Part III: After the Video

Directions: After viewing the video, answer the following questions in the space provided. Be prepared to discuss your responses while in small groups or as an entire class.

Before the Video Question
Describe how three collisions can occur during a single crash between a truck and a wall.

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1. Historically, crash research has required the cooperation and combined knowledge, skills, creativity, and passion of individuals from many different fields/subject areas. Explain how Col. John Stapp’s research combined several different fields of study to save human lives.

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2. Crash test dummies are tough, complicated, and expensive, with some costing over $130,000.
   a. List the three types of measurements most dummies record.

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   b. Describe how these measurements can be used to predict whether or not injuries will occur in a crash.

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3. Explain how the term biofidelity is used to describe the effectiveness of crash test dummies in injury biomechanics research.

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4. In a collision a vehicle occupant may experience a blunt force trauma to his/her chest. Summarize how the thoracic body cavity and major bones in the chest area can protect a person’s heart and lungs in a collision.

5. a. In the two images below, draw arrows to indicate the direction the brain and the cerebral spinal fluid are moving before and during a frontal collision resulting in a coup-contrecoup brain injury.
   b. Write captions for each image that summarizes what’s happening to the brain and the cerebral spinal fluid.

6. The strength of any tissue or organ in a collision depends on many factors, including its elasticity and the type of stress it experiences. Distinguish between stress and strain AND explain how stress and strain affect human tissue.
7. Describe how shockwaves create stress and strain and injure tissue.

8. Interpret this statement: Trauma to human tissue is like failure to a structure. In your answer, describe how critical stress limit relates to tissue trauma and structural failure.

9. Analyze the photos of one of Tony Kanaan’s IndyCar racecars below. Circle AND label three safety features of the car that help reduce forces on drivers and thus prevent injuries during a crash.

10. Describe how new technologies, such as crash recorders, help engineers build safer racecars.
11. In the video, a 223-pound crash test dummy was lowered onto Dr. Jones’ chest while he was sandwiched between two beds of nails. Similarly, the diagram below shows a man lying between two beds of nails while having a concrete block shattered on his chest.

\[\text{Diagram of man between beds of nails with concrete block.}\]

a. In the diagram above, how are forces from the man’s weight, forces from the concrete block, and forces from the impact of the sledgehammer reduced to allow the man to survive the experience?

b. How are the same physics concepts applied in the bed-of-nails demonstration utilized to improve a vehicle’s crashworthiness?
12. One of the key principles to keeping people safe in vehicle crashes is extending impact time. If the change of momentum occurs over a longer period of time, the resulting force of the impact is smaller. Examine the pictures below of the driver’s area of a NASCAR-style racecar. Circle AND label safety features that reduce impact forces by extending the impact time.

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Driver’s seat inside a stock car

Steering wheel and dashboard of a stock car