Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Due Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2023 Year 12 Integrated Science – Unit 4 – Task 11: Vehicle Safety Investigation**

**Assessment Type: Extended Response**

**Weighting: 10% Duration: 4 Lesson Research**

**PHYSICS BEHIND CAR SAFETY FEATURES**

There were 20.1 million registered motor vehicles as of 31 January 2021 in Australia. Cars are Australian’s primary mode of transport and are responsible for moving, with 92% of households owning a car. There have been over 190 000 fatalities since 1925, with the road death toll dropping from 3,798 in 1970 to 1,195 in 2019.

**The four principles that are important in minimising personal injury in vehicle collisions are:**

1. Increasing the time of the collision or the time the occupants take to stop
2. Spreading the forces of impact over the largest possible area & ensuring stability of the vehicle.
3. Minimizing contact of the person with the interior of the vehicle
4. Keeping the person inside the vehicle

**Task:**

Use the following as a guide, and include as much Physics terminology and relevant examples as possible:

1. Explain why each of the four principles mentioned above can minimise personal injury. Describe each of these principles (A, B, C and D) independently and demonstrate your understanding by using examples.
2. Research a recent model vehicle (OR fictional vehicle upon approval by teacher), and describe features of the car, both seen and unseen, that minimise personal injury. Classify each feature as either A, B, C or D according to the principle/s it is employing.
3. Research an early model vehicle (OR a fictional vehicle upon approval by teacher), pre-1960 if possible (give model and year). Describe “features” of the car that would have made this car more likely to injure passengers during a collision. Classify each feature as either A, B, C, D according to the principle/s it is not employing, and which therefore makes it unsafe.
4. Summarise the role of safety in vehicle design, suggestions for improvements, and clearly communicate how physics principles can be applied to improve the safety of occupants.

Using the above gathered information, you are to present your findings in the form of a PowerPoint presentation, video, poster, PSA. You many work individually or in a partner. You are required to download your presentation as a PDF and submit it to SEQTA.

For more detail of what is expected refer to the rubric for the presentation.

**There are two parts of this assessment:**

1. Presentation

2. In-class validation test without notes

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| **Content/Scientific Merit** | **Acceptable Performance** | | | | | **Unacceptable Performance** | | |
|  | **Excellent (4)** | | **Good (3)** | | **Average (2)** | **Requires major improvement (1)** | **Failed (0)** | |
| **Demonstrates an understanding of the key physics behind the research** | The key physics is clearly and correctly identified and described and is integrated within the presentation | | Minor error and/or omission are made when presenting the physics | | The physics to be investigated is correctly identified but is described in a confusing manner. | The physics is correctly identified, but major errors or omissions are made. | No mention of the physics is made, or it is described incorrectly | |
| **Demonstrates an understanding of the role of safety in vehicle design** | Understands the purpose and use of each safety feature | | Minor error and/or omission in understanding purpose of each safety feature | | Multiple minor errors and/or major error or omission in this area | Major errors or omissions are made. | Misunderstands purpose and/or use of relevant equipment | |
| **Communication of details of the research** | Diagrams and information are clear and complete | | Diagrams and/or information are present but with a minor error and/or omission | | Diagrams and/or information are present, but with multiple minor errors and/or omissions OR an important detail is missing | Diagrams and/or information are extremely vague, or contain major errors or omissions | Diagrams and/or information are missing or incorrect | |
| **Understanding of mathematical model, equations and assumptions of same** |  | |  | | All mathematical model(s) & relevant equations are provided. All significant assumptions are correctly identified and discussed | Minor error and/or omission with math model, equations or assumptions | Mathematical model(s) equation(s) or assumption(s) are not provided or are incorrectly used | |
| **Identification of shortcomings in safety designs and suggests improvements.** | All major shortcomings of safety design are identified and specific suggestions for improvement are made | | Minor error and/or omission in identifying shortcomings or providing suggestions | | Multiple minor errors and/or omissions OR a major error or omission in identifying shortcomings or providing suggestions | Major errors or omissions in identifying shortcomings or suggestions | No attempt is made to identify any shortcomings or provide suggestions OR the attempt is vague, incorrect or inappropriate | |
| **Presentation Merit** | **Acceptable Performance** | | | | | **Unacceptable Performance** | | |
|  | **Excellent (4)** | **Good (3)** | | **Average (2)** | | **Requires Major Improvement (1)** | | **Failed (0)** |
| **Appearance & Layout** | Information is presented in a logical, interesting sequence that the reader can follow. Font usage, use of colour and overall appearance of presentation is aesthetically pleasing | Minor errors in sequencing: enough to notice, but not major distraction. Minor error and/or omission with appearance (font size/usage, colour etc) | | Multiple minor errors in sequencing: enough to be noticeable and distracting to audience. Multiple minor errors and/or omissions OR a major error or omission with appearance. | | Major errors in sequencing or in overall appearance | | No logical sequence to presentation. Font usage, usage, colour, or overall appearance is distracting to audience. |
| **Graphics** | Use of graphics explains reinforces text and presentation. | Minor error and/or omission with use of graphics (missing an explanation or better graphic needed to reinforce text | | Multiple minor errors and/or omissions OR a major error or omission with use of graphics | | Major errors with use of graphics | | Graphics missing or are superfluous to presentation. |
| **Use of English** | Correct use of English language (spelling, grammar, punctuation) throughout the presentation | Minor error and/or omission during presentation. | | Multiple minor errors and/or omissions OR a major error or omission with use of graphics | | Several minor mistakes OR major errors in use of English | | Multiple major errors in use of English |