Potential Energy
(Page 247)

Potential energy is the energy stored by an object due to its position or condition.

For all forms of potential energy, there is no absolute zero position or condition. You must assign a reference position (or establish a reference line or zero line) to determine potential energy.

↳ $E_g = 0$

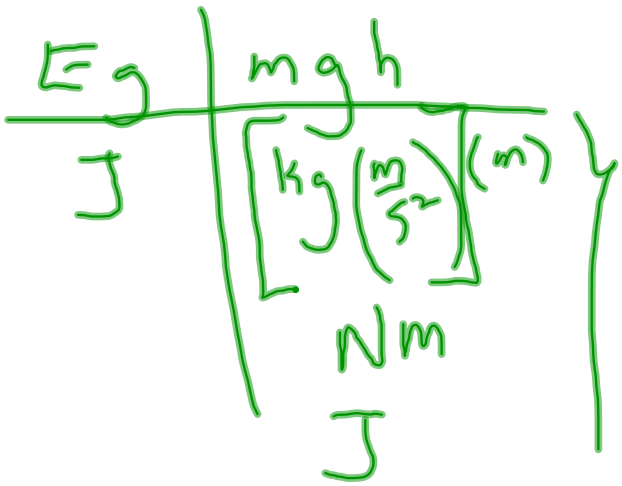
Gravitational Potential Energy

Gravitational potential energy is the potential energy an object has because of its position above Earth's surface.

$$E_g = mgh$$

E_g -> gravitational potential energy (J)
m -> mass (kg)
g -> magnitude of the acceleration due to gravity (m/s^2)
h -> height (m)

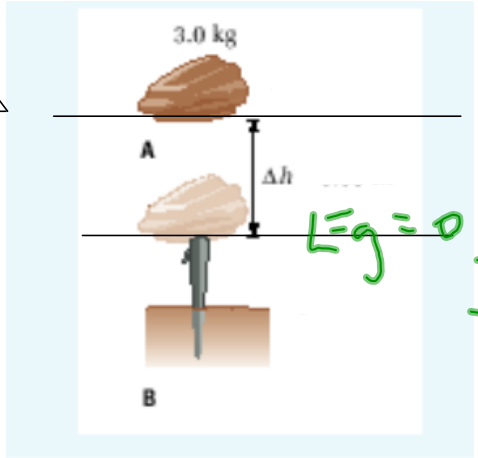
Check Units



MODEL PROBLEM

Calculating Gravitational Potential Energy

You are about to drop a 3.0 kg rock onto a tent peg. Calculate the gravitational potential energy of the rock after you lift it to a height of 0.68 m above the tent peg.



$E_g = 0$ reference level -> $E_g = 0$ J, h = 0 m

zero line

$E_g = mgh$

$E_g = (3.0)(9.80)(0.68)$

$E_g = 20$ J

Textbook: Page 250, PP # 27 -29

L1
#28. density = mass / volume
* 1 mL = 1 cm³

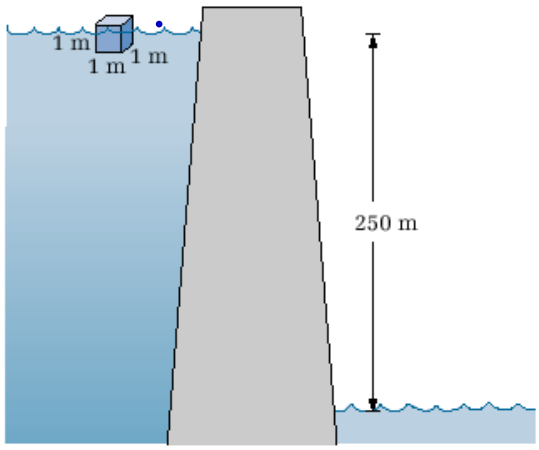
PRACTICE PROBLEMS

27. A framed picture that is to be hung on the wall is lifted vertically through a distance of 2.0 m. If the picture has a mass of 4.45 kg, calculate its gravitational potential energy with respect to the ground.

28. The water level in a reservoir is 250 m above the water in front of the dam. What is the potential energy of each cubic metre of surface water behind the dam? (Take the density of water to be 1.00 kg/L.)

L1

29. How high would you have to raise a 0.300 kg baseball in order to give it 12.0 J of gravitational potential energy?



mass = (1000 L)(1.00 kg / L) ⇒ 1000 kg

$(1\text{ m})^3 \times \left(\frac{1\text{ cm}}{10^{-2}\text{ m}}\right)^3 \times \frac{1\text{ mL}}{1\text{ cm}^3} \times \frac{10^{-3}\text{ L}}{1\text{ mL}} = \frac{10^{-3}}{10^{-6}} = 1000\text{ L}$

Work-Gravitational Potential Energy Theorem
(Page 251)

$$W = \Delta E_g$$

$$W = E_{gf} - E_{gi}$$

$$W = mgh_f - mgh_i$$

$$Fd = mgh_f - mgh_i$$

Textbook: Page 254, PP # 30-33

PRACTICE PROBLEMS

30. A student lifts her 2.20 kg pile of textbooks into her locker from where they rest on the ground. She must do 25.0 J of work in order to lift the books. Calculate the height that the student must lift the books.

31. A 46.0 kg child cycles up a large hill to a point that is a vertical distance of 5.25 m above the starting position. Find

(a) the change in the child's gravitational potential energy

(b) the amount of work done by the child against gravity

32. A 2.50 kg pendulum is raised vertically 65.2 cm from its rest position. Find the gravitational potential energy of the pendulum.

33. A roller-coaster train lifts its passengers up vertically through a height of 39.4 m from its