Gravitational Potential Energy Quiz 2.4

Fill in the blanks.

1. In order to calculate gravitational potential energy you need to know mass, change in height and the constant 9.80 m/s^2.
2. A base level is some arbitrary reference point.
3. If an object is thrown vertically, at maximum height the gravitational potential energy will be equal to the E_T of the object.
4. In any system, total mechanical energy will be equal to the sum of E_g and E_k.
5. At maximum height, determine the gravitational potential energy of a 52 g golf ball that has been thrown vertically 8.3 m. 4.2 J

Problems

1. A 12.6 kg box is at the top of a frictionless incline.

What is the gravitational potential energy of the box with respect to the bottom of the incline?

$m = 12.6\ kg$
$g = 9.80\ m/s^2$
$\Delta h = 7.6\ m$

$E_p = mg\Delta h$
$= (12.6\ kg)(9.80\ m/s^2)(7.6\ m)$
$= 940\ J$

2. A 210 kg weight is lifted from the floor to a point 2.5 m above the floor.
   a) What is the gravitational potential energy relative to the floor?

$m = 210\ kg$
$\Delta h = 2.5\ m$
$g = 9.80\ m/s^2$

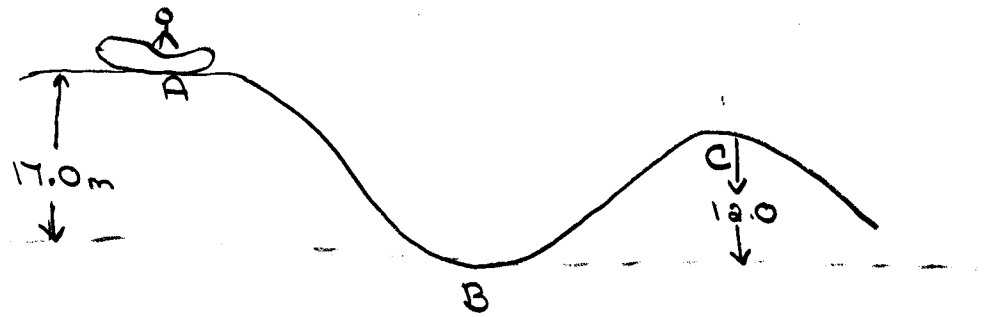
$E_p = mg\Delta h$
$= (210\ kg)(9.80\ m/s^2)(2.5\ m)$
$= 5100\ J$

   b) What is the gravitational potential energy relative to the lifters shoulders which is 1.8 m from the floor?

$m = 210\ kg$
$\Delta h = 2.5\ m - 1.8\ m = 0.7\ m$
$g = 9.80\ m/s^2$

$E_p = mg\Delta h$
$= (210\ kg)(9.80\ m/s^2)(0.7\ m)$
$= 1400\ J$

3. A group of friends is having a great time tobogganing down a hill. The mass of the friends and the toboggan is 250 kg.



a) Calculate the gravitational potential energy at point A.

$m = 250\text{kg}$
$g = 9.80\ \text{m/s}^2$
$\Delta h = 17.0\text{m}$

$E_p = mg\Delta h$
$= (250\text{kg})(9.80\ \text{m/s}^2)(17.0\text{m})$
$= 41650\text{J}$

$E_p = 42000\text{J}$

b) Determine the total mechanical energy at point A.

$E_T = E_p + E_k$ Since $E_k = 0$ $E_T = 42000\text{J}$

c) Calculate the speed of the toboggan at point B.

Since the gravitational energy will be zero $E_T = E_k$

$E_k = \frac{1}{2}mv^2$

$42000\text{J} = \frac{1}{2}(250\text{kg})v^2$ $v = 18\ \text{m/s}$

d) Calculate the speed of the toboggan at point C.

$E_T = 42000\text{J}$
$m = 250\text{kg}$
$\Delta h = 12.0\text{m}$
$g = 9.80\ \text{m/s}^2$

$E_T = E_k + E_g$

$E_T = \frac{1}{2}mv^2 + mg\Delta h$

$42000\text{J} = \frac{1}{2}(250\text{kg})v^2 + (250\text{kg})(9.80\ \frac{\text{m}}{\text{s}^2})(12.0\text{m})$

$42000\text{J} = 125v^2 + 29400$

$v = 10.\ \text{m/s}$