

Physics

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(Chapter 9) (Mechanical Properties of Solids) (Exercises)
(Class 11)

Question 9.3:

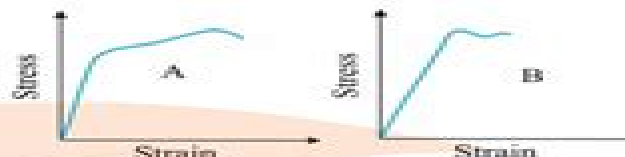
The stress-strain graphs for materials **A** and **B** are shown in Figure. The graphs are drawn to the same scale.

- (a) Which of the materials has the greater Young's modulus?
(b) Which of the two is the stronger material?

Answer 9.3:

- (a) A material has the greater Young's modulus.
(b) A material is the strongest in both.

For a given strain, the stress for material **A** is more than it is for material **B**, as shown in the two graphs.



$$\text{Young's modulus} = Y_1 = \frac{\left(\frac{F_1}{A_1}\right)}{\left(\frac{\Delta L_1}{L_1}\right)}$$

For a given strain, if the stress for a material is more, then Young's modulus is also greater for that material. Therefore, Young's modulus for material **A** is greater than it is for material **B**.

The amount of stress required for fracturing a material, corresponding to its fracture point, gives the strength of that material. Fracture point is the extreme point in a stress-strain curve. It can be observed that material **A** can withstand more strain than material **B**.

Hence, material **A** is stronger than material **B**.

Question 9.4:

Read the following two statements below carefully and state, with reasons, if it is true or false.

- (a) The Young's modulus of rubber is greater than that of steel;
(b) The stretching of a coil is determined by its shear modulus.

Answer 9.4:

- (a) False
(b) True

For a given stress, the strain in rubber is more than it is in steel.

$$\text{Young's modulus, } Y = \frac{\text{stress}}{\text{strain}}$$

$$\text{For a constant stress: } Y \propto \frac{1}{\text{strain}}$$

Hence, Young's modulus for rubber is less than it is for steel.

Shear modulus is the ratio of the applied stress to the change in the shape of a body. The stretching of a coil changes its shape. Hence, shear modulus of elasticity is involved in this process.

Question 9.5:

Two wires of diameter 0.25 cm, one made of steel and the other made of brass are loaded as shown in Fig. 9.13. The unloaded length of steel wire is 1.5 m and that of brass wire is 1.0 m. Compute the elongations of the steel and the brass wires.

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D Kirk



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Analytical and Computational Methods of Advanced Engineering Mathematics Grant B. Gustafson, Calvin H. Wilcox, 2012-12-06 NOTES This text focuses on the topics which are an essential part of the engineering mathematics course ordinary differential equations vector calculus linear algebra and partial differential equations Advantages over competing texts 1 The text has a large number of examples and problems a typical section having 25 quality problems directly related to the text 2 The authors use a practical engineering approach based upon solving equations All ideas and definitions are introduced from this basic viewpoint which allows engineers in their second year to understand concepts that would otherwise be impossibly abstract Partial differential equations are introduced in an engineering and science context based upon modelling of physical problems A strength of the manuscript is the vast number of applications to real world problems each treated completely and in sufficient depth to be self contained 3 Numerical analysis is introduced in the manuscript at a completely elementary calculus level In fact numerics are advertised as just an extension of the calculus and used generally as enrichment to help communicate the role of mathematics in engineering applications 4 The authors have used and updated the book as a course text over a 10 year period 5 Modern outline as contrasted to the outdated outline by Kreysig and Wylie 6 This is now a one year course The text is shorter and more readable than the current reference type manuals published all at around 1300 1500 pages

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Ajawad I Haija is a professor of physics at Indiana University of Pennsylvania M Z Numan is professor and chair of the department of physics at Indiana University of Pennsylvania W Larry Freeman is Emeritus Professor of Physics at Indiana University of Pennsylvania *Global Attractors in Abstract Parabolic Problems* Jan W. Cholewa, Tomasz Dlotko, 2000-08-31

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