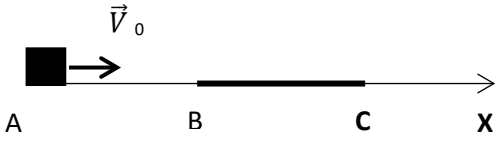
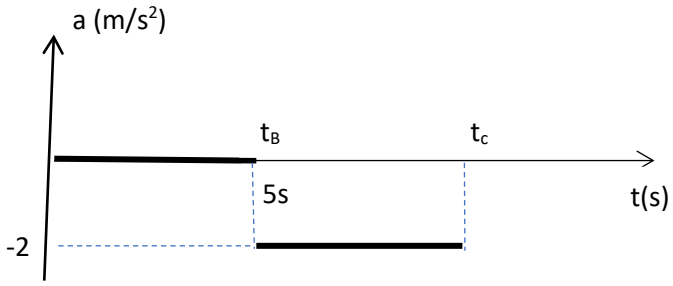
Tutorials 4 P1 (DYNAMIQUE)

(Du 19/112023 Au 07/12/2024)

Exercise 1 an object of mass m = 0.5Kg is launched at t=0s from the origin X_0 = 0m (point A), with an initial speed V_0 = 10m/s, on a horizontal track ABC (X axis), constituted of a smooth part (without friction) AB, and a rough part (with friction) BC. The object stops at point C, g = $10ms^{-2}$.

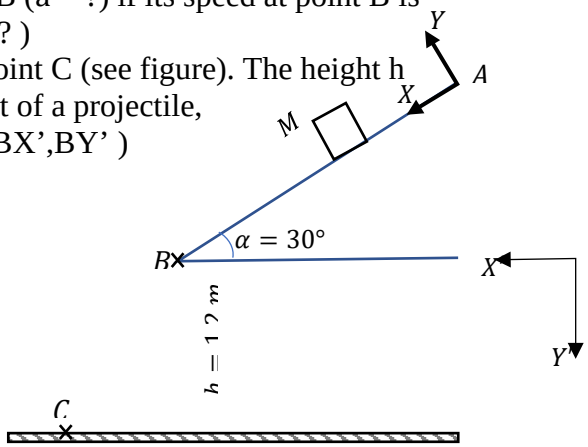
1/ Draw a diagram of the forces acting on the AB part then on the BC part.
2/ Give the nature and the equations of movement of the two parts AB and BC.
3/ Deduce the distances AB and BC.
4/ Calculate the coefficient of kinetic friction μ over the BC part.





Exercice 2

A mobile M of mass m = 100g is launched from a point A with a speed V_A on a rough plane (with friction), inclined at an angle α = 30° with respect to the horizontal (see figure).
We give AB = 30cm, g = 10 m/s², the coefficient of kinetic friction μ_c = 0,2.
1/ Calculate the acceleration of the mobile M on the path AB ($\vec{a}$ = ?) if its speed at point B is V_B = 2 m/s, deduce the value of the speed at point A(V_A = ?)
2/ At point B, the mobile M falls, it reaches the ground at point C (see figure). The height h from point C is h = 1,2 m. Using the equations of movement of a projectile,
a/ Give the coordinates of point C (X'c,Y'c) in the frame(BX',BY') (see figure).
b/ Deduce the speed of the mobile M at point C (V_c = ?).



Exercice 3

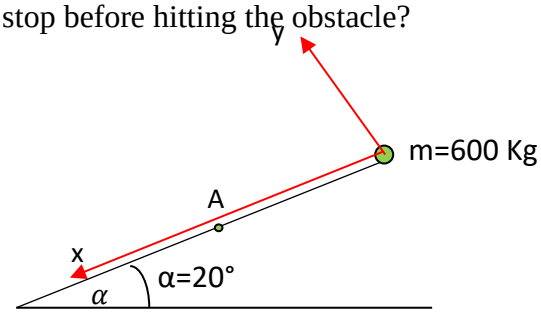
A mobile assimilated to a material point of mass m=600Kg descends on an inclined plane making an angle α=20° with the horizontal. The coefficient of kinetic friction between the surfaces in contact is μ_C = 0,3. From point O, we launch the mobile downward with an initial speed v_0=45Km/h (figure below). We take g =$10m/s^2$

1. Determine the acceleration a_1 of the mobile M over the path OA, give the nature of movement. We give OA= 200 m.

At point A, the mobile sees an obstacle in front of him located at a distance of 100 m and begins to brake (point B) after 0,7s (reaction time of the mobile).

2. Calculate the speed v_A at point A and the distance Δx covered during this time knowing that it keeps its speed constant.

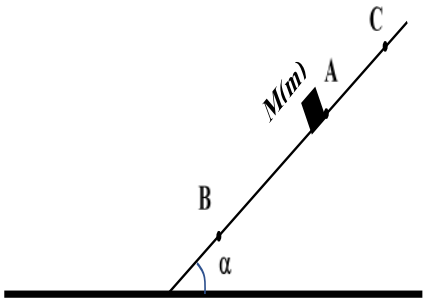
3. If the braking force of the mobile M is Fr = 6000 N. Determine the acceleration a_2 of the mobile in this case, Will the mobile be able to stop before hitting the obstacle?



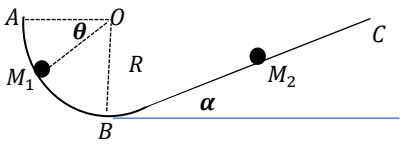
Exercice 4 :

An object M, which we will assimilate to a material point, of mass m = 0.1Kg, slides on a slope of an inclined plane that makes an angle $\alpha = 20°$ with the horizontal.

1- The object is abandoned from point A without initial speed. Considering the frictions negligeable, determine the nature of movement of M. Justify.
2- Calculate the time taken by the mass to arrive at point B if AB = 2 m.
3- In fact, this duration is 1.3s, by admitting the existence of frictions characterised by one coefficient of kinetic friction μ:
   a) Represent the forces acting on M in this case.
   b) Deduce the value of this coefficient of friction μ.
4- The object is now launched from point B towards point A with a speed of 3 m/s. Determine the position of point C where the speed of the object is canceled ($BC = ?$):
   a) If we neglect the frictions.
   b) If the coefficient of friction is $\mu = 0.11$.



Exercice 5: A material point departs from A with an initial speed V_0 at t=0, on the trajectory ABC. AB is a quarter of a circle with radius R and BC is a plane forming an angle α with the horizontal such that BC = l. The movement takes place without friction on the AB part and with friction μ on the BC part.
1. Find the speed at point M_1.
2. Find the speed at point M_2.
3. Deduce the speed at the arrival point.



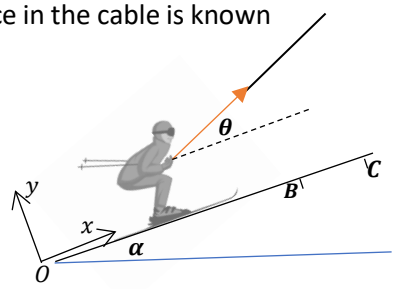
Exercice 6 :

The position vector of a body M of mass m = 3 Kg is given by:

$$\overrightarrow{OM} = t(t-3)\,\vec{i} - 2t^2\,\vec{j} + (2t-1)\,\vec{k}$$

1/ Find the force $\vec{F}$ acting on this body.
2/ Caclulate its moment $\vec{M}(\vec{F})$ with respect to the origin.
3/ Calculate its momentum.
4/ Calculate its angular momentum with respect to the origin.

Exercice 7 : A skier of mass m = 40 kg is pulled by a cable on a slope with a constant inclination **α =15°** with respect to the horizontal. He moves with a constant velocity $\vec{v} = v_0\vec{\imath} = 45\,\vec{\imath}$ m/s (see figure). The angle between the cable and the slope is **θ = 30°**. We neglect the friction exerted by the air over the skier, but we keep account of the friction of the ground on the skis. The force in the cable is known and equals T = 250 N.



1- Draw a diagram of the forces acting on the skier.
2- Using Newton laws, calculate the coefficient of kinetic friction **μ** between the snow and the skis.
3- Calculate the skier's momentum.
4- Determine the acceleration vector which the skier is subjected to if he lets go the pull cable at point B.
5- What will be the skier's speed at the height of the path (point C) and give the nature of movement. Take g=10ms^{-2} ; the distance BC = 118 m.