InkPhysics

QUESTION WORKBOOK

Density and Hooke's law

Materials · Year 12

AQA 3.4.2.1 · CIE 4.3, 6.1, 6.2 · OCR A 3.2.4, 3.4.1, 3.4.2

10 questions · 30 marks

NAVY SCREEN EDITION

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SECTION A · Warm-up

A1 Define density and state its SI unit. [2]

A2 A block has a mass of 540 g and a volume of 200 cm^3. Calculate its density in g cm^{-3} and in kg m^{-3}. [2]

A3 State Hooke's law for a spring. [2]

SECTION B · Standard

B1 A spring extends by 4.0 cm when a force of 2.0 N is applied. Calculate (a) its spring constant and (b) the force needed to extend it by 6.0 cm (within its limit of proportionality). [3]

B2 Steel has a density of 7800 kg m^{-3}. Express this in g cm^{-3} and calculate the mass of a 50 cm^3 steel component. [3]

B3 A spring of spring constant 200 N m^{-1} is stretched by 0.10 m within its limit of proportionality. Calculate the energy stored, and confirm your value using ½FΔL. [4]

B4 An irregular metal object of mass 0.50 kg is lowered into a measuring cylinder and displaces 62.5 cm^3 of water. Calculate the density of the metal in kg m^{-3}. [3]

SECTION C · Stretch

C1 Two springs have spring constants 50 N m^{-1} and 100 N m^{-1}. Calculate the effective spring constant when they are combined (a) in series and (b) in parallel, and find the extension of each combination under a 3.0 N load. [4]

C2 A spring of spring constant 800 N m^{-1} is compressed by 5.0 cm and used to launch a 0.20 kg ball horizontally. Assuming all the stored energy is transferred to the ball, calculate the launch speed. [4]

C3 Explain what happens to a spring stretched beyond its limit of proportionality, and how this appears on a force–extension graph. [3]