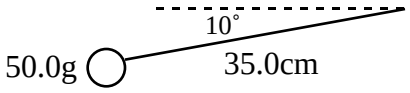
Name:_____

Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 20 points. You must show your work in a logical fashion starting with the correctly applied physical principles which are on the last page. Your score will be maximized if your work is easy to follow because partial credit will be awarded.

1. The initial mass of a rocket is 1.50×10^4kg and the initial acceleration is 5.00m/s^2 upward. (a)Find the weight of the rocket and (b)find the upward force on the rocket exerted by the exhaust gases from the engine. (c)If this upward force is the "action" force acting on the rocket, find the size of the "reaction" force. (d)Name the object that the reaction force acts on.

2. A 50.0g ball is twirled overhead at the end of a 35.0cm string. The string makes a 10.0˚ angle with the horizontal. (a)Draw the forces that act on the ball is the sketch at the right. (b)Find the speed of the ball and (c)the number of revolutions per minute.



3. Charles "Gabby" Street was a catcher for the Washington Senators from 1909 to 1911. He reputedly caught a 145g baseball dropped from the top of the Washington Monument which is 152m tall. Modern wind tunnel measurements suggest that the maximum speed of a dropped baseball should be about 42.7m/s. Find (a)the work done by gravity on the falling ball, (b)the net work done on the ball during its fall and (c)the work done by air resistance during the fall.

4. A 60.0kg bungee jumper steps off a 55.0m high bridge. The unstretched length of the cord is 30.0m and it stretches an additional 20.0m when the jumper is at the lowest point. Find the spring constant of the cord assuming air resistance is negligible and the cord is massless.

5. The force of electrical attraction between a proton and an electron in a hydrogen atom is given by $F = \frac{a}{x^2}$ where $a=2.30\times10^{-28}\,N\cdot m^2$ and x is the distance between them. Find the work done by the electric force if the electron is initially 200×10^{-12}m away and moves toward the proton until it is 50.0×10^{-12}m away. Explain physically (not mathematically) why your answer should be positive.