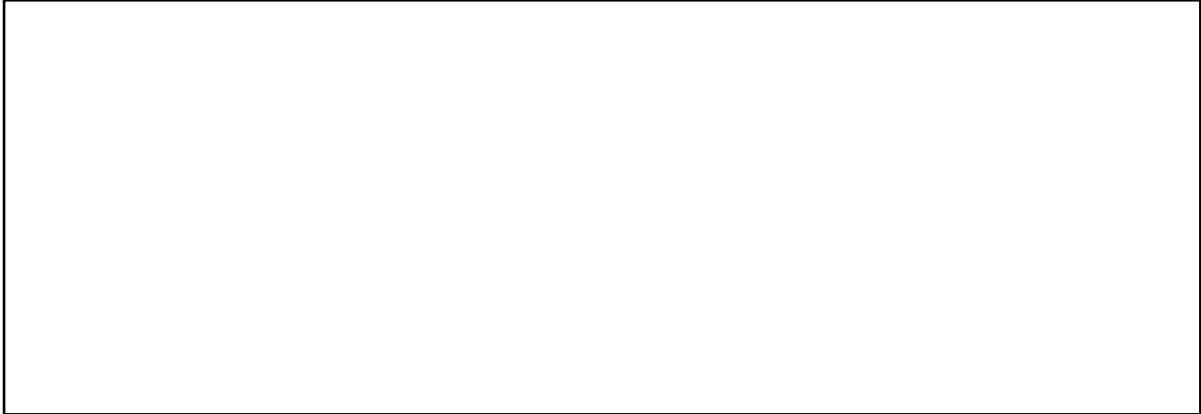


Connected Particles

When we have multiple connected objects moving in the same straight line, **they can be considered either as two separate particles, or as a single particle**, but all forces acting on the particle must be considered.

What assumptions are made?



Example (EdExcel M1 June 2009 Q6)

A car of mass 800 kg pulls a trailer of mass 200 kg along a straight horizontal road using a light towbar which is parallel to the road. The horizontal resistances to motion of the car and the trailer have magnitudes 400 N and 200 N respectively. The engine of the car produces a constant horizontal driving force on the car of magnitude 1200 N. Find

(a) the acceleration of the car and trailer, (3)

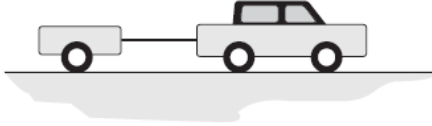
(b) the magnitude of the tension in the towbar. (3)

The car is moving along the road when the driver sees a hazard ahead. He reduces the force produced by the engine to zero and applies the brakes. The brakes produce a force on the car of magnitude F newtons and the car and trailer decelerate. Given that the resistances to motion are unchanged and the magnitude of the thrust in the towbar is 100 N,

(c) find the value of F . (7)

Test Your Understanding

4. A car of mass 900 kg is towing a trailer of mass 100 kg along a horizontal road. There are resistance forces of 60 N and 20 N acting on the car and the trailer respectively.



- (a) The engine applies a driving force of 480 N. Calculate
- (i) the acceleration of the car and trailer
 - (ii) the tension in the towbar. (4)
- (b) The brakes are now applied, bringing the car to a halt from a speed of 10 ms^{-1} in a distance of 50 m. Find
- (i) the magnitude of the braking force
 - (ii) the force in the towbar. (6)

Vertical Example

A brick P of mass 4 kg is suspended by a vertical, light inextensible string. Another brick Q of mass 6 kg is suspended from P by another light inextensible string, as shown in the diagram. The bricks start from rest and are then raised 2 m in 4 seconds. Find the tension in each string.

