STEM CAREER ADVENTURES

Physicist: Creating Amusement Park Rides

6-8 grade

Adventure Description:

In this adventure, students will think like a physicist and design a new ride for an amusement park.

Activity

Teacher Note: You will need to prepare a "car with riders" for each group of students. See Handout: Teacher Prep.

Step 1: Background Information on Physicists and Energy (5 minutes)

- Explain to students that there are many types of amusement park rides. Some rides run along a track like a roller coaster, some rides swing round in circles, and others drop people straight down towards the ground! Today, students will only be focused on creating a drop ride. Show Handout: Drop Rides and Energy.
- Explain to students that physicists are responsible for studying forces (pushes and pulls) that affect objects. Because they study forces, they are responsible for making rides both fun and safe! When amusement ride cars drop toward the ground, they create a lot of energy! Physicists need to find a way to absorb all that energy or someone could get hurt!
- Teacher note: In this lesson, students will only learn about drop rides. Other amusement park rides use energy differently. Make sure students understand that they are only learning about rides that drop straight down and come to a sudden stop when they reach the ground.

Step 2: Class Demonstration (5 minutes)

- Explain to students that you will now demonstrate what would happen if physicists didn't think about safety when they design an amusement park.
- Place 2 quarters in a plastic egg (or other small container). Explain that the plastic egg represents a car that people sit in while on a ride that drops straight down. The coins represent the people.
- Explain to students that you will be dropping the egg from different heights. Remember, the higher the ride starts, the more energy will need to be absorbed at the bottom of the ride.
- First, hold the egg 6 inches above the ground and drop it. Tell students to watch what happens.
- Discuss how there isn't enough energy to break the egg open at the bottom of the 6 inch drop.
- Repeat again, holding the egg 24 inches above the ground. Tell students to watch what happens. Discuss the following:
    - As the egg and coins are held further from the ground, the drop creates more energy. At 24 inches, there is enough energy to break open the egg! Ask students what this means for the riders on the roller coaster.

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- As a class, discuss how roller coaster rides must have safety features to handle all of the extra energy at the bottom of the ride. Without safety measures, the energy could crack the car open and hurt the riders. Show Handout: Safety Features and discuss how these features manage energy and ensure that riders don't get hurt.

Step 3: Building a Ride (25+ minutes)

- Explain to students that they will design a new ride called "Big Drop." Explain that this ride will drop straight toward the ground. The safety measure that will be used will be a layer of padding around the car!
- Provide students with Handout: Steps to Create Ride.
- As a class, read through the steps. Divide students into pairs or small groups. Provide pairs with the following materials:
  - Plastic egg
  - Coins
  - Art supplies and building materials
  - Ruler
  - Tape
- Have students complete Step 1. Provide students with tape and a tape measure so they can measure and mark where 2, 4, and 8 feet are from the floor.
- Have students complete Steps 2-3, building the platforms and designing the padding for the cars.
- As students are working, ask the following questions:
  - What materials do you think will absorb more energy? (Answers will vary, but most will say that soft materials or materials that can easily bend will absorb more energy)
  - Do you think the riders are in danger at the top of the ride, or at the bottom? (The bottom)
  - How will you protect the riders from the impact when they hit the ground?

Step 4: Testing Ride (10 minutes)

- Explain to students that they will now complete Step 4, testing their ride to see if their padding can absorb all of the energy to keep the cars and riders safe at three different platforms.
- During testing, ask the students the following questions:
  - What changes as you drop your ride from higher platforms? (As distance above the ground increases, the energy increases.)
  - Why do you think some cars are breaking open and others aren't? (The cars that do not break open were able to absorb all of the energy at the bottom of the ride, the cars that did break open could not absorb all the energy, so some of the energy got used to break open the car.)

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- Does the way that your car falls have any impact on whether or not your riders get hurt? (some students will build a car that only has protection on one side, but the car might land on an unprotected side, other students might build a car that has corners and it might work differently depending on how it falls)

Step 5: Fine Tuning the Design (5 minutes)

- Explain to students that they will now move on to Step 5, fine tuning their design. Students can make changes to their design by using different materials, adding materials, etc.
- During testing, ask the students the following questions:
  - What materials are you adding to your design?
  - How will these materials keep riders safe?

Discussion (5-10 minutes)

- Have students compare their results and discuss the following: which cars broke and which stayed together? What materials seemed to work best to absorb the energy when the car fell?
- Have a concluding class discussion about how physicists must be aware of the amount of energy that their ride produces and how they will keep riders safe.

Materials List

Provided online:

- Handout: Teacher Prep
- Handout: Drop Rides and Energy
- Handout: Safety Features
- Handout: Steps to Create Ride

Not provided (each explorer needs):

- Plastic egg (or other small container that will be the car)
- Coins (to represent the riders)
- Art supplies and building materials
- Ruler
- Tape

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