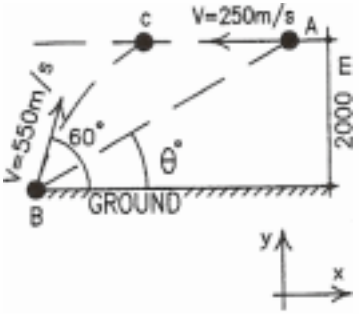
MECH 230 DYNAMICS
PREVIOUS QUIZ 1

No.1– (25%)

Particle A is moving along a horizontal line at an altitude of 2000 m with a constant velocity of 250 m/s in the direction shown. A gun fires particle B at a velocity of 550 m/s at an angle of 60° as shown and hits particle A at C.



5% 1- Write the horizontal and vertical equations of position and velocity as a function of time for particles A and B.

10% 2- Determine the instant of time when particle B meets particle A at C.

10% 3- Determine the angle θ between the horizontal and the line of site BA when the gun is fired.

No.2– (25%)

The position vector of a particle is given by $\mathbf{r} = 12\,t^2\,\mathbf{i} + 3\,t^3\,\mathbf{j}$, where **r** is measured in meters and t in seconds.

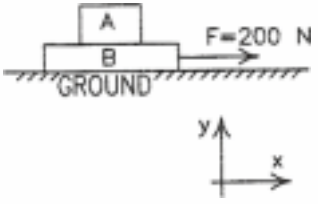
10% 1- Determine the velocity and acceleration at t=2 seconds. Show these vectors on a clear sketch.

10% 2- Determine the tangential and normal components of acceleration at t=2s.

5% 3- Determine the radius of curvature of the path for the position at t=2s.

No.3– (25%)

The 20 kg block A lies on the 10 kg block B. A 200 N horizontal force is applied on block B. The static coefficient of friction between block A and block B is $\mu_s=0.2$. The static coefficient of friction between block B and the ground is $\mu_s=0.3$.



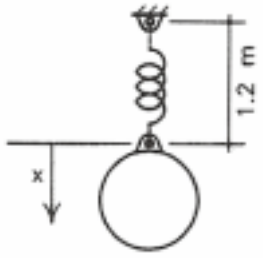
10% 1- Draw the free body diagrams and the kinetic diagrams of blocks A and B separately. Draw, also, the combined free body diagram and the kinetic diagram of blocks A and B.

5% 2- Check that block A slips on block B.

10% 3- Determine the accelerations of blocks A and B.

No.4– (25%)

A 27 kg sphere connected to a spring of 1.2 m free length and a stiffness of k=1750 N/m is released from rest at x=0 m.



5% 1- Draw the free body diagram and the kinetic diagram of the sphere.

10% 2- Determine the maximum elongation of the spring.

10% 2- Determine the maximum speed of the sphere.