Flipping Physics Lecture Notes: Average Velocity Example Problem with Three Velocities

Example Problem: Buster and mr.p embark on a southward journey. First they walk South at 6.5 km/hr for 1.1 hours. Then they stop to take a nap for 18 minutes and then continue South at 5.5 km/hr for 1.2 hours. (a) What was their average velocity for the whole trip? (b) What was their displacement for the whole trip?

Knowns: $v_1 = 6.5\frac{km}{hr};\ \Delta t_1 = 1.1hr;\ \Delta t_2 = 18\,\text{min}\times\frac{1hr}{60\,\text{min}} = 0.3hr;\ v_2 = 0;\ v_3 = 5.5\frac{km}{hr};\ \Delta t_3 = 1.2hr$

(a) v_{total} = ? (b) Δx_{total} = ? (all directions are South)

$$v = \frac{\Delta x}{\Delta t} \Rightarrow (\Delta t)v = \frac{\Delta x}{\Delta t}(\Delta t) \Rightarrow v\Delta t = \Delta x \Rightarrow v_1\Delta t_1 = \Delta x_1 \Rightarrow \Delta x_1 = \left(6.5\frac{km}{hr}\right)(1.1hr) = 7.15km$$

$\Delta x_2 = v_2\Delta t_2 = (0)(0.3) = 0km$ & $\Delta x_3 = v_3\Delta t_3 = \left(5.5\frac{km}{hr}\right)(1.2hr) = 6.6km$

Part	Δt (hr)	v $\left(\frac{km}{hr}\right)$ South	Δx (km)
1	1.1	6.5	7.15
2	0.3	0	0
3	1.2	5.5	6.6

$\Delta x_t = \Delta x_1 + \Delta x_2 + \Delta x_3 = (7.15) + 0 + (6.6) = 13.75 \approx \boxed{14km\,South}$ Answer to Part (b)

Part (a) $\Delta t_t = \Delta t_1 + \Delta t_2 + \Delta t_3 = (1.1) + (0.3) + (1.2) = 2.6hr$

$$v_t = \frac{\Delta x_t}{\Delta t_t} = \frac{13.75km}{2.6hr} = 5.28846 \approx \boxed{5.3\frac{km}{hr}South}$$

Note: $\frac{v_1 + v_2 + v_3}{3} = \frac{7.15 + 0 + 6.6}{3} = 4.58\overline{3} \neq 5.28846 = v_{avg}$

This is only true if each part is for an equal amount of time.