Science—Forces (Physics)

Year 9 Term 5

Trinity Academy Bradford Trinity Academy Halifax

(1) Scalars and Vectors, Motion

- **Forces are measured in Newtons using a Newton meter**
- **Forces can change the speed, direction and shape of an object**
- **Resultant force–** The overall force acting upon an object

Scalar– A quantity with magnitude (size) only

Vector– A quantity with magnitude and direction

Scalars	Vectors
Mass	Force (e.g. weight)
Time	Displacement
Distance	Velocity
Speed	Acceleration
Temperature	Momentum
Energy / work done	
Power	

Speed (m/s) = Distance (m) ÷ time (s)

Weight (N) = mass (kg) x gravity

Kinetic Energy (J) = 0.5 x mass (kg) x velocity^2

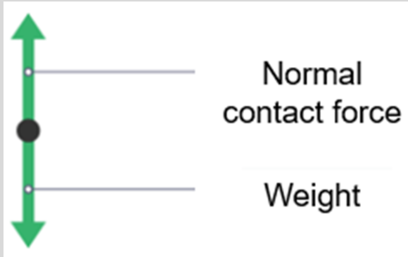
Work done (J) = force (N) x distance (m)

Power (W)= work done (J) ÷ time(s)

(2) Force Diagrams

Newton's 1st Law– An object will remain stationary or travelling at constant velocity unless acted upon by an external force.

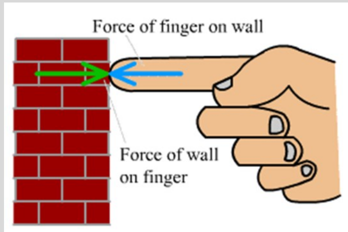
If an object is stationary or travelling at constant speed, the forces acting on an object are balanced (in equilibrium) and the resultant force is 0N.



Terminal velocity– The object is travelling at constant speed as a result of the forces acting on it being in equilibrium

Newtons 3rd Law– For every action, there is an equal and opposite reaction

For example, the force of your finger on the wall and the force of the wall on your finger.



If the force of the wall was larger, your finger would be pushed back. If the force of your finger was larger it would push the wall back!

These two forces are equal and opposite, so neither object moves.

(3) Acceleration and PAG

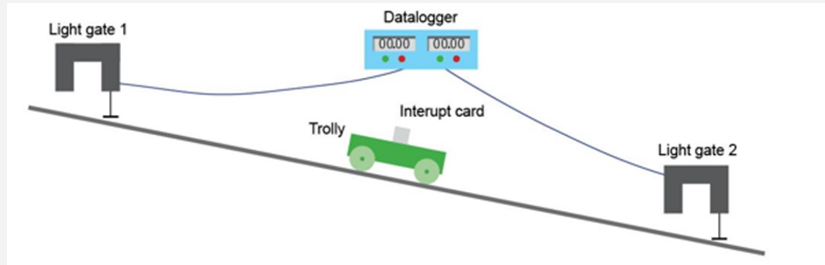
Newton's 2nd law – Force= mass x acceleration (F=ma)

Acceleration (m/s^2) = change in velocity ÷ time

PAG:

Use 2 light gates attached the a data logger to record the velocity of the trolley at the top of the ramp and then at the bottom. The data logger can use this to calculate acceleration of the trolley.

Using light gates improves accuracy as it removes human error of pressing a stopwatch and calculates the acceleration closer to the true value.

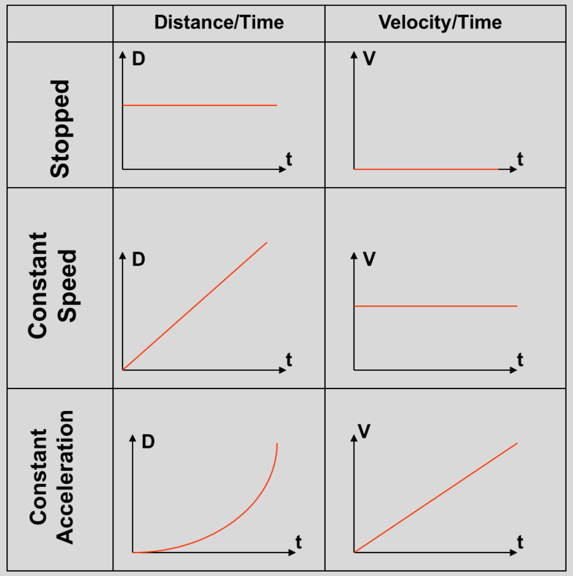


(4) Distance/ Time graphs, Velocity/ Time graphs

Distance/ Time graphs show the distance an object moves in a given time. The shape of the line tells us the motion of the object. The speed can be calculated by using the equation:

Speed= distance ÷ time

The steeper the gradient, the faster the speed.



A Velocity/Time graph looks different as it plots how velocity changes over time. If velocity increases, an object is accelerating.

Trinity TV

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Trinity TV > Year > Subject

(5) Momentum and Elastic energy

Momentum

Law of conservation of momentum – Momentum before a collision is equal to the momentum after. This applies when there are no external forces.

Total momentum before= Total momentum after

Momentum (Kgm/s)= mass (kg) x velocity (m/s)

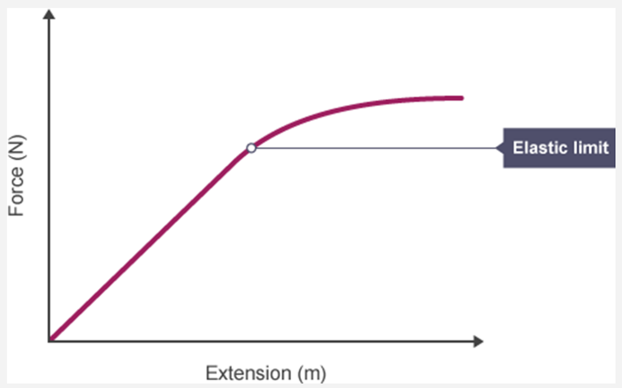
Inertia– How difficult it is to change the velocity of an object

Elastic energy–

Elastic energy= 0.5 x spring constant x extension^2

As a spring stretches, the extension of the spring is directly proportional to the force applied. This means that if force doubles, the extension doubles.

This occurs until it reaches its elastic limit, which is when the relationship is no longer proportional.



(6) Hooke's law and Elastic energy

We can investigate Hooke law and elastic energy in the following practical:

1. Place a spring on a hanger and measure its original length.
2. Add a 0.1Kg mass to the spring.
3. Measure the extended length of the spring. Remove the mass.
4. Repeat, increasing the mass by 0.1Kg each time.
5. Calculate the spring extension using original length– extended length.
6. Plot the results on a graph.