Question

A blue lab cart is traveling west on a track when it collides with and sticks to a red lab cart traveling east. The magnitude of the momentum of the blue cart before the collision is 2.0 kilogram • meters per second, and the magnitude of the momentum of the red cart before the collision is 3.0 kilogram • meters per second. The magnitude of the total momentum of the two carts after the collision is

Solution. Use the Conservation of Momentum Principle:

If the net external force acting on a system of objects is zero, the total momentum p_{tot} of the system is conserved.

For this problem we have

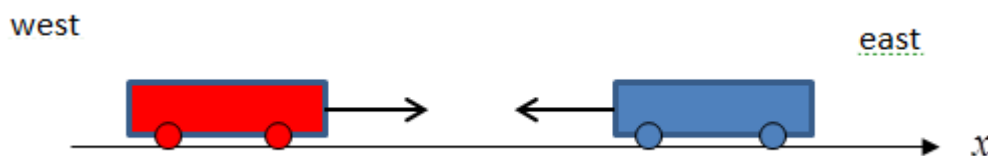$$p_{tot} = p_{red} + p_{blue} = \text{const}$$

where p_{red} is the magnitude of the momentum of the red cart before the collision

$$p_{red} = 3.0 \text{ kilogram} \bullet \text{meters per second}$$

and p_{blue} is the magnitude of the momentum of the blue cart before the collision

$$p_{blue} = -2.0 \text{ kilogram} \bullet \text{meters per second}$$

p_{blue} has the minus sign since blue cart moves towards the opposite of the red cart

Find the total momentum p_{tot} before the collision

$$p_{tot} = 3.0 - 2.0 = 1.0 \text{ kilogram} \bullet \text{meters per second}$$

Since the total momentum p_{tot} of the system is conserved, then the total momentum of the two carts after the collision is the same as before the collision

$$p_{tot} = 1.0 \text{ kilogram} \bullet \text{meters per second}$$

Answer: The magnitude of the total momentum of the two carts after the collision is 1.0 kilogram • meters per second.