Student research workbook. Answer each of the following questions. Your answers will be used to help you write you report on the Physics of Crumple Zones.

Part 1: Speed and Energy

What is the **final** speed of a car after a collision?

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If a car is traveling at 50 km/hr and gets in a collision, what it its **change** in velocity?

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What is the kinetic energy of a car after a collision? Use E = ½ mv2 to justify your answer.

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What happens to the kinetic energy of a moving car as it’s speed increases (doubles)?

Use E = ½ mv2 to justify your answer.

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When a car stops normally (using the brakes), what happens to the kinetic energy?

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Explain what happens to the kinetic energy of a car during a collision. (Where does the energy go? Discuss different types of energy)

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Discuss how passenger safety is related to speed and energy, and why high speed crashes are so much more dangerous than low speed crashes.

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Part 2: Acceleration and personal injury

Define the term acceleration in terms of motion (speed).

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Describe how the acceleration changes if the **duration** of the acceleration changes but **change in velocity** (∆v) is kept constant (for example a car goes from 100 km/h to 0 km/h in 1 second compared with 100 km/h to 0 km/h in 10 seconds).

-Bonus: Use the equation a = ∆v/∆t in your answer.

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What happens to a human who experiences extremely rapid acceleration (or deceleration)?

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Explain how it is safer for occupants in a car crash if they experience lower acceleration.

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Car crashes usually happen very quickly. Use the physics ideas of **acceleration** and **time** to describe how a collision could made safer for the occupants.

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Part 3: Crumple zones

What is a crumple zone? Why were they designed?

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Describe the construction of the crumple zone at the front end of a car. Include a description of the materials used and why.

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Use physics ideas of **time** and **acceleration** to describe how the crumple zone protects passengers during a collision.

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Use the physics idea of **energy** and **energy** **transfer** to describe how the crumple zone protects passengers during a collision.

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Describe the construction of the passenger compartment of a car. Include a description of the materials used.

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Why is it important for the **crumple zone** and the **passenger compartment** to be made of **different** materials (think about passenger safety and the **purpose** of each part of the car).

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Report Template

**Introduction**

Introduce the topic: Why are car accidents dangerous. What are some of the safety features that car manufactures include. Introduce the idea of crumple zones as a safety feature.

**Part 1: Speed and Energy**

-Describe the importance of speed in car collisions and how that relates to Energy.

**Part 2: Acceleration and Personal Injury**

-Using the physics principal of acceleration, discuss how injuries are caused during collisions and how physics can be used to minimise those injuries.

**Part 3: Crumple Zone**

-Describe the construction of crumple zones.

-Use the ideas of acceleration and energy transfer to describe how crumple zones work to minimize injury during a collision.

**Conclusion**

-Summarise your findings by linking the ideas of crumple zone design, energy dissipation, acceleration, duration of a collision, and passenger safety.