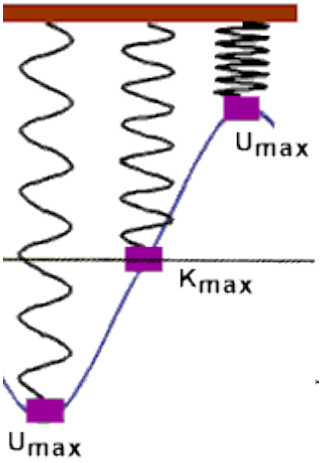
Experiment 7
Gravitational & Elastic Potential Energy *of a Spring*

Aim:

1. Determination of Elastic Potential Energy of a spring (PE_s).
2. Determination of Gravitational Potential Energy (PE_g) of a spring with added mass.

Principle:

The force per unit of length needed to stretch a spring is referred to as the Spring Constant and the principle of Physics that describes the behaviour of springs is called Hooke's Law. If a force causes an object to move in the same direction as the force, then work is done. Work requires a change in potential energy. The ***"elastic potential energy"*** stored in a spring is related to the spring constant but is not the same thing.



Materials: Springs, Masses, Ring, Stand, Ruler, and holders.

Part I. determining the spring constant

Procedure:

1.) Measure the length of the spring with no added mass. Record this length in the data table.
2.) Hang a mass on the spring. Calculate and record the force (weight) of the mass.
3.) Measure and record the distance the spring is ***stretched*** (the ***change*** in length).

Mass /gr	Force (F=mg) Newton	X/ meter	ΔX / meter	K = F/ΔX (N/m)
500				

Where X is the length of the spring before mass loaded.
ΔX is the change of length after mass loaded.
K is spring's constant .
F forces produced from the mass.

Note: you use the K in the next part of the experiment.

Part II. Kinetic energy and Potential Energy:

Introduction: When a force is applied over a distance, Work is done in the same direction as the applied force. This relationship can be expressed as:

$$Work = (Force)(Distance) \quad or \quad W = Fx$$

But $F_s = \frac{1}{2} kx$.

Thus

$$W_s = \frac{1}{2} kx^2$$

The work done stretching a spring must be equal to the change in the potential energy stored in the spring, called the ***Elastic Potential Energy*** of the spring.

$$PEs = W_s$$

$$PE_s = \frac{1}{2} kx^2 \ldots\ldots\ldots\ldots\ldots (1)$$

k = spring constant and x = change in length

Procedure:

1. Load mass into the spring and record the change in length.

2. Calculate ***PEs*** use equation 1.

3. Calculate PE_g use equation 2.

4. Calculate Velocity use equation 4.

5. Calculate KE_s use equation 3.

6. Compare both KE_s and ***PEs to*** PE_g.

Mass /g	Mass /kg	Change of Length /m	PE_g /joule	PE_s /joule	Velocity /ms^{-1}	KE_s /joule
400						
700						

PE_s is the elastic potential energy of spring in joule.

PE_g is the gravitational potential energy in joule.

$$\mathbf{PE_g = mgy \quad \ldots\ldots(2)}$$

Note: in equation 2, y=X and used only for the fact that the changes in length is due to y-axis.

$$\mathbf{KEs = \tfrac{1}{2}\, mv^2 \ldots..(3)}$$

$$\mathbf{V_f^2 = V_0^2 + 2gy \ldots\ldots.(4)}$$

Here, g is average gravitation =9.8/2 =4.9 why?

Note that:

1. A part of gravitational potential energy produced is transferred to the spring and stored as a potential energy.

2. The rest of the gravitational energy is converted to kinetic energy. The combination of the both energy is equal to the gravitational potential energy. That means the energy is conserved.