Momentum 1

Play 2014

1. A bullet of mass $5\,\text{g}$ travelling at $450\,\text{m s}^{-1}$ strikes a target of mass $1.5\,\text{kg}$. After the collision the bullet and target stick together. Calculate the speed at which the target moves after the collision.

2. A basketball player throws the ball whilst travelling horizontally through the air (she is jumping). The initial speed of the player is $4\,\text{m s}^{-1}$ and the ball travels away from her at $19\,\text{m s}^{-1}$ (relative to her). If the player has a mass of $72\,\text{kg}$ and the ball has a mass of $600\,\text{g}$, calculate the speed of the player, relative to the ground, after the throw.

3. Two trolleys are held together by a piece of rope which acts against the spring. When the rope is cut the spring extends, pushing the trolleys apart. The spring is compressed by $3.0\,\text{cm}$ and has a spring constant of $35\,\text{N m}^{-1}$.

   (a) Calculate the energy stored in the spring.

   (b) Write an expression for the total kinetic energy of the system after the trolleys have been released.

   (c) Write an expression for the total momentum of the system after the trolleys have been released.

   (d) If the mass of trolley A is $200\,\text{g}$ and the mass of trolley B is $500\,\text{g}$, calculate the velocity of each trolley.