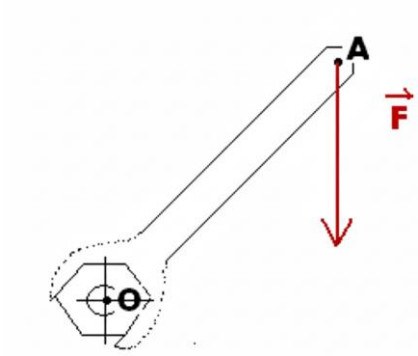
The moment of a force

Exercise 01 :

To tighten a nut, we can consider that the hand exerts a force applied at point **A**, located at the end of the wrench. The axis of rotation **Δ** of the nut is horizontal; the force lies in a plane perpendicular to the nut's axis, and its direction is vertical.

Calculate the **moment of this force** with respect to the axis **(O, Δ)**, given that: $\left(\overrightarrow{OA}, \vec{F}\right) = 50^{\circ}; AO = 20\ cm; F = 20N$.

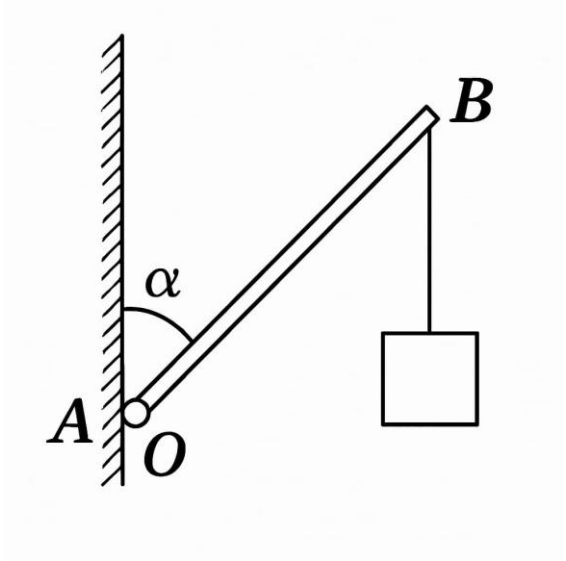


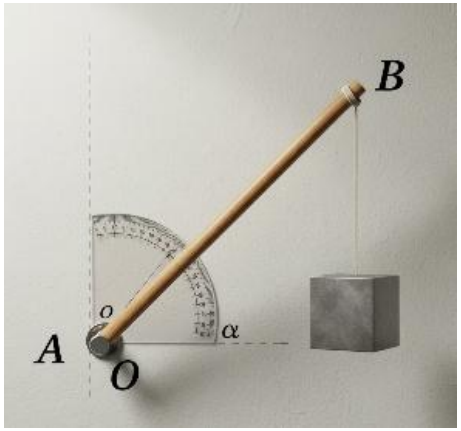
Exercise 02 :

A rod of negligible weight is fixed into a wall at point **A**. It supports at point **B** a load of weight **2500 N**.

Calculate the moment of this load about the horizontal axis passing through the built-in end **A**.

Given: **AB = 1.5 m**, $\alpha = 55^{\circ}$



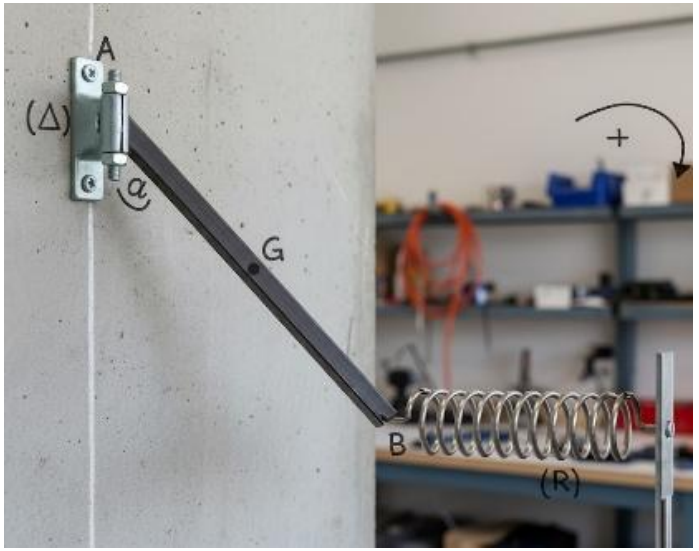


Exercise 03 :

The system shown in the figure consists of:

- **AB:** a homogeneous rod of mass **M** and length **L**, pivoting about a fixed axis located at point **A**.
- **R:** a horizontal helical spring of stiffness **k**, attached at point **B**.

At equilibrium, the rod forms an angle **α** with the vertical.

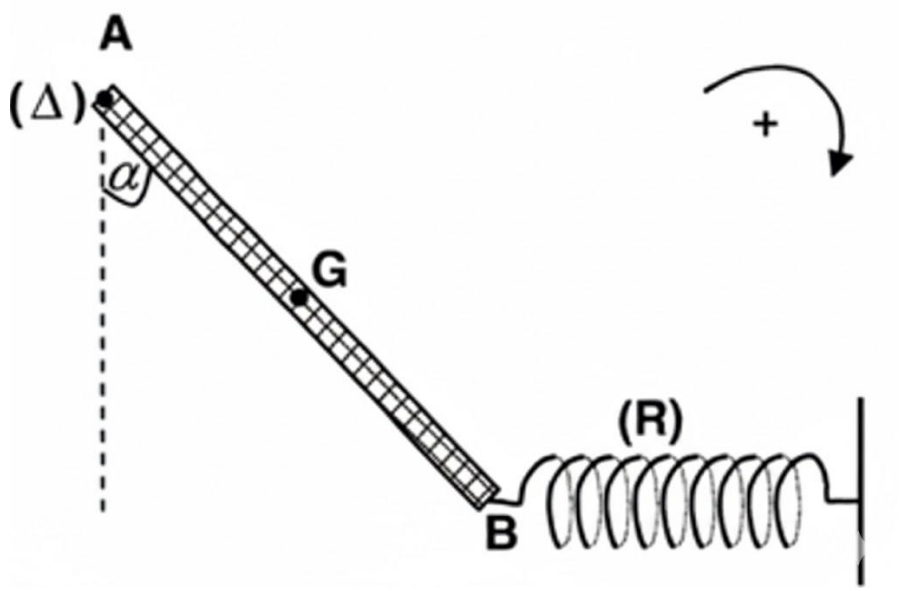


1. Draw the free-body diagram of the rod at equilibrium, showing all forces acting on it.

2-a. Write the expression of the moment produced by each force with respect to the axis through point **A**.

2-b. State the condition of rotational equilibrium of the rod.

3. Derive the expression of the spring extension **a** as a function of **m**, **k**, **α**, and **L**, then perform the numerical calculation. Given: $k = 100\ N{\cdot}m^{-1}$; $M = 500\ g$; $\alpha = 45°$



4. Determine the characteristics (magnitude, direction and line of action) of the reaction force exerted by the pivot at point **A**.