EXERCISE-I

Young's Modulus and Breaking Stress

1. On increasing the length by 0.5 *mm* in a steel wire of length 2 *m* and area of cross-section $2\,\text{mm}^2$, the force required is [*Y* for $\text{steel} = 2.2\times10^{11}\ \text{N/m}^2$]]

(A) 1.1×10^5 N (B) 1.1×10^4 N
(C) 1.1×10^3 N (D) 1.1×10^2 N

2. If Young's modulus of iron is $2\times10^{11}\ \text{N/m}^2$ and the interatomic spacing between two molecules is 3×10^{-10} *metre*, the interatomic force constant is

(A) 60 *N*/*m* (B) 120 *N*/*m*
(C) 30 *N*/*m* (D) 180 *N*/*m*

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

(A) 4×10^6 *dynes* (B) 2×10^{12} *dynes*
(C) 2×10^{12} *newtons* (D) 2×10^8 *dynes*

4. The material which practically does not show elastic after effect is

(A) Copper (B) Rubber
(C) Steel (D) Quartz

5. If the temperature increases, the modulus of elasticity

(A) Decreases (B) Increases
(C) Remains constant (D) Becomes zero

6. A force *F* is needed to break a copper wire having radius *R*. The force needed to break a copper wire of radius 2*R* will be

(A) *F*/2 (B) 2*F*
(C) 4*F* (D) *F*/4

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

8. The diameter of a brass rod is 4 *mm* and Young's modulus of brass is $9\times10^{10}\ \text{N/m}^2$. The force required to stretch by 0.1% of its length is

(A) 360π N (B) 36 *N*
(C) $144\pi\times10^3$ N (D) $36\pi\times10^5$ N

9. 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) $\dfrac{1}{2}y^2x$ (D) $\dfrac{1}{2}yx^2$

10. 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) 2*l*
(C) $\dfrac{l}{2}$
(D) None of the above

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

(A) 0.49×10^4 N/m
(B) 1.96×10^4 N/m
(C) 4.9×10^4 N/m
(D) 0.196×10^4 N/m

12. The ratio of diameters of two wires of same material is *n* : 1. The length of wires are 4 *m* each. On applying the same load, the increase in length of thin wire will be

(A) n^2 times
(B) *n* times
(C) 2*n* times
(D) None of the above

13. Longitudinal stress of $1\,\text{kg}/\text{mm}^2$ is applied on a wire. The percentage increase in length is $(Y = 10^{11}\ \text{N}/\text{m}^2)$

(A) 0.002 (B) 0.001

(C) 0.003 (D) 0.01

14. A steel wire is stretched with a definite load. If the Young's modulus 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

15. The interatomic distance for a metal is 3×10^{-10} m. If the interatomic force constant is 3.6×10^{-9} N/Å, then 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}

16. 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

17. 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

18. The elasticity of *invar*

(A) Increases with temperature rise

(B) Decreases with temperature rise

(C) Does not depend on temperature

(D) None of the above

19. After effects of elasticity are maximum for

(A) Glass (B) Quartz

(C) Rubber (D) Metal

20. 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

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

(A) 4.2 *N* (B) 4.4 *N*

(C) 2.4 *N* (D) 8.8 *N*

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

(A) Minimum volume elasticity

(B) Maximum volume elasticity

(C) Maximum Young's modulus

(D) Maximum modulus of rigidity

23. The length of a wire is 1.0 *m* and the area of cross-section is $1.0 \times 10^{-2}\ \text{cm}^2$. 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) $2.0 \times 10^{10}\ \text{N}/\text{m}^2$ (B) $4 \times 10^{10}\ \text{N}/\text{m}^2$

(C) $2.0 \times 10^{11}\ \text{N}/\text{m}^2$ (D) $2 \times 10^{10}\ \text{N}/\text{m}^2$

24. The quality of the material which opposes the change in shape, volume or length is called

(A) Intermolecular repulsion

(B) Intermolecular behaviour

(C) Viscosity

(D) Elasticity

25. For silver, Young's modulus is $7.25 \times 10^{10}\ \text{N}/\text{m}^2$ and Bulk modulus is $11 \times 10^{10}\ \text{N}/\text{m}^2$. Its Poisson's ratio will be

(A) – 1 (B) 0.5

(C) 0.39 (D) 0.25

26. The longitudinal strain is only possible in

(A) Gases (B) Fluids

(C) Solids (D) Liquids

27. If the density of the material increases, the value of Young's modulus

(A) Increases

(B) Decreases

(C) First increases then decreases

(D) First decreases then increases

28. Young's modulus of rubber is 10^4 N/m^2 and area of cross-section is 2cm^2. If force of 2×10^5 dynes is applied along its length, then its initial length l becomes

(A) 3*L*

(B) 4*L*

(C) 2*L*

(D) None of the above

29. The elastic limit for a gas

(A) Exists

(B) Exists only at absolute zero

(C) Exists for a perfect gas

(D) Does not exist

30. 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

31. 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

32. When a weight of 10 *kg* is suspended from a copper wire of length 3 *metres* and diameter 0.4 *mm*, its length increases by 2.4 *cm*. If the diameter of the wire is doubled, then the extension in its length will be

(A) 9.6 *cm* (B) 4.8 *cm*

(C) 1.2 *cm* (D) 0.6 *cm*

33. 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) $4\times10^3 N$ (B) $16\times10^3 N$

(C) $\frac{1}{4}\times10^3 N$ (D) $\frac{1}{16}\times10^3 N$

34. 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) 2 : 1

(C) 1 : 4 (D) 1 : 2

35. 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

36. The ratio of two specific heats of gas 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) 1.4 *P*

37. The relation between γ, η and *K* for a elastic material is

(A) $\frac{1}{\eta}=\frac{1}{3\gamma}+\frac{1}{9K}$ (B) $\frac{1}{K}=\frac{1}{3\gamma}+\frac{1}{9\eta}$

(C) $\frac{1}{\gamma}=\frac{1}{3K}+\frac{1}{9\eta}$ (D) $\frac{1}{\gamma}=\frac{1}{3\eta}+\frac{1}{9K}$

38. A fixed volume of iron is drawn into a wire of length *L*. The extension *x* 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*

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

(A) 20 *N* (B) 30 *N*
(C) 60 *N* (D) 120 *N*

40. To keep constant time, watches are fitted with balance wheel made of

(A) Invar (B) Stainless steel
(C) Tungsten (D) Platinum

41. A wire is stretched by 0.01 *m* by a certain force *F*. Another wire of 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*

42. The possible value of Poisson's ratio is

(A) 1 (B) 0.9
(C) 0.8 (D) 0.4

43. The coefficient of linear expansion of brass and steel are α_1 and α_2. If we take a brass rod of length l_1 and steel rod of length l_2 at 0°*C*, their difference in length $(l_2 - l_1)$ will remain the same at a temperature if

(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) $\alpha_1 l_1 = \alpha_2 l_2$

44. A rod is fixed between two points at 20°*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 developed in the rod if temperature of rod becomes 10°*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) $1.10 \times 10^6\ N/m^2$

45. The extension of a wire by the application of load is 3 *mm*. 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*

46. A rubber pipe of density $1.5 \times 10^3\ N/m^2$ and Young's modulus $5 \times 10^6\ N/m^2$ is suspended from the roof. The length of the pipe is 8 *m*. What will be the change in length due to its own weight

(A) 9.6 *m* (B) $9.6 \times 10^3\ m$
(C) $19.2 \times 10^{-2}\ m$ (D) $9.6 \times 10^{-2}\ m$

47. 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*

48. If a spring is extended to length *l*, then according to Hook's law

(A) $F = kl$ (B) $F = \frac{k}{l}$
(C) $F = k^2 l$ (D) $F = \frac{k^2}{l}$

49. 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

50. An iron rod of length 2*m* and cross section area of $50\,mm^2$, stretched by 0.5 *mm*, when a mass of 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) $19.6 \times 10^{20}\ N/m^2$

51. On applying a stress of 20×10^8 N/m^2 the length of a perfectly elastic wire is doubled. Its Young's modulus will be

(A) $40\times10^8 N/m^2$ (B) $20\times10^8 N/m^2$

(C) $10\times10^8 N/m^2$ (D) $5\times10^8 N/m^2$

52. When a uniform wire of radius *r* is stretched by a 2*kg* weight, the increase in its length is 2.00 *mm*. If the radius of the wire is *r*/2 and other conditions remain the same, the increase in its length is

(A) 2.00 *mm* (B) 4.00 *mm*

(C) 6.00*mm* (D) 8.00 *mm*

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

(A) $a-b$ (B) $5b-4a$

(C) $2b-\frac{1}{4}a$ (D) $4a-3b$

54. Stress to strain ratio is equivalent to

(A) Modulus of elasticity

(B) Poission's Ratio

(C) Reyhold number

(D) Fund number

55. Which is correct relation

(A) $Y<\sigma$ (B) $Y>\sigma$

(C) $Y=\sigma$ (D) $\sigma=+1$

56. If the interatomic spacing in a steel wire is 3.0Å and $Y_{steel}=$ $20\times10^{10} N/m^2$ then force constant is

(A) 6×10^{-2} N/Å (B) 6×10^{-9} N/Å

(C) 4×10^{-5} N/Å (D) 6×10^{-5} N/Å

57. A copper wire of length 4.0*m* and area of cross-section $1.2\,cm^2$ is stretched with a force of 4.8×10^3 *N*. If Young's modulus for copper is $1.2\times10^{11} N/m^2$, the increase in the length of the wire will be

(A) 1.33 *mm* (B) 1.33 *cm*

(C) 2.66 *mm* (D) 2.66 *cm*

58. A metal bar of length *L* and area of cross-section *A is* clamped between two rigid supports. For the material of the rod, its Young's modulus is *Y* and coefficient of linear expansion is α. If the temperature of the rod is increased by $\Delta t^{o}C$, 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) $Y\alpha AL\Delta t$

59. According to Hook's law of elasticity, if stress is increased, the ratio of stress to strain

(A) Increases

(B) Decreases

(C) Becomes zero

(D) Remains constant

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

(A) 1.38 *cm* (B) 3.5 *cm*

(C) 1.75 *cm* (D) 2.45 *cm*

61. 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) $3F/AY$

62. The mean distance between the atoms of iron is $3\times10^{-10}m$ and interatomic force constant for iron is $7N/m$ The Young's modulus of elasticity for iron is

(A) $2.33\times10^5 N/m^2$

(B) $23.3\times10^{10} N/m^2$

(C) $233\times10^{10} N/m^2$

(D) $2.33\times10^{10} N/m^2$

63. Two wires *A* and *B* are of same materials. 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 F_A / F_B should be

(A) 1 : 2 (B) 1 : 1
(C) 2 : 1 (D) 8 : 1

64. The breaking stress of a wire depends upon

(A) Length of the wire
(B) Radius of the wire
(C) Material of the wire
(D) Shape of the cross section

65. 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 its length will be

(A) $2 \times 10^{12} N$ (B) $2 \times 10^{11} N$
(C) $2 \times 10^{10} N$ (D) $2 \times 10^{6} N$

66. A rubber cord catapult has cross-sectional area $25 mm^2$ and initial length of rubber cord is 10cm. It is stretched to 5cm. and then released to project a missile of mass 5gm. Taking $Y_{rubber} = 5 \times 10^8 N/m^2$ velocity of projected missile is

(A) $20\, ms^{-1}$ (B) $100\, ms^{-1}$
(C) $250\, ms^{-1}$ (D) $200\, ms^{-1}$

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

(A) $\frac{1}{x}$ (B) $\frac{1}{x^2}$
(C) x (D) x^2

68. In the Young's experiment, If 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

69. 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

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

(A) 500 *N* (B) 1000 *N*
(C) 10000 *N* (D) 4000 *N*

Bulk Modulus

71. If the volume of the given mass of a gas is increased four times, the temperature is raised from 27°*C* to 127°C. The elasticity will become

(A) 4 times (B) 1/4 times
(C) 3 times (D) 1/3 times

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

(A) 0.4 *cc* (B) 4×10^{-5} cc
(C) 0.025 *cc* (D) 0.004 *cc*

73. If a rubber ball is taken at the depth of 200 *m* in a pool, its volume decreases by 0.1%. If the density of the water is $1 \times 10^3 kg/m^3$ and $g = 10\, m/s^2$, then the volume elasticity in N/m^2 will be

(A) 10^8 (B) 2×10^8
(C) 10^9 (D) 2×10^9

74. The compressibility 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

75. 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}

76. 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

77. Bulk modulus was first defined by
(A) Young
(B) Bulk
(C) Maxwell
(D) None of the above

78. 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

79. A ball falling in a lake of depth 200 *m* shows 0.1% decrease in its volume at the bottom. What is the bulk modulus of the material of the ball
(A) $19.6 \times 10^{8}\ \mathrm{N/m^2}$
(B) $19.6 \times 10^{-10}\ \mathrm{N/m^2}$
(C) $19.6 \times 10^{10}\ \mathrm{N/m^2}$
(D) $19.6 \times 10^{-8}\ \mathrm{N/m^2}$

80. The isothermal bulk modulus of a gas at atmospheric pressure is
(A) 1mm of *Hg*
(B) 13.6 mm of *Hg*
(C) $1.013 \times 10^{5}\ \mathrm{N/m^2}$
(D) $2.026 \times 10^{5}\ \mathrm{N/m^2}$

81. Coefficient of isothermal elasticity E_θ and coefficient of adiabatic elasticity E_φ are related by $(\gamma = C_p / C_v)$
(A) $E_\theta = \gamma E_\varphi$ (B) $E_\varphi = \gamma E_\theta$
(C) $E_\theta = \gamma / E_\varphi$ (D) $E_\theta = \gamma^2 E_\varphi$

82. 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

83. The Bulk modulus for an incompressible liquid is
(A) Zero (B) Unity
(C) Infinity (D) Between 0 to 1

84. The pressure applied from all directions 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) $\frac{\alpha\beta}{P}$

85. The pressure of a medium is changed from 1.01×10^5 *Pa* to 1.165×10^5 *Pa* and change in volume is 10% keeping temperature constant. The Bulk modulus of the medium is
(A) 204.8×10^5 *Pa* (B) 102.4×10^5 *Pa*
(C) 51.2×10^5 *Pa* (D) 1.55×10^5 *Pa*

Rigidity Modulus

86. Modulus of rigidity of diamond is
(A) Too less
(B) Greater than all matters
(C) Less than all matters
(D) Zero

87. 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

88. Which statement is true for a metal
(A) $Y < \eta$ (B) $Y = \eta$
(C) $Y > \eta$ (D) $Y < 1/\eta$

89. Which of the following relations is true
(A) $3Y = K(1-\sigma)$ (B) $K = \frac{9\eta Y}{Y+\eta}$
(C) $\sigma = (6K+\eta)Y$ (D) $\sigma = \frac{0.5Y-\eta}{\eta}$

90. 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 the 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) $\frac{r_2^2}{r_1^2}$

(C) $\frac{r_2^4}{r_1^4}$ (D) $\frac{r_1^4}{r_2^4}$

91. When a spiral spring is stretched by suspending a load on it, the strain produced is called

(A) Shearing (B) Longitudinal

(C) Volume (D) Transverse

92. The Young's modulus of the material of a wire is $6\times10^{12}\ N/m^2$ and there is no transverse strain in it, then its modulus of rigidity will be

(A) $3\times10^{12}\ N/m^2$

(B) $2\times10^{12}\ N/m^2$

(C) $10^{12}\ N/m^2$

(D) None of the above

93. 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) $2\times10^{10}\ N/m^2$ (D) $3\times10^{10}\ N/m^2$

94. Modulus of rigidity of a liquid

(A) Non zero constant

(B) Infinite

(C) Zero

(D) Can not be predicted

95. For a given material, the 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

96. 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

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

(A) Volume stress (B) Shearing strain

(C) Longitudinal strain (D) Metallic strain

98. 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 of the type

(A) Shape (B) Size

(C) None (D) Shape and size

99. 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°

100. Mark the wrong statement

(A) Sliding of molecular layer is much easier than 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

Work Done in Stretching a Wire

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

(A) *Kl*/2 (B) *Kl*

(C) $Kl^2/2$ (D) Kl^2

102. 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

103. 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

104. 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) Converts into heat energy
(C) Remains as potential energy
(D) None of the above

105. A brass rod of cross-sectional area 1cm^2 and length 0.2 *m* is compressed lengthwise by a weight of 5 kg. If Young's modulus of elasticity of brass is $1\times10^{11}\,\text{N}/\text{m}^2$ and $g = 10\,\text{m}/\sec^2$, then increase in the energy of the rod will be

(A) $10^{-5}\,J$ (B) $2.5\times10^{-5}\,J$
(C) $5\times10^{-5}\,J$ (D) $2.5\times10^{-4}\,J$

106. If one end of a wire is fixed with a rigid support and the other end is stretched by a force of 10 *N*, then the increase in length is 0.5 *mm*. The ratio of the energy 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

107. 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*

108. 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 1 *mm*, will be

(A) 1 (B) $\frac{1}{4}$
(C) $\frac{1}{3}$ (D) $\frac{1}{2}$

109. The Young's modulus of a wire is *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) $\frac{E}{Y}$

110. 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

111. The length of a rod is 20 *cm* and area of cross-section 2cm^2. The Young's modulus of the material of wire is $1.4\times10^{11}\,\text{N}/\text{m}^2$. 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}

112. If a spring extends by *x* on loading, then the 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) $\frac{2T^2}{k}$

113. On stretching a wire, the elastic energy stored per unit volume is

(A) $Fl/2AL$ (B) $FA/2L$
(C) $FL/2A$ (D) $FL/2$

114. When a force is applied on a wire of uniform cross-sectional area $3\times10^{-6}\,\text{m}^2$ and length 4*m*, the increase in length is 1 *mm*. Energy stored in it will be $(Y = 2\times10^{11}\,\text{N}/\text{m}^2)$

(A) 6250 *J* (B) 0.177 *J*
(C) 0.075 *J* (D) 0.150 *J*

115. *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) $K(l_2^2 - l_1^2)$ (D) $\frac{K}{2}(l_2^2 - l_1^2)$

116. When a 4 *kg* mass is hung vertically on a light spring that obeys Hooke's law, the spring stretches by 2 *cms*. The work required to be done by an external agent in stretching this spring by 5 *cms* will be $(g = 9.8\,\text{metres / sexc}^2)$

(A) 4.900 *joule* (B) 2.450 *joule*
(C) 0.495 *joule* (D) 0.245 *joule*

117. A wire of length *L* and cross-sectional area *A* is made of a material of Young's modulus *Y*. It is stretched by an amount *x*. The work done is

(A) $\frac{YxA}{2L}$ (B) $\frac{Yx^2A}{L}$
(C) $\frac{Yx^2A}{2L}$ (D) $\frac{2Yx^2A}{L}$

118. The elastic energy 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

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

(A) 6×10^{-2} J (B) 4×10^{-2} J
(C) 2×10^{-2} J (D) 1×10^{-2} J

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

(A) 9×10^{11} J (B) 4.5×10^{7} J
(C) 9×10^{7} J (D) 4.5×10^{11} J