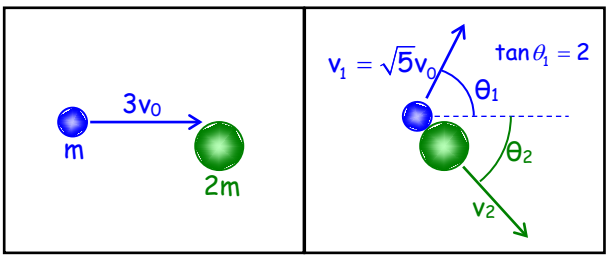
HOMEWORK SET 8: CONSERVATION LAWS
Due Wednesday, September 27, 2023

1) The figure shows the result of a collision between two objects of unequal mass.

a) Find the speed v_2 of the larger mass after the collision and the angle θ_2.

b) Show that the collision is elastic.

USE RATIOS FOR THE SINES & COSINES INSTEAD OF FINDING THE ANGLES USING YOUR CALCULATOR.

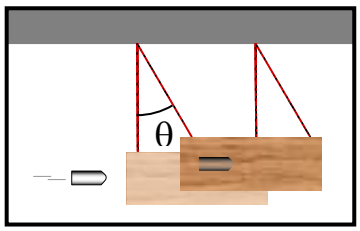


2) A 6 kg projectile is launched at an angle of 30° with the horizontal and an initial speed of 40 m/s. At the top of its flight, it explodes into two parts with masses of 2 and 4 kg. The fragments move horizontally just after the explosion, and the 2 kg piece lands back at the launch site.

a) Where does the 4 kg piece land? (MOMENTUM IS CONSERVED IN THE EXPLOSION, KINEMATICS WILL TELL YOU THE SPEED OF THE 2 kg PIECE SO YOU CAN FIND v_0 FOR THE 4 kg PIECE.) x_4 = 212m

b) Compute the kinetic energy of the projectile just before the explosion and the total kinetic energy of the fragments just after the explosion to find the energy of the explosion. ΔE = 7.18 kJ

3) A woman of mass m stands at the edge of a rotating circular turntable. The turntable has a radius *R*, moment of inertia *I*, and rotates without friction. The angular velocity about the vertical axis through the center of the turntable is ω_0. The woman walks radially inward. What is the final angular velocity of the system? Assume $m_{woman}R^2 = 3I$ and that the woman has a moment of inertia of *I/10* when she is standing at the center (HINT: USE THE PARALLEL AXIS THEOREM TO FIND HER MOMENT OF INERTIA AT THE EDGE.). $\omega_f = 3.73\ \omega_0$



4) A 16 g bullet is fired into the bob of a ballistic pendulum of mass 1.5 kg. When the bob is at its maximum height, the strings make an angle of 60° with respect to the vertical. The length of the pendulum is 2.3 m. Find the initial speed of the bullet.

DON'T FORGET TO CONSERVE MOMENTUM!! v_b= 449.8 m/s

5) A 2.0 kg block slides down a frictionless curved ramp from rest onto a rough horizontal surface (on to the brown surface) until it stops at d.

a) Write an expressions for the block's speed at the bottom of the ramp and the work done by friction in the horizontal slide.

b) For h = 2 m and μ_k = 0.25, find the distance the block slides.