※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

(1) The searchlight in Fig. 1 casts a spot of the light along the face of a wall that is located 100m from the searchlight. Determine the magnitudes of the velocity and acceleration at which the spot appears to travel across the wall at the instant $\theta = 45°$. The searchlight rotates at a constant rate of $\dot\theta = 4\,rad/s$. (15%)　Fig. 1
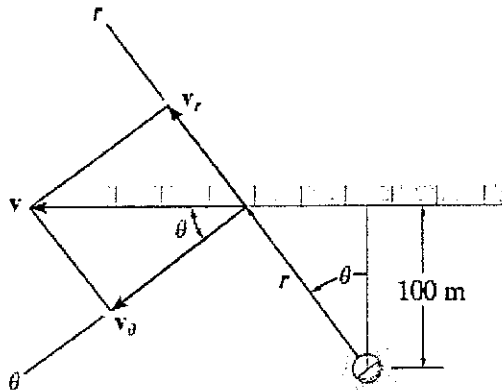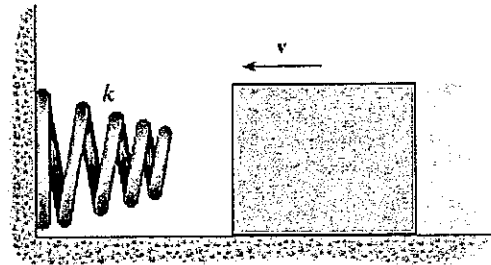

Fig.　1

Fig.　2

(2) The 1.5-kg block slides along a smooth plane and strikes a nonlinear spring with a speed of $v=4m/s$. The spring is termed "nonlinear' because it has a resistance of $F = kx^2$, where $k=900N/m^2$. Determine the speed of the block after it has compressed the spring $x = 0.2m$. (15%)　Fig 2

(3) The pendulum consists of the 3-kg slender rod and the 5-kg thin plate. Determine the location $\bar{y}$ of the center of mass G of the pendulum, then calculate the moment of inertia of the pendulum about an axis perpendicular to the page and passing through G. (15%)　Fig 3
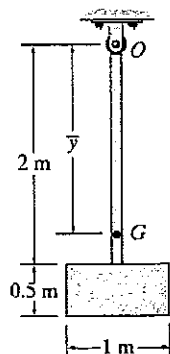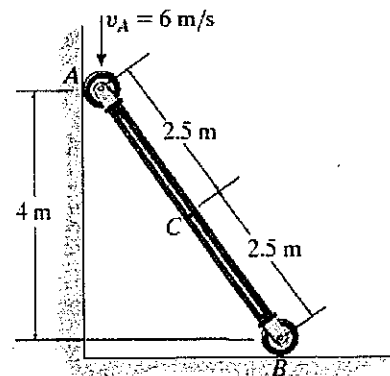

Fig. 3

Fig. 4

(4) Determine the angular velocity of the rod and the velocity of point C at the instant shown. (15%)　Fig. 4

(5) The 50-kg cylinder has an angular velocity of 30rad/s when it is brought into contact with the horizontal surface at C. If the coefficient of kinetic friction is $\mu_k = 0.2$, determine how long it will take for the cylinder to stop spinning. What force is developed in link AB during this time? For the computation, neglect the weight of the link. (20%) Fig. 5
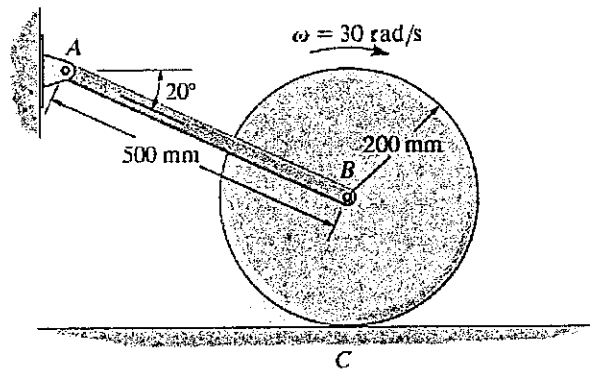

Fig 5.

(6) If a force F=200N is applied to the 30-kg cart, **show** that the 20-kg block A will slide on the cart. Also determine the time for block A to move on the cart 1.5m. The coefficients of static and kinetic friction between the block and the cart are μ_s=0.3 and μ_k=0.25. Both the cart and the block start from rest. (20%) Fig. 6
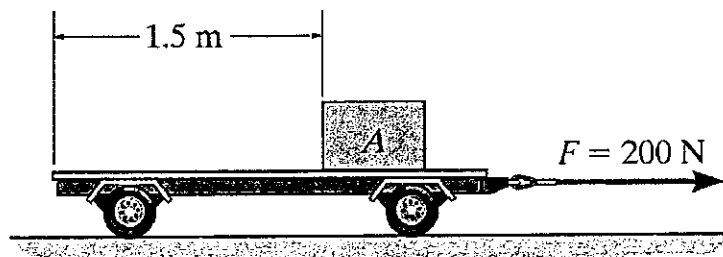

Fig 6