Name: _____ Date: _____

Why the Front of a Car Is Built to Crumple

Circle group

Cars are built to be strong. Yet the front and back of many cars are made to crumple when something hits them hard. They fold like a squeezed paper cup. That seems backward. Wouldn't a stiff car be safer? Engineers found it would not. The reason comes from forces.

A moving car and the people in it have motion energy. In a sudden stop, that motion must be taken away. How fast it is taken away changes the size of the push on the passengers. A very short stop takes a huge force. A longer stop takes a smaller force.

Think about dropping an egg. On a hard floor, it stops at once and cracks. Onto a thick pillow, it takes longer to slow down. It is much less likely to break. The pillow does not take away less motion. It spreads the stopping over more time.

A crumple zone works like the pillow. The front of the car folds and uses up the motion energy slowly. The passengers slow down more gently. The middle of the car, where people sit, is made extra strong so it keeps its shape. Seat belts hold people in place so they slow down with the car. Together, these parts help keep riders safe.

Questions

1. What is a crumple zone?

_____

_____

2. Which takes a huge force, a very short stop or a longer stop?

_____

_____

3. Why does an egg crack on a hard floor?

_____

_____

4. How is a crumple zone like a thick pillow?

_____

_____

5. Why is the middle of the car extra strong?

_____

_____

6. What do seat belts do in a sudden stop?

_____

_____

Words to know

crumple: to fold up and wrinkle when pressed
engineer: a person who designs and builds things
force: a push or a pull on something
passenger: a person riding in a vehicle
stiff: hard to bend or fold

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: _____

Why the Front of a Car Is Built to Crumple

Triangle group

Cars are built to be strong, yet the front and back of many are designed to crumple like a squeezed paper cup when something hits them hard. That seems backward. Wouldn't a stiffer car be safer? Engineers found that the answer is no, and the reason comes from the science of forces.

A moving car, and everyone riding in it, has motion energy. In a sudden stop, that motion must be removed. How quickly it is removed changes how big the push on the passengers is. Stopping in a very short time takes a huge force. Stopping over a longer time takes a smaller force.

Think about dropping an egg. On a hard floor, it stops almost instantly and cracks. Onto a thick pillow, it takes longer to slow down, and it is far less likely to break. The pillow does not remove any less motion. It spreads the stopping out over more time.

A crumple zone works like the pillow. As the front of the car folds, it uses up the motion energy slowly, so the passengers slow down more gently. Meanwhile, the middle of the car, where people sit, is made extra strong so that it keeps its shape. Seat belts hold people in place so that they slow down along with the car. Together, these parts help keep riders safe.

Questions

1. What is a crumple zone?

_____

_____

2. Which takes a huge force, stopping in a very short time or over a longer time?

_____

_____

3. Why does an egg crack on a hard floor?

_____

_____

4. How is a crumple zone like a thick pillow?

_____

_____

5. Why is the middle of the car made extra strong?

_____

_____

6. What do seat belts do in a sudden stop?

_____

_____

Words to know

crumple: to fold up and wrinkle when pressed
engineer: a person who designs and builds things
force: a push or a pull on something
passenger: a person riding in a vehicle
stiff: hard to bend or fold

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: _____

Why the Front of a Car Is Built to Crumple

Square group

Automobiles are built to be sturdy, and yet the front and rear sections of many are deliberately designed to crumple like a squeezed paper cup whenever something strikes them forcefully. This seems counterintuitive, since a stiffer car might appear safer. Engineers discovered, however, that the opposite is true, and the explanation comes from the science of forces.

A moving car, along with everyone riding inside it, carries motion energy. During a sudden stop, all of that motion has to be removed, and the speed at which it is removed determines how large a push the passengers feel. Stopping in an extremely short span of time requires an enormous force, whereas stopping over a longer span requires a much smaller one.

Consider what happens when an egg is dropped. On a hard floor it halts almost instantly and cracks. Onto a thick pillow, it takes longer to slow down and is far less likely to break. The pillow does not absorb any less motion; it simply stretches the stopping out over a greater amount of time.

A crumple zone operates in the same way as the pillow. As the front of the car folds, it gradually consumes the motion energy, so the passengers decelerate more gently. Meanwhile, the central part of the car, where people sit, is reinforced so that it holds its shape. Seat belts keep people in place so that they slow down together with the vehicle. All of these parts work as a team to protect riders.

Questions

1. What is a crumple zone designed to do?

_____

_____

2. Which requires an enormous force, stopping in a short span of time or over a longer span?

_____

_____

3. Why does a dropped egg crack on a hard floor?

_____

_____

4. In what way does a crumple zone operate like a thick pillow?

_____

_____

5. Why is the central part of the car reinforced?

_____

_____

6. What is the job of seat belts during a sudden stop?

_____

_____

Words to know

crumple: to fold up and wrinkle when pressed
engineer: a person who designs and builds things
force: a push or a pull on something
passenger: a person riding in a vehicle
stiff: hard to bend or fold

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: Why the Front of a Car Is Built to Crumple

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

Circle: Why the Front of a Car Is Built to Crumple

Easier · 210 words · Flesch-Kincaid grade 3

1. A part of the car made to fold when it is hit hard.
2. A very short stop.
3. It stops at once.
4. Both spread the stopping over more time.
5. So it keeps its shape where people sit.
6. They hold people in place so they slow down with the car.

Triangle: Why the Front of a Car Is Built to Crumple

This passage · 223 words · Flesch-Kincaid grade 4.6

1. A part of the car designed to fold when it is hit hard.
2. Stopping in a very short time.
3. It stops almost instantly.
4. Both spread the stopping out over more time.
5. So that it keeps its shape where people sit.
6. They hold people in place so they slow down along with the car.

Square: Why the Front of a Car Is Built to Crumple

Harder · 249 words · Flesch-Kincaid grade 8.6

1. Fold when something strikes the car forcefully.
2. Stopping in an extremely short span of time.
3. It halts almost instantly.
4. Both stretch the stopping out over a greater amount of time.
5. So that it holds its shape where people sit.
6. They keep people in place so they slow down together with the vehicle.