

# **TEACHER WARNING**

This lesson includes a video of people in a vehicle collision.

This may evoke heightened emotional states due to related traumatic events that teachers, students, and/or their families may have experienced. Please see the unit front matter, the teacher reference associated with this lesson, and the callouts in the *Teacher Guide* for guidance around how to support social and emotional needs as you move through this unit. Never ask

#### **Student Content Advisory**



In this lesson, we will watch a video of a controlled vehicle crash. The occupants took safety precautions, and no one was injured in the crash.

If needed, you can use strategies from the *Student Mindfulness Resource* handout or focus on something else while the video is being played.

If at any future point in the unit you find you need support, let your teacher or a trusted adult know how you are feeling.

Be aware that your teacher and/or your classmates may have experienced trauma related to this topic. Approach conversations about car crashes and car safety with respect, guided by your class's community agreements.

# Navigation



#### With your class

Analyze this video to determine the timeline of the events.

What safety features affect the timeline of the collision?



RoadandTrack

# Analyze Video of a Collision

# Turn and Talk



2) What do we know about the **velocity** of the **occupants** before and after the collision?

#### **Revisit the Relationships We Have Developed**

#### **Turn and Talk**

- What do we know about the relationship between mass, velocity, force, and time?
- Using our relationships, why might a large change in velocity like in this collision be problematic?

#### **Analyze Animation of a Vehicle Collision**



With your class Use the animation to analyze the collision at a slower pace.



#### Slide G

#### **Analyze Animation of a Vehicle Collision**



With your class Use the animation to analyze the collision without safety features.



#### **Consider Simulation Data**

#### **Turn and Talk**

If we simulated these collisions using the Vehicle Collision Simulation, what data might help us make sense of the motion of the vehicle and the crash test dummy?

#### **Predict Velocity Changes**

# With your class



What do you expect to see in the velocity data from the simulation for these two collisions?

#### Analyze Data

R

With a partner

What happens with the velocities at the moments on our timelines?

Time (s)	Vehicle velocity (mph)	Occupant velocity (mph)
0.56	40	40.00
0.57	33.29	39.95
0.58	26.58	39.46
0.59	19.87	38.05
0.60	13.16	35.29
0.61	6.45	26.58
0.62	0	16.28
0.63	0	4.72
0.64	0	-5.61
0.65	0	-13.02
0.66	0	-19.51
0.67	0	-24.56
0.68	0	-27.78
0.69	0	-28.88
0.70	0	-24.84
0.71	0	-20.8
0.72	0	-16.76
0.73	0	-12.72
0.74	0	-8.68
0.75	0	-4.64
0.76	0	-0.60
0.77	0	0

l Airbag	Collision without Seat Belt and Airbag			
Occupant locity (mph)	Time (s)	Vehicle velocity (mph)	Occupant velocity (mph)	
40.00	0.56	40.00	40.00	
39.95	0.57	33.29	40.00	
39.46	0.58	26.58	40.00	
38.05	0.59	19.87	40.00	
35.29	0.60	13.16	40.00	
26.58	0.61	6.45	40.00	
16.28	0.62	0	38.72	
4.72	0.63	0	0	
-5.61		1.1.1		
-13.02				
-19.51				
-24.56				
-27.78				
-28.88				
-24.84				
-20.8				
-16.76				
-12.72				
-8.68				
-4.64				
-0.60				
0				

 $\rightarrow$  Be ready to share with the class.

# **Update Our Timeline Models**

# With your class



What velocity data should we add to our timelines?

Slide M

#### **Compare Timelines**

#### **Turn and Talk**

What similarities and differences do you see between the two crash test dummies' timelines?

#### **Experience Timings**

#### With your class



Using a stopwatch or a timer, let's try to see how long these collision intervals are.

- 1. Your teacher will identify a time on the timeline that we will try to capture on our timers or stopwatches.
- 2. We will try to start and stop our timers or stopwatches for each time interval to see how long it is.

#### **Consider the Impact of Safety Features**

#### **Turn and Talk**

What evidence have our timelines provided us that help us explain what safety features do to keep people safe?

#### **Consider the Impact of Safety Features**

# > Exit Ticket

Considering the evidence we assembled in our timelines and our mathematical relationships, what other variables might help us understand how safety features affect risk to occupants in a collision?

$$\Delta t = \frac{m^* \Delta v}{F} \qquad F = \frac{m^* \Delta v}{\Delta t}$$

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