

Abdelhafid Boussouf University Centre of Mila,

Institute of Sciences and Technology

Department of Technical sciences

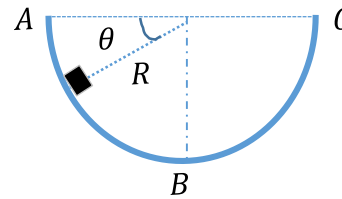
Series N°4: Work and energy

Exercise 1

A particle m moves on the semi-spherical path from the point A without initial velocity.

1- If the all path is smooth

- Give the velocity of m at a point on the path (\widehat{AB}) depending on the angle θ .
- Find the maximum height (h) that the particle reaches.

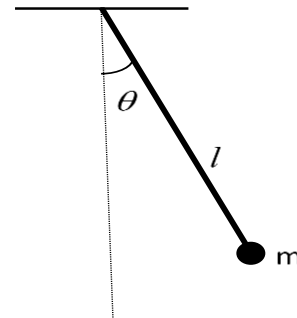


2- If the path \widehat{AB} is rough and the path \widehat{BC} is smooth.

- Find the work done by the friction force if the particle arrives at B with a velocity $V_B = \sqrt{gR}$.
- Find the maximum height (h) that the particle reaches
- If the particle leaves the point A with an initial velocity V_0 and reaches the point C with a zero speed ($V_C = 0$). Find the work done by the friction force.

Exercise 2

A simple pendulum ($l = 20\text{cm}, m = 60\text{g}$) was shifted by an angle $\theta = 20^\circ$ from its equilibrium position and allowed to oscillate.

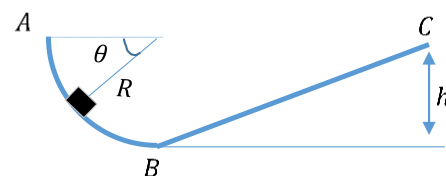


- 1- If we eliminate the friction force, find the speed in the vertical position V_B .
- 2- If the $V_B = 0.2\text{ms}^{-1}$ deduce the work done by the force friction

Exercise 3

A mass M moves along the path ABC (figure).

AB is a quarter of the circle, and AC is a straight line inclined at an angle θ and of height $2h=BC$. M moves without friction on part AB but with kinetic friction on part BC. The mass starts moving from the point A. By using the notions of work and energy, find:



- The velocity (in function of θ, R and g) at a point m_1 on the path AB. Deduce the velocity at B (V_B).
- The velocity (in terms of θ, x, g and μ_k) at a point m_2 on the path BC.
- What is the height (h) that the particle can reach the point C with zero speed.

Exercise 4

A particle moves from the origin to the point $c(1,1)$ under the effect of the force $\vec{f} = (4x^3 - y^2)\vec{i} - 2xy\vec{j}$. Find the work done by this force if the particle takes the path:

- From the origin to the point $a(0,1)$ then to the point c .
- From the origin to the point $b(1,0)$ then to the point c .
- Along the path $y = x^2$.

Exercise 5

A force $f = 6t$ (N) acts on a particle whose mass is 2 kg . If the particle starts from rest, find the work done by the force during the first 2 s.