Answer on Question 66882, Physics, Mechanics, Relativity

Question:

A truck of mass $2000\ kg$ moving on a highway experiences an average frictional force of $800\ N$. If it's speed increases from $25\ ms^{-1}$ to $35\ ms^{-1}$ over a distance of $500\ m$, what is the force generated by the truck?

Solution:

Let's first apply the Newton's Second Law of Motion:

$$\sum F_x = ma_x,$$

$$F_{truck} - F_{fr} = ma,$$

here, F_{truck} is the force generated by the truck, F_{fr} is the force of friction, m is the mass of the truck and a is the acceleration of the truck.

Then, from this formula we can find the force generated by the truck:

$$F_{truck} = F_{fr} + ma\ (1).$$

We can find the acceleration of the truck from the kinematic equation:

$$v_f^2 = v_i^2 + 2ad,$$

here, v_i is the initial speed of the truck, v_f is the final speed of the truck, a is the acceleration of the truck and d is the distance. Then, we get:

$$a = \frac{v_f^2 - v_i^2}{2d} = \frac{\left(35\ \frac{m}{s}\right)^2 - \left(25\ \frac{m}{s}\right)^2}{2 \cdot 500\ m} = 0.6\ \frac{m}{s^2}.$$

Substituting the acceleration of the truck into the equation (1), we get:

$$F_{truck} = F_{fr} + ma = 800\ N + 2000\ kg \cdot 0.6\ \frac{m}{s^2} = 2000\ N.$$

Answer:

$F_{truck} = 2000\ N.$