

Potential Energy

Formulae: $E_p = Fd$ $E_p = mgh$

Example Problems:

1. A 15.0 kg object is lifted from the floor to a vertical height of 2.5 m. What is the potential energy (gravitational) of the object with respect to the floor?

$$\begin{aligned} E_p &= mgh \\ &= (15.0 \text{ kg})(9.81 \text{ m/s}^2)(2.50 \text{ m}) \\ &= 368 \text{ J} \end{aligned}$$

NOTE: Gravitational potential energy is usually expressed in relation to some point. (Example: with respect to the floor.)

2. An archer pulls on the bow string with a force of 12.0 N while drawing the arrow back a distance of 2.0×10^{-1} m. Calculate the potential energy of the bow-arrow system.

$$\begin{aligned} E_p &= Fd \\ &= (12.0 \text{ N})(2.00 \times 10^{-1} \text{ m}) \\ &= 2.40 \text{ J} \end{aligned}$$

Practice Problems:

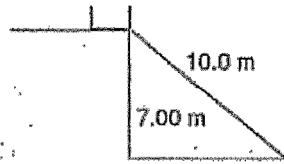
1. A 25.0 N object is held 2.10 m above the ground. What is the potential energy of the object with respect to the ground?

(52.5 J)

2. An uncompressed spring is 20.0 cm in length. What is the potential energy of this spring when an average force of 65.0 N compresses it to a length of 13.5 cm?

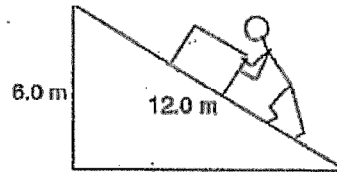
(4.2 J)

3.



A 2.75 kg box is at the top of a frictionless incline as shown in the diagram. What is the potential energy of the box with respect to the bottom of the incline?

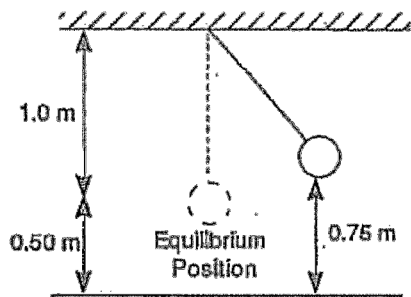
5.



A 2.00×10^2 kg object is pushed to the top of an incline as shown in the diagram. If the force applied along the incline is 6.00×10^2 N, what is the potential energy of the object when it is at the top of the incline with respect to the bottom of the incline?

(189 J)

4.



The bob of a pendulum has a mass of 2.0 kg. This bob is pulled sideways so that it is 0.75 m above the table top. What is the potential energy of the bob with respect to the equilibrium position?

(1.2×10^4 J)

(4.9 J)