Section 10.2.5 – Common Forms of Energy

1. Kinetic Energy

Kinetic energy (E_k) is the energy associated with a moving object. In order to have kinetic energy, an object needs to have both mass and speed.

The equation for kinetic energy is as follows:

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

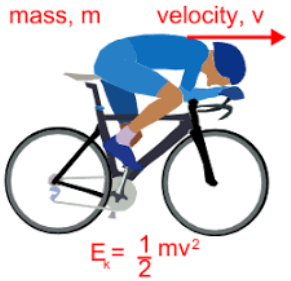
Where E_k represents kinetic energy (Joules)
m represents the mass of the object (kg)
v represents the speed of the object (ms^{-1})

Example.1

If the combined mass of the cyclist and his bicycle is 100 kg, what would be the kinetic energy of the rider/bike system if they were travelling at 20 ms^{-1}

E_k = ?
m = 100 kg
v = 20 ms^{-1}

$$E_k = \frac{1}{2}mv^2$$
$$= \frac{1}{2} \times 100 \times (20)^2$$
$$= 20000\ J$$
$$= 20\ kJ$$



Example.2

Go online and research Usain Bolt's mass and top speed. From this data, calculate his maximum kinetic energy.

E_k = ?
m =
v =

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

http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway_pre_2011/forces/energyrev1.shtml

2. Gravitational Potential Energy

Gravitational potential energy ($\boldsymbol{E_{gp}}$) is the energy associated with the elevation of an object above a reference height. In order to have gravitational potential energy, an object needs to have both mass and an elevated height.

The equation for kinetic energy is as follows:

$$E_{gp} = mgh$$

Where E_{gp} represents gravitational potential energy (Joules)
m represents the mass of the object (kg)
g represents the gravitational field strength of Earth (10 Nkg^{-1})
h represents the height of elevation (m)

Example.3

What is the gain in gravitational potential energy, when a 50kg weight is raised a height of 60 cm?

E_{gp} = ?
m = 50 kg
h = 60 cm
= .60 m
g = 10 Nkg^{-1}

$$E_{gp} = mgh$$
$$= 50 \times 10 \times .60$$
$$= 300\ J$$

Example.4

What is your gain in gravitational potential energy, when you climb 3 m up a ladder?
(Assume you climb straight vertically up)

E_{gp} = ?
m =
h =
g = 10 Nkg^{-1}

$$E_{gp} = mgh$$
$$=$$

http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway_pre_2011/forces/themeridesrev1.shtml

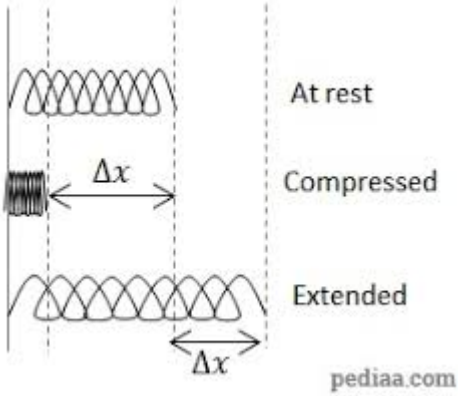
3. Strain Potential Energy

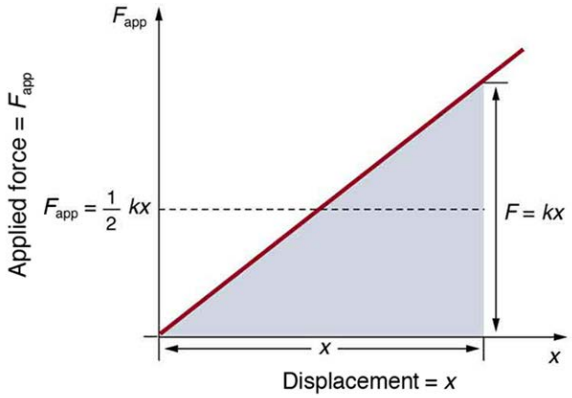
Strain potential energy ($\boldsymbol{E_{sp}}$) is the energy associated with the stretching or compression of on elastic material. In order to determine an objects strain potential energy, one needs to know the objects spring constant and the amount it has either been extended or compressed by.

The equation for kinetic energy is as follows:

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

Where E_{sp} represents strain potential energy (Joules)
k represents the spring constant (Nkg^{-1})
Δx represents the change in length (m)
[either compression or extension]





Example.5

What is the gain in strain potential energy, when a rubber band of spring constant 50 Nm^{-1} is stretched (extended) by 20 cm?

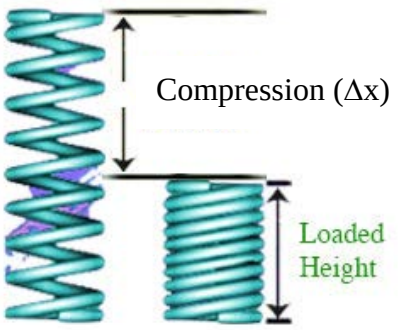
E_{sp} = ?
k = 50 Nm^{-1}
Δx = 20 cm
= .20 m

$$E_{sp} = \frac{1}{2}k\Delta x^2$$
$$= \frac{1}{2} \times 50 \times (.20)^2$$
$$= 1\,J$$

Example.6

What is the gain in strain potential energy, when a spring of spring constant 200 Nm^{-1} is compressed by 75 cm?

E_{sp} = ?
k = 200 Nm^{-1}
Δx = 75 cm
= .75 m



$$E_{sp} = \frac{1}{2}k\Delta x^2$$
$$= \frac{1}{2} \times 200 \times (.75)^2$$
$$= 56.25\ J$$

http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/forces/forceselasticityrev2.shtml