"UNDERSTANDING CAR CRASHES: IT’S BASIC PHYSICS"
Concept Organizer

**Part I: Before the Video**

**Directions:** Before viewing the video, answer the question below. Be prepared to discuss your answer.

**Why do some spectacular racecar crashes produce only minor injuries?**

**Part II: During the Video**

**Directions:** While viewing the video, complete the fill-in-the blank statements with the correct terms OR circle the correct answers if provided. (Times in left margin indicate when each item is discussed.)

**IIHS’s Vehicle Research Center**

1. It is a fascinating place where research engineers assess the crash performance of vehicles by running tests and where they evaluate new _________________ to prevent injuries.

**Test Track Laws**

2. Why did the dummy get left behind? It’s called _________________, the property of matter that causes it to resist any change in its motion.

3. Isaac Newton’s First Law of Motion states: A body at rest remains at _________________ unless acted upon by an external force; and a body in motion continues to move at a constant _________________ in a straight line unless it is acted upon by an external force.

**Crashing Dummies**

4. Now watch what happens when the car crashes into a barrier. The front end of the car is crushing and absorbing _________________ which slows down the rest of the car.

5. In this case, it is the steering wheel and windshield that apply the _________________ that overcomes the dummy’s inertia.

**Crash-Barrier Chalkboard**

6. Newton explained the relationship between crash forces and inertia in his (Circle one): 1st 2nd 3rd Law of Motion.

7. Fill in the blanks to complete the formula.
   \[ F_t = \text{_______________} \quad \rightarrow \quad F_t = m\Delta v \quad m\Delta v = \text{_______________} \]

*These times are for the full-length video. Disregard times if watching individual video chapters.*
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Surfers, Cheetahs, and Elephants ...oh my!
8. Momentum is inertia in motion. It’s the product of an object’s mass and its ________________.

Soccer Kicks, Slap Shots, and Egg Toss
9. Impulse is the product of ________________ and the time interval during which the force acts.
10. The wall applies a ________________ force over a shorter time.
11. The sheet applies a smaller force over a ________________ time.

Fighter pilots, astronauts, and crash occupants
12. People often refer to g’s as forces but they are not. A g is a standard unit of ________________.
13. People in serious car crashes experience high g’s and this can cause ________________.
14. Three things that extend the time of impact in a collision are: crumple zones, ________________, and ________________.

Conserving momentum and energy - it’s the law!
15. Momentum has a directional property, so it is called a ________________ quantity.

Newton and energy
16. Weight vs. Size in car crashes:

___________ helps you in all kinds of crashes.
___________ is primarily an advantage in a crash with another vehicle.

17. Energy is the ability to do ________________.
18. Motion related energy is called ________________ energy.
   Energy due to an object’s position or condition is called ________________ energy.
19. At what point in the pendulum’s swing is its potential energy equal to its kinetic energy?

Engineering safer vehicles
20. We use the term ________________ to describe the protection a car offers its occupants during a crash.
21. If we can ________________ the front end of the car without allowing any damage to the occupant compartment then the people inside can be protected against serious injury.
22. When the ________________ collapses, you are going to have injuries to the occupants.

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