Worksheet: Force & Extension (Hooke's Law)

PhysicsSheets

Specification: GCSE Physics (AQA 4.5.3 / Edexcel SP12)

Hooke's Law: $F = k \times e$

Rearranged Forms: $k = \frac{F}{e}$ | $e = \frac{F}{k}$

Units: F (Force applied to spring, Newtons, N) | k (Spring constant, Newtons per metre, N/m) | e (Extension, metres, m)

Section A: Units, Rearranging & Conversions

1. State the correct SI unit for each variable in Hooke's Law ($F = k \times e$):

a) Force (F): _____

b) Spring constant (k): _____

c) Extension (e): _____

2. Rearrange the formula $F = k \times e$ to make the following variables the subject:

a) Spring constant (k): $k =$ _____

b) Extension (e): $e =$ _____

3. Perform the following unit conversions, showing your working where appropriate:

a) Convert 25 cm to metres (m).

b) Convert 0.5 kN to Newtons (N).

c) Convert 50 N/cm to Newtons per metre (N/m).

d) Convert 150 mm to metres (m).

e) Convert 0.03 kN to Newtons (N).

f) Convert 2 N/mm to Newtons per metre (N/m).

Section B: Practice Calculations

4. Use Hooke's Law ($F = k \times e$) to solve the following problems. Show your working clearly, including the equation, substitution, and final answer with units.

a) A spring has a spring constant of 200 N/m. Calculate the force required to extend it by 0.15 m.

b) A different spring has a spring constant of 50 N/m. What force is needed to cause an extension of 0.08 m?

c) A force of 12 N causes a spring to extend by 0.06 m. Calculate the spring constant (k) of this spring.

d) A spring has a spring constant of 100 N/m. What extension will be produced if a force of 25 N is applied to it?

Section C: Challenge Context & Multi-step Problems

5. A student is investigating the extension of a spring in a school laboratory.

a) The spring has a spring constant of 250 N/m. A mass of 2.0 kg is hung from the spring. Assuming the acceleration due to gravity (g) is 9.8 N/kg, calculate the extension of the spring in metres. Show all your working.

b) Another spring extends by 4.0 cm when a force of 20 N is applied. Calculate the force required to extend the *same* spring by 15 cm. Show your working clearly, including the calculation of the spring constant.