what net braking force must be applied to stop a car with mass of 900kg initially travelliing at velocity of 100kmh-1 within a straight line distance of 50m?

Solution:

$m = 900\ kg$ - mass of the car;

$V = 100\frac{km}{h} \approx 27.8\frac{m}{s}$ - the initial speed of the car;

$S = 50m$ - braking distance;

a – deceleration of the car.

Equations of motion for the car on the X-axis:

$$S = Vt - \frac{at^2}{2} \qquad (1)$$

Rate equation for the car along the X-axis

$$0 = V - at$$

$$t = \frac{V}{a} \qquad (2)$$

$(2) in\ (1)$:

$$S = V \cdot \frac{V}{a} - \frac{aV^2}{2a^2}$$

$$S = \frac{V^2}{2a}$$

$$a = \frac{V^2}{2S} \qquad (3)$$

Hence, we have acceleration, so we can now use Newton's second law (the projection on the X-axis) for the car:

$$\vec{F} = m\vec{a}$$

$$x: F = ma \qquad (4)$$

$(3) in (4)$:

$$F = \frac{mV^2}{2S} = \frac{900\ kg \cdot \left(27.8\frac{m}{s}\right)^2}{2 \cdot 50m} = 6950N$$

Answer: net braking force is $6950N$.