**QUESTION:**

A driver, drives a truck of mass 10 ton at a velocity of 72km/hr sees an obstruction on the road at a distance of 145m.if person at reaction of driver is in 0.8second,find weather accident will took place or not. if the retarding force of brake is 16000n.

**SOLUTION:**

During the $t_r = 0.8$ second (the time of reaction) the truck continues to move at constant velocity $\upsilon_0$ and travels the distance:

$$s_1 = \upsilon_0 t_r$$

Then, when a driver begins to brake, the truck begins to move with deceleration. We find the value of deceleration using Newton's second law:

$$F = m \cdot a$$
$$a = \frac{F}{m}$$

Here F is the force of brake and m is the truck's mass.

So, now we can find the time $t_s$, it takes the truck to stop since driver begins to brake. The truck's velocity $\upsilon_t$ depends on time according to the following equation (because it is motion with constant acceleration):

$$\upsilon_t = \upsilon_0 - a \cdot t$$

And when $t = t_s$ truck's velocity is $v_t = 0$, therefore

$$0 = \upsilon_0 - a \cdot t_s$$
$$t_s = \frac{\upsilon_0}{a} = \frac{m\upsilon_0}{F}$$

The distance traveled since driver begins to brake depends on time according to the following equation (because it is motion with constant acceleration):

$$s_2 = \upsilon_0 t - \frac{a \cdot t^2}{2}$$

Substituting t with $t_s$ we find the distance, the truck travels since driver begins to brake and until truck stops:

$$s_2 = \upsilon_0 \cdot \frac{m\upsilon_0}{F} - \frac{F}{2m}\frac{m^2\upsilon_0^2}{F^2} = \frac{m\upsilon_0^2}{F} - \frac{m\upsilon_0^2}{2F} = \frac{m\upsilon_0^2}{2F}$$

(There is another way to obtain the previous equation – without finding the time $t_s$ :

$\upsilon^2 = \upsilon_0^2 + 2 \cdot a \cdot s_2$ , since the final velocity of the truck is equal to zero, and $a < 0$ and $|a| = \frac{F}{m}$ we get $s_2 = \frac{\upsilon_0^2}{2a} = \frac{\upsilon_0^2}{2\frac{F}{m}} = \frac{m\upsilon_0^2}{2F}$ )

Total distance traveled

$$s_{tot} = s_1 + s_2 = \upsilon_0 t_r + \frac{m\upsilon_0^2}{2F}$$

(72 km/hr=20 m/s)

$$s_{tot} = 20 \cdot 0.8 + \frac{10 \cdot 10^3 \cdot 20^2}{2 \cdot 16 \cdot 10^3} = 141 \text{ m.}$$

Hence, the truck will stop before an obstruction.

**ANSWER**

The accident won't took place