Name: _____

Please show all of your work, no credit will be given if there is no work. Partial credit will be given where warranted, so show me your physics reasoning. Do not forget to give units for numeric answers and use appropriate significant figures.

This quizzam is open notes and open book but not open internet, i.e. do not google the problems for solutions.You have 45 minutes to complete this quizzam. Good luck!

1. (2 points) Give an example of a situation where there is both force and displacement, but the force does no work. Why is no work done in this case?

2. (2 points) What is a conservative force and how does this relate to potential energy?

3. (1 point) Under what circumstances is momentum conserved?

4. (3 points) A 65.0 kg sprinter accelerates from rest to 7.0 m/s over a distance of 20.0 m. Using energy considerations, find the average force she exerts on the track during this acceleration? (Hint: use the work-energy theorem)

5. (3 points) A child's pogo stick has a spring with a force constant of $k = 2.70 \times 10^4$ N/m. How high will a 45 kg child jump if the spring can be compressed by 10 cm?

6. (2 points) A ball with an initial velocity of 15 m/s bounces off of a vertical wall at the top of its trajectory (i.e. it is going horizontally when it hits the wall). What was the impulse delivered by the wall, if the ball travels at the same speed after the bounce as before it?

7. (2 points) A large blob of mud weighing 0.5 kg is thrown at an initially stationary 1.0-kg cart. If the mud is traveling horizontally with a velocity of 1 m/s prior to the impact and sticks to the cart, how fast will the combined cart and mud travel as a result of this impact?

8. BONUS (3 points) While playing billiards, the cue ball is shot towards a second billiard ball (initially at rest) with a speed of 1.3 m/s. If the second ball travels at an angle of 10° in order to enter the pocket, what is the velocity (magnitude AND direction) of the cue ball after this impact? (Hint: this is an elastic collision between two objects with the same mass. You may use the fact that $\theta_1 - \theta_2 = 90°$ for such a collision.)