

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

6 Connected particles

Exercise A, Question 18

Question:

The diagram shows a car pulling a trailer in a straight line on a horizontal stretch of road.

The mass of the car is 1250 kg and the total resistance force acting on the car is 500 N.

The mass of the trailer is 250 kg and the total resistance force acting on the trailer is 100 N.

(a) During part of the journey, a constant braking force is applied to the car, causing the car and trailer to decelerate at a constant rate of 0.5 m s^{-2} .

(i) By considering the forces on the trailer, find the magnitude of the force in the towbar between the car and the trailer.

(ii) Find the magnitude of the braking force applied to the car.

(b) Later in the journey, the car and trailer travel with constant speed.

State the magnitude of the tension in the towbar. [A]



Solution:

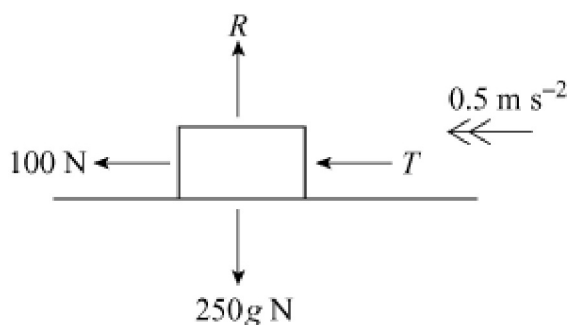
(a) (i) Using $F = ma$ horizontally

$$-T - 100 = -250 \times 0.5$$

$$T = 25$$

\therefore Magnitude of the force in the towbar is 25 N

Forces acting on trailer;



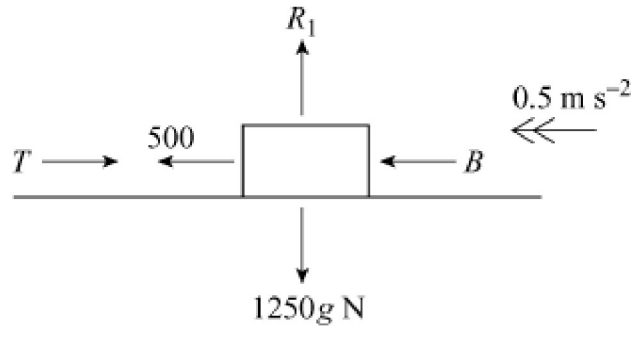
(ii) Let B be the braking force applied to the car.

Using $F = ma$ horizontally

$$-B - 500 + T = -1250 \times 0.5$$

$$B = 150$$

∴ Magnitude of the braking force is 150 N



(b) When travelling at constant speed, the forces acting on the trailer are as shown.
 $T = 100$ (no acceleration)

∴ Tension is 100 N

