

## Energy and Momentum

*Sometimes we need to apply both energy conservation and momentum conservation.*

A ballistic pendulum is a device used to measure the speed of a bullet. A bullet of mass  $m$  is fired at a block of wood (mass  $M$ ) hanging from a string. The bullet embeds itself in the block, and causes the combined block plus bullet system to swing up a height  $h$ . What is  $v_0$ , the speed of the bullet before it hits the block?

First, is it correct to set the bullet's initial kinetic energy equal to the final gravitational potential energy of the block plus bullet? If not explain why not, and describe the method you would use instead to find the answer.

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Find an expression for the initial speed of the bullet.

Two balls hang from strings of the same length. Ball A, with a mass of 4 kg, is swung back to a point 0.8 m above its equilibrium position. Ball A is released from rest and swings down and hits ball B. After the collision ball A rebounds to a height of 0.2 m above its equilibrium position, and ball B swings up to a height of 0.05 m.

What is the speed of ball A just before the collision?

What is the speed of ball A just after the collision?

What is the speed of ball B just after the collision?

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What is the mass of ball B?

What type of collision is this?

super-elastic    elastic    inelastic    completely inelastic

Justify your answer in two different ways.