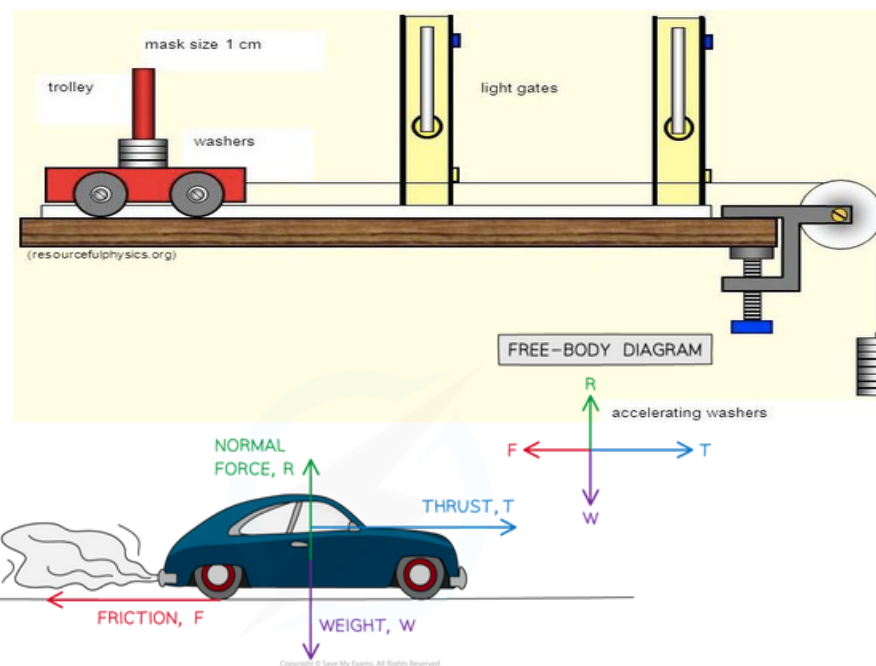
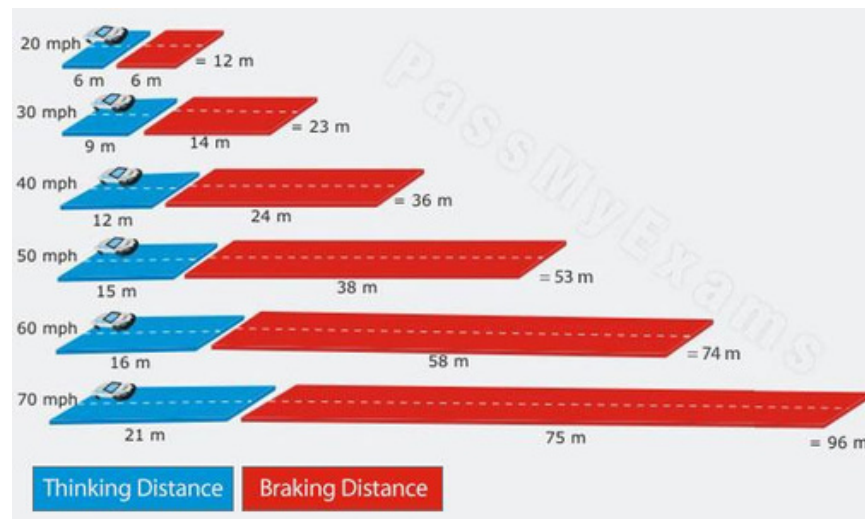


- 1 A **resultant** force is the **sum** of all the **forces** acting on an object.
- 2 A **free body diagram** represents all of the forces acting on one object and the forces are represented as arrows, the **size of the arrow** represents the **size of the force** and the direction of the arrow represents the direction the force is acting in.
- 3 To find the **resultant force** when two forces are acting on an object in **opposite directions** you **subtract** the smaller force from the larger force.
- 4 To find the **resultant force** when two forces are acting on an object in the **same direction** you **add** the forces together.
- 5 **Newton's first law of motion** states that **unless an external force** acts on the object then a moving object will continue to move at the same speed and direction and a stationary object will remain at rest.
- 6 A centripetal force can be any one of several different forces that keep an object moving in a circle. **(higher tier only)**
Examples of centripetal force include gravity, friction and tension.
- 7
- 8 The gravitational field strength on Earth is 10 N/kg
- 9 Weight (N) = mass (kg) x gravitational field strength (N/kg). $W = m \times g$
- 10 Weight is a force so the standard units of measurement for weight are Newtons (N).
- 11 Newton's second law of motion states that the acceleration in the direction of a resultant force depends on
 - The size of the force (for the same mass, the bigger the force the bigger the acceleration)
 - The mass of the object (for the same force the more massive the object is the smaller the acceleration)
- 12 Force (N) = mass (kg) x acceleration (m/s^2). $F = m \times a$



- 13 **Inertial mass** of an object is the **force** on it **divided** by the **acceleration** the force produces.
- 14 **Newton's third law of motion** states that for **every action force** there is an **equal and opposite reaction force**.
- 15 Newton's third law applies to forces acting on **two separate objects**.
- 16 Momentum is a measure of how difficult it is to stop an object that is moving.
- 17 Only objects that are moving have momentum. Objects that are **not moving** have a **momentum of zero**.
- 18 **Momentum** (kg m/s) = **mass** (kg) x **velocity** (m/s).
 $P = m \times v$
- 19 **Momentum is conserved** (this means **total momentum before** = **total momentum after**). This applies when we look at momentum in collisions.

- 1 The **stopping distance** of a vehicle = the **thinking distance** + the **braking distance**.
- 2 The **thinking distance** is the distance the vehicle travels during the time it takes for the driver to react.
- 3 Factors that can **increase the thinking distance** are things that can increase the driver's reaction time such as being under the influence of **alcohol, drugs** or **tiredness**.
- 4 Most people have a typical reaction time of 0.25s
- 5 The braking distance is the distance the car travels during the time it takes for the vehicle to come to a complete stop once the driver has applied the brakes.
- 6 Factors that can **increase the braking distance** are things that can affect the vehicle itself. Examples of this include the **condition of the road surface, condition of the brakes** and the **mass** of the vehicle.
- 7 The speed the vehicle is travelling at can affect both the thinking and the braking distance. The faster the speed of the vehicle, the further it will travel in a given time.
- 8 The energy transferred by a force acting over a distance is called **work done**.
Work done (J) = force(N) x distance(m). $E = f \times d$
- 9
- 10 The energy stored in a moving object is called kinetic energy.
Kinetic energy (J) = $\frac{1}{2} \times \text{mass(kg)} \times \text{velocity}^2(\text{m/s})$
- 11 **$KE = \frac{1}{2} \times m \times v^2$**
- 12 The **braking distance** of a vehicle depends on its kinetic energy and so it depends on the square of its velocity. This means that if the **velocity doubles**, the **braking distance** is multiplied by 22 which is 4 (**quadrupled**).



- 13 The **force** in a road collision depends on the **rate of change of momentum**. This can be shown as **$F = \frac{mv - mu}{t}$**
- 14 Crumple zones and air bags increase the time taken for the momentum of the driver to decrease which produces a smaller impact force.