Name: _____ Date: _____

A Crushed Hood and Why That Is Good News

Circle group

A car with a badly folded front may look like a failure. In fact, the damage often means the car did its job. Modern cars have crumple zones. These are parts at the front and back that are built to fold in a planned way in a crash.

The idea comes from physics. When a moving car stops fast, the people inside must lose all their speed. The force they feel depends on how fast that happens. A very short stop gives a very big force. A slightly longer stop gives a much smaller force, even though the change in speed is the same. A crumple zone makes the stop last a little longer.

As the front folds, it also takes in energy. The metal bends and twists. The energy of the moving car goes into changing the shape of the metal and not into the people. Engineers pick the shape of each beam and panel so the parts fold in a planned order.

The middle of the car works in the opposite way. The place where people sit is a strong steel cage that keeps its shape. The crumple zone bends, so the cage does not have to. Seat belts and airbags hold people in place. They spread out the force that is left.

Older cars were often built to be as stiff as possible. That seemed safer. Tests showed the opposite. A stiff car stops all at once and gives more force to the people inside.

Questions

1. What is a crumple zone?

_____

_____

2. What happens to the force if the stop lasts longer?

_____

_____

3. Where does the energy of the moving car go as the front folds?

_____

_____

4. What is the place where people sit made of?

_____

_____

5. Why is a badly crushed hood sometimes good news?

_____

_____

6. Why was a very stiff older car not really safer?

_____

_____

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

A Crushed Hood and Why That Is Good News

Triangle group

A car with a badly folded front end may look like a failure of engineering. In fact, the damage often means the car did its job. Modern cars are built with crumple zones, areas at the front and back that are designed to collapse in a controlled way during a collision.

The reasoning comes from physics. When a moving car stops suddenly, the people inside must lose all of their speed, and the force they feel depends on how quickly that happens. Stopping in a very short time produces a very large force. Stopping over a slightly longer time produces a much smaller one, even though the change in speed is the same. A crumple zone stretches out the moment of stopping by a small but important fraction of a second.

As the front of the car folds, it also absorbs energy. The metal bends and twists, so the energy of the moving car goes into reshaping the metal instead of into the passengers. Engineers choose the shape of every beam and panel so the parts fold in a planned order.

Meanwhile, the middle of the car works in the opposite way. The passenger compartment is built as a stiff safety cage of strong steel that is meant to keep its shape. The crumple zone does the bending, so the cage does not have to. Seat belts and airbags then hold the passengers in place and spread the remaining force across the strongest parts of the body.

Older cars were often built to be as rigid as possible, which seemed safer. Testing showed the opposite. A stiff car stops abruptly and passes more force to the people inside it.

Questions

1. What is a crumple zone?

_____

_____

2. What happens to the force if the stopping time is longer?

_____

_____

3. Where does the energy of the moving car go as the front folds?

_____

_____

4. How is the passenger compartment built?

_____

_____

5. Why is a badly crushed hood sometimes good news?

_____

_____

6. Why was a very rigid older car not actually safer?

_____

_____

Words to know

collision: a crash when two moving things hit each other
absorb: to take in energy so it does not pass on
compartment: a separate space inside a larger thing
rigid: stiff and not able to bend
controlled: carried out in a planned, steady way

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

A Crushed Hood and Why That Is Good News

Square group

A car with a badly folded front end may look like a conspicuous failure of engineering. In fact, the damage often means that the vehicle accomplished exactly what it was designed to do. Modern cars are built with crumple zones, areas at the front and back that are engineered to collapse in a controlled and predictable way during a collision.

The reasoning comes from physics. When a moving car stops suddenly, the people inside must lose all of their speed, and the force they feel depends on how quickly that happens. Stopping in a very short time produces a very large force. Stopping over a slightly longer time produces a much smaller one, even though the change in speed is exactly the same. A crumple zone stretches out the moment of stopping by a small but critically important fraction of a second.

As the front of the car folds, it also absorbs energy. The metal bends and twists, so the energy of the moving car is spent reshaping the metal instead of being delivered to the passengers. Engineers deliberately choose the shape of every beam and panel so that the parts fold in a carefully planned order.

Meanwhile, the middle of the car is designed to behave in the opposite manner. The passenger compartment is built as a stiff safety cage of strong steel that is meant to keep its shape. The crumple zone does the bending, so the cage does not have to. Seat belts and airbags then hold the passengers in place and spread the remaining force across the strongest parts of the body.

Older cars were often built to be as rigid as possible, which seemed to be the safer approach. Testing eventually showed the opposite. A stiff car stops abruptly and passes considerably more force along to the people inside it.

Questions

1. What is a crumple zone?

_____

_____

2. What happens to the force when the stopping time is slightly longer?

_____

_____

3. Where does the energy of the moving car go as the front folds?

_____

_____

4. How is the passenger compartment built?

_____

_____

5. Why can a badly crushed hood be considered good news?

_____

_____

6. Why was a very rigid older car not actually the safer design?

_____

_____

Words to know

collision: a crash when two moving things hit each other
absorb: to take in energy so it does not pass on
compartment: a separate space inside a larger thing
rigid: stiff and not able to bend
controlled: carried out in a planned, steady way

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: A Crushed Hood and Why That Is Good News

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: A Crushed Hood and Why That Is Good News

Easier · 248 words · Flesch-Kincaid grade 3.3

1. A part at the front or back of a car built to fold in a planned way.
2. The force is much smaller.
3. Into changing the shape of the metal.
4. A strong steel cage that keeps its shape.
5. It means the crumple zone took in energy that would have reached the people.
6. It stopped all at once and gave more force to the people inside.

Triangle: A Crushed Hood and Why That Is Good News

This passage · 279 words · Flesch-Kincaid grade 6.8

1. An area at the front or back of a car designed to collapse in a controlled way.
2. The force is much smaller.
3. Into reshaping the metal.
4. As a stiff safety cage made of strong steel.
5. It means the crumple zone absorbed energy that would have reached the passengers.
6. It stopped abruptly and passed more force to the people inside.

Square: A Crushed Hood and Why That Is Good News

Harder · 305 words · Flesch-Kincaid grade 8.5

1. An area at the front or back of a car engineered to collapse in a controlled way.
2. The force becomes much smaller.
3. Into reshaping the metal instead of reaching the passengers.
4. As a stiff safety cage of strong steel that keeps its shape.
5. It shows the crumple zone absorbed energy that would otherwise have reached the passengers.
6. It stopped abruptly and passed more force along to the people inside.