INVESTIGATION OF THE DAMPING OF A SPRING

Specification reference: **A2 Unit 3.2 - Vibrations**

Theory:

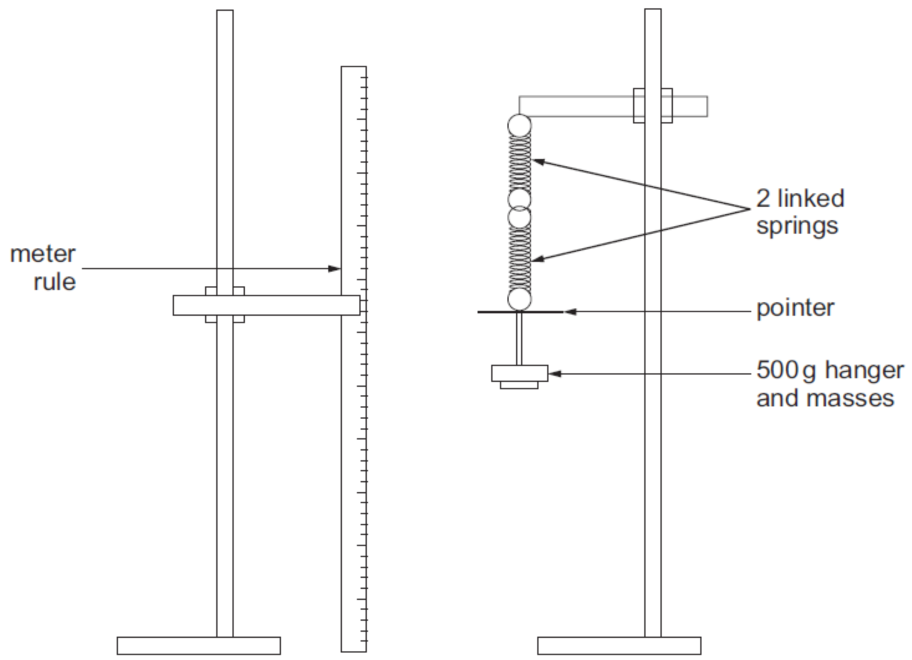
The relationship between the amplitude of oscillation, A, and time, t, can be expressed by:

$$A = A_0 e^{-\lambda t}$$

Where A_0 = initial amplitude
And λ = an unknown constant

If we take the log of both sides we get $\ln A = -\lambda t + \ln A_0$. This can be compared with the equation for a straight-line $y = mx + c$ and so a graph of $\ln A$ against t will give a straight line of gradient λ and intercept $\ln A_0$.

Apparatus:



500 g hanger and masses
2 linked springs
pointer
2 clamps and stands
G-clamps (if required)
metre rule (resolution ± 0.001 m)
stopwatch

Further guidance for technicians:

The resolution of the stopwatch should be ± 0.01 s. The G-clamp ensures that the apparatus is stable whilst the spring is oscillating.

Experimental Method:

Place the 500 g mass on the spring system and attach a pointer so its position can be easily read on the metre rule. Displace the mass by a further 2.5 cm. Let go of the mass and simultaneously start the stopwatch. Let the mass oscillate continuously and measure the new amplitude of the system every minute for the next eight minutes. Repeat this two more times and find the mean amplitude at each time. Determine $\ln A$ for each time t and plot a graph to enable you to find λ.

Extension:

A series of cards of different diameters could be included to investigate the effect of different surface area on damping (the cards could be placed on top of the different masses).

Practical techniques:

Use ICT such as computer modelling, or data logger with a variety of sensors to collect data, or use of software to process data.

Relevant previous practical past papers:

- PH3 2007 Q1
- PH6 2012 Experimental task