1. How fast does a 5 kg toy car have to move to have the same amount of KE as a 200 kg wagon moving west at 10 m/s? b) Does the toy car have to move west to have the same amount of KE?

$$KE_W = \frac{1}{2} m_W V_W^2$$

$$KE_W = \frac{1}{2}(200)(10^2)$$

$$KE_W = 10{,}000\ J$$

$$KE_W = KE_T$$

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$$10{,}000 = \frac{1}{2} m_T V_T^2$$

$$10{,}000 = \frac{1}{2}(5) V_T^2$$

$$V_T = 63.2\ \frac{m}{s}$$

$\frac{m_W}{m_T} = 40$

$\frac{V_T}{V_W} = 6.3$

CONFIRMS SENSITIVITY OF KE EQUATION; MORE SENSITIVE TO V.

Dec 16-8:46 AM

Potential energy - gravitational PE_g

Is the energy associated with the position (height) of an object in relation to an arbitrarily established zero reference level.

$$PE_g = m \cdot g \cdot h$$

$$\left[kg \cdot \frac{m}{s^2} \cdot m\right] = \left[kg \cdot \frac{m^2}{s^2}\right] = [J]$$

m = MASS

g = ACCELERATION DUE TO GRAVITY

h = HEIGHT RELATIVE TO ZERO LEVEL.

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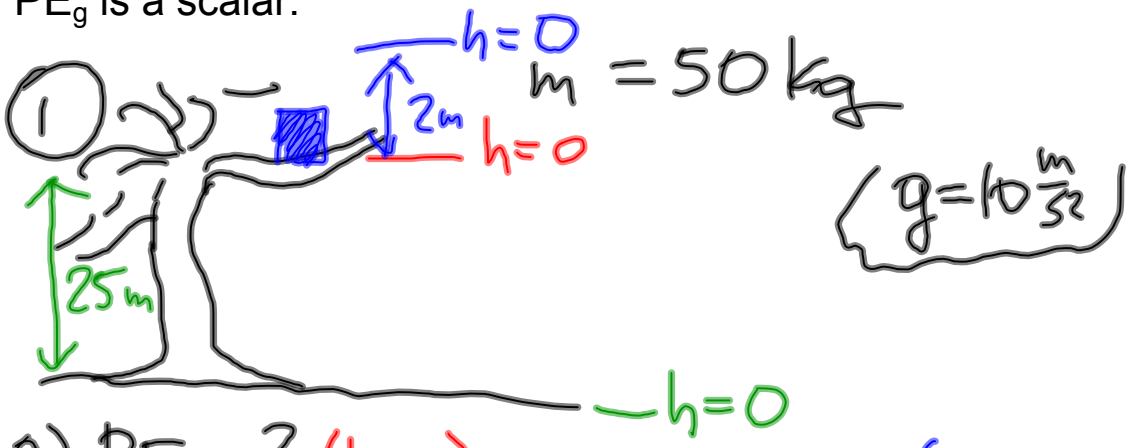
Bank account analogy.

PE_g	Bank Account
+	+ HAVE SPENDING POTENTIAL
0	$0 (BANK SETS THIS UP.)
−	− HAVE SPENDING DEFICIT

Dec 16-8:58 AM

PE_g can be (−), ZERO, (+).

PE_g is a scalar.



a) $PE_g = ?$ (h=0)

b) $PE_g = ?$ (h=0)

c) $PE_g = ?$ (h=0)

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a) $PE_g = (50)(10)(0)$

$PE_g = 0$

b) $PE_g = (50)(10)(25)$

$PE_g = 12{,}500\ J$

c) $PE_g = (50)(10)(-2)$

$PE_g = -1{,}000\ J$

Dec 16-9:23 AM

2. How high above the ground does a 5 kg cat need to climb to have the same amount of energy as a 10 kg doggy running at 9 m/s east?

$$KE_D = PE_g$$

$$\frac{1}{2} m_D v_D^2 = m_c g h_c$$

$$\frac{1}{2}(10)(9^2) = (5)(10) h_c$$

$$\boxed{h_c = 8.1 \text{ m}}$$

Dec 16-9:28 AM

Elastic potential energy PE_e

It is energy associated with objects which stretch/compress.

$$\boxed{PE_e = \frac{1}{2} k (\Delta x)^2}$$

$$\left[\frac{N}{m} \cdot m^2\right] = \left[kg \frac{m}{s^2} \cdot m\right] = \left[kg \frac{m^2}{s^2}\right] = [J]$$

k = SPRING COEFFICIENT (STIFFNESS)

Δx = CHANGE IN LENGTH

Dec 16-9:40 AM

3. A 500 N/m spring was stretched an unknown distance. It had PE_e at that instant equal to 2,000 J. How much was it stretched?

$$PE_e = \frac{1}{2}k\Delta x^2$$

$$2{,}000 = \frac{1}{2}(500)(\Delta x)^2$$

$$\Delta x = 2.83\ m$$

HW Ch. 6.2 p. 206 # 30, 32.

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