Answer on Question #40130, Physics, Mechanics | Kinematics | Dynamics

a) A force F=A(x÷a-1) is acting on a particle along the x-axis. Determine the work done by the force in moving the particle from x=0 to x=2a.

b) A block of mass 6.0 kg slides from rest at a height of 2.0 m down to a horizontal surface where it passes over a 1.5 m rough patch. After crossing this patch it climbs up another incline which is at an angle of 30° to the ground. The rough patch has a coefficient of kinetic friction. μk=0.25. What height does the block reach on the incline before it comes to rest?

Solution

a) A force acting on a particle along the x-axis is

$$F(x) = A\left(\frac{x}{a} - 1\right).$$

The work done by the force F in moving the particle from x=0 to x=2a:

$$W = \int_0^{2a} A\left(\frac{x}{a} - 1\right) dx = A\left[\frac{x^2}{2a} - x\right]\Big|_0^{2a} = A\left(\frac{(2a)^2}{2a} - 2a - 0\right) = A \cdot 0 = 0.$$

Answer: 0.

b) $h_1 = 2.0\ m$ – initial height of block, h_2 – final height of block, $m = 6.0\ kg$ – mass of block, $\mu_k = 0.25$ - coefficient of kinetic friction, $d = 1.5\ m$ – distance on horizontal rough surface.

According to the law of conservation of energy initial potential energy of block is equal to sum f final potential energy of block and work done against friction force:

$$mgh_1 = mgh_2 + \mu_k mgd.$$

The final height of block:

$$h_2 = h_1 - \mu_k d = 2.0 - 0.25 \cdot 1.5 = 1.6\ m.$$

Answer: $1.6\ m$.