Answer on Question#56401 - Physics - Mechanics - Relativity

A truck of mass m= 9000kg is moving with speed $v_i = 18\frac{\text{m}}{\text{s}}$, when the driver decides to stop and applies the brakes. After $t = 6\text{s}$ the truck stops. Assuming that the stopping is with constant deceleration calculate the following:

a) The distance traveled by the car during stopping

b) The acceleration of the truck

c) The loss of energy due to friction

Solution:

Let the acceleration of the truck be a, then the final speed v_f of the truck and the deceleration time t are related by

$$v_f - v_i = at$$

Since $v_f = 0\frac{\text{m}}{\text{s}}$, we obtain

$$a = -\frac{v_i}{t} = -\frac{18\frac{\text{m}}{\text{s}}}{6\text{s}} = -3\frac{\text{m}}{\text{s}^2}$$

The distance l traveled by truck is

$$l = v_i t + \frac{at^2}{2} = 18\frac{\text{m}}{\text{s}} \cdot 6\text{s} - \frac{3\frac{\text{m}}{\text{s}^2}(6\text{s})^2}{2} = 54\text{m}$$

According to the law of conservation of energy the loss of energy is equal to the initial kinetic energy of the truck

$$E_l = \frac{mv_i^2}{2} = \frac{9000\text{kg}\left(18\frac{\text{m}}{\text{s}}\right)^2}{2} = 1458\text{kJ}$$

Answer:

a) 54m
b) $-3\frac{\text{m}}{\text{s}^2}$
c) 1458kJ