# Answer on Question#53488 - Physics - Mechanics - Kinematics - Dynamics

A school bus heading east through a small town accelerates as it passes the sign post at $s = 0$. Marking the city limits. Its acceleration is constant $a = 5\frac{\text{m}}{\text{s}^2}$ at time 0; it is $l_0 = 5$ m east of the (+) sign post and has a velocity of $v_f = 3\frac{\text{m}}{\text{s}}$ (a) Find his position and velocity at 2 seconds. (B) where is it when its velocity is $v_B = 5\frac{\text{m}}{\text{s}}$.

Solution:

(a) To find bus's velocity at $t = 2$ s we'll use the following formula

$$v_f - v_i = at,$$

where $v_i$ – initial velocity, $v_f$ – final velocity. Since at $t = 0$s the velocity is $v_i = 3\frac{\text{m}}{\text{s}}$, then

$$v_f = v_i + at = 3\frac{\text{m}}{\text{s}} + 5\frac{\text{m}}{\text{s}^2} \cdot 2\text{s} = 13\frac{\text{m}}{\text{s}}$$

Its position is defined by

$$s(t) = l_0 + v_i \cdot t + \frac{at^2}{2}$$

Therefore

$$s(2) = 5\text{m} + 3\frac{\text{m}}{\text{s}} \cdot 2\text{s} + \frac{5\frac{\text{m}}{\text{s}^2} \cdot (2\text{s})^2}{2} = 21\text{m}$$

(b) Its displacement $\Delta s$ (as it accelerates from $v_i$ to $v_B$) can be found from the following formula

$$v_B^2 - v_i^2 = 2a\Delta s$$

Thus

$$\Delta s = \frac{v_B^2 - v_i^2}{2a} = \frac{\left(5\frac{\text{m}}{\text{s}}\right)^2 - \left(3\frac{\text{m}}{\text{s}}\right)^2}{2 \cdot 5\frac{\text{m}}{\text{s}^2}} = 1.6\text{m}$$

The final position is then given by

$$s = l_0 + \Delta s = 5\text{m} + 1.6\text{m} = 6.6\text{m}$$

Answer:

(a) $v_f = 13\frac{\text{m}}{\text{s}}$
$s(2) = 21\text{m}$

(b) $s = 6.6\text{m}$