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Name:

COLLISIONS

**Key Physics:**

* Collisions
* Momentum
* Velocity

**Keywords**

**Learning Goals:**

* Interpret "before-and-after" pictures of collisions.
* Apply the law of conservation of momentum to solve problems of collisions.
* Explain why energy is not conserved and varies in some collisions.
* Determine the change in mechanical energy in collisions of varying “elasticity”.
* Define ELASTIC and INELASTIC collisions in terms of momentum and energy conservation

Find the pHET website and enter a search for ‘Collision Lab’

Exercise 1: The Effect of Mass in Collisions

Set both masses to 0.5kg and make sure elasticity is 100%

Run the sim

Write down a description of what happens:

Increase mass 2 in 1kg steps and describe what happens:

Predict what would happen if you made mass 1 greater than mass 2. Try it – were you right? Describe what happens:

Exercise 2: The Effect of Elasticity in Collisions

Set both masses to 0.5kg and make sure elasticity is 0%

Run the sim

Write down a description of what happens:

Increase mass 2 in 1kg steps and describe what happens:

Predict what would happen if you made mass 1 greater than mass 2. Try it – were you right? Describe what happens:

Explain, in your own words, the difference between an ELASTIC and an INELASTIC collision:

Exercise 3: Momentum and Energy in Collisions

Before you start you will need to write down the following 3 pieces of information:

1. The equation for momentum
2. The Law of Conservation of Momentum
3. The equation for Kinetic Energy

Set up the sim with equal masses and 100% Elasticty

Select ‘Show Values’

Draw up a table to record results of collisions for a range of 6 values of mass 1, keeping mass 2 constant.

Your table **must** record:

mass of each particle

velocity of each particle before colliding

velocity of each particle after colliding

momentum of each particle before colliding

momentum of each particle after colliding

KE of each particle before colliding

KE of each particle after colliding

TOTAL momentum before the collision

TOTAL momentum after the collision

TOTAL KE before the collision

TOTAL KE after the collision

(That’s a lot of information – but not even imaginably near what the LHC produces in collision experiments!)

Explain, in your own words, what happens to total momentum and total KE in an elastic collision between particles of equal mass:

Exercise 4: Are Momentum and Kinetic Energy conserved in all collisions?

Now you’re on your own! Your task, as a Particle Physicist, is to design your own experimental simulations to investigate what happens to total momentum and total KE when:

1. The masses of the particles is not equal
2. The collisions are not 100% elastic

Design your experiments, run them, record the results and then produce a short scientific report on your conclusions.

Exercise 5: What have you learnt about collisions?

Look back at the Learning Goals. List each one and write down what you have learnt about each one.