PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

MECHANICAL PROPERTIES OF SOLIDS

Physics

1. Two wires A and B are of the same material. Their lengths are in the ratio 1 : 2 and the diameter are in the ratio 2 : 1. If they are pulled by the same force, then increase in length will be in the ratio

A. $2:1$

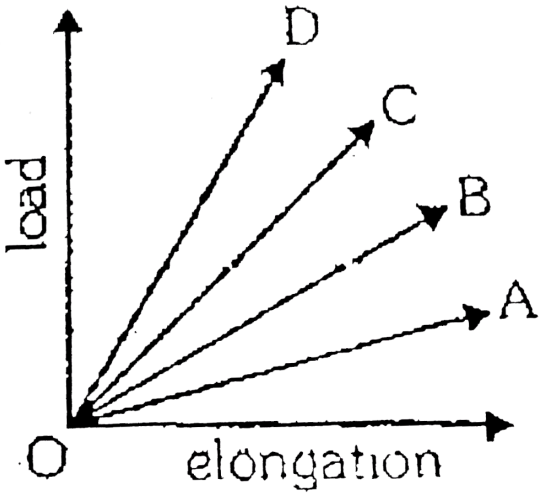
B. $1:4$

C. $1:8$

D. $8:1$

Answer:

Watch Video Solution



2.

The load versus elongation graph for four wires of the same material and same length is shown in the figure. The hinnest wire is represented by the line

A. OA

B. OC

C. OD

D. OB

Answer:

Watch Video Solution

3. A spring of force constant $800N/m$ has an extension of 5cm. The work done in extending it from 5cm to 15cm is

A. $16J$

B. $8J$

C. $32J$

D. $24J$

Answer:

Watch Video Solution

4. A metal wire of length L_1 and area of cross section A is ttached to a rigid support. Another metal wire of length L_2 and of the same cross sectional area is attached to the free end of the first wire. A body of mass M is then suspended from the free end of the second wire, if Y_1 and Y_2 are the Young's moduli of the wires respectively the effective force constant of the system of two wires is

A. $\frac{Y_1Y_2A}{2(Y_1L_2+L_1)}$

B. $\frac{Y_1Y_2A}{(L_1L_2)^{1/2}}$

C. $\frac{Y_1Y_2A}{(Y_1L_2)+Y_2L_1}$

D. $\frac{(Y_1Y_2)^{1/2}A}{(L_2L_1)^{1/2}}$

Answer:

Watch Video Solution

5. The approximate depth of an ocean is $2700m$. The compressibility of water is $45.4\times10^{-11}Pa^{-1}$ and density of water is $10^3\frac{kg}{m^3}$. What

fractional compression of water will be obtained at the bottom of the ocean?

A. 1.0×10^{-2}

B. 1.2×10^{-2}

C. 1.4×10^{-2}

D. 0.8×10^{-2}

Answer:

Watch Video Solution

6. The Young's modulus of steel is twice that of brass. Two wires of the same length and of the same area of cross section, one of steel and another of brass are suspended from the same roof. If we want the lower ends of the wires to be at the same level, then the weight added to the steel and brass wires must be in the ratio of

A. $2:1$

B. $4:1$

C. $1:1$

D. $1:2$

Answer:

Watch Video Solution

7. Choose the wrong statement

A. The bulk modulus for solids is much larger than for liquid

B. Gases are least compressible

C. The incompressibility of the solids is due to the tight coupling between neighbouring atom

D. The reciprocal of the bulk modulus is called compressibilit

Answer:

Watch Video Solution

8. A copper wire of length 1.0 m and a steel wire of length0.5 m having equal cross-sectional areas are joined end to end. The composite wire is stretched by a certain load which stretches the copper wire by $1mm$. If the Young's modulii of copper and steel are respectively $1.0 \times 10^{11} Nm^{-2} \text{and} 2.0 \times 10^{11} Nm^{-2}$,

the total extension of the composite wire is:

A. $1.75mm$

B. $2.0mm$

C. $1.5mm$

D. $1.25mm$

Answer:

Watch Video Solution

9. A cube at temperature $0^\circ C$ is compressed equally from all sides by an external pressure P. By what amount should its temperature be raised to bring it back to the size it had before the external pressure was applied. The bulk modulus of the material of the cube is B and the coefficient of linear expansion is a

A. $P/B\alpha$

B. $P/3B\alpha$

C. $\pi a/B$

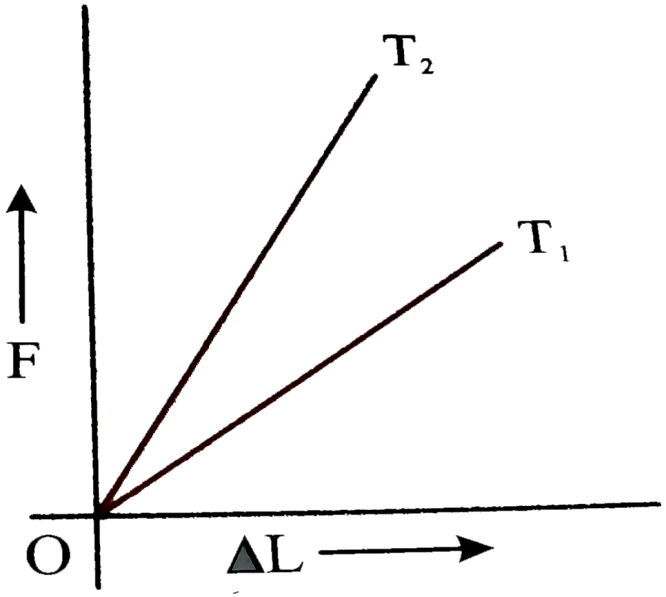
D. B/P

Answer:

Watch Video Solution

10. The graph shows the change $'\Delta l'$ in the length of a thin uniform wire used by the application of force F at different temperatures T_1 and T_2.

The variation suggests that



A. $T_1 > T_2$

B. $T_1 < T_2$

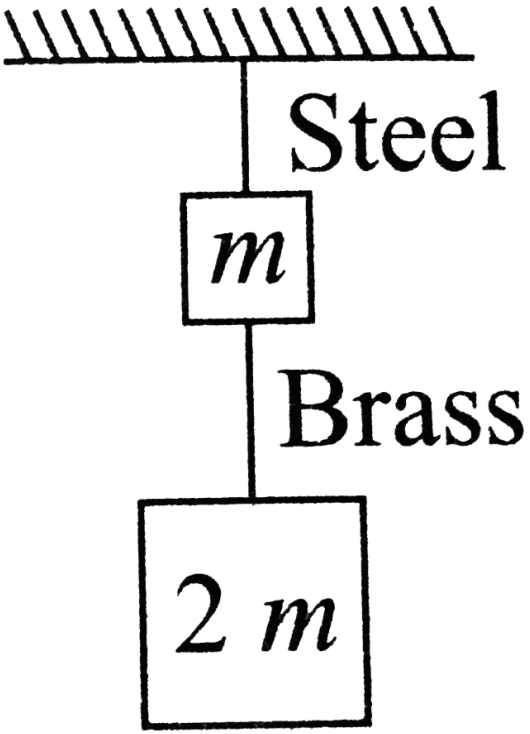
C. $T_2 > T_1$

D. $T_1 \geq T_2$

Answer:

Watch Video Solution

11. If the ratio of lengths, radii and Young's moduli of steel and brass wires in the figure are a, b and c respectively then the corresponding ratio of increase in their lengths is



A. $\frac{3c}{ab^2}$

B. $\frac{2a^2c}{b}$

C. $\frac{3a}{2b^2c}$

D. $\frac{2ac}{2b^2}$

Answer:

Watch Video Solution

12. Young's modulus of brass and steel are $10 \times 10^{10} N/m^2$ and $2 \times 10^{11} N/m^2$, respectively. A brass wire and a steel wire of the same length are extended by $1mm$ under the same force. The radii of the brass and steel wires are R_B and R_S respectively. Then

A. $R_S = \sqrt{2} R_B$

B. $R_S = R_B/\sqrt{2}$

C. $R_S = 4R_B$

D. $R_S = R_B//4`$

Answer:

Watch Video Solution

13. Steel ruptures when a shear of$3.5 \times 10^8 Nm^{-2}$ is applied. The force needed to punch a $1cm$ diameter hole in a steel sheet $0.3cm$ thick is nearly:

A. $1.4 \times 10^4 N$

B. $2.7 \times 10^4 N$

C. $3.3 \times 10^4 N$

D. $1.1 \times 10^4 N$

Answer:

Watch Video Solution

14. A ball falling in a lake of depth $400m$ has a decrease of $0.2\,\%$ in its volume at the bottom. The bulk modulus of the material of the ball is $\left(\text{in} Nm^{-2}\right)$

A. 9.8×10^9

B. 9.8×10^{10}

C. 1.96×10^{10}

D. 1.96×10^{9}

Answer:

Watch Video Solution

15. A circular tube of mean radius $8cm$ and thickness $0.04cm$ is melted up and recast into a solid rod of the same length. The ratio of the torsional rigidities of the circular tube and the solid rod i

A. $\frac{(8.02)^4 - (7.98)^4}{(0.8)^4}$

B. $\frac{(8.02)^2 - (7.98)^2}{(0.8)^2}$

C. $\frac{(8.02)^2 - (7.98)^2}{(0.8)^2}$

D. $\frac{0.8^2}{8.02^3 - (7.98)^2}$

Answer:

Watch Video Solution

16. Two wires are made of the same material and have the same volume. However wire 1 has cross-sectional area A and wire 2 has cross-sectional area 3A. If the length of wire 1 increases by Δx on applying force F, how much force is needed to stretch wire 2 by the same amount?

A. $4F$

B. $6F$

C. $9F$

D. F

Answer:

Watch Video Solution

17. In materials like aluminium and copper, the correct order of magnitude of various elastic modului is:

A. Young's modulus lt shear modulus lt bulk modulus

B. Bulk modulus lt shear modulus lt Young's modulus

C. Shear modulus lt Young's modulus lt bulk modulus

D. Bulk modulus lt Young's modulus lt shear modulus.

Answer:

Watch Video Solution

18. What percent of length of a wire will increses by applying a stress fo $1kg.\ Wt/mm^2$ on it.

$[Y = 1 \times 10^{11} Nm^{-2} \text{and} 1kgwt = 9.8N]$

A. $0.0067\ \%$

B. $0.0098\ \%$

C. $0.0088\ \%\ \%$

D. $0.0078\ \%$

Answer:

Watch Video Solution

19. An elastic spring of unstretched length L and force constant K is stretched by amoun t x .It is further stretched by another length y The work done in the second streaching is

A. $\frac{1}{2}ky^2$

B. $\frac{1}{2}k\left(x^2+y^2\right)$

C. $\frac{1}{2}k(x+y)^2$

D. $\frac{1}{2}ky(2x+y)$

Answer:

Watch Video Solution

20. Two, spring P and _(Q) of force constants K_p and $k_Q\left(k_Q = \frac{kp}{2}\right)$ are stretched by applying forces of equal magnitude. If the energy stored in $\_\ (Q)iaE,$ then the energy stored in P is

A. E

B. $E2$

C. $E/2$

D. `E//4

Answer:

Watch Video Solution

21. The pressure that has to be applied to the ends of a steel wire of length 10cm to keep its length constant when its temperature is raised by $100^\circ C$ is : (For steel Young's modulus is $2 \times 10^{11} Nm^{-2}$ and coefficient of thermal expansion is $1.1 \times 10^{-5} K^-1$)

A. $2.2 \times 10^8 Pa$

B. `2.2xx10^(9) Pa

C. `2.2xx10^(7) Pa

D. `2.2xx10^(6) Pa

Answer:

Watch Video Solution

22. A steel ring of radius r and cross section area A is fitted on to a wooden disc of radius $R(R > r)$. If Young's modulus be R, then the force with which the steel ring is expanded is

A. $AY(R/r)$

B. $AY(R-r)/r$

C. (Y//A)[(R-r)//r]`

D. Yr/AR

Answer:

Watch Video Solution

23. Two wires A and B of same material and of equal length with the radii in the ratio $1:2$ are subjected to identical loads. If the length of A increases by $8mm$, then the increase in length of B is

A. $2mm$

B. $4mm$

C. $8mm$

D. $16mm$

Answer:

Watch Video Solution

24. A material has Poisson ratio 0.5. If a rod of material has a longitudinal strain 2×10^{-3}, the percentage change in volume is :

A. 0.6

B. 0.4

C. 0.2

D. Zero

Answer:

Watch Video Solution

25. The upper end of a wire of diameter 12mm and length 1m is clamped and its other end is twisted through an angle of 30°. The angle of shear is

A. 18°

B. 0.8°

C. 36°

D. 0.36°

Answer:

Watch Video Solution

26. The pressure on an object of bulk modulus B undergoing hydraulic compression due to a stress exerted by surrounding fluid having volume strain $\left(\frac{\Delta V}{V}\right)^2$

A. $B^2\left(\frac{\Delta V}{V}\right)$

B. $B\left(\frac{\Delta V}{V}\right)^2$

C. $\frac{l}{B}\left(\frac{\Delta V}{V}\right)$

D. $B\left(\frac{\Delta V}{V}\right)$

Answer:

Watch Video Solution

27. A structural steel rod has a radius of 10 mm and length of 1.0 m. A 100 kN force stretches it along its length. Young's modulus of structural steel is $2 \times 10^{11} Nm^{-2}$. The percentage strain is about

A. $0.16\ \%$

B. $032\ \%$

C. $0.08\ \%$

D. $024\ \%$

Answer:

Watch Video Solution

28. A beam of metal supported at the two edges is loaded at the centre. The depression at the centre is proportional to

A. Y^2

B. Y

C. $1/Y$

D. $1/Y^2$

Answer:

Watch Video Solution

29. When a 4 kg mass is hung vertically on a light string that obeys Hooke's law, the spring stretches by 2 cm. The work required to be done by an external agent in stretching this spring by 5 cm will be ($g = 9.8 \frac{metrs}{\sec^2}$)

A. $4.900 joe$

B. $0.450 jolue$

C. $0.495 joe$

D. $0.245 joe$

Answer:

Watch Video Solution

30. The length of a metal wire is l_1 when the tension in it is T_1 and is l_2 when the tension is T_2. Then natural length of the wire is

A. $\frac{l1 + l}{2}$

B. $(l1T_2 + l_2T_1$

C. $\frac{l1T_2 + l_2T_1}{T_2 - T_1}$

D. $\sqrt{T_1T_2l_1l_2}$

Answer:

Watch Video Solution

31. The bulk moduli of ethanol, mercury and water are given as $0.9, 25$ "and "2.2 respectively in units of 10^9

Nm^{-2}. F or $agivenvalueofpressure, the\frac{t}{i}onalcompression \in volumeis$ (DeltaV)/V$Whichofthefollow \in gstatementsabou$(DeltaV)/V`for these three liquids is correct ?

A. $Ethanol > Water > Mercury$

B. $Water > Ethanol > Mercury$

C. $Mercury > Ethanol > Water$

D. $Ethanol > Mercury > Water$

Answer:

Watch Video Solution

32. The graph given is a stress-strain curve for

A. elastic objects

B. plastics

C. elastomers

D. None of these

Answer:

Watch Video Solution

33. A metal rod of Young's modulus $2 \times 10^{10} Nm^{-2}$ undergoes an elastic strain of $0.06\ \%$. The energy per unit volume stored in $Jm^{-3}$is

A. 3600

B. 7200

C. 10800

D. 14400

Answer:

Watch Video Solution

34. Two wires of the same material and length but diameters in the ratio $1:2$ are stretched by the same force. The potential energy per unit volume for the two wires when stretched will be of the ratio.

A. $1:2$

B. $4:1$

C. $2:1$

D. $16:1$

Answer:

Watch Video Solution

35. The length of an elastic string is a metre when the longitudinal tension is 4 N and b metre when the longitudinal tension is 5 N. The length of the string in metre when the longitudinal tension is 9 N is

A. $a-b$

B. $5b - 4a$

C. $2b - \frac{1}{4}a$

D. $4a - 36$

Answer:

Watch Video Solution

36. A force of 103 newton, stretches the length of a hanging wire by 1 millimetre. The force required to stretch a wire of same material and length but having four times the diameter by 1 millimetre is

A. $4 \times 10^3 N$

B. $16 \times 10^3 N$

C. $\frac{1}{4} \times 10^3 N$

D. $\frac{1}{16} \times 10^3 N$

Answer:

Watch Video Solution

37. A steel wire of length l and cross sectional area A is stretched by 1 cm under a given load. When the same load is applied to another steel wire of double its length and half of its cross section area, the amount of stretching (extension) is

A. $0.5cm$

B. $2cm$

C. $4cm$

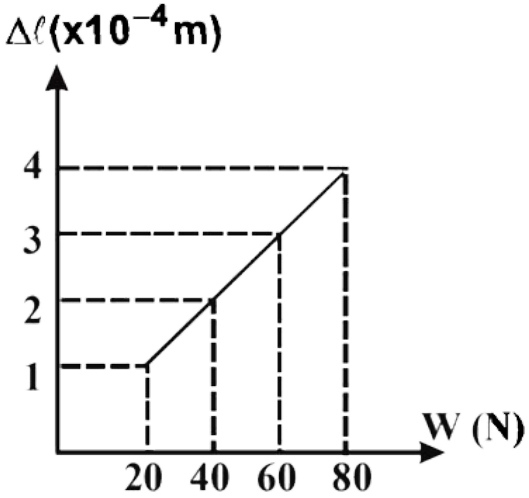
D. $1.5cm$

Answer:

Watch Video Solution

38. The adjacent graph shows the estension (Δl) of a wire of length 1m suspended from the top of a roof at one end and with a load W

connected to the other end. If the cross-sectional area of the wire is $10^{-6}m^2$, calculate the Young's modulus of the material of the wire.



A. $2 \times 10^{11} N/m^2$

B. $2 \times 10^{11} N/m^2$

C. $3 \times 10^{12} N/m^2$

D. $2 \times 10^{13} N/m^2$

Answer:

Watch Video Solution

39. If a rubber ball is taken at the depth of 200 m in a pool, its volume decreases by$0.1\,\%$ If the density of the water is `1xx10^(3)Kg//m^(3)"and"g=10ms^(2), then the volume elasticity in N//m2 will be

A. 10^8

B. 2×10^8

C. 10^9

D. 2xx10^(9)`

Answer:

Watch Video Solution

40. A ball falling in a lake of depth $200m$ shows a decrease of $0.1\,\%$ in its volume at the bottom. The bulk modulus of elasticity of the material of the ball is (take $g = 10ms^{-2}$)

A. $19.6 \times 10^8 N/m^2$

B. $19.6 \times 10^{10} N/m^2$

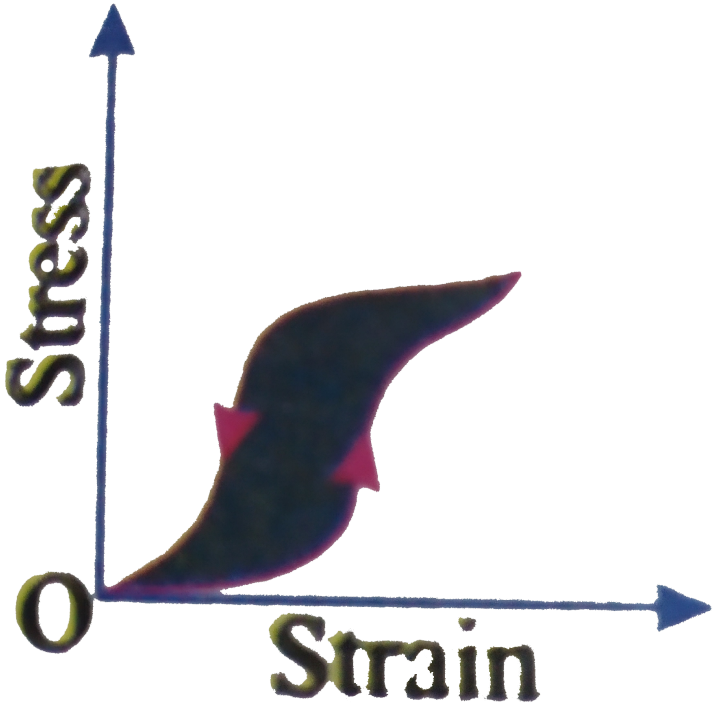
C. $19.6 \times 10^{10} N/m^2$

D. $19.6 \times 10^8 N/m^2$

Answer:

Watch Video Solution

41. The diagram shows a forc-extension graph for a rubber band. Consider of the following statements



I. It will be easier to compress this rubber than expand it

II. Rubber does not return to its original length after it is streched

III. The rubber band will get heated id it is streched and realeased

Which of these can be deduced from the graph

A. III only

B. II and III

C. I and III

D. I only

Answer:

Watch Video Solution

42. The Poisson's ratio of a material is 0.5. If a force is applied to a wire of this material, there is a decrease in the cross-sectional area by 4%. The percentage increase in the length is:

A. 1%

B. 2%

C. 2.5%

D. 4%

Answer:

Watch Video Solution

43. Copper of fixed volume V is drawn into wire of length l. When this wire is subjected to a constant force F, the extension produced in the wire is $\triangle l$. Which of the following graphs is a straight line?

A. $(\Delta l) versis \frac{1}{l}$

B. $\left(\Delta l \text{versus} l^2\right.$

C. $\Delta l \text{versus} \frac{1}{l^2}$

D. $\Delta l \text{versus} l$

Answer:

Watch Video Solution

44. When a 4 kg mass is hung vertically on a light string that obeys Hooke's law, the spring stretches by 2 cm. The work required to be done by an external agent in stretching this spring by 5 cm will be ($g = 9.8 \frac{metrs}{\sec^2}$)

A. 4.900joule`

B. $2.450joe$

C. 0.495joule`

D. $0.245joe$

Answer:

Watch Video Solution