

Physics 101
Quiz # 4
Chapter 9

Name : Solution

Id :

Sec. #: 26

A railroad car of weight 9800 N can roll without friction along a straight horizontal track. Initially a man of weight 490 N is standing on the car, which is stationary. What is the change in the velocity of the car if the man runs towards left with a speed of 20 m/s relative to the ground?

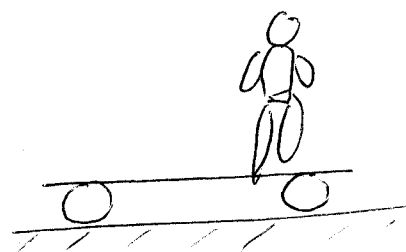
Let U_m , U_c be the speeds of the man and the car respectively.

The mass of the car

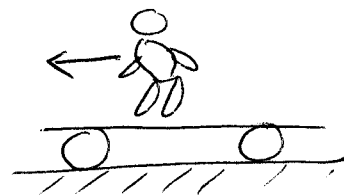
$$M = \frac{9800}{9.8} = 1000 \text{ kg}$$

The mass of the man is

$$m = \frac{490}{9.8} = 50 \text{ kg}$$



Initially



Finally

No external forces $\Rightarrow$ Momentum is conserved

$$(\vec{P}_{\text{tot}})_{\text{initially}} = (\vec{P}_{\text{tot}})_{\text{finally}}$$

$$\text{But } U_{mi} = U_{ci} = 0$$

$$\Rightarrow 0 = m U_{mf} + M U_{cf} = 50 \times (-20) + 1000 \times U_{cf}$$

$$\Rightarrow U_{cf} = 1 \text{ m/s}$$

i.e. car moves to the right with speed 1 m/s relative to the ground $\Rightarrow \Delta U_c = U_{cf} - U_{ci} = 1 \text{ m/s}$