seat of a vehicle** |
| **Suggestions from gallery walk using the posters not related to milestones**   1. **Could students conduct an interview with a mechanic or car designer?** 2. **Driving question might be a little yes or no ish** 3. **Broaden the driving question** 4. **Students could research other safety features**   **Other comments: Standards are well detailed,**  **Standards connect well with student products connects to** | | | |  |
| **Suggestions in red related to milestones** | 1. **Suggestions:**   **Find their own videos on crashes**   1. **Include concrete data in research** | **1 Create a rubric** |  | **Present during lunches** |
| **Key student question**  Are seatbelts / airbags necessary? | **Key student question**  How does conservation of momentum / impulse and newton’s three laws apply to crashes? | **Key student question**  How can the various media platforms help convey the findings? | **Key student question**  How can questions from physics teachers help refine the findings and answers questions not thought of yet | **Key student question**  How effective was the message conveyed in school? |
| **Formative assessment**  **Students will write down questions that they are wondering about** | **Formative assessment**  **After day 2 and day 4 research “Check in with student groups for 5 min to report on progress and make suggestions“**  **Last two days is working on their presentation** | **Formative assessment**  **Use a rubric to assess presentation on accuracy, relevance, vocab, use of formulas, and Participation. This will be completed by students and teacher. One rubric per group**  **After groups receive rubric feed back allow them time to revise** | **Formative assessment**  **Have physics teachers raise questions in a positive manner for further revision** | **Formative assessment**  **Final presentations during lunches with some kind of reward system for student body looking at presentation.** |
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Project Presentation Part A: Tuning Protocol Prep In the Tuning Protocol, you will be explaining your project’s learning goals and how it meets the Essential Project Design Elements, and your colleagues will give you feedback. You’ll begin by stating the grade level and subject area, the project title if you have one, and the learning goals. Before explaining the Elements, tell your listeners if you would especially like feedback on any particular issue. Record notes about the questions below to help plan your presentation; if you need more information about an Element, see the Project Design Rubric in Resources. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Key Knowledge, Understanding, and Success Skills: What standards-derived key knowledge, understanding, and success skills are you teaching and assessing through this project? **HS-PS2-1**. Analyze data to support the claim that Newton’s Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. [Clarification Statement: Examples of data could include tables, graphs, or diagrams (vector diagrams) for objects subject to a net unbalanced force, for objects in equilibrium (Newton’s First Law), or for forces describing the interaction between two objects (Newton’s Third Law).][Assessment Boundary: Assessment is limited to macroscopic objects moving at non-relativistic speeds whose measured quantities can be classified as either vector or scalar.]

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**What is the central problem or question students will tackle? What is your project’s driving question? Should safety devices be required for passengers in a back seat of a vehicle?**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. Sustained Inquiry: How will students engage in questioning and investigation?

**Complete research on car accidents and seatbelt / air bag usage. They ultimately will create a presentation to the entire class**

**Presentations**

* 1. **Multimedia (Video/ power point/ posters choose 2 of the 3) report on how seatbelts saving lives (two groups of three report to class)** 
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  2. **Multimedia (Video/ power point/ posters choose 2 of the 3) report on seatbelts usage in back seat** 
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     1. **Pros of air bags**
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**How could air bags become more safe in the back seat** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **3. Authenticity: What are the real-world aspects of your project?**

Most students have either been in an accident or know someone who was in one.

Should safety devices be mandatory for passengers in the back seat of a motor vehicle? And why?

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They will be able to “choose “ between seatbelt restraints and air bags for passengers in the back seat of a vehicle \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **5. Reflection: How and when will you build in opportunities for students to reflect on what and how they are learning, and on the project itself?**

When the students meet with me and discuss their ongoing progress on days 2 and 4. They will also be critiquing each other within their group

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Peer review during presentations. I will have students that are not presenting complete the rubric along with three positive comments and one question they are still wondering about. After first revisions are made, students will informally present to other physics teachers, in groups, for more formal feedback

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**7. Public Product: What are the major products in your project, and how will they be made public?**

Students will present their findings during the three lunches along with completing an electronic survey, and obtain some reward for completing the survey. Ie. Free homework pass/candy bar/ bottle of water/ other???? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ©2019 BUCK INSTITUTE FOR EDUCATION PBLWork s.org

Rubric for presentation

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| **Multimedia Project : Project Based Learning safety device requirement for passengers in the back seat** | | | | | | |  |  |
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| Teacher Name: **Mr. Procopio** | |  |  |  |  |  |  |  |
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| Student Name:     \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | |  |  |  |  |  |
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| CATEGORY | 4 | 3 | 2 | 1 |  |  |  |  |
| Presentation | Well-rehearsed with smooth delivery that holds audience attention. | Rehearsed with fairly smooth delivery that holds audience attention most of the time. | Delivery not smooth, but able to maintain interest of the audience most of the time. | Delivery not smooth and audience attention often lost. |  |  |  |  |
| Content | Covers topic in-depth with details and examples. Subject knowledge is excellent. | Includes essential knowledge about the topic. Subject knowledge appears to be good. | Includes essential information about the topic but there are 1-2 factual errors. | Content is minimal OR there are several factual errors. |  |  |  |  |
| Attractiveness | Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation. | Makes good use of font, color, graphics, effects, etc. to enhance to presentation. | Makes use of font, color, graphics, effects, etc. but occasionally these detract from the presentation content. | Use of font, color, graphics, effects etc. but these often distract from the presentaion content. |  |  |  |  |
| Workload | The workload is divided and shared equally by all team members. | The workload is divided and shared fairly by all team members, though workloads may vary from person to person. | The workload was divided, but one person in the group is viewed as not doing his/her fair share of the work. | The workload was not divided OR several people in the group are viewed as not doing their fair share of the work. |  |  |  |  |
| Content application | Uses formulas as they apply and relevant to specific content presented including: Equations, Givens and unknowns, and answers with units | Uses formulas as they somewhat apply to specific content presented including Equations, Givens and unknowns, and answers with units | Uses formulas as they barely apply to specific content presented including Equations, Givens and unknowns, and answers with units | Uses formulas as they do not apply to specific content presented including Equations, Givens and unknowns, and answers with units |  |  |  |  |
| Accuracy | Research is accurate and relevant to presentation. Completely accurate work would include reproducible results and /or appropriately documented references | Research is mostly accurate and relevant to presentation. Mostly accurate would include reproducible results and /or appropriately documented references with a few inconsistencies | Research is somewhat accurate but not relevant to presentation. somewhat accurate would include some reproducible results and /or little appropriately documented references with a few inconsistencies | Research is inaccurate and not relevant to presentation. completely inaccurate and not contain reproducible results and /or incorrectly documented references with many inconsistencies |  |  |  |  |
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| Date Created: **Jul 21, 2022 01:47 pm (CDT)** | |  |  |  |  |  |  |  |

**Calendar time line**

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| **Monday 1/16/23** | **Tuesday 1/17/23** | **Wednesday 1/18/23** | **Thursday 1/19/23** | **Friday 1/20/23** |
| **Intro into project** | **Research and create presentation** | **Research and create presentation** | **Research and create presentation** | **Research and create presentation** |
|  |  |  |  |  |
| **Monday 1/23/23** | **Tuesday 1/24/23** | **Wednesday 1/25/23** | **Thursday 1/26/23** | **Friday 1/27/23** |
| **Presentation and revision** | **Presentation and revision** | **Presentation and revision** | **expert feedback** | **Public product** |