

1. A spring must give a 1250-kg satellite a speed of 2.20 m/s relative to an orbiting space shuttle, applying a maximum acceleration of 4.50g. Ignore the spring's mass, the recoil kinetic energy of the shuttle, and changes in gravitational potential energy. What must the force constant of the spring be?

2. A 70-kg circus performer is shot from a spring cannon. The spring is of negligible mass and has a force constant of 900 N/m. The performer will compress the spring with a force of 4150 N. He will encounter an average friction force of 55 N on his 4.5 m path in the barrel. The end of the barrel is 3.0 m above his initial rest position. At what speed will he emerge?

3. A 7.50-g bullet is fired horizontally into a 1.50-kg wooden block resting on a horizontal surface. The coefficient of kinetic friction between the block and the surface is 0.25. The bullet sticks in the block, and the block slides 0.310 m. What was the bullet's initial speed?

4. A rocket is fired in deep space, where gravity is negligible. The rocket has an initial mass of 6500 kg, ejects gas at a relative velocity of magnitude 2200 m/s, and needs to reach an initial acceleration of 22.0 m/s². How much gas must be ejected in the first second?

5. A flywheel is spinning at 650 rpm. Power is abruptly cut. After 25 unpowered seconds, the flywheel has made 250 complete revolutions. How many seconds after the power outage does the flywheel stop spinning?

6. Four spheres, 0.1 kg each, are arranged in a square 0.5 m on a side, connected by rods of negligible mass. Find the moment of inertia of the system about an axis (a) through the center of the square, perpendicular to its plane (coming out of the figure); (b) through the center of the square, horizontal to its plane, passing through two opposite spheres (as pictured).

