Energy and block assignment

Assignment – Physics 1 1 . Two carts, one twice the mass of the other, experience the same force for the same time. What is their difference in momentum? What is their difference in kinetic energy? 2. A 12 g bullet is fired horizontally into a 96 g wooden block initially at rest on a horizontal surface. After impact, the block slides 7. 5 m before coming to rest. If the coefficient of kinetic friction between block and surface is 0. 60, what was the speed of the bullet immediately before impact? You have to use the conservation of the total energy of the system to do this problem:

Initially, you have, in the total of your system, a bullet that is moving at a certain speed and a block that is stationary: Initial total energy = Potential Energy + Kinetic Energy + Elastic Energy There is no potential energy nor is there a spring in the system so no elastic energy. Initial total energy = Kinetic Energy. Since the only thing that is moving in the system is the bullet, then you calculate the kinetic energy of the system at the initial state (before the bullet hits the block): Kinetic energy = 1/2mv2 where m = 0. 012kg so kinetic enery = . 5 * 0. 012 * 0. 6v2 We don’t know the initial velocity of the bullet because that is what we are trying to find. Now, you say that Initial Energy of the system = Final energy of the system because no Energy is lost or created, all energy is merely transfered or transformed. Initial Energy = Final Energy Final Energy: At the end, you have: A block with a bullet lodged inside it that is not moving. Therefore No Kintetic Energy, No Potential Energy and no Elastic Energy. However, your block did “ Work” in order to combat the friction force and to move the block over a distance of 7. 5 meters.

This energy was lost in the friciton and was expulsed as heat when the block was moving. So final Energy = Work done to move the block from O to 7. 5 meters. Work = Force * distance where distance is 7. 5 meters The force is the friction force because that is what the block had to combat in order to move. Friction force = u*N N = (mass of bullet + mass of block)* 9. 81 u = 0. 65 F = 0. 65 * 0. 012 * 0. 1 * 9. 81 = 7. 23918 Newtons = 7. 24 N Work = Force * distance = 7. 24 * 7. 5 = 54. 3 Joules So initial energy = final energy 0. 006V2 = 54. 3 v2 = 9050 v = 95. 131487952202240322969478674 91 v = 95 m Is

So the bullet was moving at 95 m/s right before it hit the block. 3. A ball bounces upward from the ground with a speed of 14 m/s and hits a wall with a speed of 12 m/ s. How high above the ground does the ball hit the wall? Ignore air resistance. 4. A 200 g mass is attached to a spring of spring constant k. The spring is compressed 15 cm from its equilibrium value. When released the mass reaches a speed of 5 m/s. What is the spring constant (in N/m)? 5. A 34-g bullet traveling at 120m/s embeds itself in a wooden block on a smooth surface. The block then slides toward a spring and collides with it.

The block compresses the spring (k= 100 N/m) a maximum of 1. 25 cm. Calculate the mass of the block of wood. 6. If a force of 300N is exerted upon a 60 kg mass for 3 seconds, how much impulse does the mass experience? 7. An 80-kg man and his car are suddenly accelerated from rest to a speed of 5 m/s as a result of a rear-end collision. Assuming the time taken to be 0. 3s, find: a) the impulse on the man and b) the average force exerted on him by

the back seat of his car. 8. An airplane propeller is rotating at 1900 rev/min. a. Compute the propeller’s angular velocity in rad/s. b.

How long in seconds does it take for the propeller to turn through 30. 0 degrees? 9. A disk with a 1. 0-m radius reaches a maximum angular speed of 18 rad/s before it stops 30 revolutions after attaining the maximum speed. How long did it take the disk to stop? 10. A net torque of 36 N. m acts on a wheel rotating about a fixed axis for 6 s. During this time the angular speed of the wheel increases from O to 12 rad/s. The applied force is then removed, and the wheel comes to rest in 75 s. a. What is the moment of inertia of the wheel? b. What is the magnitude of the frictional torque? c. How many revolutions does the wheel make?