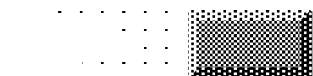
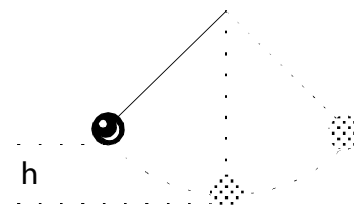


AP PhyzJob: The Skid, The Swing, and The Ballistic Pendulum



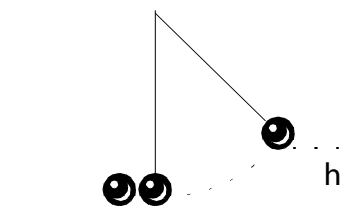
1. Consider a 1 kg box sliding along a frictionless surface at 10 m/s. It crosses over to a rough surface (such that $\mu = 0.5$). How far will it skid before coming to a stop? (Hints: kinetic energy, work, friction.)
2. Consider a 1 kg box sliding along a frictionless surface at 20 m/s. It crosses over to a rough surface (such that $\mu = 0.5$). How far will it skid before coming to a stop?
3. Consider a 2 kg box sliding along a frictionless surface at 10 m/s. It crosses over to a rough surface (such that $\mu = 0.5$). How far will it skid before coming to a stop?
4. Consider a 1 kg box sliding along a frictionless surface at 10 m/s. It crosses over to a rough surface (such that $\mu = 1.0$). How far will it skid before coming to a stop?

5. The highest point in the swing of the bowling ball pendulum was 1.5 m above the lowest point. How fast was the bowling ball moving when it passed through the lowest point?

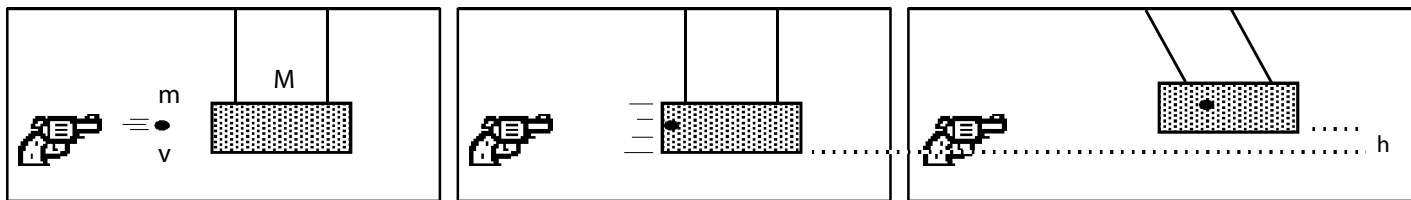


6. A 5 kg bowling ball has 30 kg·m/s of momentum as it passes through its lowest point. How high above the lowest point will it get?

7. A 5 kg bowling ball rolling at 8 m/s collides elastically with a 5 kg bowling ball pendulum weight. The first bowling ball comes to a stop upon collision. How high will the second ball rise above its low point?



8. The Ballistic Pendulum. Before the advent of sophisticated electronic timing devices, the muzzle velocity of bullets emerging from guns was often determined by the following method. A bullet of mass m is fired at an unknown speed v into a block of mass M , which is suspended as a pendulum. The bullet lodges in the pendulum block, which swings up to a height h above its equilibrium position (low point). Knowing m , M , and h , it is possible to determine the bullet speed v .



(In your answers below, use only m , M , h , v , g , and constants.)

- What is the initial momentum of the bullet?
- What is the momentum of the bullet and block when the bullet lodges in the block?
- What is the speed of the bullet and block system when the bullet lodges?
- What is the kinetic energy of the bullet and block system when the bullet lodges?
- How much potential energy will the bullet and block have when they reach their maximum height h ? Write two expressions for this.
- Now, write an expression for the muzzle speed v of the bullet in terms of m , M , h , g , and constants.
- If the mass of the bullet was 9.5 g and the mass of the block was 5.4 kg and the pendulum rose to a height of 6.3 cm, what was the bullet's speed?
- Compare the initial energy of the bullet before it hits the block to the energy of the bullet and block together right when the bullet lodges. How much energy is "lost?" What happened to this energy?