PHYSICS

BOOKS - UNIVERSAL BOOK DEPOT 1960 PHYSICS (HINGLISH)

ELASTICITY

Ordinary Thinking

1. The length of an iron wire is L and area of cross-section is A. The increase in length is l

on applying the force F on its two ends. Which of the statement is correct

A. Increase in length is inversely proportional to its length L

B. Increase in length is proportional to area of cross-section A

C. Increase in length is inversely proportional to A

D. Increase in length is proportional to Yound's modulus.

Answer: C

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2. The increase in length is l of a wire of length L by the longitudinal stress. Then the stress is protortional to

A. L/l

B. l/L

C. $l \times L$

D. $l^2 \times L$

Answer: B

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3. The dimensions of four wires of the same material an given below. In which wire the increase in the length will be maximum?

A. Length 100 cm, Diameter 1 mm

B. Length 200 cm, Diameter 2 mm

C. Length 300 cm, Diameter 3 mm

D. Length 50 cm, Diameter 0.5 mm

Answer: D

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4. 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: C

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5. The young's modulus of a wire of length (L) and radius (r) is Y. If the length is reduced to $\frac{L}{2}$ and radius $\frac{r}{2}$, then its young's modulus will be

A. Y/2

B. Y

C. 2 Y

D. 4 Y

Answer: B

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6. 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: C

7. When a certain weight is suspended from a long uniform wire, its length increases by $1 cm$. If the same weight is suspended from another wire of the same material and length but having a diameter half of the first one, the increases in length will be

A. 0.5 cm

B. 2 cm

C. 4 cm

D. 8 cm

Answer: C

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8. Hook's law defines

A. Stress

B. Strain

C. Modulus of elasticity

D. Elastic limit

Answer: C

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9. A wire is loaded by 6 kg at its one end, the increase in length is 12 mm . If the radius of the wire is doubled and all other magnitudes are unchanged, then increase in length will be

A. 6 mm

B. 3 mm

C. 24 mm

D. 48 mm

Answer: B

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10. The area of cross-section of a wire of length 1.1 meter is $1mm^2$. It is loaded with 1 kg. if young's modulus of copper is $1.1 \times 10^{11} N/m^2$ then the increase in length will be (if $g = 10m/s^2$)-

A. 0.01 mm

B. 0.075 mm

C. 0.1 mm

D. 0.15 mm

Answer: C

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11. On increasing the length by 0.5 mm in a steel wire of length 2 m and area of cross section $2mm^2$, the force required is [Y for steel $= 2.2 \times 10^{11} \frac{N}{m^2}$]

A. $1.1 \times 10^5 N$

B. $1.1 \times 10^4 N$

C. $1.1 \times 10^3 N$

D. $1.1 \times 10^2 N$

Answer: D

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12. If young's modulus of iron be $2 \times 10^{11} Nm^{-2}$ and interatomic distance be

$3 \times 10^{-10} m^{-2}$, the intertomic force constant will be (in N/m)

A. 60 N/m

B. 120 N/m

C. 30 N/m

D. 180 N/m

Answer: A

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13. In CGS system, the Young's modulusm of a steel wire is 2×10^{12}. To double the length of a wire of unit cross-section area, the force

A. 4×10^{6} dynes

B. 2×10^{12} dynes

C. 2×10^{12} newtons

D. 2×10^{8} dynes

Answer: B

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14. The material which practically does not exhibit elastic after effect is

A. Copper

B. Rubber

C. Steel

D. Quartz

Answer: D

15. The temperature of a wire is doubled. The Young's modulus of elasticity

A. Decreases

B. Increases

C. Remains constant

D. Becomes zero

Answer: A

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16. A force F is needed to break a copper wire having radius R. The force needed to break a copper wire of same length and radius 2R will be

A. $F/2$

B. 2 F

C. 4 F

D. $F/4$

Answer: C

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17. The relationship between Young's modulus Y, Bulk modulus K and modulus of rigidity η is

A. $Y = \dfrac{9\eta K}{\eta + 3K}$

B. $\dfrac{9YK}{Y + 3K}$

C. $Y = \dfrac{9\eta K}{3 + K}$

D. $Y = \dfrac{3\eta K}{9\eta + K}$

Answer: A

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18. The diameter of a brass rod is 4 mm and Young's modulus of brass is $9 \times 10^{10} N/m^2$. The force required to stretch by 0.1 % of its length is

A. $360\pi N$

B. $36N$

C. $144\pi \times 10^3 N$

D. $36\pi \times 10^5 N$

Answer: A

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19. If x longitudinal strain is produced in a wire of Young's modulus y, then energy stored in the material of the wire per unit volume is

A. yx^2

B. $2yx^2$

C. $\frac{1}{2}y^2x$

D. $\frac{1}{2}yx^2$

Answer: D

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20. In a wire of length L, the increase in its length is l. If the length is reduced to half, the increase in its length will be

A. l

B. $2l$

C. $\frac{l}{2}$

D. None of the above

Answer: C

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21. The Young's modulus of a rubber string 8 cm long and density $1.5kg/m^3$ is $5 \times 10^8 N/m^2$ is suspended on the ceiling in a room. The increase in length due to its own weight will be-

A. 9.6×10^{-5}m

B. 9.6×10^{-11} m

C. 9.6×10^{-3} m

D. $9.6m$

Answer: B

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22. A and B are two wires. The radius of A is twice that of B. They are stretched by the some load. The the stress on B is

A. Equal to that on A

B. Four times that on A

C. Two times that on A

D. Half that on A

Answer: B

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23. If the length of a wire is reduced to half, then it can hold the.....load

A. Half

B. Same

C. Double

D. One fourth

Answer: B

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24. To double the length of a iron wire having $0.5cm^2$ area of cross-section, the required force will be $\left(Y = 10^{12}\text{dyne/cm}^2\right)$

A. $1.0 \times 10^{-7}N$

B. $1.0 \times 10^{7} N$

C. $0.5 \times 10^{-7} N$

D. 0.5×10^{12} dyne

Answer: D

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25. The spring balance does not read properly after its long use because

A. The elasticity of spring increases

B. The elasticity decreases

C. Its plastic power decreases

D. Its plastic power increases

Answer: B

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26. Two wires of equal length are made of the same material. Wire A has a diameter that is twice as that of wire B. If identical weights are suspended from the ends of these wires, the increase in length is

A. Four times for wire A as for wire B

B. Twice for wire A as for white B

C. Half for wire A as for wire B

D. One-fourth for wire A as for wire B

Answer: D

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27. Why is a spring made of steel, not of copper?

A. Copper is more costly than steel

B. Copper is more elastic than steel

C. Steel is more elastic than copper

D. None of the above

Answer: C

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28. Steel and copper wires of same length are stretched by the same weight one after the other. Young's modulus of steel and copper are $2 \times 10^{11} \frac{N}{m^2}$ and $1.2 \times 10^{11} \frac{N}{m^2}$. The ratio of increase in length is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{5}{4}$

D. $\frac{5}{2}$

Answer: B

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29. An area of cross-section of rubber string is $2cm^2$. It length is doubled when stretched with a linear force of 2×10^5 dynes. The Young's modulus of the rubber in dyne/cm^2 will be

A. 4×10^5

B. 1×10^5

C. 2×10^5

D. 1×10^4

Answer: B

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30. Increase in length of a wire is 1 mm when suspended by a weight. If the same weight is suspended on a wire of double its length and double its radius, the increase in length will be

A. $2mm$

B. $0.5mm$

C. $4mm$

D. $0.25mm$

Answer: B

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31. The temperature of a wire of length 1 metre and area of cross-section $1cm^2$ is increased from $0^\circ C$ to $100^\circ C$. If the rod is not allowed to increased in length, the force required will be $\left(\alpha = 10^{-5} / .^\circ C \text{ and } Y = 10^{11} N / m^2\right)$

A. $10^3 N$

B. $10^4 N$

C. $10^5 N$

D. $10^9 N$

Answer: B

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32. A rod of length l and area of cross-section A is heated from $0^\circ C$ to $100^\circ C$. The rod is so placed that it is not allowed to increase in length, then the force developed is proportional to

A. l

B. l^{-1}

C. A

D. A^{-1}

Answer: C

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33. An aluminium rod has a breaking strain 0.2%. The minimum cross-sectional area of the rod in m^2 in order to support a load of $10^4 N$ is fi (Young's modulus is $7 \times 10^9 Nm^{-2}$)

A. $1 \times 10^{-2} m^2$

B. $1.4 \times 10^{-3} m^2$

C. $3.5 \times 10^{-3} m^2$

D. $7.1 \times 10^{-4} m^2$

Answer: D

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34. Two wires of copper having the length in the ratio $4:1$ and their radii ratio as $1:4$ are stretched by the same force. The ratio of longitudinal strain in the two will be

A. $1:16$

B. $16:1$

C. $1:64$

D. $64:1$

Answer: B

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35. A weight of 200 kg is suspended by vertical wire of length $600.5cm$. The area of cross-section of wire is $1mm^2$. When the load is removed, the wire contracts by $0.5cm$. The Young's modulus of the material of wire will be

A. $2.35 \times 10^{12} N/m^2$

B. $1.35 \times 10^{10} N/m^2$

C. $13.5 \times 10^{11} N / m^2$

D. $23.5 \times 10^9 N / m^2$

Answer: A

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36. If a load of $9kg$ is suspended on a wire, the increase in length is $4.5mm$. The force constant of the wire is

A. $0.49 \times 10^4 N / m$

B. $1.96 \times 10^4 N/m$

C. $4.9 \times 10^4 N/m$

D. $0.196 \times 10^4 N/m$

Answer: B

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37. The ratio of diameters of two wires of same material is $n:1$. The length of each wire is $4m$. On applying the same load, the increases in the length of the thin wire will be $(n > 1)$

A. n^2 times

B. n times

C. 2n times

D. None of the above

Answer: A

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38. Longitudinal stress of $1kg/mm^2$ is applied on a wire. The percentage increase in length is

$(Y = 10^{11} N/m^2)$

A. 0.002

B. 0.001

C. 0.003

D. 0.01

Answer: B

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39. A steel wire is stretched with a definite load. If the Young's modulues of the wire is Y. For decreasing the value of Y.

A. Radius is to be decreased

B. Radius is to be increased

C. Length is to be increased

D. None of the above

Answer: D

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40. The interatomic distance for a metal is 3×10^{-10} m. If the interatomic force constant is $3.6 \times 10^{-9} N/Å$. The the Young's modulus in N/m^2 will be

A. 1.2×10^{11}

B. 4.2×10^{11}

C. 10.8×10^{-19}

D. 2.4×10^{10}

Answer: A

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41. Two identical wires of rubber and iron are stretched by the same weight, then the number of atoms in the iron wire will be

A. Equal to that of rubber

B. Less than that of the rubber

C. More than that of the rubber

D. None of the above

Answer: C

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42. The force constant of a wire does not depend on

A. Nature of the material

B. Radius of the wire

C. Length of the wire

D. None of the above

Answer: D

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43. The elasticity of invar

A. Increase with temperature rise

B. Decreases with temperature rise

C. Does not depend on temperature

D. None of the above

Answer: C

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44. After effects of elasticity are maximum for

A. Glass

B. Quartz

C. Rubber

D. Metal

Answer: A

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45. In suspended type moving coil galvanometer, quartz suspension is used because

A. It is good conductor of electricity

B. Elastic after effects are negligible

C. Young's modulus is greater

D. There is no elastic limit

Answer: B

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46. A force of 200 N is applied at one end of a wire of length 2m and having area of cross-section $10^{-2}cm^2$. The other end of the wire is rigidly fixed. If coefficient of linear expansion of the wire $\alpha = 8 \times 10^{-6} / . ^{\circ} C$ and Young's modulus $Y = 2.2 \times 10^{11} N / m^2$ and its temperature is increased by $5^{\circ} C$, then the increase in the tension of the wire will be

A. 4.3 N

B. 4.4 N

C. 2.4 N

D. 8.8 N

Answer: D

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47. When compared with solids and liquids, the gases have

A. Minimum volume elasticity

B. Maximum volune elasticity

C. Maximum Young's modulus

D. Maximum modulus of rigidity

Answer: A

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48. The length of a wire is $1.0 m$ and the area of cross-section is $1.0 \times 10^{-2} cm^2$. If the work done for increase in length by $0.2 cm$ is 0.4 joule, then Young's modulus of the material of the wire is

A. $2.0 \times 10^{10} N/m^2$

B. $4 \times 10^{10} N/m^2$

C. $2.0 \times 10^{11} N/m^2$

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

Answer: C

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49. The quality of the material which opposes the changes in shape, volumer or length is called

A. Intermolecular repulsion

B. Intermolecular behaviour

C. Viscosity

D. Elasticity

Answer: D

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50. For silver Young's modulus is $7.5 \times 10^{10} N / m^2$ and Bulk modulus is $11 \times 10^{10} N / m^2$. Its poisson's ratio will be

A. -1

B. 0.5

C. 0.39

D. 0.25

Answer: C

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51. The longitudinal strain is only possible in

A. Gases

B. Fluids

C. Solids

D. Liquids

Answer: C

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52. If the density of the material increase, the value of young's modulus

A. Increases

B. decreases

C. First increases then decreases

D. First decreases then increases

Answer: A

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53. Young's modulus of rubber is $10^4 N/m^2$ and area of cross section is $2cm^2$. If force of $2 \times 10^5 dyn$ is applied along its length, then its final length becomes

A. 3 L

B. 4 L

C. 2 L

D. None of the above

Answer: C

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54. For a gas elastic limit

A. Exists

B. Exists only at absolute zero

C. Exists for a perfect gas

D. Does not exist

Answer: A

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55. If Young's modulus for a material is zero, then the state of material should be

A. Solid

B. Solid but powder

C. Gas

D. None of the above

Answer: B

56. Liquids have no Poisson's ratio because

A. It has no definite shape

B. It has greater volume

C. In has lesser density than solid

D. None of the above

Answer: A

57. A wire of length L and radius a rigidlyl fixed at one end. On stretching the other end of the wire with a force F, the increase in its length is L, if another wire of same material but of length 2 L and radius 2 a is stretched with a force 2 F, the increase in its length will be

A. l

B. $2l$

C. $\frac{l}{2}$

D. $\frac{l}{4}$

Answer: A

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58. In steel, the Young's modulus and the strain at the breaking point are $2 \times 10^{11} Nm^{-2}$ and 0.15 respectively the stress at the break point for steel is

A. $1.33 \times 10^{11} Nm^{-2}$

B. $1.33 \times 10^{12} Nm^{-2}$

C. $7.5 \times 10^{-13} Nm^{-2}$

D. $3 \times 10^{10} Nm^{-2}$

Answer: D

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59. Which of the following statements is correct

A. Hooke's law is applicable only within elastic limit

B. The adiabatic and isothermal elastic constants of a gas are equal

C. Young's modulus is dimensionless

D. Stress multiplied by strain is equal to the stored energy

Answer: A

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60. The force required to stretch a steel wire $1cm^2$ in cross - section to increase its length by 1% ,if its Young's modulus is $2\times10^{11}Nm^{-2}$,is

A. $2\times10^{6}N$

B. $2\times10^{3}N$

C. $2\times10^{-6}N$

D. $2\times10^{-7}N$

Answer: A

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61. Which one of the following substances possesses the highest elasticity-

A. Rubber

B. Glass

C. Steel

D. Copper

Answer: C

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62. Which one of the following quantities does not have the unit of force per unit area

A. Stress

B. Strain

C. Young's modulus of elasticity

D. Pressure

Answer: B

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63. A Copper wire and steel of the same diameter and length are connected end to end and a force is applied, which stretches their combined length by 1 cm. The two wires will have

A. Different stresses and strains

B. The same stress and strain

C. The same strain but different stresses

D. The same stress but different strains.

Answer: D

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64. 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. $AE\frac{R}{r}$

B. $AE\left(\frac{R-r}{r}\right)$

C. $\frac{E}{A}\left(\frac{R-r}{A}\right)$

D. $\frac{Er}{AR}$

Answer: B

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65. A wire extends by $1mm$ when a force a applied. Double the force is applied to another wire of some material and length but half the radius of cross-section. The elongation of the wire in mm will be

A. 8

B. 4

C. 2

D. 1

Answer: A

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66. Two wires of the same material have lengths in the ratio $1:2$ and their radii are in the ratio $1:\sqrt{2}$ If they are stretched by applying equal forces, the increase in their lengths will be in the ratio

A. $2:\sqrt{2}$

B. $\sqrt{2}:2$

C. $1:1$

D. $1:2$

Answer: C

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67. When a weight of $10kg$ is suspended from a copper wire of length 3 metres and diameters $0.4mm$, its length increases by

$2.4cm$. If the diameter of the wire is doubled, then the extension in its length will be

A. $9.6cm$

B. $4.8cm$

C. $1.2cm$

D. $0.6cm$

Answer: D

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68. A force of 10^3 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: B

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69. Two wires 'A' and 'B' of the same material have radii in the ratio $2:1$ and lengths in the ratio $4:1$. The ratio of the normal forces required to produce the same change in the lengths of these two wires is

A. $1:1$

B. $1:2$

C. $1:4$

D. $1 : 2$

Answer: A

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70. Density of rubber is d. A thick rubber cord of length L and cross-section area. A undergoes elongation under its own weight on suspending it. This elongation is proportional to

A. dL

B. Ad / L

C. Ad / L^2

D. dL^2

Answer: D

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71. The ratio of two specific heats of has C_p / C_v for argon is 1.6 and for hydrogen is 1.4. Adiabatic elasticity of argon at pressure P is E

Adiabatic elasticity of hydrogen will also be equal to E at the pressure

A. P

B. $\frac{8}{7}P$

C. $\frac{7}{8}P$

D. $1.4P$

Answer: B

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72. The relation betweent γ, η and K for a elastic material is

A. $\frac{1}{\eta} = \frac{1}{3\gamma} + \frac{1}{3K}$

B. $\frac{1}{K} = \frac{1}{3\gamma} + \frac{1}{9\eta}$

C. $\frac{1}{\gamma} = \frac{1}{3K} + \frac{1}{9\eta}$

D. $\frac{1}{\gamma} = \frac{1}{3\eta} + \frac{1}{9K}$

Answer: D

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73. A fixed volume of iron is drawn into a wire of length l. The extension produced in this wire by a constant force F is proportional to

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

B. $\frac{1}{L}$

C. L^2

D. L

Answer: C

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74. A wire of cross-sectional area $3mm^2$ is first stretched between two fixed points at a temperature of $20^\circ C$. Determine the tension when the temperature falls to $10^\circ C$ Coefficient of linear expansion $\alpha = 10^{-5} .^\circ C^{-1}$ and $Y = 2 \times 10^{11} N/m^2$

A. 20 N

B. 30 N

C. 60 N

D. 120 N

Answer: C

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75. To keep constant time, watches are fitted with balance whell made of

A. Invar

B. Stainless steel

C. Tungsten

D. Platinum

Answer: A

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76. A wire is stretched by 0.01 m by a certain force F. Another wire of the same material whose diameter and length are double to the original wire is stretched by the same force. Then its elongation will be

A. 0.005 m

B. 0.01 m

C. 0.02 m

D. 0.002 m

Answer: A

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77. What is the possible value of Poisson's ratio of a substance?

A. 1

B. 0.9

C. 0.8

D. 0.4

Answer: D

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78. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Length of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperature, which one of the following relations holds good?

A. $\alpha_1 l_2 = \alpha_2 l_1$

B. $\alpha_1 l_2^2 = \alpha_2 l_1^2$

C. $\alpha_1^2 l_1 = \alpha_2^2 l_2$

D. $\alpha_1 l_2 = \alpha_2 l_2$

Answer: D

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79. A rod is fixed between two points at $20^\circ C$. The coefficient of linear expansion of material of rod is $1.1 \times 10^{-5} / .^C$ and Young's modulus is $1.2 \times 10^{11} N/m$. Find the stress develop in the rod if temperature of rod becomes $10^{\circ} C$

A. $1.32 \times 10^{7} N/m^2$

B. $1.10 \times 10^{15} N/m^2$

C. $1.32 \times 10^{8} N/m^2$

D. $1.10 \times 10^{6} N/m^2$

Answer: A

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80. The extension of a wire by the application of load is $3mm$. The extension in a wire of the same material and length but half the radius by the same load is

A. 12 mm

B. 0.75 mm

C. 15 mm

D. 6 mm

Answer: A

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81. A thick rope of rubber of density $1.5 \times 10^3 kgm^{-3}$ and Young's modulus $5 \times 10^6 Nm^{-2}$, 8 m in length, when hung from ceiling of a room, the increases in length due to its own weight is

A. $9.6m$

B. 9.6×10^3m

C. 19.2×10^{-2} m

D. 9.6×10^{-2} m

Answer: D

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82. In which case there is maximum extension in the wire, if same force is applied on each wire

A. L = 500 cm, d = 0.05 mm

B. L = 200 cm,d = 0.02 mm

C. L = 300 cm,d = 0.03 mm

D. L = 400 cm,d = 0.01 mm

Answer: D

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83. If a spring is extended to length l, the according to Hook's law

A. $F = kl$

B. $F = \frac{k}{l}$

C. $F = k^2 l$

D. $F = \frac{k^2}{l}$

Answer: A

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84. Which of the following affects the elasticity of a substance

A. Hammering and annealing

B. Change in temperature

C. Impurity in substance

D. All of these

Answer: D

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85. An iron rod of length 2m and cross section area of $50mm^2$, stretched by 0.5 mm, when a mass 250 kg is hung from its lower end. Young's modulus of the iron rod is

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

B. $19.6 \times 10^{15} N / m^2$

C. $19.6 \times 10^{18} N / m^2$

D. $19.6 \times 10^{20} N / m^2$

Answer: A

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86. In soild, inter-atomic forces are

A. Totally repulsive

B. Totally attractive

C. Combination of (a) and (b)

D. None of these

Answer: C

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87. A force F is applied on the wire of radius r and length L and change in the length of wire is l. If the same force F is applied on the wire of the same material and radius 2r and length 2L. Then the change in length of the other wire is

A. l

B. $2l$

C. $l/2$

D. $4l$

Answer: C

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88. The modulus of elasticity is dimesionally equivalent to

A. Surface tension

B. Stress

C. Strain

D. None of these

Answer: B

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89. Under elastic limit the stess is

A. inversely, proportional to strain

B. Directly proportional to strain

C. Square root of strain

D. Independent of strain

Answer: B

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90. A stell wire of 1m long $1mm^2$ cross section area is hang from rigid end. The length of 1kg is hung from it then change in length will be (given $Y = 2 \times 10^{11} N/m^2$)

A. 0.5 mm

B. 0.25 mm

C. 0.05 mm

D. 5 mm

Answer: C

Watch Video Solution

91. A load W produces an extension of $1mm$ in a thread of radius r. Now if the load is made

$4W$ and radius is made $2r$ all other things remaining same, the extension will become.

A. $4mm$

B. $16mm$

C. $1mm$

D. $0.25mm$

Answer: C

Watch Video Solution

92. The units of Young's modulus of elasticity are

A. Nm^{-1}

B. $N-m$

C. Nm^{-2}

D. $N-m^2$

Answer: C

Watch Video Solution

93. Two similar wires under the same load yield elongation of $0.1mm$ and $0.05mm$ respectively. If the area of cross-section of the first wire is $4mm^2$, then the area of cross-section of the second wire is

A. $6mm^2$

B. $8mm^2$

C. $10mm^2$

D. $12mm^2$

Answer: B

Watch Video Solution

94. A 5 m long aluminium wire $\left(Y = 7 \times 10^{10} \frac{N}{m^2}\right)$ of diameter 3 mm supprts a 40 kg mass. In order to have the same elongation in a copper wire $\left(Y = 12 \times 10^{10} \frac{N}{m^2}\right)$ of the same length under the same weight, the diameter should now, in mm

A. 1.75

B. 1.5

C. 2.5

D. 5.0

Answer: C

Watch Video Solution

95. How much force is required to produce an increase of 0.2 % in the length of a brass wire of diameter 0.6 mm

(Young's modulus for brass $= 0.9 \times 10^{11} N/m^2$)

A. Nearly 17 N

B. Nearly 34 N

C. Nearly 51 N

D. Nearly 68 N

Answer: C

Watch Video Solution

96. On applying a stress of $20 \times 10^8 N / m^2$ the length of a perfectly elastic wire is doubled. It Young's modulus will be

A. $40 \times 10^8 N/m^2$

B. $20 \times 10^8 N/m^2$

C. $10 \times 10^8 N/m^2$

D. $5 \times 10^8 N/m^2$

Answer: B

Watch Video Solution

97. When a uniform wire of radius r is stretched by a $2kg$ weight, the increase in its length is $2.00mm$. If the radius of the wire is

$r/2$ and other conditions remain the same, the increase in its length is

A. $2.00mm$

B. $4.00mm$

C. $6.00mm$

D. $8.00mm$

Answer: D

Watch Video Solution

98. 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. $5b - 4b$

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

D. $4a - 3b$

Answer: B

Watch Video Solution

99. Stress to strain ratio is equivalent to

A. Modulus of elasticity

B. Poission's Ratio

C. Rehyhold number

D. Fund number

Answer: A

Watch Video Solution

100. Which is correct relation

A. $T < \sigma$

B. $Y > \sigma$

C. $Y = \sigma$

D. $\sigma = +1$

Answer: B

Watch Video Solution

101. If the interatomic spacing in a steel wire is 3.0Å and $Y_{steel} = 20 \times 10^{10} N / m^2$ then force constant is

A. $6 \times 10^{-2} N / \text{Å}$

B. $6 \times 10^{-9} N / \text{Å}$

C. $4 \times 10^{-5} N / \text{Å}$

D. $6 \times 10^{-5} N / \text{Å}$

Answer: B

Watch Video Solution

102. A copper wire of length $4.0mm$ and area of cross-section $1.2cm^2$ is stretched with a force of 4.8×10^3N. If Young's modulus for copper is $1.2 \times 10^{11} N/m^2$, the increases in the length of the wire will be

A. $1.33mm$

B. $1.33cm$

C. $2.66mm$

D. $2.66cm$

Answer: A

Watch Video Solution

103. A metal bar of length L and area of cross-section A is clamped between two rigid supports. For the material of the rod. It Young's modulus is T and Coefficient if linear expansion is α. If the temperature of the rod is increased by $\Delta t^{\circ} C$, the force exerted by the rod on the supports is

A. $YAL\Delta t$

B. $YA\alpha\Delta t$

C. $\frac{YL\alpha\Delta t}{A}$

D. $Y\alpha AL\Delta t$

Answer: B

Watch Video Solution

104. According to Hooke's law of elasticity, if stress is increaed, the ratio of stress to strain

A. Increases

B. Decreases

C. Becomes zero

D. Remains constant

Answer: D

Watch Video Solution

105. A pan with set of weights is attached with a light spring. When disturbed, the mass-spring system oscillates with a time period of $0.6s$ When some additional weights are added then time period is $0.7s$ the extension caused by the additional weigts is approximately given by

A. 1.38 cm

B. 3.5 cm

C. 1.75 cm

D. 2.45 cm

Answer: B

Watch Video Solution

106. A uniform plank of Young's modulus Y is moved over a smooth horizontal surface by a constant horizontal force F. The area of cross section of the plank is A. The compressive strain on the plank in the direction of the force is

A. F / AY

B. $2F / AY$

C. $\frac{1}{2}(F / AY)$

D. $3F / AY$

Answer: A

Watch Video Solution

107. The mean distance between the atoms of iron is 3×10^{-10} m and interatomic fore constant for iron is $7N/m$. The Young's modulus of elasticity for iron is

A. $2.33 \times 10^{5} N/m^{2}$

B. $23.3 \times 10^{10} N/m^{2}$

C. $233 \times 10^{10} N/m^{2}$

D. $2.33 \times 10^{10} N/m^2$

Answer: D

Watch Video Solution

108. Two wires A and B are of same material. Their lengths are in the ratio 1:2 and diameters are in the ratio 2:1 when stretched by force F_A and F_B respectively they get equal increase in their lengths. Then the ratio $\frac{F_A}{F_B}$ should be

A. $1:2$

B. $1:1$

C. $2:1$

D. $8:1$

Answer: D

Watch Video Solution

109. The breaking stress of a wire depends on

A. Length of the wire

B. Radius of the wire

C. Material of the wire

D. Shape of the cross section

Answer: C

Watch Video Solution

110. The area of cross section of a steel wire $(Y = 2.0 \times 10^{11} N/m^2)$ is $0.1 cm^2$. The force required to double is length will be

A. $2 \times 10^{12} N$

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

C. $2 \times 10^{10} N$

D. $2 \times 10^{6} N$

Answer: D

Watch Video Solution

111. A rubber cord catapult has cross-sectional area $25 mm^2$ and initial length of rubber cord is $10 cm$. It is stretched to $5 cm$. And then released to protect a missle of mass $5gm$

Taking $Y_{\text{nibber}} = 5 \times 10^7 N/m^2$ velocity of

projected missle is

A. $20ms^{-1}$

B. $100ms^{-1}$

C. $250ms^{-1}$

D. $200ms^{-1}$

Answer: C

Watch Video Solution

112. According to Hook's law force is proportional to

A. $\frac{1}{x}$

B. $\frac{1}{x^2}$

C. x

D. x^2

Answer: C

Watch Video Solution

113. In the Young's experiment. It length of wire and radius both are doubled then the value of Y will become

A. 2 times

B. 4 times

C. Remains same

D. Half

Answer: C

Watch Video Solution

114. Minimum and maximum values of Poisson's ratio for a metal lies between

A. $-\infty$ to $+\infty$

B. 0 to 1

C. $-\infty$ to 1

D. 0 to 0.5

Answer: D

Watch Video Solution

115. A wire of diameter $1mm$ breaks under a tension of 1000 N. Another wire, of same material as that of the first one, but of diameter $2mm$ breaks under a tension of

A. 500 N

B. 1000 N

C. 10000 N

D. 4000 N

Answer: D

Watch Video Solution

116. What is the value of Young's modulus for a perfectly rigid body?

A. Zero

B. Infinity

C. $1 \times 10^{10} N / m^2$

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

Answer: B

Watch Video Solution

117. A wire of length $2m$ is made from $10cm^2$ of copper. A force F is applied so that its length increases by $2mm$. Another wire of length $8m$ is made from the same volume of copper. If the force F is applied to it, its length will increase by

A. 0.8 cm

B. 1.6 cm

C. 2.4 cm

D. 3.2 cm

Answer: D

Watch Video Solution

118. A wire of cross section 4 mm is stretched by 0.1 mm by a certain weight. How far (length) will be wire of same material and length but of area $8mm$ stretch under the action of same force.

A. 0.05 mm

B. 0.10 mm

C. 0.15 mm

D. 0.20 mm

Answer: A

Watch Video Solution

119. A substance breaks down by a stress of $10N/m$. If the density of the material of the wire is $3 \times 10kg/m$, then the length of the wire of the substance which will break under its own weight when suspended vertically is

A. 66.6 m

B. 60.0 m

C. 33.3 m

D. 30.0 m

Answer: C

Watch Video Solution

120. A rubber cord $10m$ long is suspended vertically. How much does it stretch under its own weight (Density of rubber is $1500 kg/m, Y = 5 \times 10 N/m, g = 10 m/s$)

A. 15×10 m

B. 7.5×10 m

C. 12×10 m

D. 25×10 m

Answer: A

Watch Video Solution

121. The valve of Poisson's ratio lies between

A. -1 to $\frac{1}{2}$

B. $-\frac{3}{4}$ to $-\frac{1}{2}$

C. $-\frac{1}{2}$ to 1

D. 1 to 2

Answer: A

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122. The poisson's ratio cannot have the value

A. 0.7

B. 0.2

C. 0.1

D. 0.5

Answer: A

Watch Video Solution

123. It the volume of a wire remains constant when subjected to tensile stress, the value of Poisson's ratio of the material of the wire is

A. $+0.50$

B. -0.50

C. 0.25

D. -0.25

Answer: B

Watch Video Solution

124. A material has Poisson's ratio 0.5, If a uniform rod of it suffers a longtiudinal strain of 2×10^{-3} then the percentage increases in its volume is

A. 0.6

B. 0.4

C. 0.2

D. Zero

Answer: D

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125. Four identical rods are stretched by same force. Maximum extension is produced in

A. L = 10 cm,D = 1 mm

B. L = 100 cm,D = 2 mm

C. L = 200cm,D=3 mm

D. L = 300 cm,D=4 mm

Answer: B

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Bulk Modulus

1. The isotermal elasticity of a gas is equal to

A. Density

B. Volume

C. Pressure

D. Specific heat

Answer: C

Watch Video Solution

2. The adiabatic elasticity of a gas is equal to

A. $\gamma \times$ density

B. $\gamma \times$ volume

C. $\gamma \times$ pressure

D. $\gamma \times$ specific heat

Answer: C

Watch Video Solution

3. The specific heat at constant pressure and at constant volume for an ideal gas are C_p and $C_v$and its adiabatic and isothermal eleasticities are E_ϕ and E_θ respectively. The ratio of E_ϕ to E_θ is

A. C_k / C_p

B. C_p / C_v

C. $C_p C_v$

D. $1 / C_p C_v$

Answer: B

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4. The only elastic modulus that applies to fluids is

A. young's modulus

B. Shear modulus

C. Modulus of rigidity

D. Bulk modulus

Answer: D

Watch Video Solution

5. The ratio of the adiabatic to isothermal elasticities of a triatomic gas is

A. $3/4$

B. $4/3$

C. 1

D. $5/3$

Answer: B

Watch Video Solution

6. If the volume of the given mass of a gas is increased four times, the temperature is raised from $27^{\circ} C$ to $127^{\circ} C$. The elasticity will become

A. 4 times

B. $1 / 4$ times

C. 3 times

D. $1 / 3$ times

Answer: D

Watch Video Solution

7. The compressibility of water is 4×10^{-5} per unit atmospheric pressure. The decrease in volume of 100 cubic centimetre of water under a pressure of 100 atmosphere will be

A. 0.4 cc

B. $4 \times 10^{-5} cc$

C. $0.025 cc$

D. $0.004 cc$

Answer: A

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8. If a rubber ball is taken at the depth of 200 m in a pool, its volume decreases by0.1% 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. 2×10^9

Answer: D

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9. The compressility of a material is

A. Product of volume and its pressure

B. The change in pressure per unit change in volume strain

C. The fractional change in volume per unit change in pressure

D. None of the above

Answer: C

Watch Video Solution

10. When a pressure of 100 atmosphere is applied on a spherical ball, then its volume reduces to 0.01%. The bulk modulus of the material of the rubber in dyne/cm^2 is

A. 10×10^{12}

B. 100×10^{12}

C. 1×10^{12}

D. 20×10^{12}

Answer: C

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11. In the three states of matter, the elastic coefficient can be

A. young's modulus

B. Coefficient of volume elasticity

C. Modulus of rigidity

D. Poisson's ratio

Answer: B

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12. Bulk modulus was first defined by

A. Young

B. Bulk

C. Maxwell

D. None of the above

Answer: C

Watch Video Solution

13. A uniform cube is subjected to volume compression. If each side is decreased by 1 % then bulk strain is

A. 0.01

B. 0.06

C. 0.02

D. 0.03

Answer: D

Watch Video Solution

14. 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. $1.96 \times 10^{9} N/m^{2}$

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: A

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15. The isothermal bulk modulus of a gas at atmospheric pressure is

A. 1 mm of Hg

B. 13.6 mm of Hg

C. $1.013 \times 10^5 N/m^2$

D. $2.026 \times 10^5 N/m^2$

Answer: C

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16. Coefficient of isothermal elasticity E_{θ} and coefficient of adiabatic elasticity E_{ϕ} are related by $(\gamma = C_p / C_v)$

A. $E_{\theta} = \gamma E_{\phi}$

B. $E_{\phi} = \gamma E_{\theta}$

C. $E_{\theta} = \gamma / E_{\phi}$

D. $E_{\theta} = \gamma^2 E_{\phi}$

Answer: B

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17. The bulk modulus of an ideal gas at constant temperature

A. Is equal to its volume V

B. Is equal to p/2

C. Is equal to its pressure p

D. Can not be determined

Answer: C

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18. The bulk modulus for an incompresssible liquid is

A. Zero

B. unity

C. Infinity

D. Between 0 to 1

Answer: C

Watch Video Solution

19. The pressure applied from all direction on a cube is P. How much its temperature should be raised to maintain the original volume ? The volume elasticity of the cube is β and the coefficient of volume expansion is α

A. $\frac{P}{\alpha\beta}$

B. $\frac{P\alpha}{\beta}$

C. $\frac{P\beta}{\alpha}$

D. $\frac{\alpha B}{P}$

Answer: A

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20. The pressure of a medium is charged from $1.01 \times 10. Pa$ to $1.165 \times 10. Pa$ and change in volume is 10 % keeping temperature constant. The Bulk modulus of the medium is

A. $204.8 \times 10^5 Pa$

B. $102.4 \times 10^5 Pa$

C. $51.2 \times 10^5 Pa$

D. $1.55 \times 10^5 Pa$

Answer: D

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21. For a constant hydraulic stress on an object, the fractional change in the object's volume $\left(\frac{\triangle V}{V}\right)$ and its bulk modulus (B) are related as

A. $\frac{\Delta V}{V} \propto B$

B. $\frac{\Delta V}{V} \propto \frac{1}{B}$

C. $\frac{\Delta V}{V} \propto B^2$

D. $\frac{\Delta V}{V} \propto B^{-2}$

Answer: B

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Rigidity Modulus

1. Modulus of rigidity of diamond is

A. Too less

B. Greater than all matters

C. Less than all matters

D. Zero

Answer: B

Watch Video Solution

2. The ratio of lengths of two rods A and B of same material is $1:2$ and the ratio of their radii is $2:1$, then the ratio of modulus of rigidity of A and B will be

A. $4:1$

B. $16:1$

C. $8:1$

D. $1:1$

Answer: D

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3. Which statement is true for a metal

A. $Y < \eta$

B. $Y = \eta$

C. $Y > \eta$

D. $Y < 1/\eta$

Answer: C

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4. Which of the following relations is true

A. $3Y = K(1 - \sigma)$

B. $K = \dfrac{9\eta Y}{Y + \eta}$

C. $\sigma = (6K + \eta)Y$

D. $\sigma = \dfrac{0.5Y - \eta}{\eta}$

Answer: D

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5. Two wires A and B of same length and of the same material have the respective radii r_1 and r_2. Their one end is fixed with a rigid support, and at other end equal twisting couple is applied. Then the ratio of the angle of twist at the end of A and the angle of twist at the end of B will be

A. $\frac{r_1^2}{r_{2^2}}$

B. $\frac{r_2^2}{r_2^2}$

C. $\frac{r_2^4}{r_1^4}$

D. $\frac{r_1^4}{r_2^4}$

Answer: C

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6. A spring is stretched by applying a load to its free end. The strain produced in the spring is

A. Shearing

B. Longitudinal

C. Volume

D. Transverse

Answer: A

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7. The Young's modulus of the material of a wire is $6 \times 10^{12} N / m^2$ and there is no transverse strain in it.then it modulus of rigidity will be

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

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

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

D. None of the above

Answer: A

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8. If the Young's modulus of the material is 3 times its modulus of rigidity, then its volume elasticity will be

A. Zero

B. Infinity

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

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

Answer: B

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9. Modulus of rigidity of a liquid

A. None zero constant

B. Infinite

C. Zero

D. Can not be predicted

Answer: C

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10. For a given material, Young's modulus is 2.4 times that of rigidity modulus. Its Poisson's ratio is

A. 2.4

B. 1.2

C. 0.4

D. 0.2

Answer: D

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11. A cube of aluminium of sides 0.1 m is subjected to a shearing force of 100 N. The top face of the cube is displaced through 0.02 cm with respect to the bottom face. The shearing strain would be

A. 0.02

B. 0.1

C. 0.005

D. 0.002

Answer: D

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12. The reason for the change in shape of a regular body is

A. Volume stress

B. Shearing strain

C. Longitudinal strain

D. Metallic strain

Answer: B

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13. The lower surface of a cube is fixed. On its upper surface, force is applied at an angle of 30° from its surface. The change will be the type

A. Shape

B. Size

C. None

D. Shape and size

Answer: D

Watch Video Solution

14. The upper end of a wire of radius 4 mm and length 100 cm is clamped and its other end is twisted through an angle of 30°. Then angle of shear is

A. 12°

B. 0.12°

C. 1.2°

D. 0.012°

Answer: B

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15. Mark the wrong statement

A. Sliding of molecular layer is much easier compression or expansion

B. Reciprocal of bulk modulus of elasticity is called compressibility

C. It is difficult to twist a long rod as compared to small rod

D. Hollow shaft is much stronger than a solid rod of same length and same mass.

Answer: C

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16. A 2m long rod of radius 1 cm which is fixed from one end is given a twist of 0.8 radians the shear strain developed will be

A. 0.002

B. 0.004

C. 0.008

D. 0.016

Answer: B

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17. A rod of length l and radius r is joined to a rod of length $l/2$ and radius $r/2$ of same material. The free end of small rod is fixed to a rigid base and the free end of larger rod is given a twist of θ°, the twist angle at the joint will be

A. $\theta / 4$

B. $\theta / 2$

C. $5\theta / 6$

D. $8\theta / 9$

Answer: D

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18. Shearing stress causes change in

A. Length

B. Breadth

C. Shape

D. Volume

Answer: C

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Work Done In Stretching A Wire

1. If the potential energy of a spring is V on stretching it by $2cm$, then its potential energy when it is stretched by $10cm$ will be

A. $V/25$

B. $5V$

C. $V/5$

D. $25V$

Answer: D

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2. The work done in stretching an elastic wire per unit volume is or strain energy in a stretched string is

A. Stress $\times$ Strain

B. $\frac{1}{2} \times$ Stress $\times$ Strain

C. $2 \times$ Strain $\times$ strain

D. Stress/Strain

Answer: B

Watch Video Solution

3. Calculate the work done, if a wire is loaded by 'Mg' weight and the increase in lengt is$l$

A. Mgl

B. Zero

C. $Mgl/2$

D. $2Mgl$

Answer: C

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4. Two wires of same diameter of the same material having the length l and $2l$.If the force F is applied on each, the ratio of the work done in the two wires will be

A. $1:2$

B. $1:4$

C. $2:1$

D. $1:1$

Answer: D

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5. A 5 metre long wire is fixed to the ceiling. A weight of 10 kg is hung at the lower end at is 1 metre above the floor. The wire was alongated by 1 mm. The energy stored in the wire due to stretching is

A. Zero

B. 0.05 joule

C. 100 joule

D. 500 joule

Answer: B

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6. If the force constant of a wire is K, the work done in increasing the length of the wire by l is

A. $K/2$

B. Kl

C. $Kl^2/2$

D. Kl^2

Answer: C

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7. If the tension on a wire is removed at once, then

A. It will break

B. Its temperature will reduce

C. There will be no change in its temperature

D. Its temperature increases

Answer: D

Watch Video Solution

8. When strain is produced in a body within elastic limit, its internal energy

A. Remains constant

B. Decreases

C. Increases

D. None of the above

Answer: C

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9. When shearing force is applied on a body, then the elastic potential energy is stored in it. On removing the force, this energy

A. Converts into kinetic energy

B. Coverts into heat energy

C. Remains as potential energy

D. None of the above

Answer: B

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10. A brass rod of cross-sectional area $1cm^2$ and length $0.2cm$ is compressed lengthwise by a weight of $5kg$. If Young's modulus of elasticity of brass is $1 \times 10^{11} N/m^2$ and

$g = 10m / \sec^2$, then increase in the energy of the rod will be

A. $10^{-5} J$

B. $2.5 \times 10^{-5} J$

C. $5 \times 10^{-5} J$

D. $2.5 \times 10^{-4} J$

Answer: B

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11. If one end of a wire is fixed with a rigid support and the other end is stretched by a force of 10 N, the increase in length is 0.5 mm. The ratio of enegry of the wire and the work done in displacing it through 1.5 mm by the weight is

A. $\frac{1}{3}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. 1

Answer: C

Watch Video Solution

12. A wire is suspended by one end. At the other end a weight equivalent to 20 N force is applied. If the increase in length is 1.0 mm, the increase in energy of the wire will be

A. 0.01 J

B. 0.02 J

C. 0.04 J

D. 1.00 J

Answer: A

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13. In the above question, the ratio of the increase in energy of the wire to the decrease in gravitational potential energy when load moves downwards by $1mm$, will be

A. 1

B. $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{1}{2}$

Answer: D

Watch Video Solution

14. The Young's modulus of a wire Y. If the energy per unit volume is E, then the strain will be

A. $\sqrt{\frac{2E}{Y}}$

B. $\sqrt{2EY}$

C. EY

D. $\frac{E}{Y}$

Answer: A

Watch Video Solution

15. The ratio of Young's modulus of the material of two wires is $2:3$. If the same stress is applied on both, then the ratio of elastic energy per unit volume will be

A. $3:2$

B. $2:3$

C. $3:4$

D. $4:3$

Answer: A

Watch Video Solution

16. The length of a rod is $20cm$ and area of cross-section $2cm^2$. The Young's modulus of the material of wire is $1.4 \times 10^{11} N/m^2$. If the rod is compressed by 5 kg-wt along its length, then increase in the energy of the rod in joules will be

A. 8.57×10^{-6}

B. 22.5×10^{-4}

C. 9.8×10^{-5}

D. 45.0×10^{-5}

Answer: A

Watch Video Solution

17. If a spring extends by x on loading, then then energy stored by the spring is (if T is tension in the spring and k is spring constant)

A. $\frac{T^2}{2x}$

B. $\frac{T^2}{2k}$

C. $\frac{2x}{T^2}$

D. $\frac{2T^2}{k}$

Answer: B

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18. On stretching a wire, the elastic energy stored pre unit volume is

A. $Fl/2AL$

B. $FA/2L$

C. $FL/2A$

D. $FL/2$

Answer: A

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19. When a force is applied on a wire of uniform cross-sectional area $3 \times 10^{-6} m^2$ and length 4 m, the increase in length is 1mm. Energy stored in it will be $\left(Y = 2 \times 10^{11} \frac{N}{m^2}\right)$

A. 6250 J

B. 0.177 J

C. 0.075 J

D. 0.150 J

Answer: C

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20. K is the force constant of a spring. The work done in increasing its extension from l_1 to l_2 will be

A. $K(l_2 - l_1)$

B. $\frac{K}{2}(l_2 + l_1)$

C. $K\left(l_2^2 - l_1^2\right)$

D. $\frac{K}{2}\left(l_2^2 - l_1^2\right)$

Answer: D

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21. 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 joule

B. 2.450 joule

C. 0.495 joule

D. 0.245 joule

Answer: B

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22. A wire of length L and cross sectional area A is made of a material of Young's modulus Y.

If the wire is streched by an amount x, the work done is..................

A. $\frac{YxA}{2L}$

B. $\frac{Yx^2A}{L}$

C. $\frac{Yx^2A}{2L}$

D. $\frac{2Yx^2A}{L}$

Answer: C

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23. The elastic enery stored in a wire of Young's modulus Y is

A. $Y \times \frac{\text{Strain}^2}{\text{Volume}}$

B. Stress $\times$ Strain $\times$ Volume

C. $\frac{\text{Stress}^2 \times \text{Volume}}{2Y}$

D. $\frac{1}{2}Y \times$ stress $\times$ Strain $\times$ Volume

Answer: C

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24. A wire of length $50cm$ and cross sectional area of 1 sq. mm is extended by $1mm$. The required work will be $(Y = 2 \times 10^{10} Nm^{-2})$

A. $6 \times 10^{-2} J$

B. $4 \times 10^{-2} J$

C. $2 \times 10^{-2} J$

D. $1 \times 10^{-2} J$

Answer: C

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25. The work per unit volume to stretch the length by 1% of a wire with cross sectional area of $1mm^2$ will be. $\left[Y = 9 \times 10^{11} \frac{N}{m^2}\right]$

A. $9 \times 10^{11} J$

B. $4.5 \times 10^{7} J$

C. $9 \times 10^{7} J$

D. $4.5 \times 10^{11} J$

Answer: B

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26. When load of 5 kg is hung on a wire than extension of 3 m takes place, then work done will be

A. 75 joule

B. 60 joule

C. 50 joule

D. 100 joule

Answer: A

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27. A stretched rubber has

A. Increased kinetic energy

B. Increased potential energy

C. Decreased kinetic energy

D. Decreased potential energy

Answer: B

Watch Video Solution

28. Which of the following is true for elastic potential energy density

A. Energy density $= \frac{1}{2} \times (\text{Strain})^2 \times \text{volume}$

B. Energy density $= (\text{strain})^2 \times \text{volume}$

C. Energy density $= (\text{strain}) \times \text{volume}$

D. Energy density $= (\text{stress}) \times \text{volume}$

Answer: A

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29. A wire suspended vertically from one of itsends is strached by attached a weight of $200N$ to the lower end . The weight streches the wire by $1mm$. Then the elastic energy stored in the wire is

A. 0.1 J

B. 0.2 J

C. 10 J

D. 20

Answer: A

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30. Wires A and B are made from the same material. A has twice the diameter and three times the length of B. If the elastic limits are not reached, when each is stretched by the same tension, the ratio of energy stored in A to that in B is

A. $2:3$

B. $3:4$

C. $3:2$

D. $6:1$

Answer: B

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Critical Thinking

1. An Indian rubber cord L metre long and area of cross-section A metre^2 is suspended vertically. Density of rubber is D $\mathrm{kg/metre^2}$. If the wire extends by l metre under its own weight, then extension l is

A. $L^2 Dg / E$

B. $L^2 Dg / 2E$

C. $L^2 Dg / 4E$

D. L

Answer: B

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2. A substance breaks down by a stress of $10^6 Nm^{-2}$. If the density of the material of the wire is $3 \times 10^3 kgm^{-3}$, then the length of the wire of the substance which will break under its own weight when suspended vertically is

A. 34 m

B. 30 m

C. 300 m

D. 3 m

Answer: A

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3. Two rods of different materials having coefficient of thermal expansion α_1, α_2 and young's modulii Y_1, Y_2 respectively are fixed between two rigid massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses developed in the two rods are equal provided $Y_1 : Y_2$ is equal to

A. $2:3$

B. $1:1$

C. $3:2$

D. $4:9$

Answer: C

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4. The extension in a string obeying Hooke's law is x. The speed of sound in the stretched string is v. If the extension in the string is increased to $1.5x$, the speed of sound will be

A. $1.22v$

B. $0.61v$

C. $1.50v$

D. $0.75v$

Answer: A

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5. One end of a uniform wire of length L and of weight W is attached rigidly to a point in the roof and a weight W_1 is suspended from its lower end. If S is the area of cross-section of the wire, the stress in the wire at a height 3 L/4 from its lower end is

A. $\frac{W_1}{S}$

B. $\frac{W_1 + (W/4)}{S}$

C. $\frac{W_1 + (3W/4)}{S}$

D. $\frac{W_1 + W}{S}$

Answer: C

Watch Video Solution

6. There are two wires of same material and same length while the diameter of second wire is 2 times the diameter of first wire, then ratio of extension produced in the wires by applying same load will be

A. $1:1$

B. $2:1$

C. $1:2$

D. $4:1$

Answer: D

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7. A particle of mass m is under the influence of a force F which varies with the displacement x according to the relation $F = -kx + F_0$ in which k and F_0 are constants. The particle when disturbed will oscillate

A. about x = 0, with $\omega \neq \sqrt{k/m}$

B. about x=0, with $\omega = \sqrt{k/m}$

C. about $x = F_0/k$ with $\omega = \sqrt{k/m}$

D. about $x = F_0/k$ with $\omega \neq \sqrt{k/m}$

Answer: C

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8. An elastic material of Young's modulus Y is subjected to a stress S. The elastic energy stored per unit volume of the material is

A. $\frac{2Y}{S^2}$

B. $\frac{S^2}{2Y}$

C. $\frac{S}{2Y}$

D. $\frac{S^2}{Y}$

Answer: B

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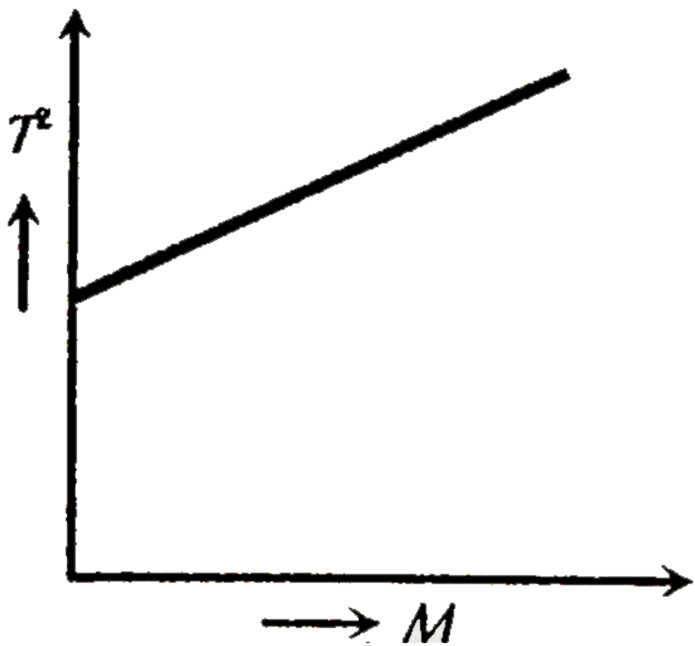
Graphical Question

1. The graph shown was obtained from experimental measurements of the period of oscillations T for different masses M placed in the scale pan on the lower end of the spring balance. The most likely reason for the line not passing through the origin is that the



A. Spring did not obey Hook's Law

B. Amplitude of the oscillations was too large

C. Clock used needed regulating

D. Mass of the pan was neglected

Answer: D

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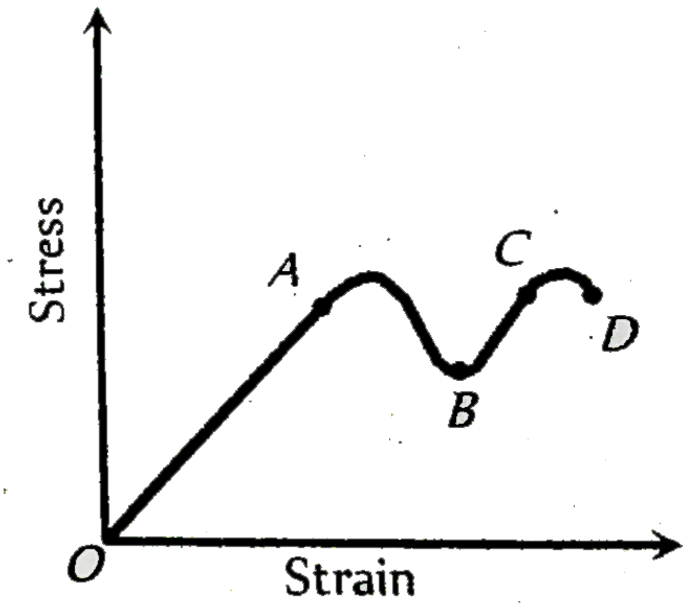
2. A graph is shown between stress and strain for a metal. The part in which Hooke's law holds good is



A. OA

B. AB

C. BC

D. CD

Answer: A

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3. In the above graph, point B indicates.

A. Breaking point

B. Limiting point

C. Yield point

D. None of the above

Answer: C

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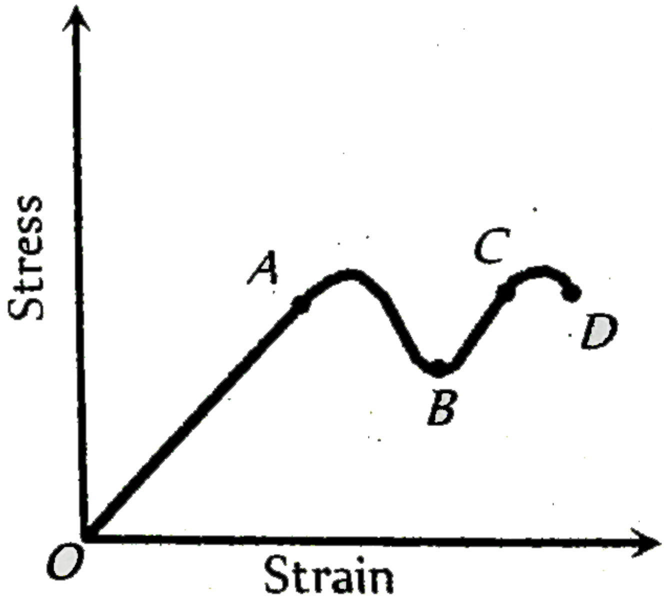
4. In the graph, point D indicates



A. Limiting point

B. Yield point

C. Breaking point

D. None of the above

Answer: C

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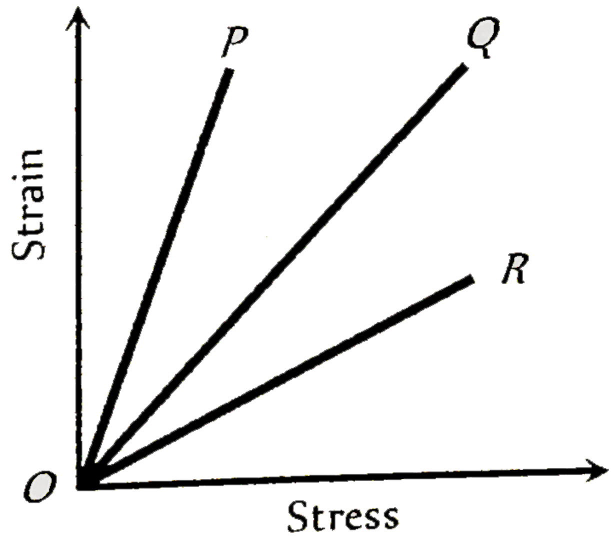
5. The strain-stress curves of three wire of different materials are shown in the figure. P,Q and R are the elastic limits of the wires. The figures shows that



A. Elasticity of wire P is maximum

B. Elastiity of wire Q is maximum

C. Tensile strength of R is maximum

D. None of the above is true

Answer: D

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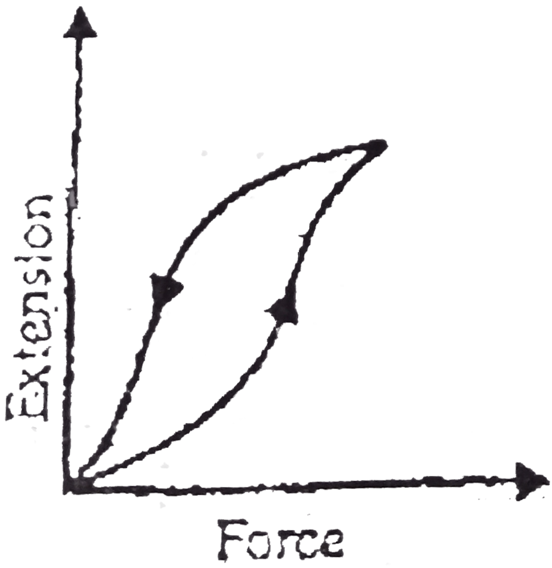
6. 

The diagram shows a force extension graph for a rubber band, consider 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 stretched.

(III). The rubber band will get heated if it is stretched and released.

Which of these can deduced from the graph-

(a). III only

(b). II and III

(c). I and III

(d). I only

A. III only

B. II and III

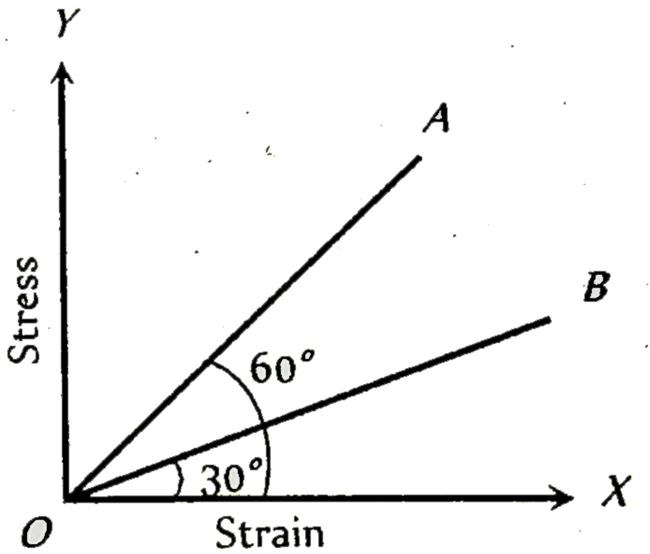
C. I and III

D. I only

Answer: A

Watch Video Solution

7. The stress versus strain graphs for wires of two materials A and B are as shown in the figure. If Y_A and Y_B are the younng's moduli of the materials, then



A. $Y_B = 2Y_A$

B. $Y_A = Y_B$

C. $Y_B = 3Y_A$

D. $Y_A = 3Y_B$

Answer: D

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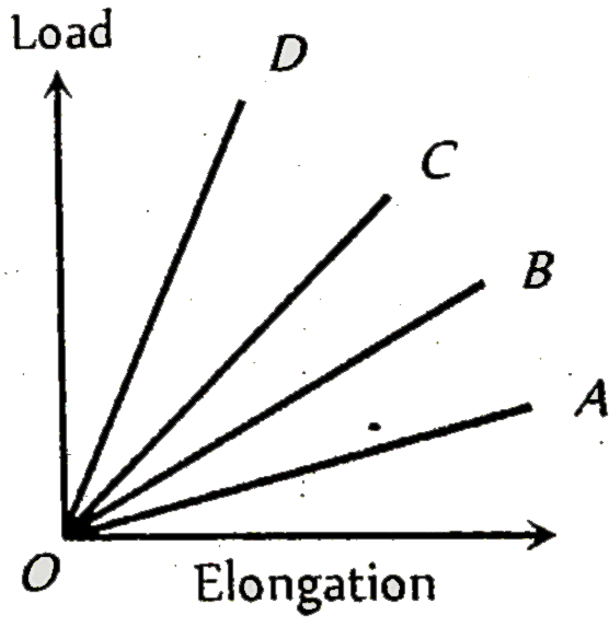
8. The load versus elongation graph for four wires of the same material is shown in the figure. The thickest wire is represented by



A. OD

B. OC

C. OB

D. OA

Answer: A

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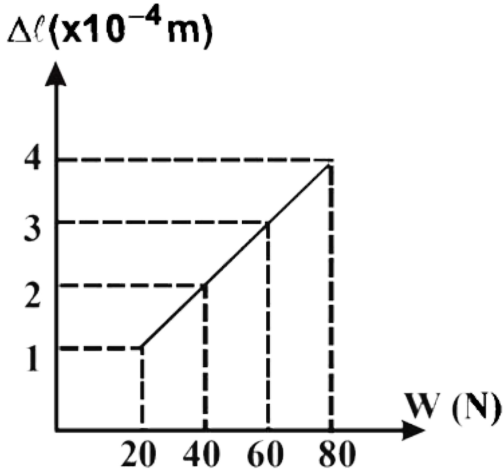
9. The adjacent graph shows the estension (Δl) of a wire of length 1m suspended from the top of a roof at one end and with a load W connected to the other end. If the cross-sectional area of the wire is $10^{-6}m^2$, calculate the Young's modulus of the material of the wire.



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: A

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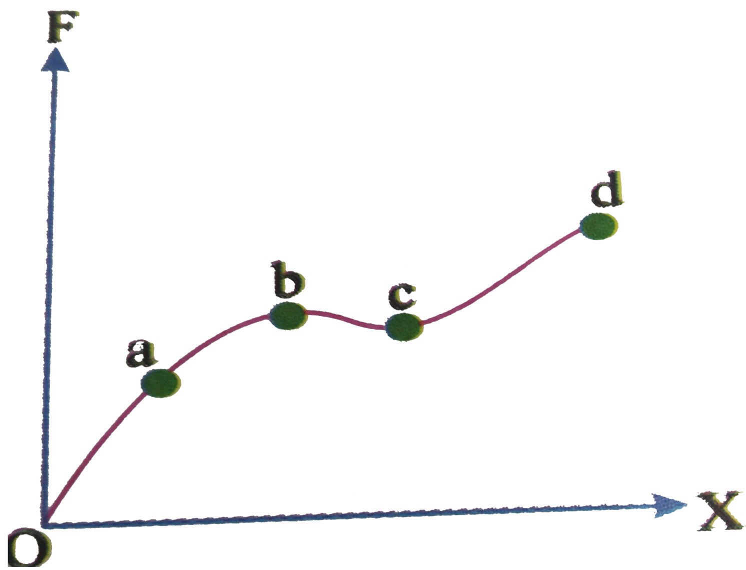
10. The diagram represents the applied force per unit area (F) with the strain (X) produced in a thin wire of uniform



cross-section in the curve shown. The region in which the wire behaves like a viscous liquid is

A. ab

B. bc

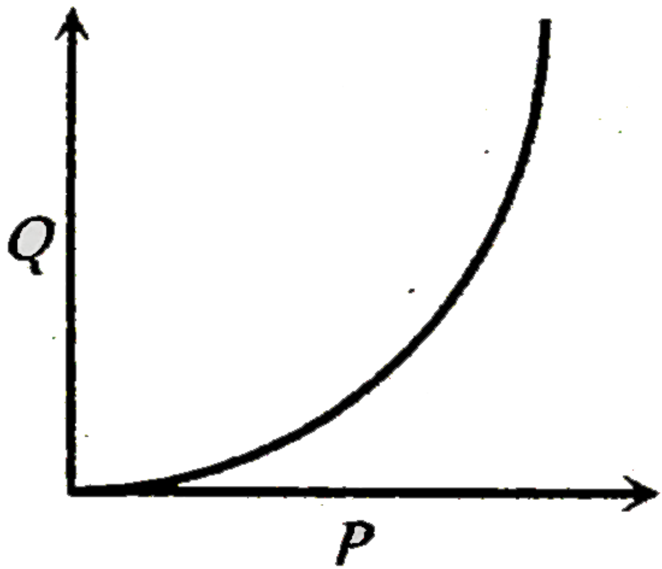
C. cd

D. oa

Answer: B

Watch Video Solution

11. The graph shows the behaviout of a length of wire in the region for which the substance obeys Hook's law. D and Q represent



A. P = applied force, Q = extension

B. P = extension, Q = applied force

C. P = extension, Q= stored elastic energy

D. P = stored elastic energy, Q = extension

Answer: C

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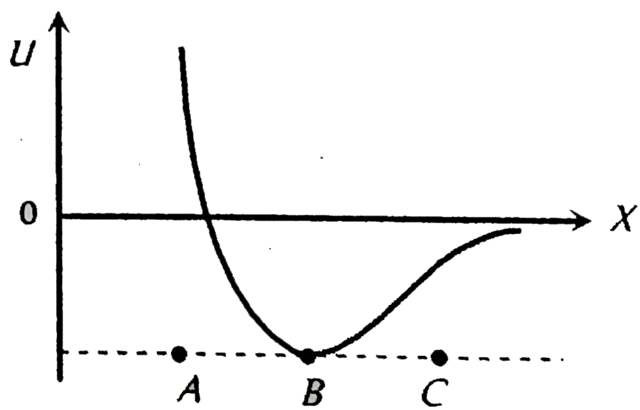
12. The potential energy U between two molecules as a function of the distance X between them has been shown in the figure. The two molecules are



A. Attracted when x lies between A and B and are repelled when X lies between B and C

B. Attracted when x lies between B and C and are repelled when X lies between A and B

C. Attracted when they reach B

D. Repelled when they each B

Answer: B

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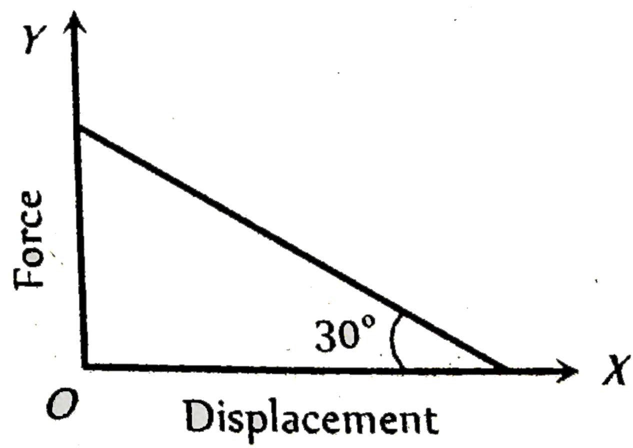
13. The valve of force constant between the applied the applied elastic force F and displacement will be



A. $\sqrt{3}$

B. $\frac{1}{\sqrt{3}}$

C. $\frac{1}{2}$

D. $\frac{\sqrt{3}}{2}$

Answer: B

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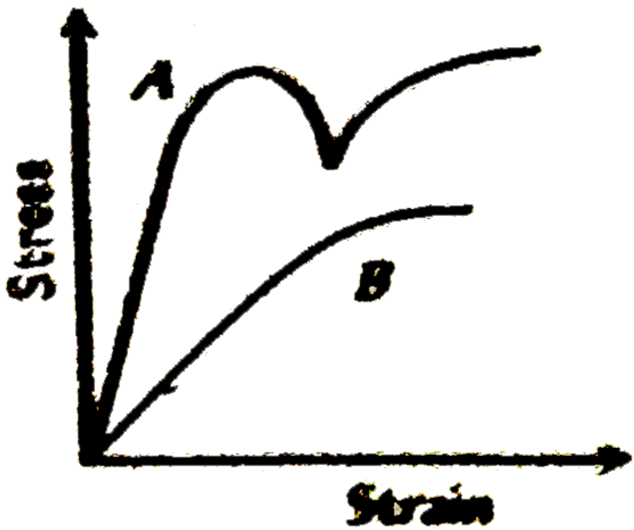
14. The diagram shows stress v/s strain curve for the materials A and B. From the curves we infer that



A. A is brittle but B is ductile

B. A is ductile and B is brittle

C. Both A and B are ductile

D. Both A and B are brittle

Answer: B

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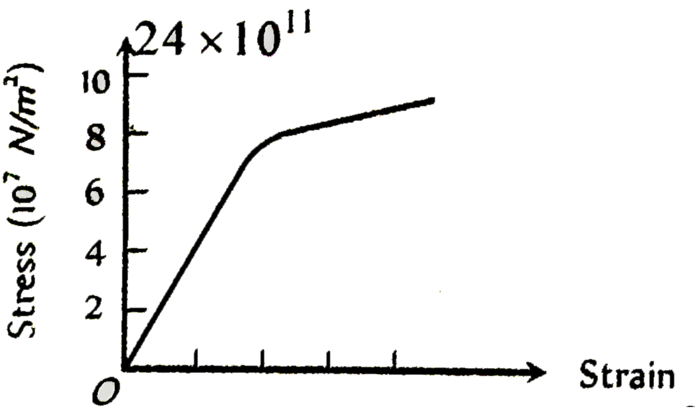
15. Which one of the following is the Young's modulus (in N/m) for the wire having the stress-strain curve shown in the figure



A. N/A

B. 8.0×10^{11}

C. 10×10^{11}

D. 2.0×10^{11}

Answer: D

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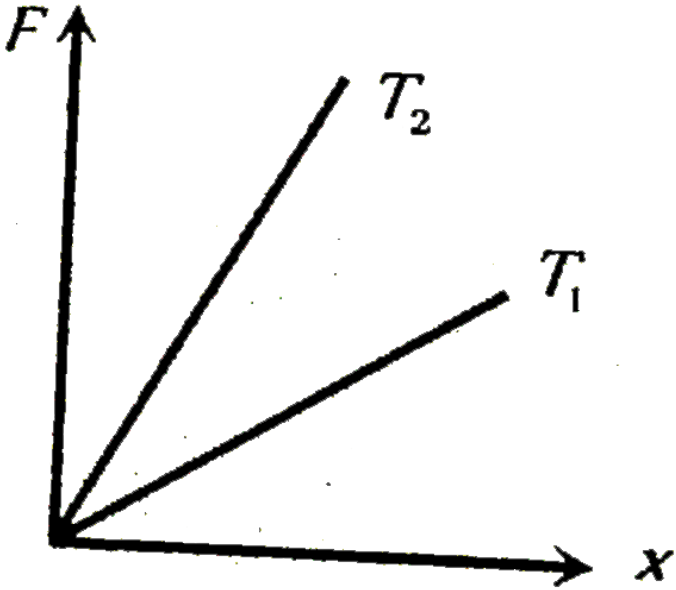
16. The diagram shows the change x in the length of the uniform wire caused by the application of stres F at two different temperatures T and T. The variations shown suggest that



A. $T_1 > T_2$

B. $T_1 < T_2$

C. $T_1 = T_2$

D. None of these

Answer: A

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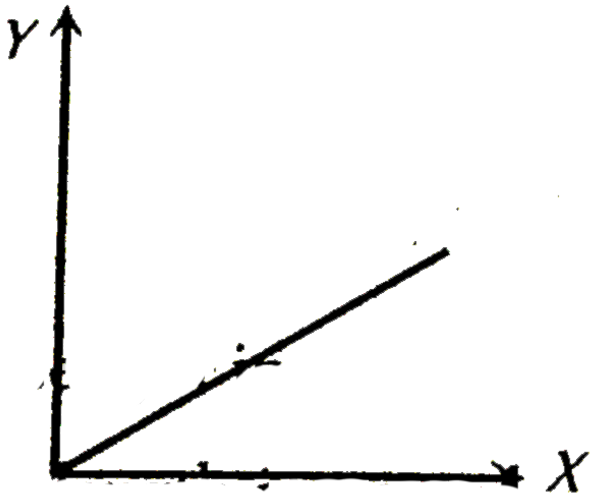
17. A student plots a graph from his reading on the determination of Young's modulus of a metal wire but forgets to label. The quantities on X and Y may be respectively.



A. Weight hung and length increased

B. Stress applied, and length increased

C. Stress applied and strain developed

D. Length increased and weight hung

Answer: C

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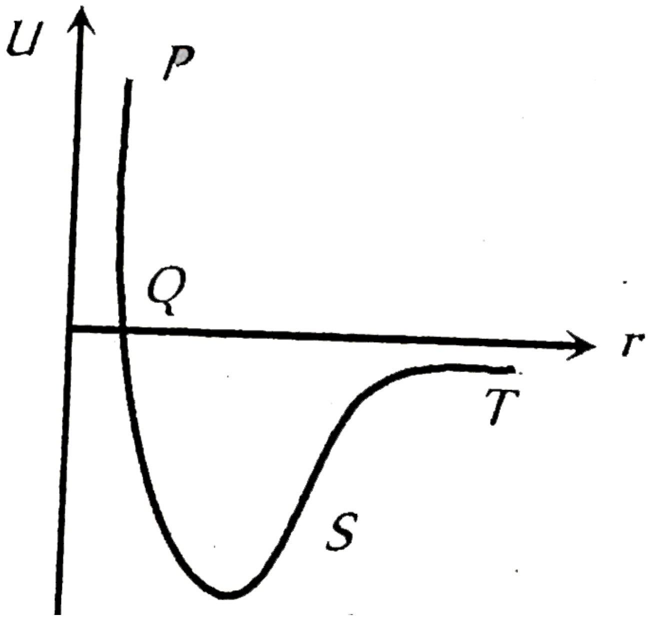
18. the points of maximum and minimum attraction in the curve between potential energy (U) and distance (r) of a diatomic molecules aree respectively.



A. S and R

B. T and S

C. R and S

D. S and T

Answer: D

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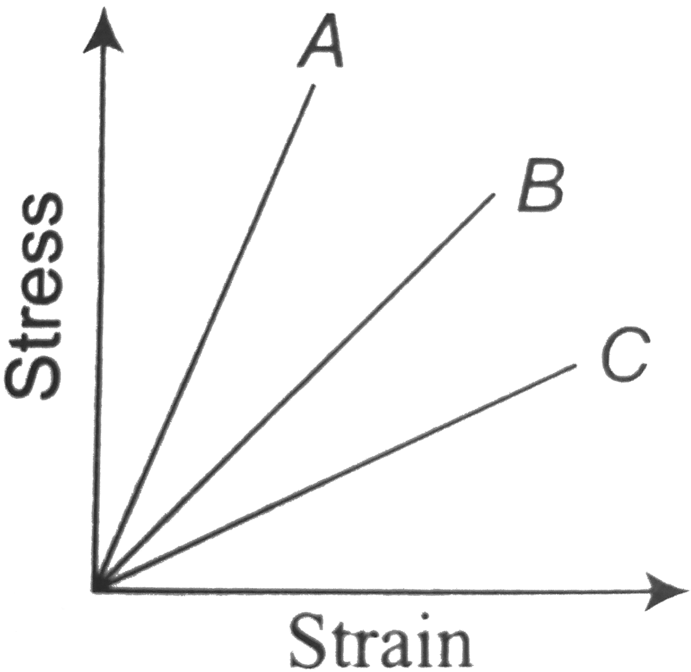

19.

The stress strain curves for brass, steel and rubber are shown in the figure. The lines A, B and C are for

A. Rubber, brass and steel respectively

B. Brass, steel and rubber respectively

C. Steel, brass and rubber respectively

D. Steel, rubber and brass respectively

Answer: C

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Assertion And Reason

1. Statement-1: The stretching of a coil is determined by its shear modulus.

Statement-2: Shear modulus change only shape of a body keeping its dimensions unchanged.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false

Answer: A

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2. Assertion : Spring balances show correct readings even after they had been used for a long time interval.

Reason : On using for long time, spring balances losses its elastic strength.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If assertion is false but reason is true

Answer: D

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3. Assertion : Steel is more elastic than rubber.

Reason : Under given deforming force, steel is deformed less than rubber.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: A

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4. In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of assertion.

(c) If assertion is true but reason is false.

(d) If assertion and reason are false.

Q. Glassy solids have sharp meting point.

Reason: The bonds between the Atoms of

glassy solids get broken at the same temperature.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: D

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5. Assertion : A hollow shaft is found to be stronger than a solid shaft made of same material.

Reason : The torque required to produce a given twist in hollow cylinder is greater than that required to twist a solid cylinder of same size and material.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.
B. If both assertion and reason are true but reason is not the correct explanation of the assertion.
C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: A

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6. Assertion : Bulk modulus of elasticity (K) represents incompressibility of the material.

Reason : Bulk modulus of elasticity is proportional to change in pressure.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: A

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7. Assertion : Strain is a unitless quantity.

Reason : Strain is equivalent to force

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: C

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8. Assertion : The bridges declared unsafe after a long use.

Reason : Elastic strength of bridges losses with time

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: A

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9. Two idential solid balls, one of ivory and the other of wet caly, are dropped from the same height on the floor. Which one will rise to a greater height after striking the floor and why ?

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: D

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10. Statement-1: Young's modulus for a perfectly plastic body is zero

Statement-2: For a perfectly plastic body, restoring force is zero.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: A

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11. Assertion : Identical springs of steel and copper are equally stretched. More work will be done on the steel spring.

Reason : Steel is more elastic than copper

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: A

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12. Assertion : Sterss is the internal force per unit area of a body.

Reason : Rubber is less elastic than steel.

A. If both assertion and reason are true and the reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of the assertion.

C. If assertion is true but reason is fa lse.

D. If the assertion and reason both are false.

Answer: B

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Self Evaluation Test

1. A wire of area of cross-section $10^{-6} m^2$ is increased in length by 0.1 %. The tension produced is 1000 N. The Young's modulus of wire is

A. $10^{12} N/m^2$

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

C. $10^{10} N/m^2$

D. $10^{9} N/m^2$

Answer: A

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2. To break a wire of one meter length, minimum 40 kg wt. is required. Then the wire of the same material of double radius and 6 m length will require breaking weight

A. 80 kg-wt

B. 240 kg-wt

C. 200 kg-wt

D. 160 kg-wt

Answer: D

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3. The breaking stress of a wire of length L and radius r is $5kg - wt/m^2$. The wire of length $2l$ and radius $2r$ of the same material will have breaking stress in $kg - wt/m^2$

A. 5

B. 10

C. 20

D. 80

Answer: A

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4. The increase in length on stretching a wire is 0.05%. If its poisson's ratio is 0.4, then its diameter

A. Reduce by 0.02 %

B. Reduce by 0.1 %

C. Increase by 0.02 %

D. Decrease by 0.4 %

Answer: A

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5. If Poission's ratio σ is $-\frac{1}{2}$ for a material, then the material is

A. Uncompressible

B. Elastic fatigue

C. Compressible

D. None of the above

Answer: A

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6. If the breaking force for a given wire is F, then the breaking force of two wires of same magnitude will be

A. F

B. 4 F

C. 8 F

D. 2 F

Answer: D

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7. If the thickness of the wire is doubled, then the breaking force in the above question will be

A. 6 F

B. 4 F

C. 8 F

D. 2 F

Answer: B

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8. On all the six surfaces of a unit cube, equal tensile force of F is applied. The increase in length of each side will (Y = Young's module, σ = Poission's ratio)

A. $\dfrac{F}{Y(1-\sigma)}$

B. $\dfrac{F}{Y(1+\sigma)}$

C. $\dfrac{F(1-2\sigma)}{Y}$

D. $\dfrac{F}{Y(1-2\sigma)}$

Answer: C

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9. Two exactly similar wire of steel and copper are stretched by equal force. If the difference in their elongations is 0.5 cm, the elongation (l) of each wire is

$Y_s(\text{steel}) = 2.0 \times 10^{11} N/m^2$

$Y_c(\text{copper}) = 1.2 \times 10^{11} N/m^2$

A. $l_s = 0.75cm, l_c = 1.25cm$

B. $l_s = 1.25cm, l_c = 0.75cm$

C. $l_s = 0.25cm, l_c = 0.75cm$

D. $l_s = 0.75cm, l_c = 0.25cm$

Answer: A

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10. If the compressibility of water is σ per unit atmospheric pressure then the decrease in volume V due to P atmospheric pressure will be

A. $\sigma P / V$

B. σPV

C. σ / PV

D. $\sigma V / P$

Answer: B

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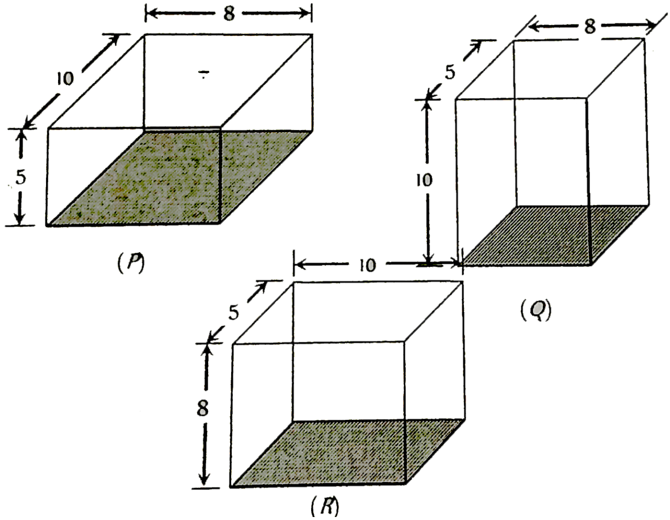
11. A rectangular block of size $10cm \times 8cm \times 5cm$ is kept in three different positions P,Q and R in turns as shown in the figure. In each case, the shaded area is rigidly fixed and a definite force F is applied tangentially to the opposite face to deform the black. The displacement of the upper face will be



A. Same in all the three cases

B. Maximum in P position

C. Maximum in Q position

D. Maximum in R position

Answer: D

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