Name: Joseph Mwangi

Lesson plan on Introduction to Momentum

Prior knowledge: Students should be proficient with the concepts and equations of basic kinematics and Newton's

Laws

PRE-LAB QUESTIONS

To engage the students ask the following questions {20 minutes}

- In a car collision, the driver's body must change speed from a high value to zero. This is true whether or not an airbag is used, so why use an airbag? How does it reduce injuries?
- Suppose airbags were not vented to allow the gas inside to escape, but remained inflated (like a balloon). Would they be as effective in protecting a passenger in a collision?
- (Closely related to what they love) What does it mean when one says, that football team has momentum?"

Expect some answers like "it exerts superiority over an opponent", "airbags are useful in preventing injuries"

Allow for some open discussion on momentum

Conclude the discussion by offering credible explanation:

- Moving objects have **momentum** (the product of the mass and the velocity of an object). Unless an outside **force** acts on an object, the object will continue to move at its present speed and direction. Cars consist of several objects, including the vehicle itself, loose objects in the car and, of course, passengers. If these objects are not restrained, they will continue moving at whatever speed the car is traveling at, even if the car is stopped by a collision.
- Stopping an object's momentum requires force acting **over a period of time**. When a car crashes, the force required to stop an object is very great because the car's momentum has changed instantly while the passengers' has not -- there is not much time to work with. The goal of restraint system is to help stop the passenger while doing as little damage to him or her as possible.
- What an airbag wants to do is to slow the passenger's speed to zero with little or no damage. The constraints that it has to work within are huge. The airbag has the space between the passenger and the steering wheel or dashboard and a fraction of a second to work with. Even that tiny amount of space and time is valuable, however, if the system can slow the passenger evenly rather than forcing an abrupt halt to his or her motion.
- Relate collisions between players in football matches to momentum, why does a lighter player moving at a higher speed knock down a stationary heavier player?

Objective of the lesson

- Students to explore momentum and derive its formula

Exploring and deriving the momentum formula {40 Minutes}:

On a horizontal track, students will roll a ball to collide with a stationary one (first of equal mass then a lighter or heavier one) and make observations. They should have a golf ball, a ping pong ball, and a marble (Or balls of different masses and sizes, this was changed to 3 marbles of different masses).

Try to limit collisions to 1 dimension i.e. after collision, balls travel on a straight line

Collisions Observation Guide

- Predict what will happen
- Observe the collisions.
- Draw a diagram of what you see.
- Explain what happened.

Before After

?

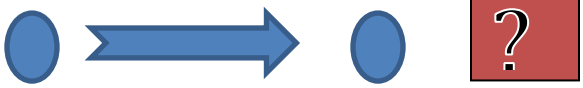

Diagram ----------

Equation

Elaborating

- Have students read their predictions, observations and compare the diagrams they draw.
- Ask whether observations agree with the law of conservation of momentum, remind them about the law (mass and velocity before should equal the product of mass and velocity after)

Explanation

- Lead students on a discussion of their observations and equations. Use questioning techniques to guide students to the concept and equation of the conservation of momentum and it elastic collision form.
- Students should do some conceptual and computational questions on elastic collisions.
- Using m1 and m2, v1 and v2 as mass for the balls and velocity respectively, develop the formula for momentum

Summary and assessment of the lesson delivery (15 Minutes)

- Summarize the points learnt i.e. elastic collision and conservation of momentum
- Ask questions related to simple concepts learnt during the lesson e.g. what is momentum?
- Give a quiz