Crash Scene Investigator

Name: Answer Guide

Date: _____

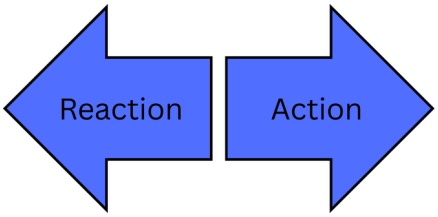
Vocabulary

Compass - a tool used to show the current directions based on Earth's magnetic field
Collision - an event where objects exert forces on one another that result in a change of motion
Newton's Third Law - for every action, there is an equal action in the opposite direction.

Introduction

Newton's Third Law

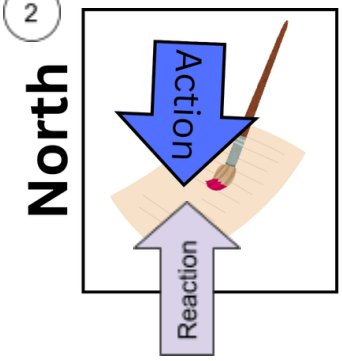
Newton's Laws tell us about how objects move. His third law tells us that if there is an action, there will always be a reaction that is equal in force, but in the opposite direction.



For each example, draw the direction of the reaction. Then, use Ari to find the direction based on the orientation of each scene. Then, create your own example.

1

2



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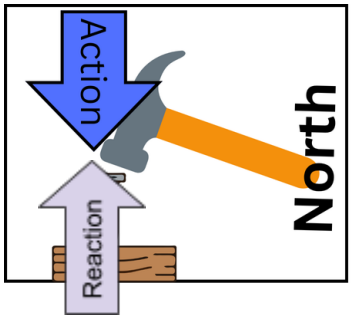

Direction of reaction:

1 Southwest

2 East

3 West

Your Example:

Student example

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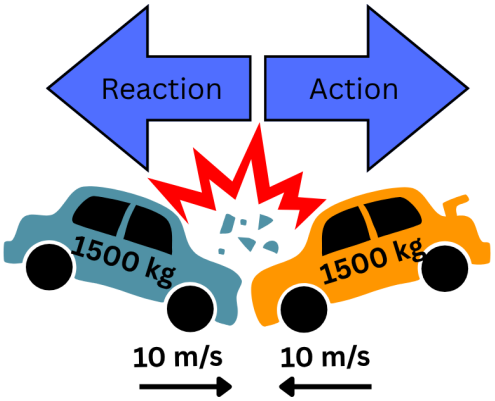
Activity 1 Analyze the Crash



In analyzing vehicle collisions, Newton's third law is used along with the velocity and masses of the vehicles involved.

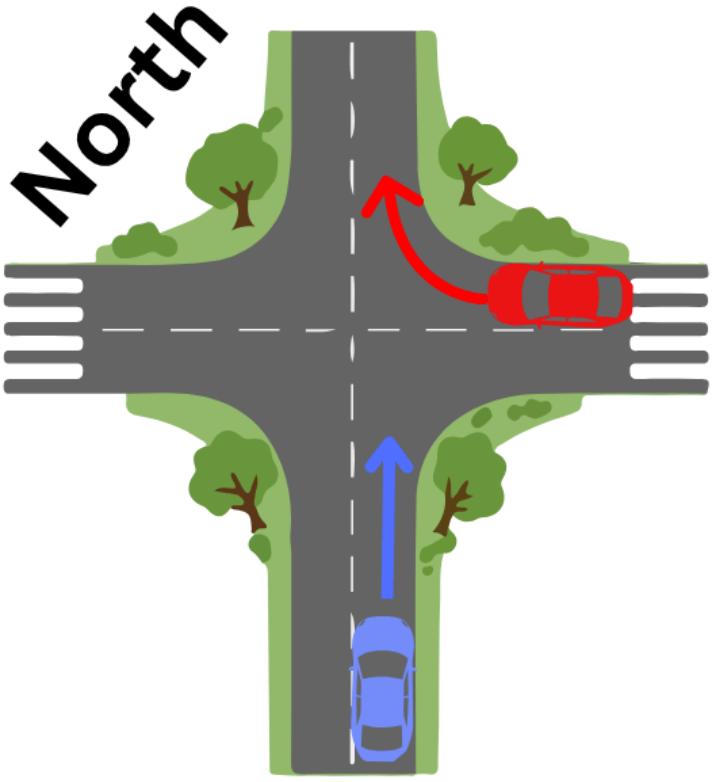
In this example, since both vehicles have the same mass and are traveling at the same velocity (in opposite directions), the impact of their collision will be the same for each vehicle. If either of them had a larger mass or were traveling at a faster velocity, this would not be true.

For each scenario, use the diagram to answer the questions and predict the possible damage.

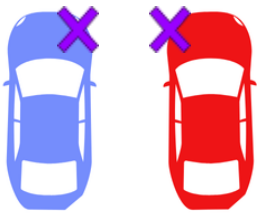
1. The red car pulls out into oncoming traffic to take a right.

What direction is the red car turning?_Northeast__

What direction is the blue car traveling? _Northeast__



Where might the damage be on each of the cars if the red car pulls out in front of the blue one?
Possible answer below.
Note - The damage to each car might vary. Be sure students can justify their reasoning.



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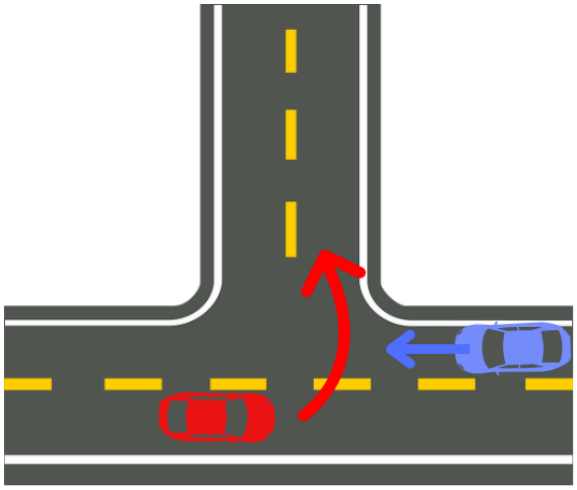
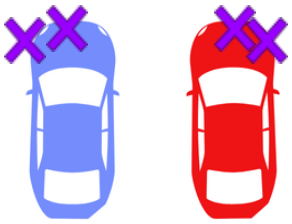
2 The red car takes a left turn without checking for oncoming traffic.

What direction is the blue car traveling?__East__

What direction is the red car turning? _South___



Where will the damage be on each of the cars if the red car cuts across just as the blue car crosses the intersection?
Possible answer below. Note - The damage to each car might vary. Be sure students can justify their reasoning.

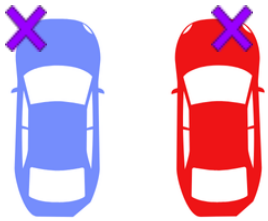


3 The red car and blue car are traveling safely through this rotary. The red car suddenly realizes they need to take the exit.

What direction is the blue car moving?__Northeast__

What direction is the red car turning? __Southeast___

Where will the damage be on each of the cars if the red car suddenly turns while the blue car is continuing in the rotary?
Possible answer below. Note - The damage to each car might vary. Be sure students can justify their reasoning.



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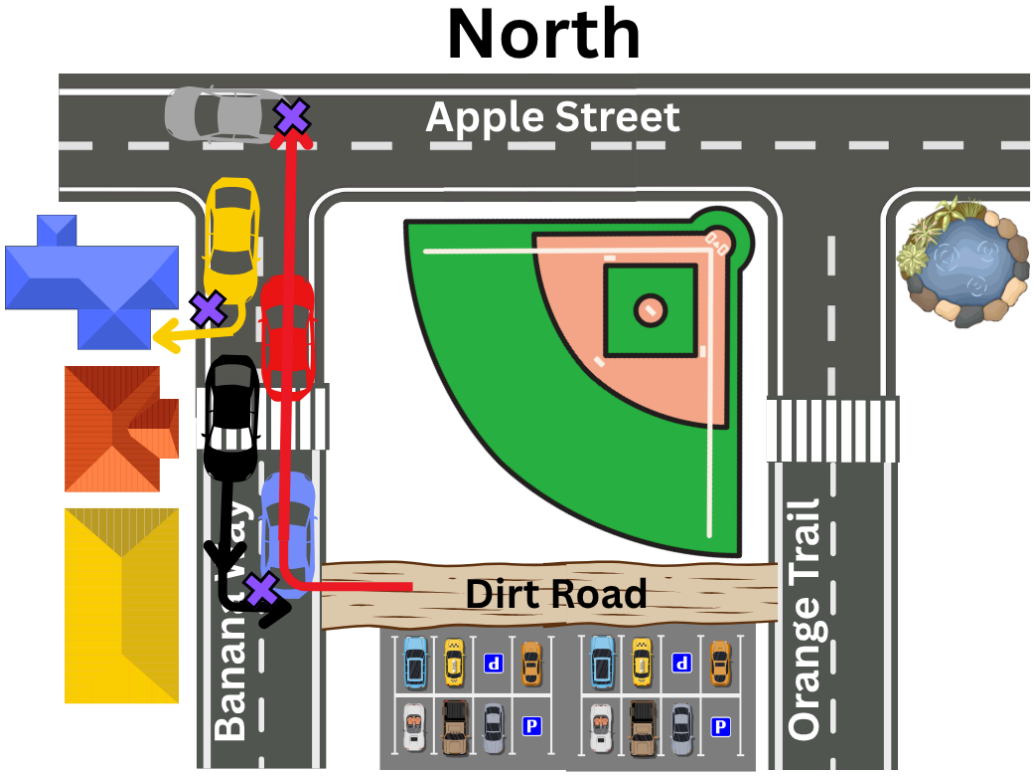
Activity 2 **Reconstruct the Collision**

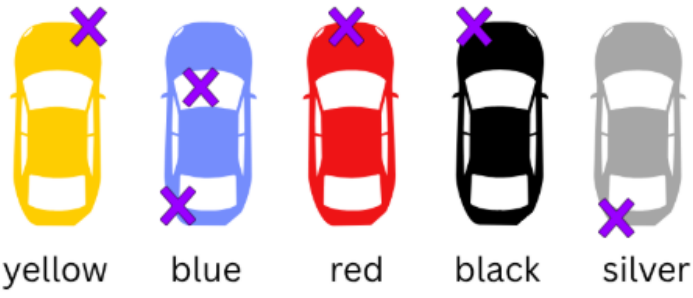
Multiple crashes at the baseball field! Read the witness statements that were taken after the incident(s). Use each statement to reconstruct a visual showing what happened on the map below.



Police Statement: Write a statement of what happened. Possible scenario below:

A baseball hit the windshield of the blue car as it was traveling North on Banana Way, causing it to hit its brakes as they were driving past the Dirt Road entrance. The black car was turning left onto Dirt Road at this time and hit the back of the blue car. The sound of this crash distracted the red car, which was driving North on Banana Way, causing it to hit the gas pedal instead of the brake and drive out into Apple Street right when the silver car, which was traveling west on Apple Street, had driven by. The red car hit the rear of the silver car.

Put an X on where you expect the damage on each vehicle:



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Witness Statements:

1 Witness 1 - I saw a red car driving north on Banana Way while I was walking my dog on Dirt Road near the parking lot. They stopped at the crosswalk and continued North. They put their right turn blinker on when they got to the stop sign at Apple Street. Then I heard a crash.

2 Witness 2 - I was driving South down Banana Way in my black car when a red car turned out of Dirt Road and started driving North. I stopped, hoping they had left a spot open for me in the parking lot. I put my blinker on to turn down Dirt Road. A yellow car behind me had to stop so I could wait to turn. There was a blue car driving North super fast, so I couldn't turn yet.

3 Witness 3 - I was driving my blue car, going North on Banana Way. Something hit my windshield, I hit my brakes, and then suddenly, someone smashed into the back of my car.

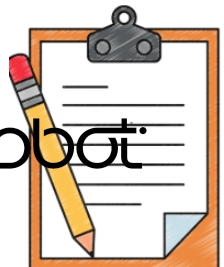
4 Witness 4 - I was driving south in my yellow car on Banana Way, and the person in front of me slammed on their brakes. I tried to avoid impact by hitting my brakes and turning my steering wheel towards the sidewalk. Thankfully, I did not hit the car in front of me.

5 Witness 5 - I drive a red car. I was about to take a left at the Apple Street intersection when I heard a crash, got frazzled, and hit my gas instead of my brake pedal. I have no idea what happened.

6 Witness 6 - I was sitting in the bleachers of the baseball field. It was a fantastic game, and our best hitter was up. I heard a loud crash, then I looked up and saw a red car go right through the stop sign and into Apple Street.

7 Witness 7 - I was listening to music nice and loud, driving West on Apple Street, heard a crash, and then the next thing I knew, the back end of my silver car was hit. I didn't see anything.

Analyzing the Witness Statements:



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1 Witness 1 - What direction was the red car turning onto Apple Street? __East_____

2 Witness 2 - What direction was the black car turning onto Dirt Road? __East_____

3 Witness 3 - What direction was the blue car coming from? ___South_____

4 Witness 4 - What direction did the yellow car turn its wheel? ____West_____

5 Witness 5 - What direction was the red car traveling? ___North_____

6 Witness 6 - If the hitter hit a ball toward right field, what direction was the ball traveling? ____West_____

7 Witness 7 - What direction was the silver car driving from? ____East_____

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Exit Ticket

1 A red vehicle claims to need a new rear bumper from a recent crash. Is this damage from the accident at the baseball field near Dirt Road? How do you know?

This damage is not from the accident at the baseball field near Dirt Road. The red car entered Apple Street, traveling North, and impacted the rear of the silver car with the front of their car. The red car would have damage to the front bumper, not the back.

2 Based on your police statement and what you know about Newton's third law, what do you think caused the damage during a vehicle collision?

Possible Answer:

Newton's Third Law tells us that the reaction during a collision is equal in force and opposite in direction. Therefore, if the force during a collision is in one direction, the reaction force will impact the vehicle(s) in the opposite direction. The amount of damage to each vehicle will depend on the mass and velocities of the vehicles involved.