Answer on Question 77019, Physics, Other

Question:

A train travel from station A to station B with a speed of 10 m/s. Then the train travels back with a speed of 15 m/s. Find the average velocity and average speed.

Solution:

a) The average velocity is defined as the displacement per unit time:

$$v_{avg} = \frac{displacement}{time\ taken}.$$

Because the train returns to the starting position, the displacement is equal to zero. Therefore, the average velocity of the train is equal to zero.

b) By the definition, the average speed is the total distance traveled divided by the total time:

$$v_{avg} = \frac{d_{tot}}{t_{tot}}.$$

Let the distance between station A and station B be d. Then, we can find the total distance:

$$d_{tot} = s_1 + s_2 = d + d = 2d.$$

Then, we can find the time that train needs to travel from A to B:

$$t_1 = \frac{s_1}{v_1} = \frac{d}{10\ \frac{m}{s}}.$$

Similarly, we can find time that train needs to travel from B to A:

$$t_2 = \frac{s_2}{v_2} = \frac{d}{15\ \frac{m}{s}}.$$

Then, we can find the total time:

$$t_{tot} = t_1 + t_2 = \frac{d}{10\ \frac{m}{s}} + \frac{d}{15\ \frac{m}{s}}.$$

Finally, we can find the average speed of the train:

$$v_{avg} = \frac{d_{tot}}{t_{tot}} = \frac{2d}{\dfrac{d}{10\,\dfrac{m}{s}} + \dfrac{d}{15\,\dfrac{m}{s}}} = \frac{2d}{\dfrac{10d}{60}} = 12\,\frac{m}{s}.$$

Answer:

a) The average velocity of the train is equal to zero.

b) $v_{avg} = 12\,\frac{m}{s}$.