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Exploring Momentum Using Interactive Physics

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Subject taught: High School Regents Physics

Grade Levels: 10-12th

Topic: Momentum

Today's Lesson: Types of Collisions

Time Frame: one block period

Objectives:

Students:
Categorize various collisions
Apply momentum to collisions
Resolve vectors into components
Solve for the resultant vector
Analyze various collisions
Diagram collisions

Essential Question: How do various types of collisions relate to momentum?

Materials and resources:

Enclosed area with border, various types of spheres (marbles, pool cue balls, superball, steel sphere, clay sphere, aluminum sphere), computer stations with IP software

Standards connection:

Standard 4- Physical setting
Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science

Key Idea 5- Energy and matter interact through forces that result in changes in motion.

Performance indicator 5.1- Students can explain and predict different patterns of motion of objects (linear and uniform circular motion, velocity and acceleration, momentum and inertia).

Major understandings
5.1a- Measured quantities can be classified as either vector or scalar.
5.1p- The impulse imparted to an object causes a change in its momentum.
5.1q- According to Newton's 3rd law, forces exert in action/reaction pairs. When one object exerts a force on a second, the second exerts a force on the first that is equal in magnitude and opposite in direction.
5.1r- Momentum is conserved in a closed system.

Lesson body: A five E Model type lesson

Engage-Anticipatory set: On a handmade track, roll various spheres against each other creating collisions. The students will eventually break into groups and perform the same.

Explore *(guided inquiry)*-Break the students into groups of four. Each group will receive a sample of the spheres, two rulers, and tape to build a simple track on the lab benches. The instructions to the groups will be to note observations of various combinations of collisions between the spheres and record the

observations in a concise manner. Also, have each group brainstorm a variety of everyday collisions and write them on their white marker boards for later use.

Explain-

(Brief Lesson notes handed out)

Inelastic collisions- Two objects collide and move forward with a common velocity.

(m1*v1i) + (m2*v2i) = (m1+m2) * vf

Kinetic energy is not constant in inelastic collisions, there is usually a decrease.

KEi = KE1i + KE2i

KEf = KE1f + KE2f

and KE = ½ m*v(sq)

Elastic collisions- Two objects collide and return to their original shape with no change in KE. After the collision, the two objects move separately.

(m1*v1i) + (m2*v2i) = (m1*v1f) + (m2*v2f)

KEi = KEf

Most collisions are neither inelastic nor elastic but somewhere in-between.

Elaboration- Open the IP software to a pre created program of collisions (collisions).Student groups are allowed to interact with the software by

1- Opening the properties of the two spheres\

2- Altering the velocity vector

3- Altering the mass of the object

4- Altering the material of the sphere

Students are to note the momentum tracking of the spheres and are to write an observation page on their software inquiry relating the variables that they have altered to collisions types and momentum

Closure Have each group go back to the list created on the whiteboards and have them classify the collision types.

Evaluation-

Assessment and evaluation

5 points	3 to 4 points	1 to 2 points
Student completes entire observation pages (2) with Student is active with in the group sharing information and contributing to discussions.	Student completes approximately 75 % of the observation pages (2). Student is at least communicating in the group with possibly less interaction.	Student completes approximately 25 % of the observation pages (2). Student is not engaged with their group. Student does not participate in discussions.