OCR A Physics GCSE

2.2 - Newton's Laws

Flashcards

What is a force?

What is a force?

A push or pull acting on an object due to an interaction with another object.

What are the two categories that all forces can be split into?

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1. Contact forces (objects touching)
2. Non-contact forces (objects separated)

Give three examples of contact forces.

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1. Friction
2. Air resistance
3. Tension

Give three examples of non-contact forces.

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1. Gravitational forces
2. Electrostatic forces
3. Magnetic forces

What is the name given to the single force that is equivalent to all the other forces acting on a given object?

What is the name given to the single force that is equivalent to all the other forces acting on a given object?

The resultant force.

State Newton's first law for a stationary object.

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If the resultant force on a stationary object is zero, the object will remain at rest.

State Newton's first law for a moving object.

State Newton's first law for a moving object.

If the resultant force on a moving object is zero, the object will remain at constant velocity (same speed in same direction).

If an object changes direction but remains at a constant speed, is there a resultant force?

If an object changes direction but remains at a constant speed, is there a resultant force?

Since there is a change in direction, there is a change in velocity and so there must be a resultant force.

When does an object fall with terminal speed? (Higher)

When does an object fall with terminal speed? (Higher)

- When the upwards forces (air resistance) and the downwards forces (weight) are equal to each other
- No resultant force, so constant speed

What happens to the magnitude of air resistance on a falling object when the velocity increases? (Higher)

What happens to the magnitude of air resistance on a falling object when the velocity increases? (Higher)

As velocity increases, the force of air resistance on the object will also increase.

State the defining equation for Newton's Second Law.

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Resultant force (N) = Mass (kg) x Acceleration (m/s^2)

$F = ma$

State Newton's Second Law in words.

State Newton's Second Law in words.

An object's acceleration is directly proportional to the resultant force acting on it and inversely proportional to its mass.

What is inertia? (Higher)

What is inertia? (Higher)

The tendency of an object to continue in its state of rest or uniform motion.

In other words, inertia is an object's resistance to motion.

What is inertial mass? (Higher)

What is inertial mass? (Higher)

- A measure of how difficult it is to change a given object's velocity.
- The ratio of force over acceleration.

State Newton's Third Law.

State Newton's Third Law.

Whenever two objects interact, the forces that they exert on each other are always equal and opposite.

State the equation used to calculate an object's momentum. (Higher)

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Momentum (kgm/s) = Mass (kg) x Velocity (m/s)

$$P = mv$$

What is the unit used for momentum? (Higher)

What is the unit used for momentum? (Higher)

kgm/s

Kilogram metres per seconds

In a closed system, what can be said about the momentum before and after a collision? (Higher)

In a closed system, what can be said about the momentum before and after a collision? (Higher)

The total momentum before is equal to the total momentum afterwards.

State an equation linking change in momentum, force and time. (Higher)

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Force x Time = Change in Momentum

$$F \Delta t = P$$

$$F \Delta t = m \Delta v$$

Explain how a seatbelt improves a passenger's safety during a collision. (Higher)

Explain how a seatbelt improves a passenger's safety during a collision. (Higher)

- The passenger must decelerate from the vehicle's velocity at impact to zero, so they experience a force.
- This force is equal to the rate of change of momentum.
- Seatbelts increase the time over which the force is applied, reducing the rate of change of momentum and therefore reducing the force felt by the passenger.

What quantity is equal to the force experienced in a collision? (Higher)

What quantity is equal to the force experienced in a collision? (Higher)

The rate of change of momentum.

What does it mean if a force is said to do ‘work’?

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The force causes an object to be displaced through a distance.

What is the equation used to calculate work done? Give appropriate units.

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Work done = Force x Distance

$$W = Fd$$

Work done (Joules), Force (Newtons), Distance (metres)

Under what circumstance is 1 joule of work done?

Under what circumstance is 1 joule of work done?

When a force of 1 Newton causes a displacement of 1 metre.

What is power?

What is power?

The rate at which work is done.

What is the unit used for power?

What is the unit used for power?

Watt (W)

What is one Watt equal to?

What is one Watt equal to?

One joule per second.

$1\ W = 1\ J/s$

State the equation used to calculate power. Give appropriate units.

State the equation used to calculate power. Give appropriate units.

Power (W) = Work Done (J) / Time (s)

What can be said about the velocity of an object travelling in circular motion at constant speed? (Higher)

What can be said about the velocity of an object travelling in circular motion at constant speed? (Higher)

The velocity is constantly changing since velocity is a vector quantity and depends on direction as well as magnitude. The direction is continually changing and so does velocity.