Newton's First Law

9th Sep

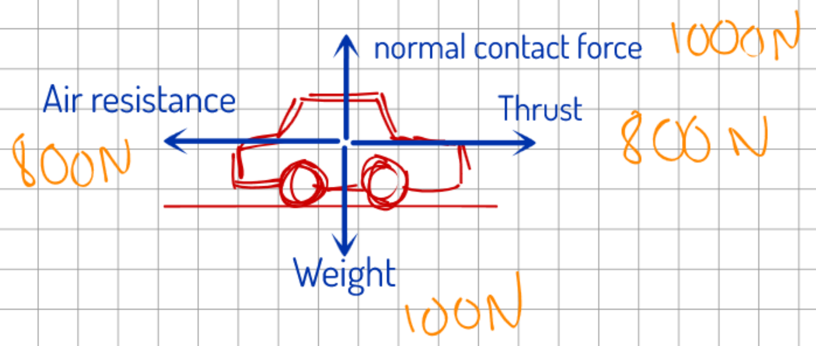
When considering the motion of any object we must;

- consider all forces acting on the object
- find if there is a RESULTANT force on the object

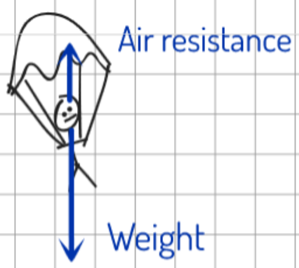
N1L: If there is NO RESULTANT FORCE on an object then the object's motion remains UNCHANGED.

If there IS A RESULTANT FORCE then object will accelerate (speed up, slow down or change direction).

Examples: A car moving at 30 mph to the right

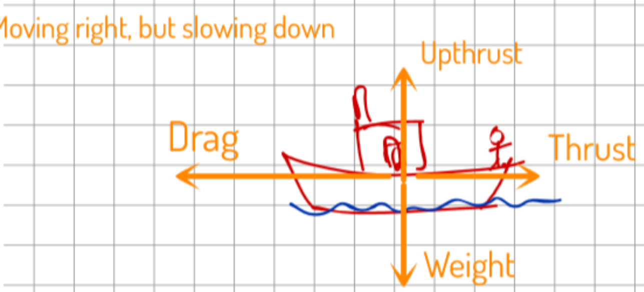


- No resultant force
- So the car moves at a constant speed.



- Resultant force downwards
- Accelerate downwards

When an object slows down (decelerates) it must have a resultant force in the opposite direction to its motion.



- Resultant force to the left, which opposes the motion to the right.
- The boat would slow and eventually stop.

Newton's Second Law

12th Sep

The ACCELERATION of an object is DIRECTLY PROPORTIONAL to the RESULTANT FORCE acting on it.

e.g. an object with a resultant force of 20 N would have twice the acceleration of an object with a resultant force of 10 N.

The ACCELERATION is also INVERSELY PROPORTIONAL to the MASS of the object.

e.g. if a 5 kg object and 10 kg object had the same resultant force the 5 kg object would have double the acceleration.

Resultant force = mass x acceleration

F = ma

- F: newtons, N
- m: kilograms, kg
- a: metres per square second, m/s^2

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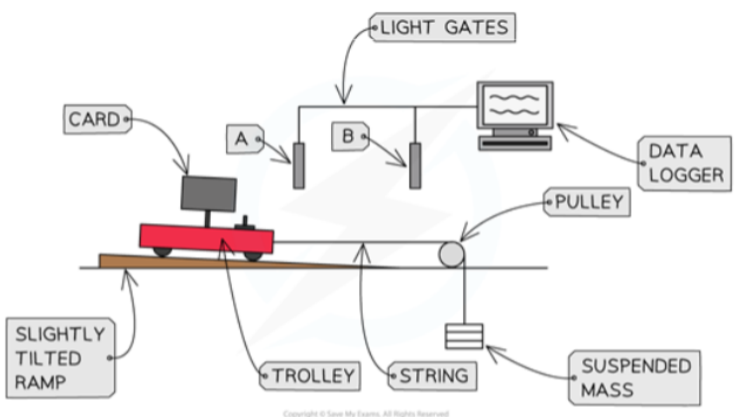
Required Practical: Newton's Second Law

20th Sep



Resultant force = mass x acceleration

- To change the resultant force on the trolley we change the mass that is on the hanger.
- To measure the resultant force we use a NEWTONMETER.
- To measure the mass we place the trolley and the suspended masses on a BALANCE.
- The LIGHT GATES and the DATALOGGER measure the acceleration.
- We measure the LENGTH OF THE CARD using a RULER. The LIGHT GATES & DATA LOGGER measure the TIME it takes for the trolley to pass each gate.
- The data logger then calculates the speed at each light gate, the time taken to travel between light gates and calculates the ACCELERATION.

Resultant Force [N]	Acceleration [m/s^2]
0.7	0.74
0.6	0.62
0.5	0.47
0.25	0.20
0.20	0.17

Resultant force

Acceleration

Mass

- The ramp was tilted to compensate for FRICTION.
- Moved masses from the hanger to the trolley. This allowed us to change the RESULTANT FORCE but keep the TOTAL MASS the same.

The acceleration is DIRECTLY PROPORTIONAL to RESULTANT FORCE.

Mass [kg]	Acceleration [m/s^2]
1.06	0.63
1.09	0.59
1.12	0.56
1.15	0.53
1.18	0.52

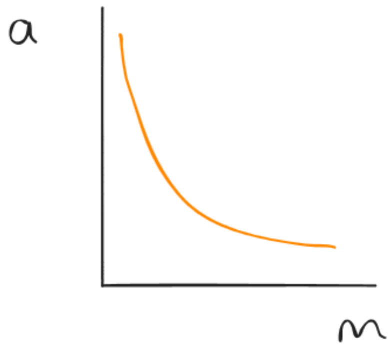
Method 2: How does changing the mass affect acceleration?

Independent variable: Mass

Dependent variable: Acceleration

Control variable: Resultant force

Notes Mass was added to the trolley. Resultant force is kept the same by having the same mass on the hanger each time.



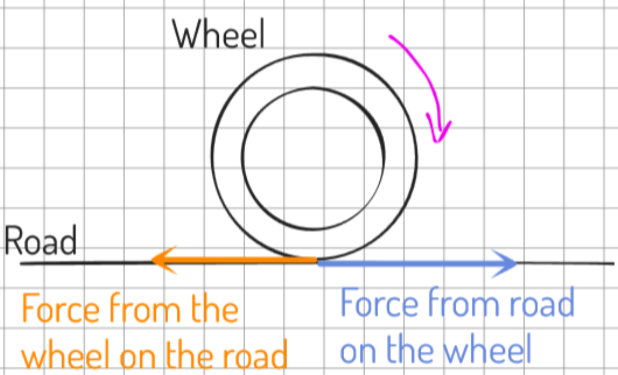
The ACCELERATION is INVERSELY PROPORTIONAL to MASS.

e.g. doubling the mass halves the acceleration

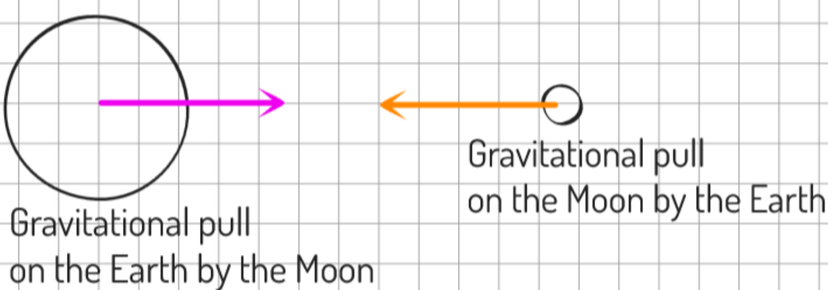
Newton's Third Law

23rd Sep

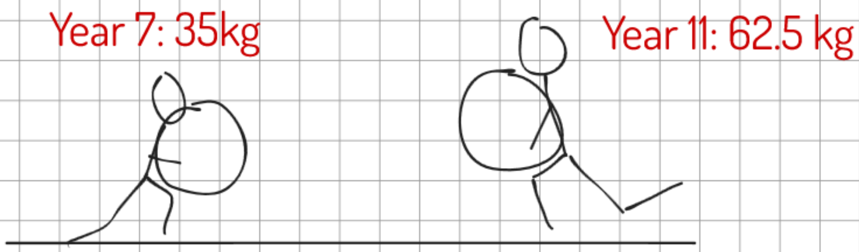
If Object A exerts a force on Object B then Object B exerts a force on Object A that is: the same size but in the opposite direction.



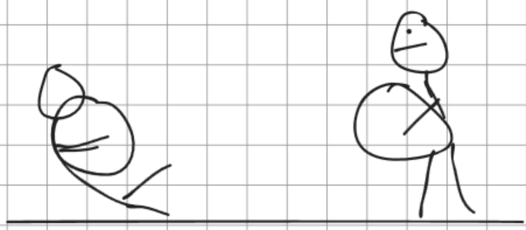
If the wheel exerts a force on the road, then the road exerts a force on the wheel that is the same size, but in the opposite direction.



After an interaction between two objects it may not seem obvious that they experience the same force because they may be affected in different ways.



When these two students interact they both experience the SAME FORCE according to N3L, but in opposite directions.



But the student with the smaller mass would experience a GREATER ACCELERATION for the same force (according to N2L).