NEWTON'S LAWS

* Newton's First Law:
Inertia is the tendency of an object to resist change in motion.

More mass = more inertia

Also stated as, "An object at rest will remain at rest and an object in motion will remain in motion unless acted upon by an unbalanced force."

Newton's 1st law

something that isn't moving won't start moving and something that is moving won't stop or change direction unless acted on by an outside force

Do now:

Which would require a greater force to cause movement, a car or bus? Why?

Which would be harder to stop? Why?

What is responsible for both of these actions?

* Newton's Second Law:
The acceleration of an object is directly proportional to the Force applied and inversely proportional to the mass of the object.

F = ma

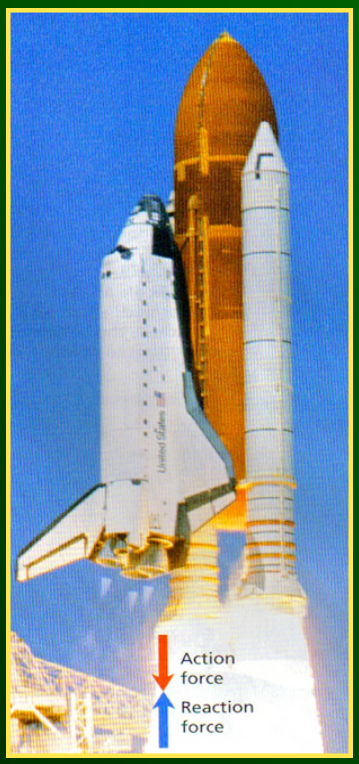
Newton's 2nd law

If force increases, acceleration increases (and vice versa)
If mass increases, acceleration decreases.

NEWTON'S THIRD LAW

* If an object exerts a force on another object, the second object exerts a force of equal strength in the opposite direction.

In other words, for every action there is an equal and opposite reaction.



MOMENTUM

* Momentum deals with an object's inertia. The higher the velocity and mass, the more momentum an object has.

Momentum = mass X velocity measured in *kg * m/s*

$p = m \cdot v$

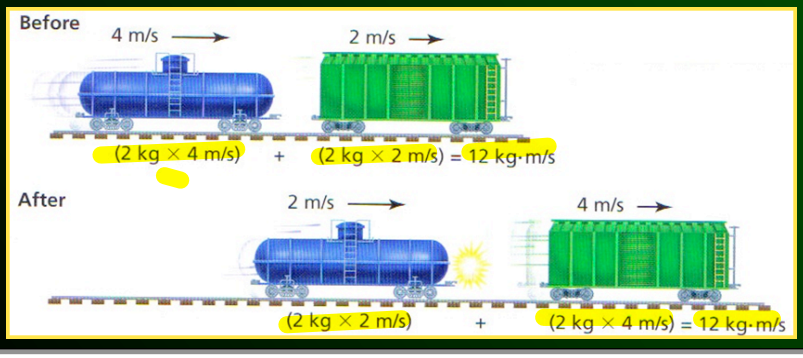
multiplied

* The Law of Conservation of Momentum states:
"The total momentum of any group of objects remains the same unless outside forces act on the objects."
When 2 objects collide in the absence of friction, momentum is not lost.

Momentum of 2 Moving Objects

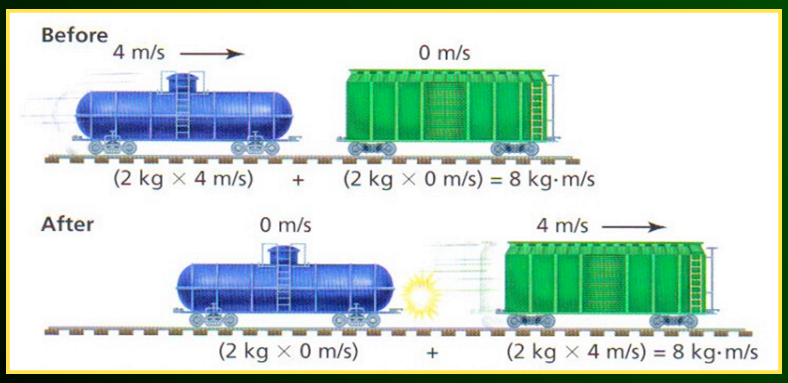
* When a fast-moving object hits a slower moving object traveling in the same direction, the slower moving object will accelerate to the speed of the fast-moving object, and the fast- moving object will slow to the speed of the slower moving object.

No momentum is lost, except to friction.



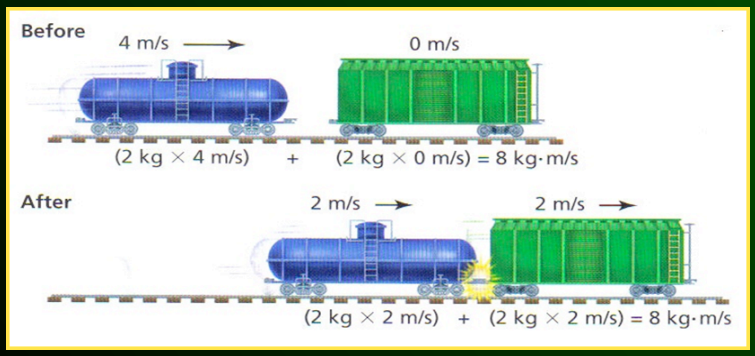
Momentum of 1 Moving Object

*** When a moving object hits a stopped object its motion transfers to the stopped object, and the first moving object will stop moving.**

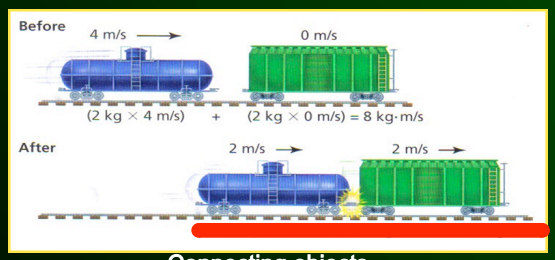


Momentum of 2 Connected Objects

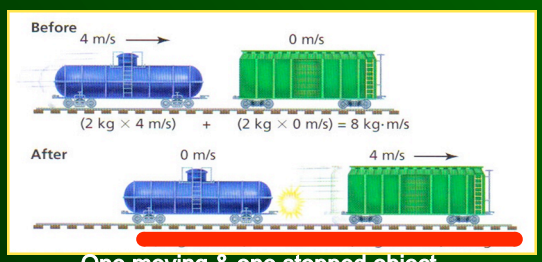
* When a moving object hits and connects with a stopped object, half of its momentum transfers to the other object and they travel together with twice the mass but half the velocity, so total momentum is conserved.



Click on the red lines to reveal the resulting momentum of the objects.

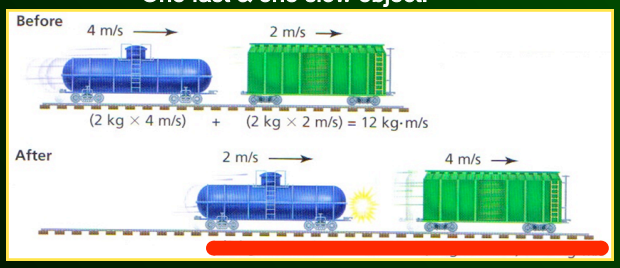


Connecting objects.



One moving & one stopped object.

One fast & one slow object.



FREE FALL

$F = m \times a$ 20 N

$W = m \times g$

* When the only force acting on a falling object is gravity, it is said to be in free fall.

* In free fall, the force of gravity is an unbalanced force that causes objects to accelerate.

* The force of acceleration due to gravity on Earth is 9.8 m/s^2

$g = 9.8\ m/s^2$

If you were to find out that gravity would disappear on Saturday, how would you prepare?

Do Now

- You will need your notebooks/binders and a pencil.
- Get in your lab groups.
- Get 2 pieces of paper, a ruler, a golf ball and a ping pong ball from the front table per lab group.
- Put the two balls at the edge of your table.
- Use the ruler to push both of the balls off the table at the same time.
- Record what you see.
- Explain why it happened then repeat 2x.
- Now take one piece of paper and crumble it.
- Take the 2 pieces of paper and put them at the edge of your table.
- Push them off at the same time.
- Record what you see.
- Explain why it happened then repeat 2x.

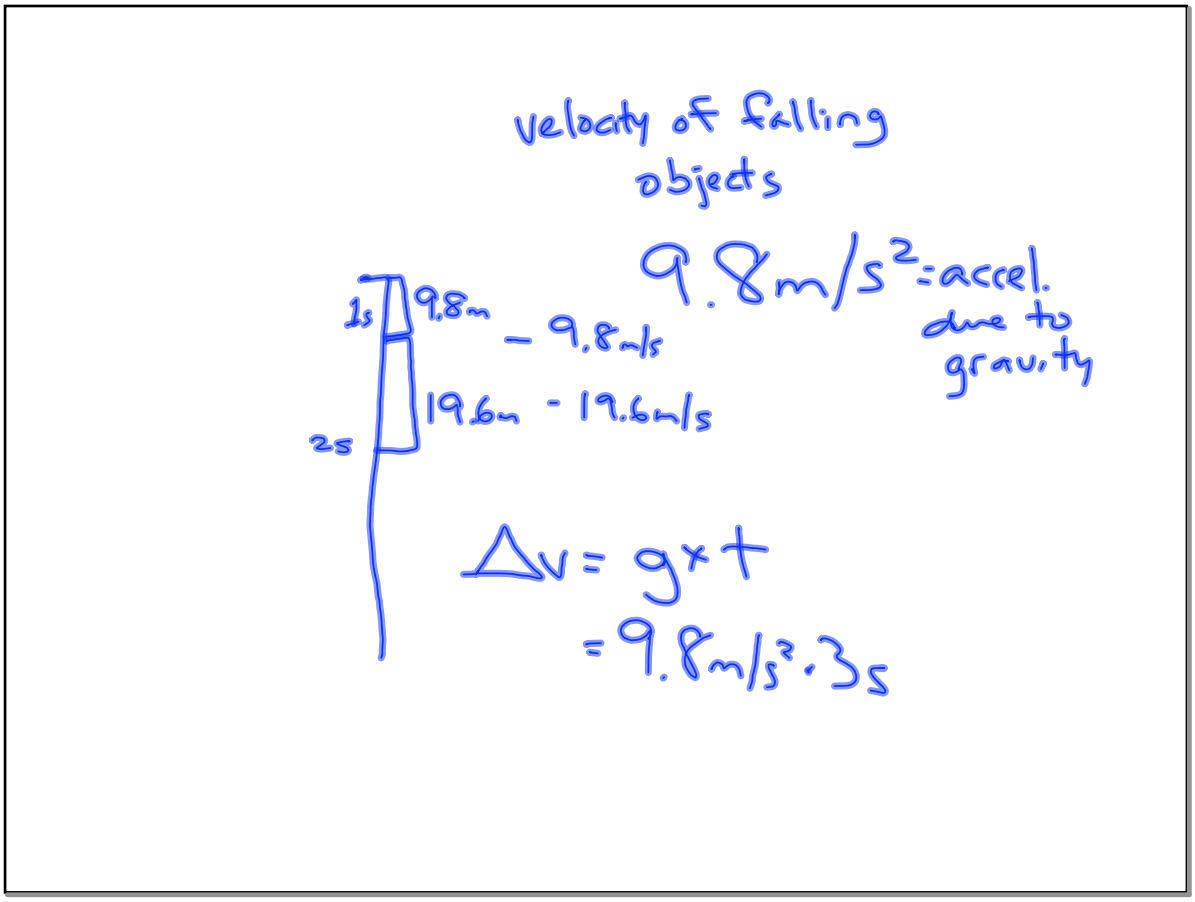
AIR RESISTANCE

* Air resistance is a type of fluid friction that falling objects experience.

* Air resistance is an upward force, opposite of gravity.

* Air resistance increases as velocity increases.

* Terminal velocity is the greatest velocity that an object reaches; such as when air resistance equals the force of gravity on a falling object.



Free fall

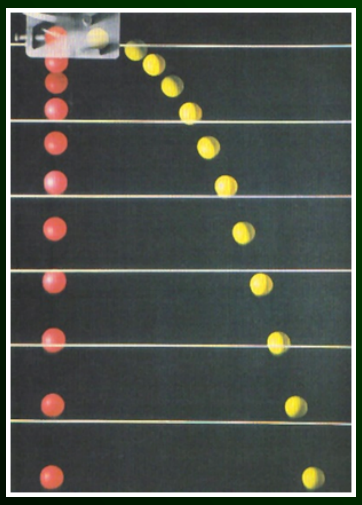
- when only the pull of gravity is acting on an object

projectile motion

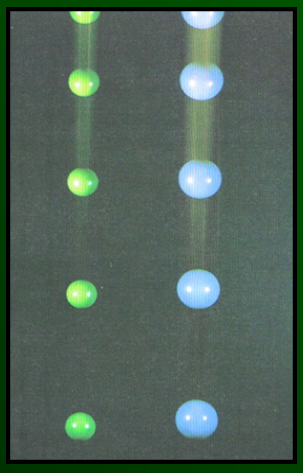
motion of an object that is propelled by a horizontal force.

FALLING MOTION

A projectile falls at the same rate as an object in free fall



In the absence of friction, all objects free fall at the same rate regardless of mass



CENTRIPETAL FORCE

* Centripetal Force is a balance between the force of gravity of one object and the inertia of the other; or a force that causes an object to move in a circle, as one body orbiting another.