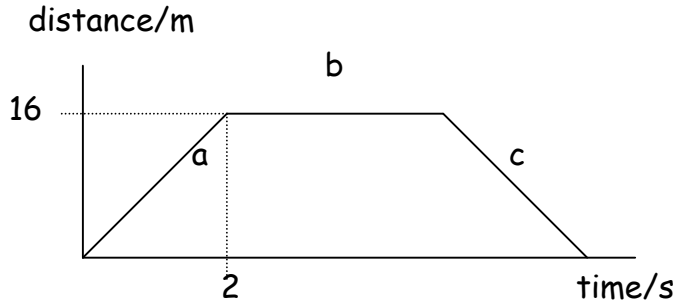


Force and Acceleration Summary

- | |
|--|
| $\text{speed (m/s)} = \frac{\text{distance (m)}}{\text{time (s)}}$ |
|--|

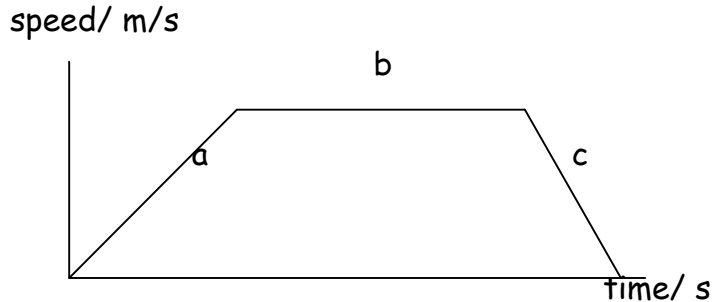
- distance - time graph



a=constant speed b=stopped c=return at constant speed

- slope of graph gives the value of the speed eg., $16 \div 2 = 8\text{m/s}$

- speed - time graph



a=constant acceleration b=constant speed c=constant deceleration

- velocity** is the change in distance per second in a **given direction**

- | |
|---|
| $\text{acceleration (m/s}^2 \text{)} = \frac{\text{change in velocity (m/s)}}{\text{time (s)}}$ |
|---|

- **stopping distance** is the distance a car travels from the point of seeing the emergency to where the car has stopped
- **stopping distance = thinking distance + braking distance**
- **thinking distance:**
 how far the car travels whilst the **driver is reacting**, is directly proportional to the cars speed ie., at **double the speed the thinking distance is doubled**
 is made longer by factors that affect the driver eg., **drink, drugs, tiredness, distraction**
- **braking distance:**
 how far the car travels whilst the **brakes are applied** when the **speed is doubled the braking distance can be as much as 4 times longer**
 is made longer by factors that affect the car or road eg., **worn brakes and tyres, icy or wet roads**
- **car safety features:**
air bags inflate in a collision,
crumple zone the front and rear of cars are designed to crumple and so absorb the energy of the impact
seat belts are designed to stretch a little
all of these increase the time for the passengers to slow down and stop therefore reducing the decelerating forces acting and causing less injury
- **balanced forces**
 if object is not moving it will remain **stationary**
 if object **already moving** it will move at a **steady speed**
- **unbalanced forces**
 object will **accelerate** if larger force is in direction object is moving
 object will **decelerate** if larger force is in the opposite direction it is moving

- **Force (N) = mass (kg) × acceleration (m/s²)**
- **Mass** - how much matter there is, measured in kg
- **Weight** - the force when gravity acts on a mass, measured in N
- **On Earth there is 10N of weight acting on every 1kg of mass so 12kg of mass will have a weight of 120N**
- **Terminal Velocity** - the maximum speed when the forward push is balanced by the air resistance and friction
- as objects falls **faster** their **air resistance increases**
- this means the **resultant force** acting downwards **decreases** (and so its acceleration decreases)
- eventually **air resistances balances** the objects **weight**
- the **resultant force is zero**, **acceleration is zero** so the object falls with a **steady speed** called terminal velocity
- **cars** and other vehicles also **have terminal velocity**, this is the maximum speed they can achieve.
- **action and reaction**
the **force** exerted by **object A** on **object B** is **equal** in size and **opposite** to the **force** exerted by **object B** on **object A**
eg., rocket propulsion, gun recoil
- **Work done in J = Force in N X distance in m**
- **Energy is transferred** - when a force acts on a moving object but the total energy remains the same ie.,
the total energy before = total energy after
- **Work done = Energy transferred**

HIGHER ONLY

- Select and use the following equations

$$\text{Kinetic Energy} = \frac{\text{mass} \times \text{speed}^2}{2}$$

- $\text{Change in potential Energy} = \text{mass} \times \text{gravitational field strength} \times \text{change in height}$

Kinetic and potential energy in J

Mass in kg

Gravitational field strength in N/kg

Change in height in m

Speed in m/s