College Physics 201 Mock Exam 2

Important equations:

Kinetic Energy (K)=1/2mv2 Potential Energy (U)=(Force)(Displacement) Momentum (P)=mv

Impulse (I)=∑F(t)=Pf-P0 Center of Mass (COM)=(m1x1+m2x2)/(m1+m2)

Torque (T)=(Force)(Lever arm) Ѡ==2π/T Fx=-kx

x(t)= Acos(Ѡt+δ) F=Y(ΔL/L0)A

1. Find the center of mass of the following two dimensional object.

MA=50kg

MB=12kg

MC=90kg

Assume Block C and A are the same size.

Y=8

A

B

Y=6

C

X=8

1. Assume you shoot a bullet from a gun with a muzzle velocity of 800 m/s. What is the recoil velocity experienced by the gun if the gun is 80 times as heavy as the bullet?
2. A car crashes into a wall at 45 m/s and is brought to rest in 0.09 seconds. Calculate the average force exerted on a 75kg test dummy by the seat belt.
3. What is the period of oscillation of a mass of 40 kg on a spring with constant k = 10 N/m? What is the angular frequency?[[1]](#footnote-1)
4. A mass of 2 kg is attached to a spring with constant 18 N/m. It is then displaced to the point x = 2. How much time does it take for the block to travel to the point x = 1?
5. A 4 kg mass attached to a spring is observed to oscillate with a period of 2 seconds. What is the period of oscillation if a 6 kg mass is attached to the spring?
6. A mass of 2 kg oscillating on a spring with constant 4 N/m passes through its equilibrium point with a velocity of 8 m/s. What is the energy of the system at this point? From your answer derive the maximum displacement, xm of the mass.
7. A vertical steel girder with a Young’s Modulus of 2.0E11 Pa is compressed 0.5mm when the weight of the upper portion of a building is placed upon the girder. The cross sectional area of the girder is 1 square meter and the original length is 20 meters. What is the amount of mass of the building resting on this particular girder?
8. A rope is attached to an 80kg block to pull it up a frictionless incline at a constant speed to a height of 3-meters.
   1. Is energy conserved?
   2. Calculate the amount of work done upon the crate.
9. A skier standing on a 100m high hill skis down to the bottom of the icy slope, then back up another hill with height 80m. What is the skier’s speed at the top of the 80m hill?
10. A force of 16N is applied to a door at a 45 degree and with respect to the door in the direction of the hinge. If the torque on the door is 2.3 Nm, what is the length of the lever arm, and the length of the door?
11. A plank is placed on a single point of stability, or a pivot point, 20cm to the right of the plank’s center of mass. A block of mass 12kg is then placed on the plank 40cm to the left of the pivot point. What is the weight of the plank if the system is in equilibrium?

1. 1 SparkNotes Editors. “SparkNote on Oscillations and Simple Harmonic Motion.” SparkNotes LLC. n.d.. http://www.sparknotes.com/physics/oscillations/oscillationsandsimpleharmonicmotion/ (accessed March 5, 2014) [↑](#footnote-ref-1)