Momentum, Collisions and Impulse Practice Problem Set

momentum = mass x velocity

PRACTICE PROBLEMS : *First, let's review how to calculate MOMENTUM. Formula:* $p = mv$

1. Calculate the momentum of a 0.15 kg ball that is moving toward home plate at a velocity of 40m/s.

2. Which has greater momentum, a 2.0 kg hockey puck moving east at 2.5 m/s or a 1.3 kg hockey puck moving south at 3.0 m/s? **SHOW YOUR WORK.**

3. A track athlete throws a 2 kg discus into a field with a velocity of 21 m/s. What is the momentum of the discus?

4. Calculate the momentum of a 700g ball that is rolling down a ramp at 4.6m/s.

5. A cannon fires a 40.5kg shell toward a target and the shell moves with a velocity of 120m/s. Calculate the shell's momentum.

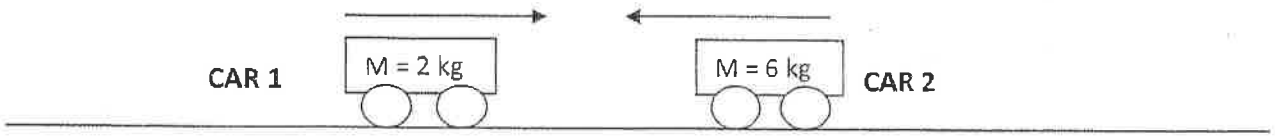
Impulse *Now, remembering that momentum and impulse can be used to find one another, perform the following calculations.* $I = Ft$ $p = mv$ $I = p$ *which can be rewritten as:* $Ft = mv$

1. Calculate the impulse required to bring a bowling ball to stop if it was thrown with a force of 15 N and it moved for 5 seconds:

2. What was the momentum of the bowling ball above before it came to a stop?

3. At what speed was the bowling ball traveling if it has a mass of 8 kg?

Collisions *During a collision, one OR two objects must be in motion; therefore, the object(s) in motion must have momentum. Look at the diagram below:*

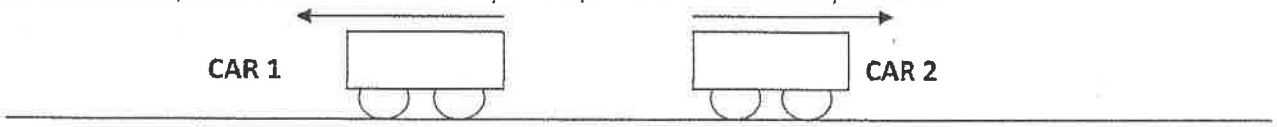


Each of these cars above is traveling towards each other with a velocity of **5 m/s.**

Since the cars are moving toward each other with a velocity of 5 m/s, they are going to collide and if they BOUNCE off of each other, this is an example of a(n) _____ *collision.*

a. What is the momentum of car 1: _____
b. What is the momentum of car 2: _____

AFTER the collision, car 1 travels with a velocity of 2 m/s. What is the velocity of car 2?



** You must remember CONSERVATION OF MOMENTUM: This simply put means that *the momentum before the collision will equal the momentum AFTER the collision.*

SO, another way of looking at this: $m\ v_{before} = m\ v_{after}$

Look at each car INDIVIDUALLY:

CAR 1: Momentum <u>before</u> the collision (letter a above):

CAR 2: Momentum <u>before</u> the collision (letter b above):

Now, calculate the momentum of car 1 AFTER the collision, based off of its new velocity (2 m/s):

This momentum is also the momentum of car 2. So, plug in the mass (m) of car 2 and use your momentum for car 1 AFTER the collision to calculate car 2's momentum AFTER the collision:

When two objects collide and STICK together, we call this a(n) _____collision.

Try this: CALCULATE the momentum of a car that has a mass of 10 kg that collides and sticks to a car with a mass of 5 kg. The cars travel together with a velocity of 8 m/s: