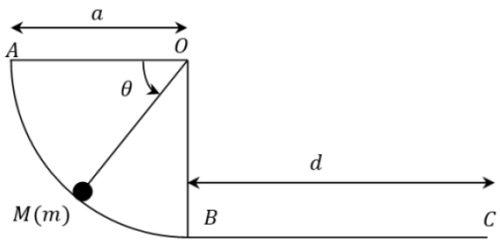
SW n° 06 of Mechanic
Work and Energy

Exercise 1

A particle of mass m, initially at rest in A, slides without friction on the circular surface AOB of radius a.

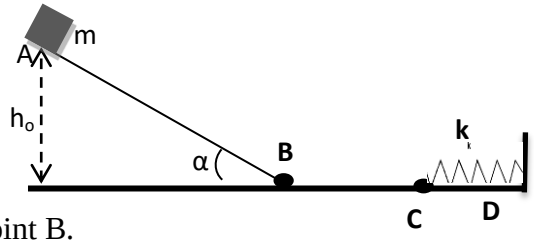


1) Determine the work of weight from A to M.
2) Determine the work of the surface-particle contact force m.
3) Determine the potential energy E_p of m at the point M ($E_p(B) = 0$).
4) Use the kinetic energy theorem to determine the speed of m at point M, deduce its kinetic energy E_c .
5) Calculate the mechanical energy E_m.
6) Show E_c , E_p and E_m ($0 < \theta < \pi 2$). Discuss.
7) The circular surface AOB is connected to a horizontal part BC, there is friction between B and C, the particle stops at a distance d from B. Determine the coefficient of kinetic friction. Given d = 3a = 3m.

Exercise 2

Consider a small block of mass m =5kg dropped without initial velocity at point A of an inclined plane at an angle α=30° to the horizontal. Point A is at a height h_0=5m from the horizontal.

1- Knowing that the coefficient of dynamic friction on plane AB is μ_d=0.2, applying the fundamental principle of dynamics:



- What is the nature of the motion on plane AB?
- Calculate the speed of the block when it reaches point B.

2- After passing through point B at speed V_B, the mass arrives at point C. Knowing that the coefficient of friction is negligible on plane BC :

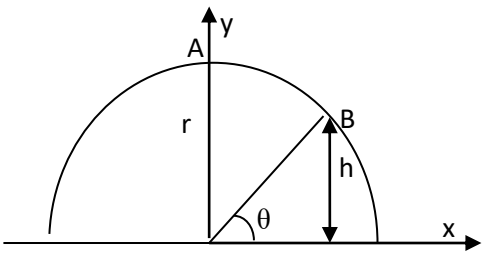
- Deduce the speed at point C?
- Calculate the maximum compression of the spring, given a stiffness constant equal to k=100N/m? (g =10 m/s^2).

Exercise 3

A piece of ice M of mass m slides without friction over the outer surface of an igloo, which is a half-sphere of radius r with a horizontal base.

At t=0, it is released from point A without any initial velocity.

- Find the expression for the velocity at point B, as a function of g, r and θ.
- Using the fundamental relation of dynamics, determine the expression of $|\vec{N}|$the reaction of the igloo on M at point B as a function of velocity v_B.



- At what height does M leave the sphere?
- At what speed does M arrive at the axis (Ox)?