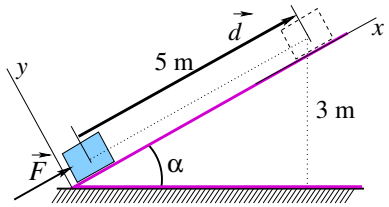
Tut #4, L1 Work and Energy — December 2023

Exercise 1 : You lift a book of mass m vertically and place it on a shelf at a height h. a) Express the work you've done on the book. b) What is the work done by the gravitational force on the book ? c) What is the net (total) work done on the book ? For simplicity, assume that the book is lifted without acceleration.

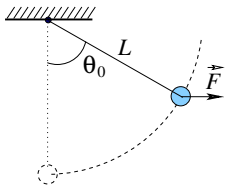
Exercise 2 : A block 10 kg is to be raised from the bottom to the top of an incline 5 m long and 3 m off the ground at the top (See figure i). a) Assuming no friction between the block and the incline, how much work must be done by a force $\vec{F}$ parallel to the incline pushing the block up at constant speed. b) How about the work a man would do if he were to raise the block vertically without using the incline ? c) make a comment. Take $g = 9.8\ \mathrm{m/s^2}$.

Exercise 3 : A man with a mass of 80 kg ascends at constant speed a staircase that is 20 m tall within 10 s. (a) Determine the power required to elevate the person. (b) If the man's body operates at 25% efficiency, calculate the expended power.



Exercise 4 : A block of mass m is moving with speed v_0 on a horizontal surface toward a spring attached to a wall as shown. The spring has a force constant (spring stiffness, ثابت صلابة نابض) k and its mass is negligible. a) Find the maximum distance d the spring will be compressed if the surface is frictionless. b) Repeat the previous question if the surface is rough with a coefficient of kinetic friction μ_k.

Exercise 5 : A horizontal force $\vec{F}$ very slowly lifts the bob (كتلة أو ثقل) of a simple pendulum, of length L, from a vertical position to a point at which the string makes an angle θ_0 to the vertical. The magnitude of $\vec{F}$ is varied so that the bob is essentially in equilibrium at all times. What is the work done by the force on the bob ?



Exercise 6 : A block of mass 2 kg slides, on a horizontal surface, a distance $d = 3$ m before coming to rest. Knowing that its initial velocity is $v_i = 4\ \mathrm{m/s}$, what is the coefficient of sliding (kinetic) friction on the surface ? *Hint : From A to B, total energy variation = work of frictional force.*