Mechanics **Name** :_____

Test 2

1) Consider the following static systems. [10 pts each]

a. Pulley system shown with hanging mass $M = 10$ kg.

Determine T_1, T_2, T_3, T_4, T_5, T_6.

b. Mass m_1 and m_2 are stacked in a corner elevated at an angle θ.

Draw a free body diagram for each mass. Determine the magnitude of each force incident on each mass.

2) Consider the following kinetic system. [20 pts]

A modified Atwood's machine with masses $m_1 = 1$ kg, $m_2 = 4$ kg and $m_3 = 8kg$ is shown. The surface beneath m_2 has a coefficient of kinetic friction $\mu_k = 0.5$.

Determine the tensions T_1 and T_2, friction force F_f and the acceleration a.

Determine the work by the friction force and the change in kinetic energy of the system after moving $\Delta x = 0.5$ meters.

3) 1-D Collisions. [20 pts]

A 8kg block moving at 5m/s to the right strikes a 2kg block moving at 10m/s to the left.

Determine the final velocities if the masses collide inelastically.

Determine the percent of kinetic energy lost in the inelastic collision.

Determine the final velocities if the masses collide elastically.

4) Consider the earth and moon orbital system. [20 pts]

Determine the force the earth exerts on the moon.

Determine the velocity of the moon.

Determine the potential, kinetic and total energy of the moon.

Determine the energy required to pull the moon away from the earth (escape).

5) A rapid-fire peashooter shoots 1.0 gram peas, 5 times a second, at a speed of 30 m/s. The peashooter is powered by a spring compressed 10 cm which holds 20 Joules of potential energy.

Determine the k constant of the spring.

Determine the average recoil force on the peashooter while it is firing.

Determine the power of the peashooter.

Determine how many peas the peashooter can shoot before running out of spring energy.