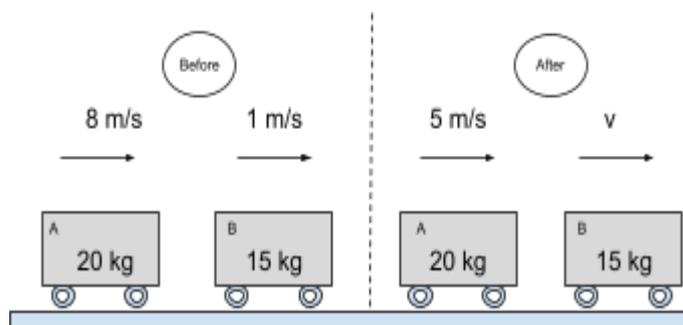


Higher Physics Masterclass 2



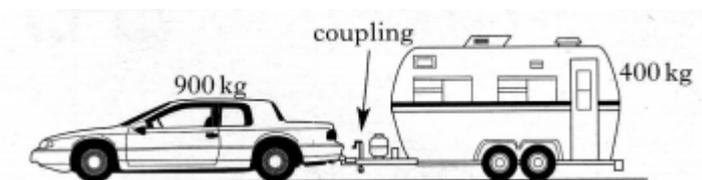
- 1) A 20 kg trolley travelling at 8 m/s collides with a 15 kg trolley travelling at 1 m/s travelling in the same direction.

After the collision the 20 kg trolley moves off at 5 m/s and the 15 kg trolley moves off with a speed v m/s.



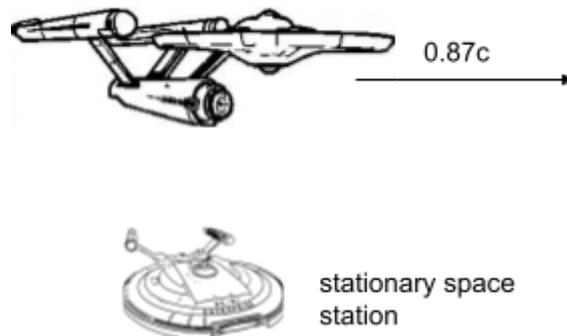
- a) Calculate the speed of the 15 kg trolley after the collision.
- b) Find the change in the momentum of the 15 kg trolley.
- c) If the collision lasted 0.5 s then find the average force given to the 15 kg trolley.
- 2) A boy kicks a sock lying on the floor across the room to his sister. The sock is kicked with a velocity of 10 m s^{-1} at 45° . Calculate
- a) the maximum height reached by the sock. [2.6m]
- b) the total time of flight of the sock. [1.4s]
- c) the range of the sock. [9.9 m]

- 3) A 900 kg car tows a 400 kg along a level road with an acceleration of 1.8 ms^{-2}



- a) Find the tension in the coupling between the car and caravan.
- b) What would be the tension in the coupling if car and caravan were travelling at a constant speed. [720 N, 0 N]

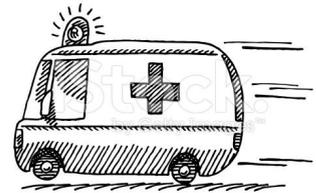
- 4) A spaceship travelling at a speed of $0.87c$ passes a stationary space station.



- On board the space ship an experiment is timed to last 4 minutes. Determine the observed time of the experiment according to an observer in the stationary space station..
 - The proper length of the travelling spaceship is 100 metres. Determine the length of the travelling spaceship according to an observer from the stationary space station.
- 5) An ambulance passes an observer on the pavement. The frequency of its siren is 1000 hertz. The speed of the ambulance as it passes the observer is 25 m s^{-1}

Determine the frequency of the sound of the siren heard by the observer when the ambulance is

- approaching the observer.
- going away from the observer.
- Using a diagram explain why the frequency is higher as the ambulance approaches the observer.



- 6) The graph below shows the force acting on a crash test dummy over a given time during a collision with a barrier

- Determine the approximate change of momentum of the crash test dummy.
- State the approximate impulse received by the crash test dummy.
- Sketch the force time graph if the collision is repeated but with a more crushable barrier.

