**SPH4U Energy and Momentum**

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1. **Calculate the final speed of a 1500 kg roller coaster if it has an initial speed of 16 m/s but reduces its elevation by 8.6 m by coasting down a frictionless incline. (5 marks)**

To begin with, we should use the idea of mechanical energy conservation.

Thus, the final speed of a 1500 kg rollercoaster with initial speed of 16m/s is .

1. **A 0.50 kg cue ball makes a glancing blow to a stationary 0.50 kg billiard ball. After the collision, the cue ball deflects with a speed of 1.2 m/s at an angle of 30.0o from its original path. Calculate the original speed of the cue ball if the billiard ball ends up travelling at 1.6 m/s. (7 marks)**

Let as the initial velocity of cue ball, while as the angle between the path of the billiard ball and cue ball. To begin with, consider the direction perpendicular to the original direction of the cue ball, which is y direction. According to the conservation of momentum principle, we can write the following.



Let us apply the conservation of the momentum principle to the original direction of the cue ball, which is x direction.

Thus, the original ball of the cue ball is .

1. **A bullet of mass 45 g is fired at a speed of 220 m/s into a 5.0 kg sandbag hanging from a string from the ceiling. The sandbag absorbs the bullet and begins to swing. To what maximum vertical height will it rise? (8 marks)**



Let us mean the velocity of a bullet while is the height of the light bulb after getting collided with a mass.

Let us calculate the initial momentum.



Let us calculate the final momentum.

Using the concept of momentum conservation and rewriting the equation as follows.

Since the kinetic energy is equal to the gravity potential energy, we can render the following involved.

Thus, the maximum vertical height to be risen is .