Answer on Question #42326 – Physics – Mechanics | Kinematics | Dynamics

a particle covers 60 km at a uniform speed at 60 km/h. what should be it's speed for the next 120 km if the average speed for the entire journey is 60 km/h.

Solution:

$S_1 = 60\ \text{km} - \text{first part of the distance;}$

$S_1 = 120\ \text{km} - \text{second part of the distance;}$

$V_1 = 60\frac{\text{km}}{\text{h}} - \text{speed on the first part of the distance;}$

$V_2 - \text{speed on the second part of the distance;}$

$V_a = 60\frac{\text{km}}{\text{h}} - \text{average speed for entire journey;}$

The average speed is the total distance divided by the total travel time.

$$V_a = \frac{S}{t} \quad (1)$$

The total distance is

$$S = S_1 + S_2 \quad (2)$$

The total time is

$$t = t_1 + t_2 = \frac{S_1}{V_1} + \frac{S_2}{V_2} = \frac{S_1}{V_1} + \frac{S_2}{V_2} = \frac{S_1V_1 + S_2V_2}{V_1V_2} \quad (3)$$

$(3)\text{and}(2)\text{in}(1)$:

$$V_a = \frac{S_1 + S_2}{\frac{S_1V_1 + S_2V_2}{V_1V_2}} = \frac{V_1V_2(S_1 + S_2)}{S_1V_1 + S_2V_2}$$

$$S_1V_1V_a + S_2V_2V_a = V_1V_2(S_1 + S_2)$$

$$V_2(V_1(S_1 + S_2) - S_2V_a) = S_1V_1V_a$$

$$V_2 = \frac{S_1V_1V_a}{V_1(S_1 + S_2) - S_2V_a} = \frac{60\text{km} \cdot 60\frac{\text{km}}{\text{h}} \cdot 60\frac{\text{km}}{\text{h}}}{60\frac{\text{km}}{\text{h}}(60\text{km} + 120\text{km}) - 120\ \text{km} \cdot 60\frac{\text{km}}{\text{h}}} = 60\frac{\text{km}}{\text{h}}$$

Answer: speed on the next 120 km should be $60\frac{\text{km}}{\text{h}}$