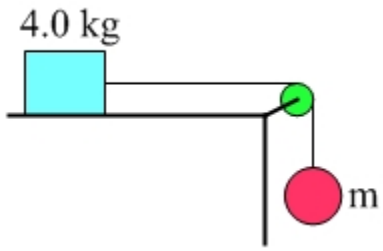
PROBLEM 1 – 10 points

A block with a mass of 4.0 kg is connected to a ball, which has an unknown mass *m*, by means of a string that passes over a frictionless pulley. Assume the mass of the pulley is negligible. The coefficient of kinetic friction between the block and the horizontal surface is $\mu_K = 0.050$. The system is released from rest, and the block and ball accelerate. When the ball has dropped through a height of 2.0 m its speed is 4.0 m/s.
Use g = 10 m/s^2.



[4 points] (a) Calculate the work done by friction on the block over the 2.0 m distance moved by the block.

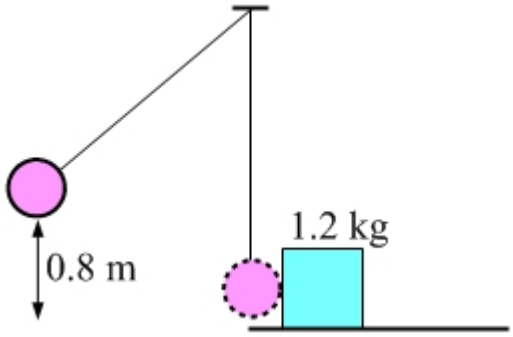
[6 points] (b) Calculate the mass of the ball.

PROBLEM 2 – 15 points

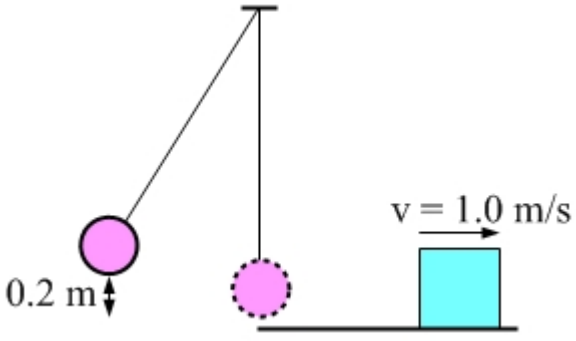
A ball with an unknown mass *m* is tied to a string and hung from the ceiling so that it rests against a block that has a mass of 1.2 kg. The ball is pulled back, raising it by 0.80 m, and released from rest. The ball then swings down and collides with the block. After the collision the block has a velocity of 1.0 m/s to the right on the frictionless surface, while the ball rebounds to a height of 0.20 m.
Use g = 10 m/s^2.

[3 points] (a) What is the velocity of the ball just before the collision?

[3 points] (b) What is the velocity of the ball just after the collision?



[5 points] (c) What is the mass of the ball?



[4 points] (d) What kind of collision is this?

[ ] elastic [ ] inelastic [ ] completely inelastic

Justify your answer:

PROBLEM 3 – 10 points

In a collision between two carts in the physics lab, the situation is as follows:

Before the collision, cart A, with mass m, has a velocity of v to the right.
Before the collision, cart B, with a mass $2m$, has a velocity of v to the left.

After the collision cart A has a velocity of v to the left.

[4 points] (a) What is the velocity of cart B after the collision?

[4 points] (b) Is kinetic energy conserved in this collision? Briefly justify your answer.

[2 points] (c) Which cart exerts more force on the other during the collision?

[ ] Cart A exerts a larger-magnitude force on B than B exerts on A.

[ ] Cart B exerts a larger-magnitude force on A than A exerts on B.

[ ] The two carts exert forces of equal magnitudes on one another.