PHYSICS

BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

MECHANICAL PROPERTIES OF SOLIDS

Exercise

1. What is a deforming force?

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2. What do you mean by deforming?

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3. Define Elastic body. Define Elastic.

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4. Give examples of elastic material (body).

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5. What is a perfectly elastic body?

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6. Define plastic body. Define Plasticity.

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7. Distinguish between Elasticity and Plasticity

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8. Give examples of plastic materials

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9. Why are bridges unsafe after a very long use?

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10. Define stress. State its unit and dimension.

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11. Define strain. State its unit, and dimension

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12. Define Tensile stress or compressive stress?

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13. What is Tensile Strain?

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14. Explain volume stress or hydraulic stress.

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15. Explain volume strain.

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16. Explain what is Shearing stress?

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17. How should be the force applied to a body to produce shearing strees?

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18. What is shearing strain?

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19. State Hooke's law and graphically represent it.

OR

State Hooke's law Draw a labelled graph of tensile stress against tensile strain for a metal up to breaking point. Show the region Hooke's law is obeyed.

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20. Explain Young's Modulus. Derive an expression for the same.

OR

Whatis young'smodulus?Describe anexperiment to find out young's modulus of material, in the form of a long string wire.

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21. Distinguish between Young's modulus, bulk modulus and modulus of rigidity.

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22. A brass wire of length 4.5 m, with cross-section area of $3 \times 10^{-5} m^2$ and a copper wire of length 5.0 m with cross section area $4 \times 10^{5} m^2$ are stretched by the same load. The same elongation is produced in both the wires. Find the ratio of Young's Modulus of brass and copper.

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23. A wire of length 20 cm and area of cross-section $1.25 \times 10^{-4} m^2$ is subjected to a load of 2.5 kg (1 kgwt = 9.8 N). The elongation produced in the wire is in 10^{-4} m. Calculate Young's Modulus of the material.

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24. Explain Bulk Modulus, derive an expression for the same. Define compressibility.

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25. A metal cube of side 1 m is subjected to a force. The force acts normally on the whole surface of a cube and its volume changes by $1.5 \times 10^{-5} m^3$. The bulk modulus of the metal is $6.6 \times 10^{10} N/m^2$. Calculate change in pressure.

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26. Explain Modulus of rigidity. Derive an expression for the same.

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27. Calculate the modulus of rigidity of a metal, if a metal cube of side 40 cmsissubjected to a shearing force of 2000 N. The upper surface is displaced through 0.5 cms with respect to the bottom. Calculate the Modulus of rigidity of the metal.

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28. What is Poisson Ratio. Define and derive it

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29. Explain the stress-strain curve with an appropriate graph.

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30. Define the terms,with examples.

(i) Brittle

(ii)Ductile

(iii)Maleable

(iv) Elastomer

(v) Explain elastic hysteresis.

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31. What do you mean by brittle substance? Give two examples.

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32. Define Strain Energy.

Derive expressions for

(i) work done per unit volume

(ii) Strain energy per unit volume.

OR

Derive an expression for strain energy per unit volume of the material of a wire.

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33. Define Hardness. State the properties of hardness

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34. State the names of the hardest material and the softest material.

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35. What is toughness? Give examples

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36. Define friction.

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37. Explain friction in solids. Give examples.

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38. Explain how lubricants help in reducing friction

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39. Explain the origin of friction.

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40. What are cohesive forces?

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41. What are adhesive forces?

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42. Explain static friction

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43. State the Laws of Static Friction

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44. Why force of static friction is known as self adjusting force?

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45. Name two factors on which the coefficients of friction depends.

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46. What is friction? Define coefficient of static friction with necessary formulae

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47. Define coefficient of Kinetic friction. Give the necessary formulae.

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48. The coefficient of static friction between a block of mass 0.25 kg and a horizontal surface is 0.4. Find the horizontal force applied to it.

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49. Explain Kinetic Friction.

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50. State the Laws of Kinetic Friction.

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51. Explain Rolling Friction

OR

What is rolling friction ? How does it arise

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52. State are the advantages of friction?

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53. State the disadvantages of friction.

OR

State any four methods of reduce friction.

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54. What are the methods of reducing friction?

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55. Calculate the coefficient of static friction for on object of mass 50 kg placed on a horizontal table pulled by attaching a spring balance. The force is increased gradually, it is observed that the object just moves, when the spring balance shows 50 N

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56. A block of mass 37 kg rests on a rough horizontal plane, having coefficient of static friction 0.3. Find out the least force required to just move the block horizontally.

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57. A body of 37 kg rests on a rough horizontalsurface. The minimum horizontal force required to just start the motion is 68.5 N. In order to keep the body moving with a constant velocity a force of 43 N is needed. What is the value (i) of the coefficient of static friction (ii) the coefficient of kinetic friction?

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58. A wire gets stretched by 4 mm due to a certain load. If the same load is applied to a wire of the same material with half length and double the diameter of the first wire. What will be the change in its length.

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59. Calculate the work done in stretching a steel wire of length 2 m and cross sectional area 0.0225 mm2, when a load of 100 N isslowly applied to its free end. (young's Modules of steel=$2 \times 10^{11} N/m^2$)

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60. A solid metal sphere of volume 0.31 m^3 is dropped in on ocean where water pressure is $2 \times 10^7 N/m^2$. Calculate the change in volume of the sphere, if the bulk modulus of the metal is $6.1 \times 10^{10} N/m^2$.

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61. A wire of mild steel has an initial length 1.5 m and diameter 0.60 mm gets extended by 6.3 mm when a certain force is applied to it. If Young's modulus of mild steel is $2.1 \times 10^{11} \frac{N}{m^2}$. Calculate the force applied

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62. A composite wire is prepared by joining a tungsten wire and steel wire Both the wires are of the same length and same area of cross section. If this composite wire is suspended to a rigid support and a force is applied to its free end, it gets extended by 3.25 mm. Calculate the increase in length of tungsten wire and steel wire separately.

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63. A steel wire having crosssectional area 1.2 mm2 isstretched by a force of 120 N. If a lateral strain of 1.455×10^{-4} is produced in the wire, calculate the Poisson's ratio. (Y for steel = $2 \times 10^{11} N/\left(m^2\right)$

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64. A telephone wire 125 m long and 1 mm in radius is stretched to a length of 125.25m when a force of 800N is applied. What is the value of young's Modulus for the material of the wire ?

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65. A rubber band originally 30 cm long isstretched to a length of 32 cm by a certain load. What is the strain produced?

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66. What is the stress in the wire which is 50 m long and 0.01 cm^2 in cross section, if the wire bears a load of 100 kg

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67. What is the strain in a wire cable of original length 50m, whose length increases by 2.5cm. when a load islifted?

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68. Calculate the horizontal force required to just move a block of mass 20kg resting on a horizontalsurface $(\mu_s = 0.3, g = 9.8m/s^2)$

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69. The minimum force required to keep a block sliding with a uniform velocity along a horizontal surface is 49N. Find the co-efficient of Kinetic Friction, if the mass of the block is 40 kg and $g = 9.8m/s$.

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70. A volume of 20 litres of wateris compressed by a pressure of 20atmospheres.If the compressibility of water is $5 \times 10^{-10} m^2/N$, calculate the change in volume of water.

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71. Find the energy stored per unit volume of a steel wire of length 1m when it is stretched by 0.2mm. Given Y for steel =$2.1x10^{11}\frac{N}{m^2}$

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72. A copper wire and steel wire both have the same length and radius are joined end to end, when the composite wire is hung from a rigid support, and the load attached at the free end, the increase in the length is found to be 1cm. Find the increase in length of copper steel wire. (Y for copper = $1.2 \times 10^{11} N/m^2$, Y for steel =$2.1 \times 10^{11} N/m^2$)

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73. There are 2 wires of the same material. Their radii and lengths are in the ratio $1:2$ If the extensions produced are equal, what isthe ratio of their loads?

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74. What pressure should be applied to a lead block, to reduce its volume by 10%. The bulk modulus of lead is $6 \times 10^9 N/m^2$

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75. A metal wire of length 2.5 m and area of cross section $1.5 \times 10^{-6} m^2$ is stretched through 2 mm. Calculate the work done during stretching. (Y= $1.25 \times 10^{11} Nm^{-2}$).

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76. Determine the pressure required to reduce the given volume by 1%. Bulk modulus of water is $2 \times 10^9 N/m^2$

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77. An aluminium wire and a steel wire are of the same length and crosssection and are joined end to end. The composite wire is hung from a rigid support, a load is suspended from the free end. If the increase in the length of composite wire is 2.77 mm, find the increase in length of each wire. $\left(Y_A = 7 \times 10^{10} \frac{N}{m^2}\right)$ (Y steel=$2 \times 10^{11} N/m^2$)

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78. Calculate the horizontal force required to just move a block of mass 40kg resting on the horizontal surface given $(\mu_s = 0.3), g = 9.8m/s^2$

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79. The minimum force required to keep a block sliding with a uniform velocity along a horizontal surface, is 49 N, Find the coefficient of Kinetic friction if the mass of the block is 8 kg and $\left(g = 9.8m/s^2\right)$.

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80. A block of mass 40 kg is at rest, on the horizontal surface, The force required to just push it is 156.8N.Calculate the force of static friction, given $\left(g = 9.8m/s^2\right)$

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81. Two wires P and Q are of the same diameter and having their lengths in the ratio $5:3$, when the wires are subjected to the some load, the corresponding extensions are in the ratio $4:3$. Compare Young's Modulus of the materials P and Q.

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82. A tangential force of 2100 N is applied on the surface area $3 \times 10^{-6}m^2$ which is 0.1m from a fixed surface. The force produces a lateral shift of 7mm of the upper surface with respect to the bottom. Calculate the modulus of rigidity of the material

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83. A volume of $10^{-3}m^3ofwateris \subset jected \rightarrow apressureof10atmospheres. Thechan \geq$ 10^-6 m^2`. Find the bulk modulus of water

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84. Two wires of the same material and of the same length are stretched by longitudinal force, each of the some magnitude. Compare the extension, produced if the radius of the first wire is twice the radius of the second wire

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85. Change in dimensionsis known as

A. deformation

B. formation

C. contraction

D. strain

Answer:

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86. The point on the stress-strain curve, at which the strain begins to increase, even without increase in stress is called

A. Elastic point

B. yield point

C. breaking point

D. neck point

Answer:

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87. Strain energy of a stretched wire is $18 \times 10^3 J$ and strain energy per unit volume of the same wire and same cross section is $6 \times 10^3 J/m^3$. Its volume will be

A. $3cm^3$

B. $3m^3$

C. $6m^3$

D. $6cm^3$

A. A. $3cm^3$

B. B. $3m^3$

C. C. $6m^3$

D. D. $6cm^3$

Answer:

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88. .....is the property of a material which enables it to resit plastic deformation.

A. Elasticity

B. Plasticity

C. Hardness

D. Ductility

Answer:

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89. The ability of a material to resist fracturing when force is applied to it, is called

A. toughness

B. hardness

C. elasticity

D. plasticity

Answer:

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90. When a force is applied to a solid, the size and shape changes due to the relative change in position of the particles, such a force is called

A. deforming force

B. Comprehensive force

C. restoring force

D. destructive force

Answer:

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91. The property by virtue of which, the body regains its original shape and size after the force is removed is called

A. ductility

B. malleability

C. elasticity

D. plasticity

Answer:

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92. If a body does not regain its original shape and size and retains, its altered shape upon removal of the deforming force, is called

A. plastic body

B. elastic body

C. ductile body

D. malleable body

Answer:

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93. The internal restoring force per unit area of the body is called

A. strain

B. stress

C. bulk modulus

D. Young's modulus

Answer:

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94. Hydraulic stress is defined as

A. $\Delta v / v$

B. $\Delta l / L$

C. $\left|\overrightarrow{F}\right| / A$

D. $\tan\theta$

Answer:

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95. Tensile strain is defined as

A. $\Delta V / V$

B. $\Delta l / L$

C. F / A

D. $h / \sin\theta$

Answer:

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96. The restoring force per unit area, developed due to applied tangential force, is called

A. stress

B. strain

C. shearing stress

D. shearing strain

Answer:

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97. Hooke's law states

A. $\frac{Stress}{Stra \in} = cons \tan t$

B. $stra \in = (stress)^2 / Y$

C. $stress = Y(stra \in)^2$

D. $stress = \frac{1}{2}Y$

Answer:

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98. ..... Modulus is the ratio of longitudinal stress to longitudinal strain

A. Bulk

B. Shear

C. Rigidity

D. Young's

Answer:

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99. Young's Modulus is maximum for

A. Lead

B. Brass

C. Copper

D. Steel

Answer:

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100. Bulk Modulus is minimum for

A. Lead

B. Aluminum

C. Copper

D. Gold

A. A. Lead

B. B. Aluminum

C. C. Copper

D. D. Gold

Answer:

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101. The modulus of elasticity related to the change in shape of on object is called

A. Young's Modulus

B. Bulk modulus

C. Modulus of rigidity

D. Hooke's Law

Answer:

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102. A steel wire of cross sectional area $3 \times 10^{-6} m^2$ can withstand a maximum strain of 10^{-3}. Young's modulus of steel is $2 \times 10^{11} N/m^2$. The maximum mass the wire can hold is $(g = 10 m/s^2)$

A. 40kg

B. 60kg

C. 80kg

D. 100kg

Answer:

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103. The ratio of $F/A\theta$ is

A. Poisson's ratio

B. Bulk modulus

C. Modulus of rigidity

D. Young's modulus

Answer:

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104. Poisson's ratio for silver is

A. 0.36

B. 0.37

C. 0.38

D. 0.42

A. A. 0.36

B. B. 0.37

C. C. 0.38

D. D. 0.42

Answer:

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105. Yield point on a stress strain curve is also called

A. elastic limit

B. proportional limit

C. fracture point

D. permanent set

Answer:

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106. A material that can be elastically stretched to a larger value of strain is called

A. brittle

B. ductile

C. malleable

D. elastomer

Answer:

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107. Elastic hysteresis is

A. Lagging of stress behind starin

B. Lagging of strain behind stress

C. stree is equal to strain

D. stress upon strain is a constant

Answer:

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108. strain energy per unit volume is

A. $\frac{1}{2}Y(stress)^2$

B. $\frac{1}{2}\frac{(stress)^2}{Y}$

C. $\frac{1}{2}\frac{(stra\in)^3}{Y}$

D. $\frac{1}{2}\frac{stress}{stra\in}$

Answer:

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109. The resistance to bending, scratching, abrasion or cutting is called

A. Hardness

B. Tough

C. Elastomer

D. Hysteresis

A. A. Hardness

B. B. Tough

C. C. Elastomer

D. D. Hysteresis

Answer:

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110. ..... is the ability of a material to resist fracturing, when a force is applied to it.

A. Hysteresis

B. Elastomer

C. Hardness

D. Toughness

Answer:

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111. The property which resist the relative motion between two surface in contact is called

A. Friction

B. Static friction

C. Kinetic friction

D. Rolling friction

Answer:

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112. The forces of attraction between surface of different materials are called

A. Cohesive forces

B. Adhesive forces

C. Compressive forces

D. Constructive foces

Answer:

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113. When the value of the frictional force is maximum, just before the body slides is called

A. force of friction

B. limiting force of friction

C. compressive force friction

D. Kinetic force of friction

A. A. force of friction

B. B. limiting force of friction

C. C. compressive force friction

D. D. Kinetic force of friction

Answer:

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114. The coefficient of static friction between a block of mass 0.25 kg is 0.4. Calculate the force applied to it. $\left(g = 9.8m/s^2\right)$

A. 0.98N

B. 0.098N

C. 9.8N

D. 980N

Answer:

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115. If a force of 0.98 N is applied to a mass of 0.25 kg $\left(g = 9.8m/s^2\right)$ the coefficient of friction is

A. 0.2

B. 0.3

C. 0.4

D. 0.5

Answer:

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116. Coefficient of Kinetic friction is maximum when

A. Rubber moves on concrete

B. Copper moves on steel

C. Aluminum moves on steel

D. Teflon moves on Teflon

A. A. Rubber moves on concrete

B. B. Copper moves on steel

C. C. Aluminum moves on steel

D. D. Teflon moves on Teflon

Answer:

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117. Use of ball bearings converts

A. Kinetic friction to static friction

B. Kinetic friction into rolling friction

C. Static friction to Kinetic friction

D. Rolling friction into Kinetic friction

A. A. Kinetic friction to static friction

B. B. Kinetic friction into rolling friction

C. C. Static friction to Kinetic friction

D. D. Rolling friction into Kinetic friction

Answer:

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118. Lateral strain//longitudinal strain is called

A. Hooke's ratio

B. Poisson

C. Modulus of rigidity

D. Young's Modulus

Answer:

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119. Dimensions of Bulk Modulus are

A. $L^{-1}M^{1}T^{-2}$

B. $L^{1}M^{-1}T^{-2}$

C. $L^{-2}M^{1}T^{-1}$

D. $L^{-1}M^{2}T^{-1}$

Answer:

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120. The change in shape or size or both, of a body, due to an external force is called.

A. formation

B. deformation

C. construction

D. destruction

Answer:

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121. The ratio of Longitudinal stress to longitudinal strain is called

A. Poisson ratio

B. Bulk modulus

C. Modulus of rigidity

D. Young's modulus

Answer:

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122. If the shearing stressin $4.2 \times 10^8 N/m^2$ and the shearing strain is 5×10^{-3}. The modulus of rigidity is

A. $8.4 \times 10^{10} N/m^2$

B. $4.8 \times 10^{10} N/m^2$

C. $6.4 \times 10^{10} N/m^2$

D. $4.6 \times 10^{10} N/m^2$

Answer:

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123. Define elastic limit.

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124. What is an elastomer.

Watch Video Solution

125. State the advantages of friction.

Watch Video Solution

126. With a well labelled graph explain elastic hysteresis.

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127. Differentiate between hardness and toughness with examples.

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128. State the laws of Kinetic Friction.

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129. A wire of length 10 m and area $0.625 \times 10^{-4} m^3$ is subjected to a load of 1.25 kg (1 kg wt = 9.8 N). The elongations produced in the wire is $0.5 \times 10^{-4} m$. Calculate young's Modulus of the material.

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130. A 3m long copper wire is stretched to produce and extension of 0.3 cm. If poisson's ratio is 0.26 for copper. What is the lateral strain

produced in the wire?

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131. What pressure is required to reduce the volume of a lead block by 1%.

Given (Bulk modulus of lead = 6×10^9 (S.I. Unit)

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132. Define the following

(i) Young's modulus

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133. Define the following

(ii) Bulk Modulus

Watch Video Solution

134. Define the following

(iii) Modulus of Elasticity

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135. The strain energy per unit volume is $6.25 \times lO^{-4} \frac{J}{m^3}$.The young's Modulus of the wire is $2 \times 10^{10} N/m^2$. Calculate strain.

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136. A. What is static friction?

B. State Hooke's law.

C. Define Poisson's ratio.

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137. Define strain energy.

Derive three expressions for strain energy

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