NAME: _____ **ID#:** _____

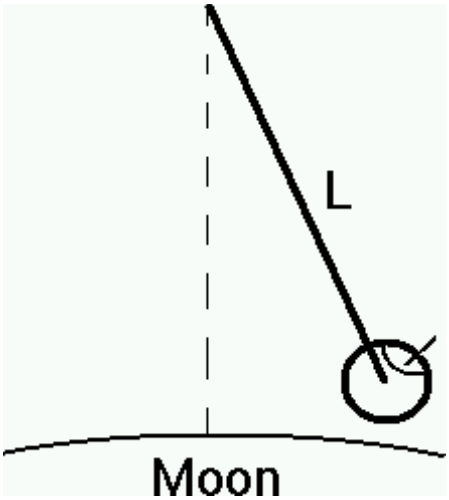
7) An apple of mass 0.1 kg is located on the surface of the moon. The moon's radius is $R_M = 1.73 \times 10^6$ *m*, and its mass is $M_M = 7.36 \times 10^{22}$ *kg*. The gravitational constant is $G = 6.67 \times 10^{-11}$ $m^3/kg\,s^2$.

a) Calculate the gravitational potential energy of the apple. (10 pts)

b) If you throw the apple vertically up with an initial speed of 1000 m/s, what maximum height will the apple reach before falling back down? Measure the height from the center of the moon. (10 pts)

c) The apple is back on the surface of the moon. Calculate the magnitude of the acceleration on the apple due to the moon's gravity. You must show all steps of your calculation. (10 pts)

For part d) , you have made a simple pendulum with the apple on the moon, using a string of length L = 2 *m*. At t = 0, you raise the pendulum to an initial angle of $\theta_o = 7^o$ and then release it.

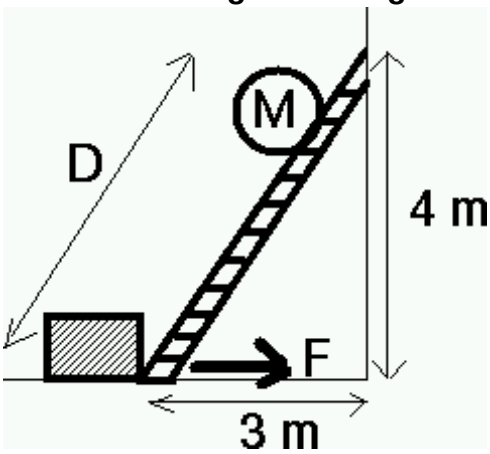


d) Write down the equation for the pendulum's angle as a function of time. Your answer should not contain any variables other than time t. (20 pts)

$\theta(t) =$ _____

NAME: _____ **ID#:** _____

8) You are climbing up a ladder of length L = 5 *m* and mass M_L = 80 *kg*, positioned as shown below. Your mass is M = 100 *kg*. The wall and the floor are both <u>frictionless</u>, and you place a heavy box on the floor that can exert a contact force on the foot of the ladder up to the maximum of F = 900 *N* . When you have climbed up a distance D along the ladder, the ladder is on the verge of falling.



a) Calculate the normal force exerted by the floor on the foot of the ladder. (10 pts)

b) Calculate the force exerted by the wall to the top of the ladder. (10 pts)

c) Taking the foot of the ladder as the pivot point, how much torque is exerted by the wall force of part b)? (10 pts)

d) Taking the foot of the ladder as the pivot point, how much torque is exerted by the weight of the ladder? (10 pts)

e) What is **D** when the ladder is about to fall? (10 pts)