Answer on Question #75243-Physics-Other

Four railroad cars, each of mass 2.50x10^4 kg, are coupled together and coasting along horizontal tracks at speed vi toward the south. A very strong but foolish actor, riding on the second car, uncouples the front car and gives it a big push, increasing its speed to 4 m/s southward. The remaining three cars continue moving south, now at 2 m/s.

a) find the initial speed of the four cars.

b) by how much did the potential energy within the body of the actor change ?

Solution

a) From the conservation of momentum:

$$4mv_i = 4m + 3m(2)$$

$$4v_i = 4 + 6$$

$$v_i = \frac{10}{4} = 2.5\frac{m}{s}.$$

b) From the conservation of energy:

$$\Delta E_p = -\Delta E_k = \frac{4m}{2}2.5^2 - \frac{4^2}{2}m - \frac{3m(2)^2}{2} = -1.5m = -3.75 \cdot 10^4 J.$$

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