1st Semester Exam Physics Practice Problems

1. Planet X has a mass of M and a radius of R. Planet Y has twice the mass and half the radius of Planet X. Solve for the gravitational constant of planet Y in terms of the gravitational constant of planet X.
2. A cube has a length of 10. cm ± 1.0 cm. Calculate the error of the volume of the cube.
3. An Olympian runs two laps around a 400 m track, starting and finishing at the same point in lane one. Show her displacement and distance traveled.
4. Calculate the energy required for a 99 kg man to jump up onto a 1.0 m box.
5. Calculate the power necessary for a 30% efficient bulldozer to push a 250 kg boulder 85 m across a gravel lot (μ = 0.42) in under a minute.
6. A piano is being held by two cables as movers try to get it into a NYC apartment. The cable coming from the window to the E makes a 45o angle between the piano and the building. The cable from the building to the W is at a 60o angle. Calculate the tension in each cable.
7. Two Honda civics (m=880 kg) are driving down the highway, one behind the other. The first car (v=40 m/s) notices an upcoming wreck, so the driver starts to brake. The car behind (v=45 m/s) initially had 75 m of gap between cars before the first car brakes. Assuming they brake with the same force (a = -3.0 m/s2), how long does the 2nd car have for reaction time?
8. A baseball is hit from a height of 1.0 m with an exit velocity (u) of 63 m/s at a launch angle of 22.5o. The ball has a mass of 0.30 kg.
   1. Calculate the horizontal distance the ball travels.
   2. Calculate the time it takes until the ball lands.
   3. Find the peak height of the baseball.
9. A rollercoaster car (m=220 kg) reaches the bottom of the loop (r=23 m) traveling a tangential velocity of 14 m/s. Calculate the normal force.
10. A solid sphere (m=25 kg) is rolled down a ramp of 25o from a height of 7.4 m. Calculate the velocity of the sphere at the bottom of the ramp assuming the friction is negligible.
11. A block (m=25 kg) is pushed up a ramp of 25o from the base to a height of 7.4 m. The ramp has a coefficient of friction of 0.30. What is the minimum force necessary to push the block up the ramp?
12. A spring (k=1600 N/m) in a pinball machine is compressed 5 cm. When the spring is released it elastically strikes a pinball (m=0.11 kg).
    1. Calculate the velocity of the pinball
    2. The pinball still moving at the same velocity (traveling S) strikes another pinball of the same mass. One pinball has a final direction of SW, while the other has a final direction of SE. Find each pinball’s resultant velocity.
13. A winch (assume cylinder) rotates at 360 rpm. The winch has a radius of 15 cm and a mass of 40 kg. Calculate the angular power generated by the winch.