Answer on Question#37800 - Physics - Mechanics

A 2.7x10^3 kg car accelerates from rest under the action of two forces. One is a forward force of 1154 N provided by traction between the wheels and the road. The other is a 915 N resistive force due to various frictional forces. How far must the car travel for its speed to reach 2.1 m/s? Answer in units of m

Solution:
Net force acting on Car:

$$\mathrm{F_{net}} = 1154\mathrm{N} - 915\mathrm{N} = 239\mathrm{N}$$

So acceleration (from the Newton's second law) a is given by:

$$\mathrm{a} = \frac{\mathrm{F_{net}}}{\mathrm{m}} = \frac{239\mathrm{N}}{2.7 \times 10^3\mathrm{kg}} = 0.89\frac{\mathrm{m}}{\mathrm{s^2}}$$

Rate equation for car:

$$\mathrm{V} = \mathrm{at} \Longrightarrow \mathrm{t} = \frac{\mathrm{V}}{\mathrm{a}}$$

Equation of motion for the car:

$$\mathrm{S} = \frac{\mathrm{at^2}}{2} = \frac{\mathrm{a}}{2} \cdot \left(\frac{\mathrm{V}}{\mathrm{a}}\right)^2 = \frac{\mathrm{V^2}}{2\mathrm{a}} = \frac{\left(2.1\frac{\mathrm{m}}{\mathrm{s}}\right)^2}{2 \cdot 0.89\frac{\mathrm{m}}{\mathrm{s^2}}} = 2.5\mathrm{m}$$

Answer: the car traveled distance 2.5 m.