Physics Problems March-2009

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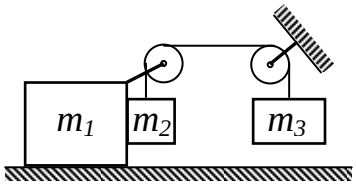
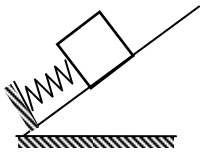
Q1. For the arrangement shown in the figure the pulleys and the strings are all ideal. What will be the acceleration of the block m_1 and the tension in the string if the system is released from an initial state of rest?



Q2. A thin light rope passed over a rough, fixed, horizontal rod has a mass M hanging on one end. The minimum required mass to be hung on the other end, to keep the system at rest is m ($< M$). Find the additional mass to be added on to m so that M may just start rising up.

Q3. The system shown in the figure is initially at rest with the spring compressed to the maximum possible extent which can still keep the block at rest. The friction coefficient of the inclined surface is μ. Suddenly the friction between the plane and the block vanishes, somehow!! Find the inclination of the plane for the block to stop moving when the spring comes to its natural length?



Q4. Two small masses m each are attached to the ends of a just taut ideal string of length $2l$ and the system at rest on a smooth horizontal surface. The midpoint of the string is pulled by applying a constant horizontal force F_o directed perpendicular to the line joining the masses. If the masses stick to each other on collision, what is the heat generated in the process? (This can also be solved very elegantly without calculus!!)

Q5. Two small blocks of masses m_1 & m_2 are kept on a smooth horizontal floor at distances $2d$ & d from a smooth & elastic vertical wall. Then m_2 is given some impulsive velocity. After some time the separation between the blocks remains constant. Find this separation & the ratio m_1/m_2.