PHYSICS LABORATORY: Finding the Spring Constant

BACKGROUND INFORMATION AND PURPOSE
As you know, the spring constant k of a spring is defined by the equation

$$\boldsymbol{F} = -k\boldsymbol{x}$$

Where **F** is the force in the spring (the tension) and **x** is its extension (both are vectors, of course). By 'extension' we mean how much longer than the spring's *original* length. The stiffer the spring, the higher the spring constant, because the greater the force necessary to stretch it. The units of k are Nm^{-1} or Ncm^{-1}.

The mass m shown in the diagram to the right is in equilibrium, which means the net force on the mass is zero.

The purpose of this laboratory is to find the value of k experimentally using two methods.

The first method will use the above equation ('Hooke's Law'). In the second, you will investigate the oscillations of a mass hanging from a spring.

If the mass is then pulled down from its equilibrium position so it has a greater extension and then let go, the mass will accelerate upwards* to start with and then oscillate about its equilibrium position. The time period of the oscillation T is given by

$$T = 2\pi\sqrt{\frac{m}{k}}$$

Where
m is in kg,
k is in N m⁻¹,
T is in seconds

SOURCE: Jonathan Smith

Tension
$T = k\boldsymbol{x}$

Weight
$\boldsymbol{w} = m\boldsymbol{g}$
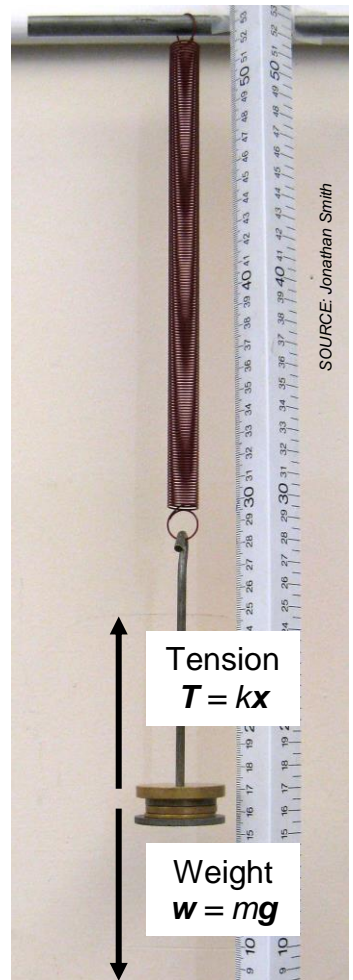
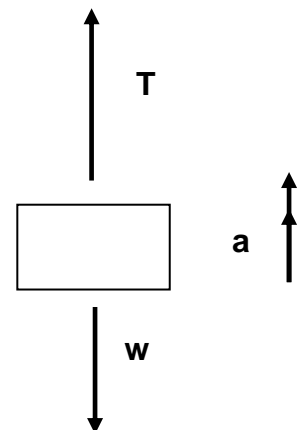In the second part of the investigation, you will use this equation to determine a value of k. Ultimately, of course, you will compare the two experimental values.

* to find the acceleration upwards we can use Newton's Second Law in the y-direction:

$$kx - mg = ma$$

… remember kx is now bigger than mg, which is why the mass accelerates upwards!

Remember:
1. **Refer to the 'Physics Lab Report Guide' before submitting your report.**
2. **Attach the 'Physics Lab Report Rubric' as a cover page to your paper copy.**

You will be marked on Data Collection and Processing (DCP) and Conclusion and Evaluation (CE) for this lab.