Exercises in Physics
Assignment # 12

Date Given: June 30, 2022
Date Due: July 7, 2022

P1. (2 points) The ballistic pendulum is a simple device to measure projectile velocity v by observing the maximum angle θ to which the box of sand with embedded projectile swings. Calculate the angle θ if the 60-g projectile is fired horizontally into the suspended 20-kg box of sand with a velocity $v = 600\,\mathrm{m/s}$.

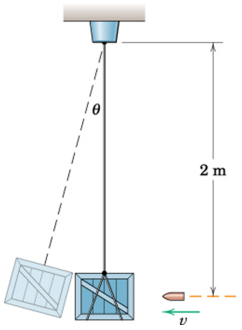

Figure 1: Illustration to Problem 1.

P2. (2 points) A tennis player strikes the tennis ball with her racket while the ball is still rising. The ball speed before impact with the racket is $v_1 = 15\,\mathrm{m/s}$ and after impact its speed is $v_2 = 22\,\mathrm{m/s}$, with directions as shown in the figure. If the 60-g ball is in contact with the racket for 0.05s, determine the magnitude of the average force $\boldsymbol{R}$ exerted by the racket on the ball. Find the angle β made by $\boldsymbol{R}$ with the horizontal.

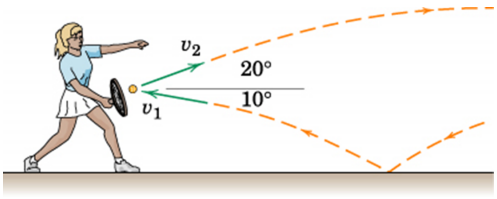

Figure 2: Illustration to Problem 2.

P3. (1 point) As a check of the basketball before the start of a game, the referee releases the ball from the overhead position shown, and the ball rebounds to about waist level. Determine the coefficient of restitution e and the percentage n of the original energy lost during the impact.

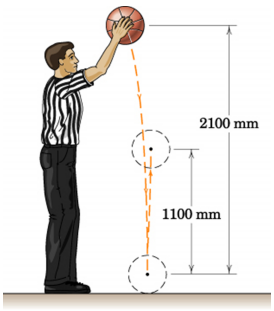

Figure 3: Illustration to Problem 3.

P4. (3 points) A child throws a ball from point A with a speed of 15 m/s. It strikes the wall at point B and then returns exactly to point A. Determine the necessary angle α if the coefficient of restitution in the wall impact is $e = 0.5$.

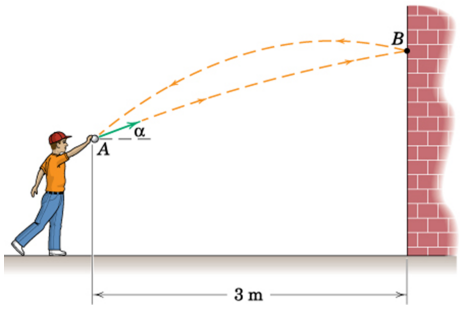

Figure 4: Illustration to Problem 4.