

Answer on Question #73878 Physics / Mechanics | Relativity

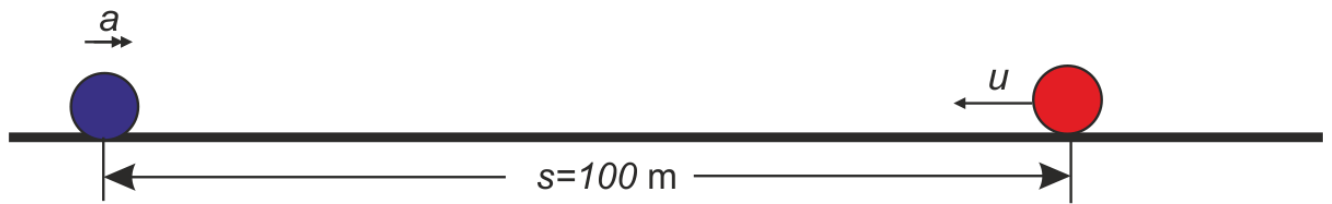
A truck accelerates from rest directly towards a car leaving a parking garage. The car has a constant velocity of $u = 25\text{m/s}$ towards the truck. The truck accelerates towards the car from $s = 100\text{ m}$ away. The collision takes $t = 2.86$ seconds to occur. The truck has a constant rate of acceleration.

A) Draw separate motion diagrams for each vehicle. Be sure to include all known and unknown variables.

B) What is the final velocity of the truck when it collides with the car?

Solution:

A) The motion diagram



B) The motion law for bodies

$$x_{\text{truck}} = \frac{at^2}{2}$$
$$x_{\text{car}} = s - ut$$

At the collision point

$$x_{\text{truck}} = x_{\text{car}}$$

So

$$\frac{at^2}{2} = s - ut$$

The acceleration of the truck

$$a = \frac{2(s - ut)}{t^2} = \frac{2(100 - 25 \times 2.86)}{2.86^2} = 6.97 \text{ m/s}^2$$

Finally, the velocity of the truck when it collides with the car

$$v = at = 6.97 \times 2.86 = 19.9 \text{ m/s}$$

Answer: 19.9 m/s

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