PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

PROPERTIES OF MATTER

Stress, Strain And Young'S Modulus Of Elasticity

1. 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

Watch Video Solution

2. A wire is suspended from the ceiling and stretched under the action of weight F suspended from its other end. The force exerted by the ceiling on it is equal and opposite to the weight.

A. Tensile stress at any cross section A of the wire $\frac{F}{A}$

B. Tensile stress at any cross section is zero

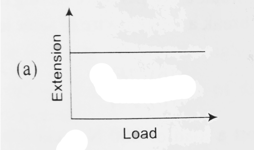
C. Tensile stress at any cross section A of the wire

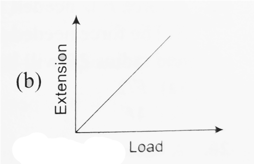
D. Tension at any cross section A of the wire is 2F

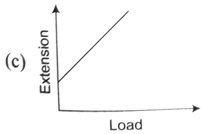
Answer: A

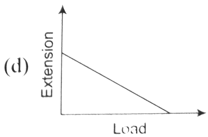
Watch Video Solution

3. Within elastic limit, which of the following graphs correctly represents the variation of extension in the length of wire with the external load?

A. 

B. 

C. 

D. 

Answer: B

Watch Video Solution

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

A. decreases

B. increases

C. becomes zero

D. remains constant

Answer: D

Watch Video Solution

5. A steel rod of length 1 m and radius 10 mm is stretched by a force 100 kN along its length. The stress produced in the rod is $Y_{Steel} = 2 \times 10^{11} Nm^{-2}$

A. $3.18 \times 10^{6} Nm^{-2}$

B. $3.18 \times 10^{7} Nm^{-2}$

C. $3.18 \times 10^{8} Nm^{-2}$

D. $3.18 \times 10^{9} Nm^{-2}$

Answer: C

Watch Video Solution

6. In the question number 5, the ercentage strain produced in the rod is

A. 0.04%

B. 0.08%

C. 0.16%

D. 0.24%

Answer: C

Watch Video Solution

7. 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

Watch Video Solution

8. 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

Answer: C

Watch Video Solution

9. 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 forces F_A and F_B respectively they get equal increase in their lengths. Then the ratio $\frac{F_A}{F_B}$ should be

A. $1:2$

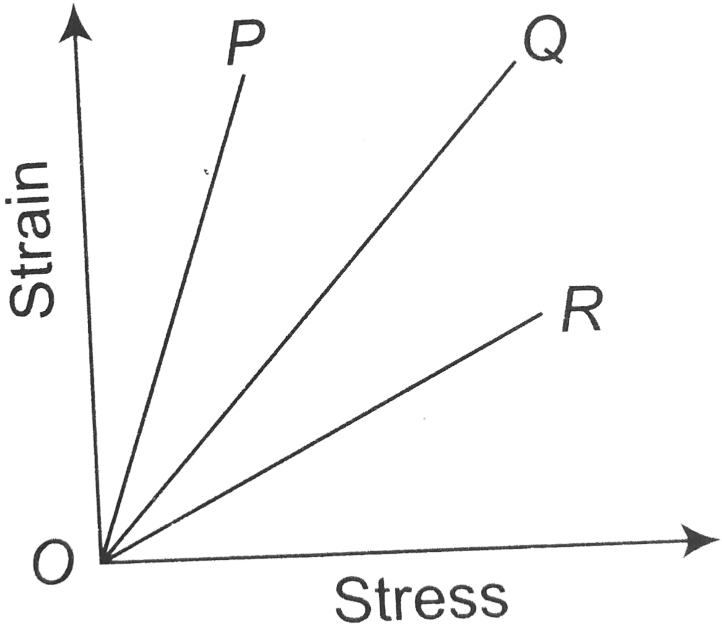
B. $1:1$

C. $2:1$

D. $8:1$

Answer: D

Watch Video Solution



10.

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

A. Elasticity of wire P is maximum

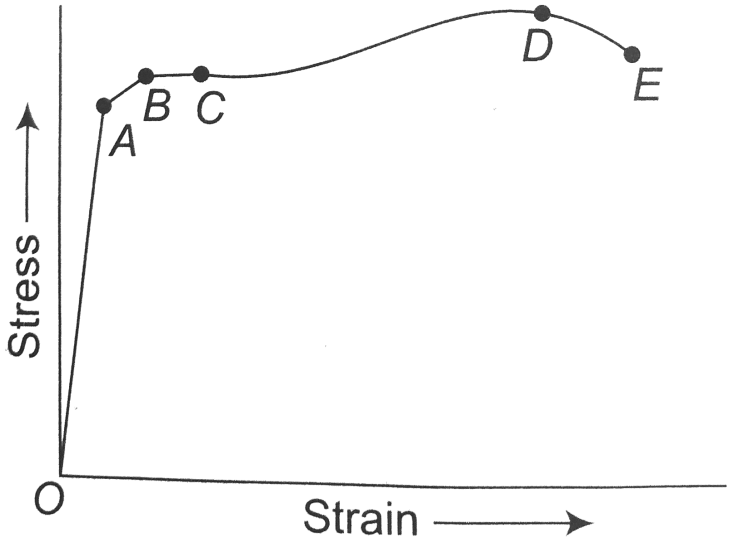
B. Elasticity of wire Q is maximum

C. Tensile strength of R is maximum

D. None of the above is true.

Answer: D

Watch Video Solution

11. 

The stress strain graph for a metal wire is as shown in the figure. In the graph, the region in which Hooke's law is obeyed, the ultimate strength and fracture are represented by

A. OA,C,D

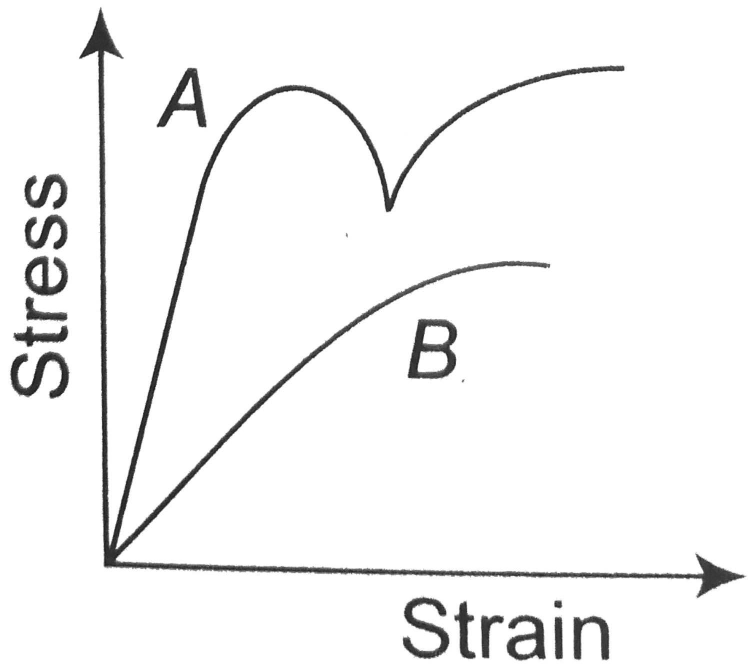
B. OB,D,E

C. OA,D,E

D. OB,C,D

Answer: C

Watch Video Solution



12.

The diagram shoes 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

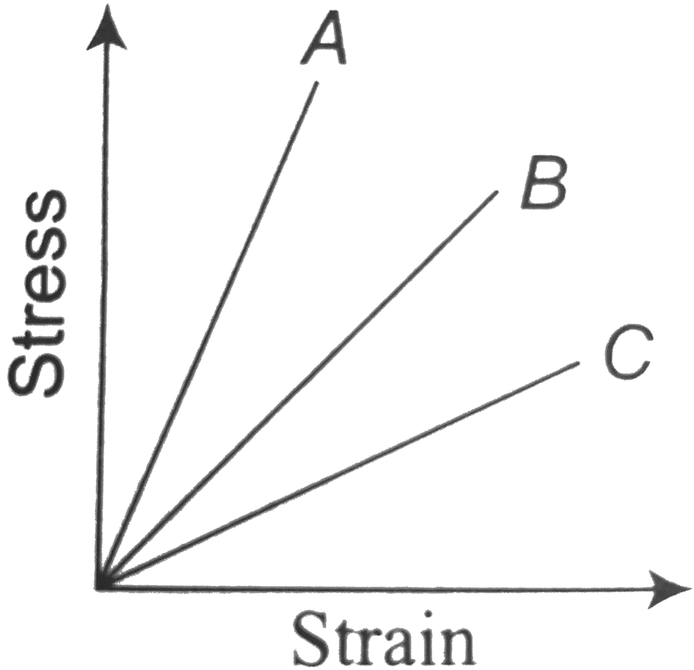
B. A is ductile and B is brittle

C. Both A and B are ductile

D. Both A and B are brittle

Answer: B

Watch Video Solution



13.

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

Watch Video Solution

14. For a perfectly rigid body

A. Young's modulus is infinite and bulk modulus is zero.

B. Young's modulus is zero and bulk modulus is infinite.

C. Young's modulus is infinite and bulk modulus is also infinite.

D. Young's modulus is zero and bulk modulus is also zero.

Answer: C

Watch Video Solution

15. Three wires P, Q and R of the same material and length have radii 0.1 cm, 0.2 cm and 0.3 cm respectively. Which wire has the highest value of Young's modulus of elasticity?

A. P

B. Q

C. R

D. All have the same value

Answer: D

Watch Video Solution

Watch Video Solution

16.

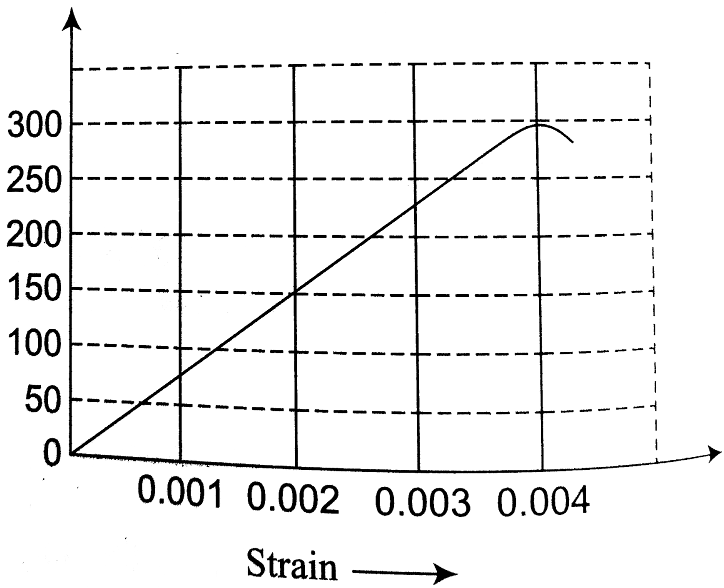


Figure shows the strain stress curve for a given material. The Young's modulus of the material is

A. $5 \times 10^{9} Nm^{-2}$

B. $5 \times 10^{10} Nm^{-2}$

C. $7.5 \times 10^{9} Nm^{-2}$

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

Answer: D

Watch Video Solution

17. 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 E, 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

Watch Video Solution

18. A substance breaks down under a stress of 10^5 Pa. If the density of the substance is $2 \times 10^3 kg/m^3$, find the minimum length of the wire made of this substance which will break under its own weight $(g = 10m / s)$.

A. 10 m

B. 2.5 m

C. 4 m

D. 5 m

Answer: D

Watch Video Solution

19. 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. $\frac{F}{2}$

B. $\frac{2}{F}$

C. 4F

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

Answer: C

Watch Video Solution

Watch Video Solution

20. A cable that can support a load of 800 N is cut into two equal parts. The maximum load that can be supported by either part is

A. 100 N

B. 400 N

C. 800 N

D. 1600 N

Answer: C

Watch Video Solution

21. 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. $7.5 \times 10^{-3} Nm^{-2}$

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

Answer: D

Watch Video Solution

22. Three wires A,B and C are of the same length and cross section. They are each stretched by applying the same force to the ends. The wire A is stretched least and comes back to its original length when the stretching force is removed. The wire B is stretched more than A and also comes back to its original length when the stretching force is removed.

The wire C is stretched most and remains stretched even when stretching force is removed. The greatest Young's modulus of elasticity is possessed by the material of wire

A. A

B. B

C. C

D. Data is not sufficient

Answer: A

Watch Video Solution

23. 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

Watch Video Solution

24. A lift is tied with thick iron and its mass is 314 kg. What should be the minimum diameter of wire if the maximum acceleration of lift is $1.2\frac{m}{\sec^2}$ and the maximum safe stress of the wire is $1 \times 10^7 \frac{N}{m^2}$?

A. 2 cm

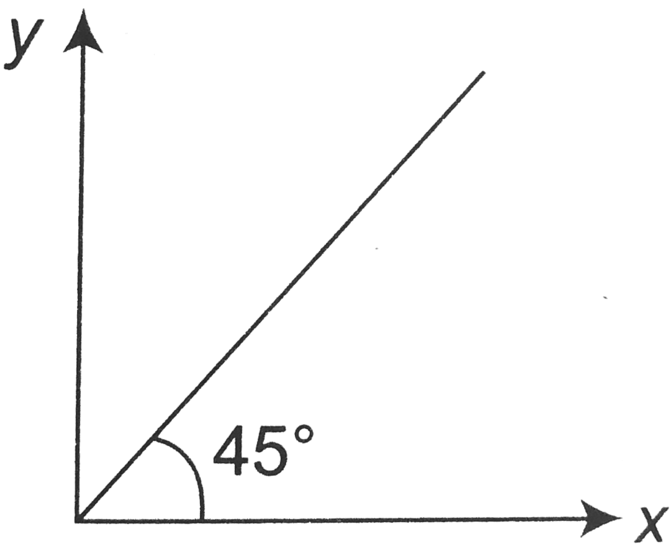
B. 1 cm

C. 1.5 cm

D. none of these

Answer: A

Watch Video Solution



25.

The product of Young's modulus of the material of the wire with its cross sectional area is equal to its length. Find the parameters representing x and y axes of the curve as shown:

A. load and increase in length

B. stress and strain

C. Young's modulus and stress

D. Young's modulus and strain

Answer: A

Watch Video Solution

26. Young's modulus of a rod is $\frac{AgL^2}{2l}$ for which elongation is λ due to its own weight when suspended from the ceiling. L is the length of the rod and A is constant, which is:

A. area

B. mass per unit length

C. mass per unit length per unit area

D. area per unit mass

Answer: C

Watch Video Solution

27. A wire of length L and density ρ and Young's modulus Y is hanging from a support. Find the elongation in the length of wire at which wire will break:

A. $\frac{L^2 \rho g}{Y}$

B. $\frac{L^2 \rho g}{2Y}$

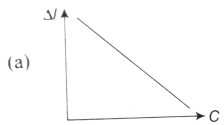
C. $\frac{2L^2 \rho g}{Y}$

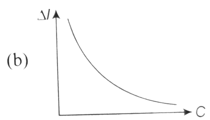
D. $\frac{L^2 \rho g}{4Y}$

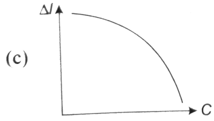
Answer: A

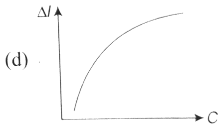
Watch Video Solution

28. The wires of same length and Young's modulus are subjected to same tensile force. If $\triangle I$ is the change in length of wire, and c is the circumference of the wire, find the correct graph. The experiment is performed on the wires of different circumference:

A. 

B. 

C. 

D. 

Answer: B

Watch Video Solution

29. A sample of a liquid has an initial volume of 1.5 L The volume is reduced by 0.2 mL, when the pressure increases by 140 kPa. What is the bulk modulus of the liquid?

A. $1.05 \times 10^9 Pa$

B. $3.05 \times 10^9 Pa$

C. $2.10 \times 10^9 Pa$

D. $5.10 \times 10^9 Pa$

Answer: A

Watch Video Solution

30. A 900 kg elevator hangs by a steel cable for which the allowable stress is $1.15 \times 10^8 \frac{N}{m^2}$. What is the minimum diameter required if the elecator accelerates upward at $1.5\frac{m}{s^2}$? Take $g = 10\frac{m}{s^2}$.

A. $\frac{6 \times 10^{-2}}{\sqrt{5\pi}}m$

B. $\frac{6 \times 10^{-2}}{\sqrt{10\pi}}m$

C. $\frac{3 \times 10^{-2}}{\sqrt{10\pi}}m$

D. $\frac{3 \times 10^{-2}}{\sqrt{5\pi}}m$

Answer: B

Watch Video Solution

31. Four uniform wires of the same material are stretched by the same force. The dimensions of wire are as given below. The one which has the minimum elongation has:

A. radius 3 mm, length 3 m

B. radius 0.5 mm length 0.5 m

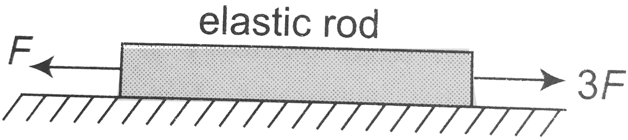
C. radius 2 mm,length 2 m

D. radius 3 mm, length 2 m

Answer: D

Watch Video Solution

Watch Video Solution

32. 

A uniform elastic rod of cross section area A natural length L and Young's modulus Y is placed on a smooth horizontal surface. Now two horizontal forces (of magnitude F and 3F) directed along the length of rod and in opposite direction act at two of its ends as shown . After the rod has acquired steady state, the extension of the rod will be

A. $\frac{2F}{YA}L$

B. $\frac{4F}{YA}L$

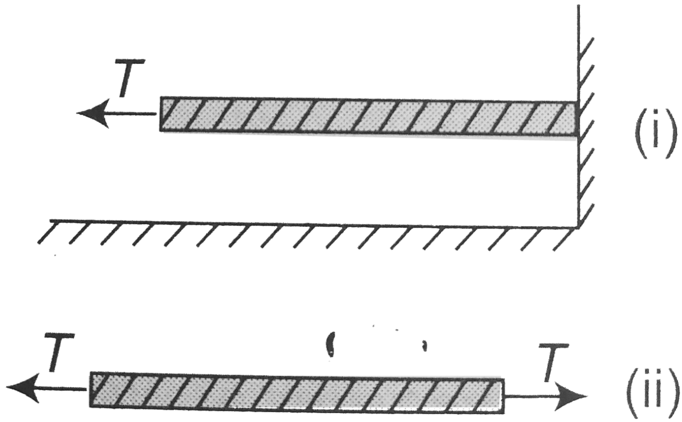
C. $\frac{F}{YA}L$

D. $\frac{3F}{2YA}L$

Answer: A

Watch Video Solution

33.



In the figure (i) an extensible string is fixed at one end and the other end is pulled by a tension T. In figure (ii) another identical string is pulled by tension T' at both the ends. The ratio of elongation in equilibrium of string in (i) to the elongation of string in (ii) is

A. $1:1$

B. $1:2$

C. $2:1$

D. 0

Answer: A

Watch Video Solution

34. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied

A. length 50 cm and diameter 0.5 mm

B. length 100 cm and diameter 1 mm

C. length 200 cm and diameter 2 mm

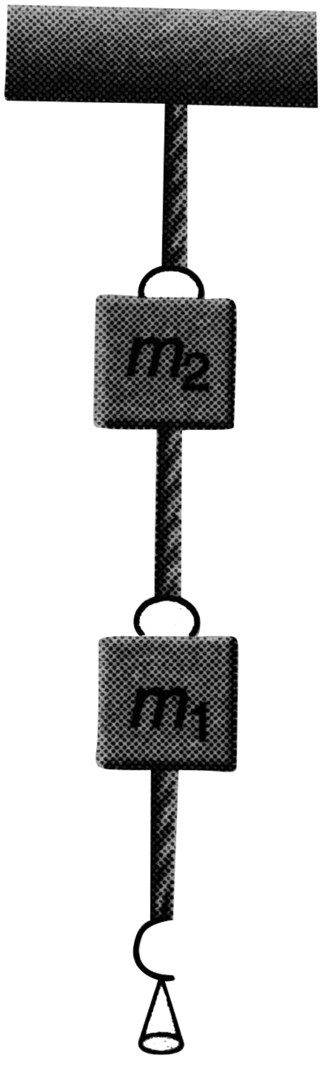
D. length 300 cm and diameter 3 mm

Answer: A

Watch Video Solution

35. Two wires shown in figure are made of the same material which has a breaking stress of $8 \times 10^8 \frac{N}{m^2}$. The area of cross- section of the upper wire is $0.006 cm^2$ and that of the lower wire is $0.003 cm^2$. The mass $m_1 = 10 kg, m_2 = 20 kg$ and the hanger is light . Find the maximum load that can be put on the hanger without breaking a wire. Which wire will break first if the load is increased ? (

Take $g = 10m/s^2$)



A. 14 kg

B. 1.4 kg

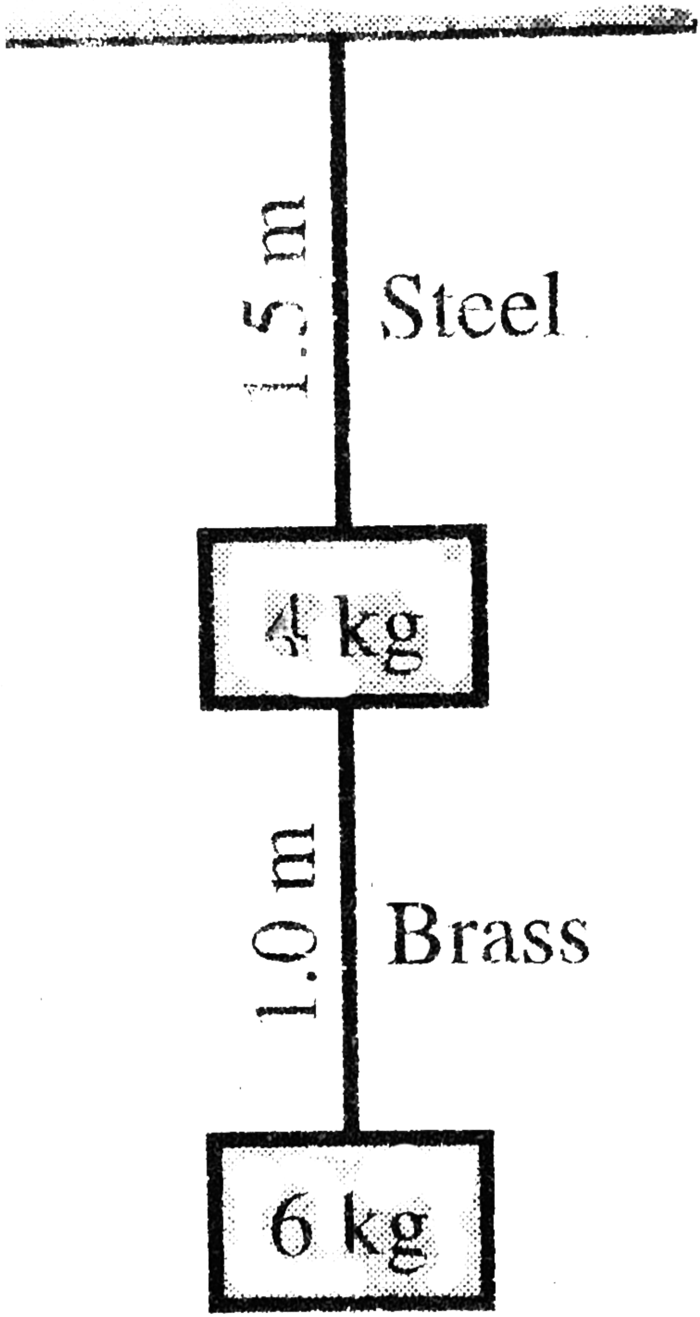
C. 1.2 kg

D. 12 kg

Answer: A

Watch Video Solution

36. Two wires of diameter $0.25 cm$, one made of steel and other made of brass, are loaded as shown in the figure. The unloaded length of the steel wire is $1.5m$ and that of brass is $1.0m$. Young's modulus of steel is 2.0×10^{11} Pa and that of brass is 1.0×10^{11} Pa. Compute the ratio of elongations of steel and brass wires. $\dfrac{\triangle\, l_{\text{steel}}}{\triangle\, l_{\text{brass}}} = ?$



A. 1.25

B. 1.5

C. 2

D. 0.5

Answer: A

Watch Video Solution

37. Which of the following statements is correct regarding poissen's ratio?

A. It is the ratio of the longitudinal strain to the lateral strain.

B. Its value is independent of the nature of the material.

C. It is unitless and dimensionless quantity.

D. The practical value of poisson's ratio lies between 0 and 1.

Answer: C

Watch Video Solution

38. If the volume of a wire remains constant when subjected to tensile stress, the value of poisson's ratio of material of the wire is

A. 0.1

B. 0.2

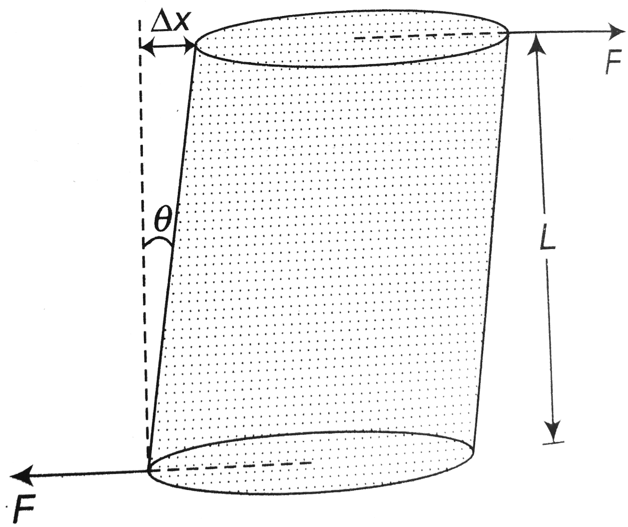
C. 0.4

D. 0.5

Answer: D

Watch Video Solution

Bulk Modulus And Shear Modulus



1.

If two equal and opposite defirming forces are applied parallel to the cross sectional area of the cylinder as shown in the figure, there is a relative displacement between the oppsite faces of the cylinder. The ratio of Ax to L is known as

A. longitudinal strain

B. volumetric strain

C. shearing strain

D. Poisson's ratio

Answer: C

Watch Video Solution

2. 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

3. 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. $\dfrac{P}{\alpha\beta}$

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

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

D. $\dfrac{\alpha\beta}{P}$

Answer: A

Watch Video Solution

4. 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

Answer: C

Watch Video Solution

5. What increase in pressure is required to decrease the volume of 200 litre of water by 0.004 percent? Given bulk modulus of water is 2100 Mpa.

A. 21 kPa

B. 84 kPa

C. 42 kPa

D. none of these

Answer: B

Watch Video Solution

6. Forces of 100 N each are applied in opposite direction on the upper and lower faces of a cube of side 20 cm. The upper face is shifted parallel to itself by 0.25 cm. If the side of the cube were 10 cm, then the displacement would be

A. 0.25 cm

B. 0.5 cm

C. 0.75 cm

D. 1 cm

Answer: B

Watch Video Solution

7. Rigidity modulus of steel is η and its Young's modulus is Y. A piece of steel of cross sectional area A is chaged into a wire of length L and area $\frac{A}{10}$ then :

A. Y increases and η decreases

B. Y and η remain the same

C. both Y and η increase

D. boty Y and η decrease

Answer: B

Watch Video Solution

8. A sample of a liquid has an initial volume of 1.5 L The volume is reduced by 0.2 mL, when the pressure increases by 140 kPz. What is the bulk modulus of the liquid?

A. $1.05 \times 10^9 Pa$

B. $1.1 \times 10^9 Pa$

C. $1.2 \times 10^9 Pa$

D. $1.4 \times 10^9 Pa$

Answer: A

Watch Video Solution

9. When temperature of a gas is $20^\circ C$ and pressure is changed from $p_1 = 1.01 \times 10^5 Pa$ to $p_2 = 1.165 \times 10^5 Pa$ then the volume changed by 10%. The bulk modulus is

A. $1.55 \times 10^5 Pa$

B. $205 \times 10^5 Pa$

C. $107.4 \times 10^5 Pa$

D. $53.7 \times 10^5 Pa$

Answer: A

Watch Video Solution

10. 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. 4×10^{-5}

C. 0.025

D. 0.004

Answer: A

Watch Video Solution

11. 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. 10^8

B. 2×10^8

C. 10^9

D. 2×10^9

Answer: D

Watch Video Solution

12. 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

Answer: C

Watch Video Solution

13. 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

Watch Video Solution

Watch Video Solution

14. 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

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

A. $19.6 \times 10^{8} \frac{N}{m^2}$

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

C. $10.6 \times 10^{10} \frac{N}{m^2}$

D. $19.6 \times 10^{-8} \frac{N}{m^2}$

Answer: A

Watch Video Solution

16. 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. $\dfrac{P\beta}{\alpha}$

D. $\dfrac{\alpha\beta}{P}$

Answer: A

Watch Video Solution

17. When temperature of a gas is $20^\circ C$ and pressure is changed from $p_1 = 1.01 \times 10^5 Pa$ to $p_2 = 1.165 \times 10^5 Pa$ then the volume changed by 10%. The bulk modulus 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

Watch Video Solution

18. 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. $\frac{\triangle V}{V} \propto B$

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

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

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

Answer: B

Watch Video Solution

19. 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

Watch Video Solution

20. 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

21. The upper end of a wire of radius $4mm$ and length $100cm$ 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

Watch Video Solution

22. 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

Answer: C

Watch Video Solution

23. A 2 m 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

Watch Video Solution

24. A block of gelatine is 60 mm be 60 mm be 20 mm when unstressed. A force of 0.245 N is applied tangentially to the upper surface, causing a 5 mm displacement relative to the lower surface. Following observations are made regarding the block. (i) the shearing strees develop on surface is 68.1 Pa

(ii) the shearing strain develop on surface is 0.25 Pa

(iii) the shear modulus of material is $272 \frac{N}{m^2}$

Regarding above statements we can say:

A. only statements (i) and (iii) are correct

B. only statements (ii) and (iii) are correct

C. only statements (i) and (ii) are correct

D. all the statements are correct

Answer: D

Watch Video Solution

25. The average depth of indian Ocean is about 3000 m. The fractional compression, $\frac{\triangle V}{V}$ of water at the bottom of the ocean is (Given Bulk modulus of the water $= 2.2 \times 10^9 Nm^{-2}$ and $g = 10ms^{-2}$)

A. 0.82%

B. $0.91\ \%$

C. $1.36\ \%$

D. $1.24\ \%$

Answer: C

Watch Video Solution

26. A square lead slab of side 50 cm and thickness 10 cm is subjected to a shearing force (on its narrow face) of $9 \times 10^4 N$. The lower edge is riveted to the floor. How much will the upper edge be displaced? (Shear modulus of lead $= 5.6 \times 10^{9} Nm^{-2}$)

A. 0.16 mm

B. 1.6 mm

C. 0.16 cm

D. 1.6 cm

Answer: A

Watch Video Solution

27. The compressibility of water is $6 \times 10^{-10} N^{-1} m^2$. If one litre is subjected to a pressure of $4 \times 10^7 Nm^{-2}$, The decrease in its volume is

A. 10 cc

B. 24 cc

C. 15 cc

D. 12 cc

Answer: B

Watch Video Solution

Watch Video Solution

28. The volume change of a solid copper cube 10 cm on an edge, when subject to a pressure of 7 Mpa is (Bulk modulus of copper $= 140 GPa$)

A. $5 \times 10^{-2} cm^3$

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

C. $15 \times 10^4 cm^3$

D. $20 \times 10^{-2} cm^3$

Answer: A

Watch Video Solution

29. Two parallel and opposite forces each 5000 N are applied tangentially to the upper and lower faces of a cubical metal block of side 25 cm. the angle of shear is (The shear modulus of the metal is 80 Gpa)

A. $10^{-4} rad$

B. $10^{-5} rad$

C. $10^{-6} rad$

D. $10^{-7} rad$

Answer: C

Watch Video Solution

Elasticity And 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. $\frac{V}{25}$

B. $5V$

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

D. $25V$

Answer: D

Watch Video Solution

2. 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 two wires will be

A. $1:2$

B. $1:4$

C. $2:1$

D. $1:1$

Answer: A

Watch Video Solution

3. A 5 metre long wire is fixed to the ceiling. A weight of $10kg$ is hung at the lower end and is $1metre$ above the floor. The wire was elongated by $1mm$. The energy stored in the wire duw to streching is

A. zero

B. $0.05jo\underline{e}$

C. $100jo\underline{e}$

D. $500jo\underline{e}$

Answer: B

Watch Video Solution

4. A brass rod of cross sectional area $1cm^2$ and length $0.2m$ 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

Watch Video Solution

5. If one end of a wire is fixed with a rigid support and the other end is streched by a force of $10N$, then the increae in length is $0.5mm$. The ratio of the energy of the wire and the work done in displacing it through $0.5mm$ by the weight is

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

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

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

D. 1

Answer: C

Watch Video Solution

6. 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. $\frac{K}{2}(l_2^2 - l_1^2)$

Answer: D

Watch Video Solution

7. 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 $\left(g = 9.8 \frac{metrs}{\sec^2}\right)$

A. $4.900 jo\underline{e}$

B. $2.450 jo\underline{e}$

C. $0.495 jo\underline{e}$

D. $0.245 jo\underline{e}$

Answer: B

Watch Video Solution

8. 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. $2:3$

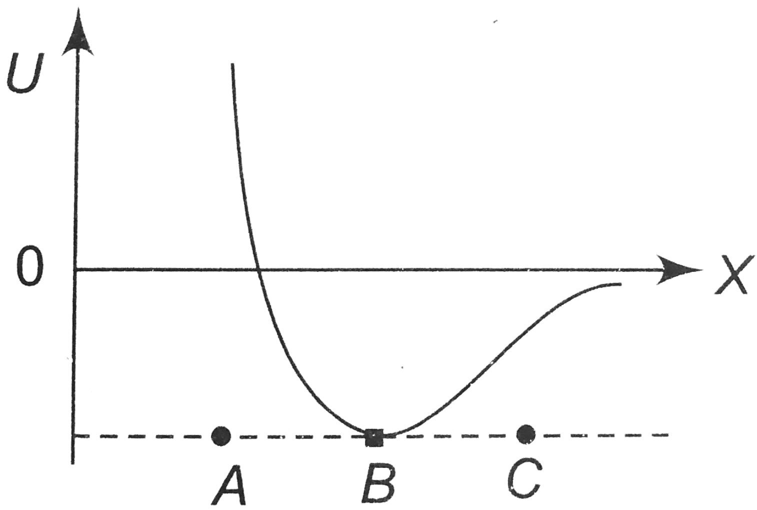
B. $3:4$

C. $3:2$

D. $6:1$

Answer: B

Watch Video Solution

9. 

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 reach B

Answer: B

Watch Video Solution

10. A uniform metal rod fixed at its ends of $2mm^2$ cross-section is cooled from $40^\circ C$ to $20^\circ C$. The coefficient of the linear expansion of the rod is 12×10^{-6} per degree celsius and its young's modulus of elasticity is $10^{11} N/m^2$. The energy stored per unit volume of the rod is

A. $2880\frac{J}{m^3}$

B. $1500\frac{J}{m^3}$

C. $5760\frac{J}{m^3}$

D. $1440\frac{J}{m^3}$

Answer: A

Watch Video Solution

11. The length of a rod is 20 cm and area of cross section $2cm^2$. The Young's modulus of the amterial of wire is $1.4 \times 10^{11}\frac{N}{m^2}$. 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

12. 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 $(Y = 2 \times 10^{11} N/m^2)$

A. 6270 J

B. 0.177 J

C. 0.075 J

D. 0.150 J

Answer: C

Watch Video Solution

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

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

Watch Video Solution

14. A smooth uniform string of natural length L_0, cross-sectional area A and Young's modulus Y is pulled along its length by a force F on a horizontal smooth surface. The elastic potential energy stored in the string is

A. $\dfrac{2F^2L_0}{AY}$

B. $\dfrac{F^2L_0}{2AY}$

C. $\dfrac{F^2L_0}{2AY}$

D. $\frac{F^2 L_0}{6AY}$

Answer: D

Watch Video Solution

15. When the load on a wire is slowly increased from $3kgwt$ to $5kgwt$, the elongation increases from 0.61 to $1.02mm$. The work done during the extension of wire is

A. $16 \times 10^{-3} J$

B. $8 \times 10^{-2} J$

C. $20 \times 10^{-2} J$

D. $11 \times 10^{-3} J$

Answer: A

Watch Video Solution

16. If the work done in strectching a wire by $1mm$ is $2J$, then work necessary for stretching another wire of same material but with double radius of cross -section and half of the length

by $1mm$ is

A. 16 J

B. 8 J

C. 4 J

D. $\frac{1}{4}J$

Answer: A

Watch Video Solution

17. A long elastic spring is stretched by $2cm$ and its potential energy is U. If the spring is stretched by $10cm$, the PE will be

A. 5 U

B. 25 U

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

D. $\frac{U}{20}$

Answer: B

Watch Video Solution

18. The elastic energy per unit volume is terms of longitudinal strain σ and Young's modulus Y is

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

B. $\frac{1}{2}Y\sigma$

C. $2Y\sigma^2$

D. $2Y\sigma$

Answer: A

Watch Video Solution

19. If the pressure p is applied normal to a wire of Young's modulus Y, the energy stored per unit volume is

A. $\frac{1}{2}p^2Y$

B. $\frac{1}{2}\frac{p^2}{Y}$

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

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

Answer: B

Watch Video Solution

20. A thick rope of density ρ and length L is hung from a rigid support. The increase in length of the rope due to its own weight is (Y is the Young's modulus)

A. $\frac{1}{4Y}\rho L^2 g$

B. $\frac{1}{2Y}\rho L^2 g$

C. $\frac{\rho L^2 g}{Y}$

D. $\frac{\rho L g}{Y}$

Answer: B

Watch Video Solution

21. A force of $10^{6} \frac{N}{m^{2}}$ is required for breaking material, If the density is $3 \times 10^{3} kgm^{-3}$ then what should be the maximum length which can be hanged so that it is the point of breaking by its own weight?

A. $34 m$

B. $340 m$

C. $3.4 m$

D. $0.34 m$

Answer: A

Watch Video Solution

22. When the load on a wire is slowly increased from $3kgwt$ to $5kgwt$, the elongation increases from 0.61 to $1.02mm$. The work done during the extension of wire is

A. $0.16J$

B. $0.016J$

C. $1.6J$

D. $16J$

Answer: B

Watch Video Solution

23. If the work done in strectching a wire by $1mm$ is $2J$, then work necessary for stretching another wire of same material but with double radius of cross -section and half of the length by $1mm$ is

A. $\frac{1}{4}J$

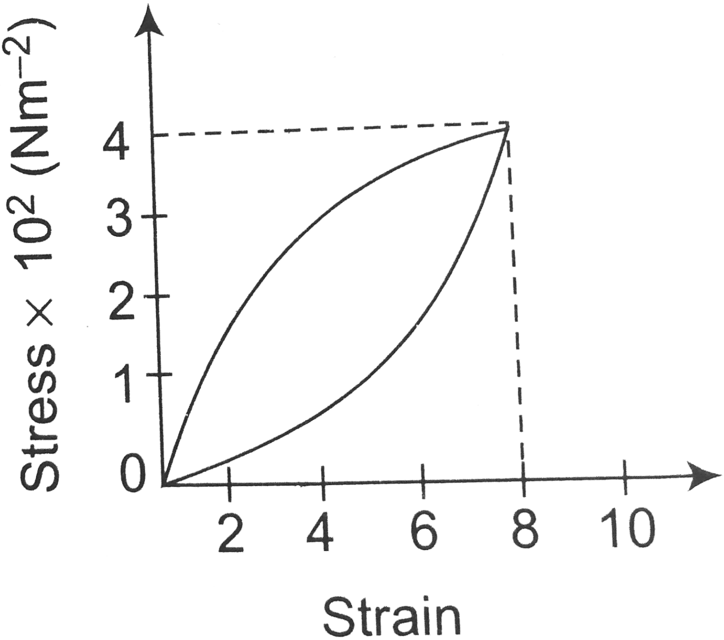
B. $4J$

C. $8J$

D. $16J$

Answer: D

Watch Video Solution



24.

A rubber of volume 2000 cc is alternately subjected to tension and released. The figure shown the stress-strain curve of rubber. Each curve is a quadrant of an ellipse. The amount of energy lost as heat per cycle per unit volume will be

A. $\left(\frac{\pi}{2}-1\right) \times 16 \times 10^2 J$

B. $\left(\frac{\pi}{4}-1\right) \times 8 \times 10^2 J$

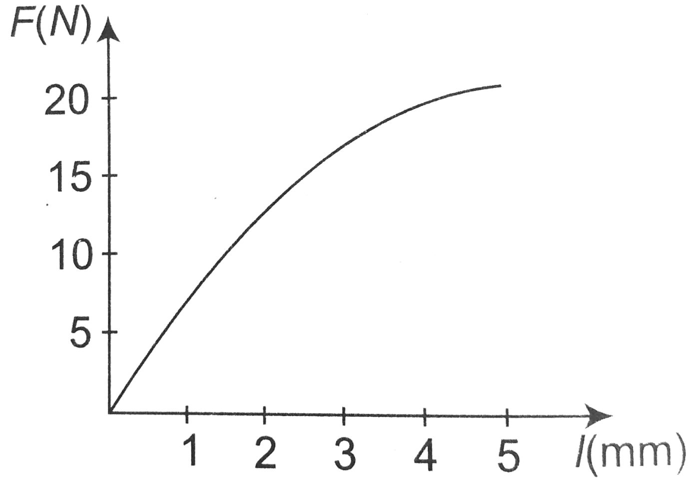
C. $\left(\frac{\pi}{4}-1\right) \times 32 \times 10^2 J$

D. $\left(\frac{\pi}{2}-1\right) \times 32 \times 10^2 J$

Answer: D

Watch Video Solution

25.



The force (F)- extension (λ) graph shows that the strain energy stored in the material under test, for an extension of $4mm$, is greater than which of the following values?

A. $80mJ$

B. $60mJ$

C. $40mJ$

D. none of these

Answer: C

Watch Video Solution

Surface Tension And Surface Energy

1. The rain are in spherical shape due to

A. Viscosity

B. Surface tension

C. Thrust on drop

D. Both (a) and (b)

Answer: B

Watch Video Solution

2. Soap helps in cleaning clothes, because

A. Chemicals of soap change

B. it increases the surface tension of the solution

C. It absorbs the dirt

D. It lower the surface tension of the solution.

Answer: D

Watch Video Solution

3. The spider and insect move and run about on the surface of water without sinking because

A. Elastic membrane is formed on water due to property of surface tension.

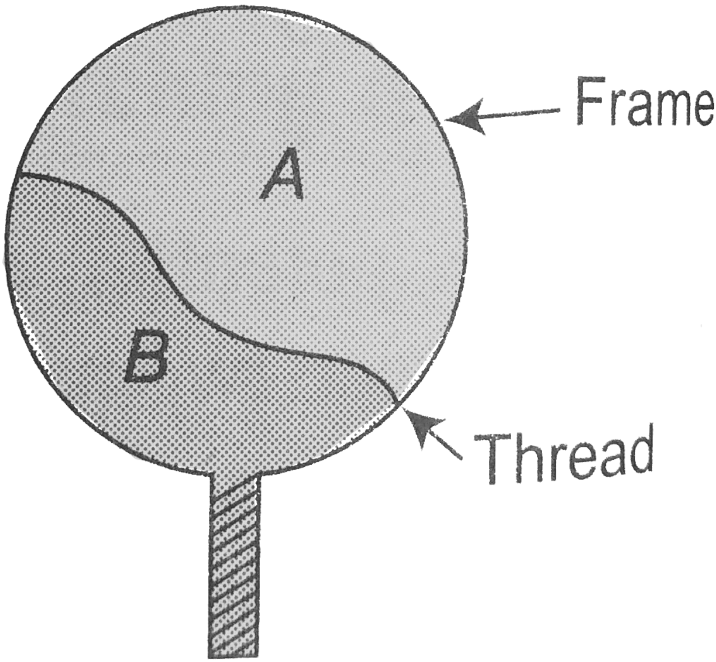
B. spiders and insects are lighter

C. Spiders and insects swim on water

D. Spider and insects experience upthurust.

Answer: A

Watch Video Solution



4.

A thread is tied slightly loose to a wire frame as in figure and the frame is dipped into a soap solution and taken out . The frame is comletely covered with the film. When the portion A puntured with a pin The thread.

A. Becomes concave towards A

B. Becomes convex towards A

C. Remains in the initial position

D. Either (a) or (b) depensing on the size of A w.r.t. B

Answer: A

Watch Video Solution

5. The maximum force, in addition to the weight required to pull a wire of $5.0cm$ long from the surface of water at temperature $20^\circ C$, is 728 dynes. The surface tension of water is

A. $7.28 \frac{N}{cm}$

B. $7.28 \frac{\text{dyne}}{cm}$

C. $72.8 \frac{\text{dyne}}{cm}$

D. $7.28 \times 10^2 \frac{\text{dyne}}{cm}$

Answer: C

Watch Video Solution

6. Consider a liquid contained in a vessel. The liquid solid adhesive force is very weak as compared to the cohesive force in the liquid. The shape of the liquid surface near the solid shall be

A. Horizontal

B. Almost vertical

C. Concave

D. Convex

Answer: D

Watch Video Solution

7. A thin metal disc of radius r floats on water surface and bends the surface downwards along the perimeter making an angle θ with vertical edge of the disc of the disc. If the disc dispplaces a weight of water W and surface tension of water is T, then the weight of metal disc is

A. $2\pi rT + W$

B. $2\pi rT \cos\theta - W$

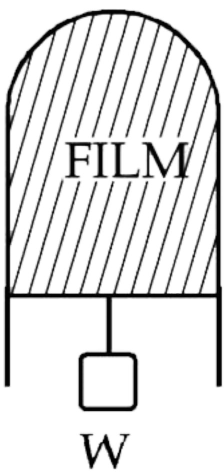
C. $2\pi rT \cos\theta + W$

D. $W - 2\pi rT \cos\theta$

Answer: C

Watch Video Solution

8. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of $1.5 \times 10^{-2} N$ (see figure). The length of the slider is 30cm and its weight negligible. The surface tension of the liquid film is



A. $0.0125 Nm^{-1}$

B. $0.1 Nm^{-1}$

C. $0.05 Nm^{-1}$

D. $0.025 Nm^{-1}$

Answer: D

Watch Video Solution

9. Energy needed in breaking a drop of radius R into n drops of radii r is given by

A. $4\pi T(\pi r^2 - R^2)$

B. $\frac{4}{3}\pi\left(r^3 n - R^2\right)$

C. $4\pi T\left(R^2 - nr^2\right)$

D. $4\pi T\left(nr^2 + R^2\right)$

Answer: A

Watch Video Solution

10. The radius of a soap bubble is increased from $\frac{1}{\sqrt{\pi}}$ cm to $\frac{2}{\sqrt{\pi}}$ cm. If the surface tension of water is $30dy \neq s$ per cm, then the work done will be

A. 180 ergs

B. 360 ergs

C. 720 ergs

D. 960 ergs

Answer: C

Watch Video Solution

11. One thousand small water drops of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

A. $1000 : 1$

B. $1 : 1000$

C. $10 : 1$

D. $1 : 10$

Answer: D

Watch Video Solution

12. A film of water is formed between two straight parallel wires of length 10 cm each separated by $0.5cm$ If their separation is increased by $1mm$ while still maintaining their parallelism, how much work will have to be done (Surface tension of water $= 7.2 \times 10^{-2} \frac{N}{m}$)

A. $7.22 \times 10^{-6} Jo\underline{e}$

B. $1.44 \times 10^{-5} jo\underline{e}$

C. $2.88 \times 10^{-5} jo\underline{e}$

D. $5.76 \times 10^{-5} jo\underline{e}$

Answer: B

Watch Video Solution

13. There is a howizontal film of soap solution. On it a thread is placed in the form of a loop. The film is pierced inside the loop and the thread becomes a circular loop of radius R. If the surface tension of the loop be T, then what will be the tension in the thread?

A. $\frac{\pi R^2}{T}$

B. $\pi R^2 T$

C. $2\pi RT$

D. $2RT$

Answer: D

Watch Video Solution

14. If a number of little droplets of water, each of radius r, coalesce to form a single drop of radius R, show that the rise in temperature will be given by $\frac{3T}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$ where T is the surface tension of water and J is the mechanical equivalent of heat.

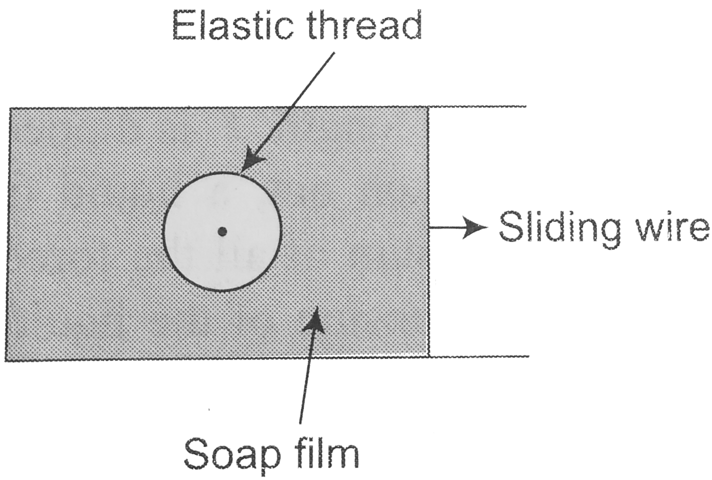
A. $\frac{2T}{rJ}$

B. $\frac{3T}{RJ}$

C. $\frac{3T}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

D. $\frac{2T}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

Answer: C



15.

The figure shows a soap film in which a closed elastic thread is lying. The film inside the thread is pricked. Now the sliding wire is moved out so that the surface area increases. The radius circle of the circle formed by elastic thread will

A. increase

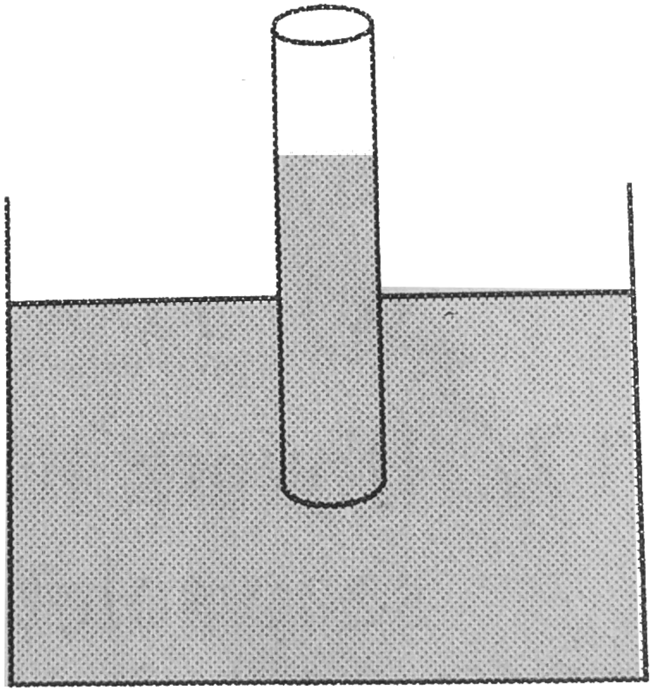
B. decrease

C. remains same

D. data insufficient

Answer: C

Watch Video Solution



16.

A long capillary tube of mass π gm, radisu $2mm$ and negligible thickness, is partially immersed in a liquid of surface tension $0.1\frac{N}{m}$. Take angle of contact zero and neglect buoyant force of liquid. The force required to hold the tube vertically, will be $\left(g = 10\frac{m}{s^2}\right)$

A. $10.4\pi mN$

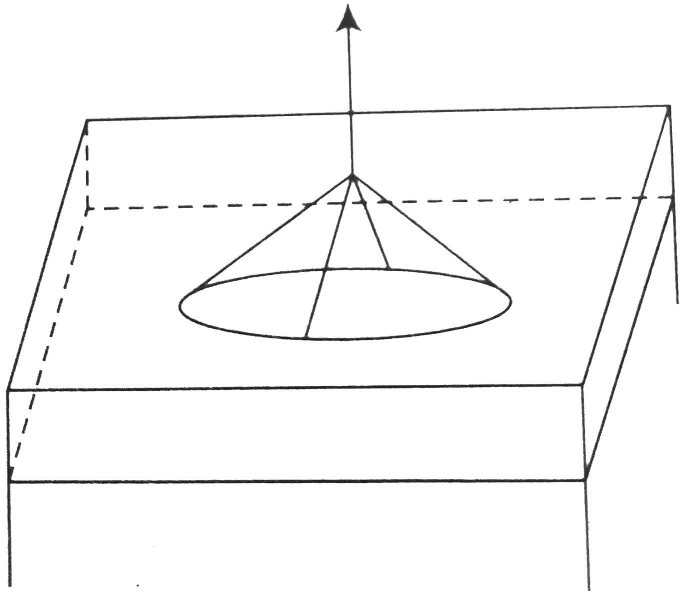
B. $10.8\pi mN$

C. $0.8\pi mN$

D. $4.8\pi mN$

Answer: B

Watch Video Solution



17.

The surface tension of water is $75\frac{dy\neq}{cm}$. Find the minimum vertical force required to pull a thin wire ring up (refer figure) if it is initially resting on a horizontal water surface. The circumference of the ring is $20cm$ and its weight is $0.1N$

A. $0.125N$

B. $0.225N$

C. $0.115N$

D. $0.130N$

Answer: D

Watch Video Solution

18. A paper disc of radius R from which a hole of radius r is cut out is floating in a liquid of the surface tension S. The force on the disc due to the surface tension is

A. $T.3\pi R$

B. $T.2\pi(R+r)$

C. $T.4\pi(R+r)$

D. $T.2\pi(R-r)$

Answer: B

Watch Video Solution

19. A wire of mass $1g$ is kept horizontally on the surface of water. The length of the wire that does not break the surface film is (surface tension of water is $70dy \neq cm^{-1}$)

A. $3cm$

B. $4cm$

C. $7cm$

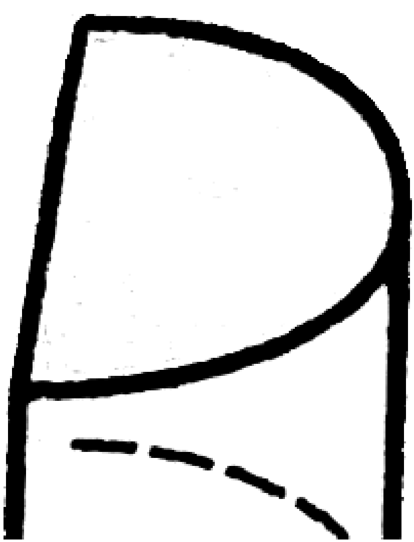
D. $14cm$

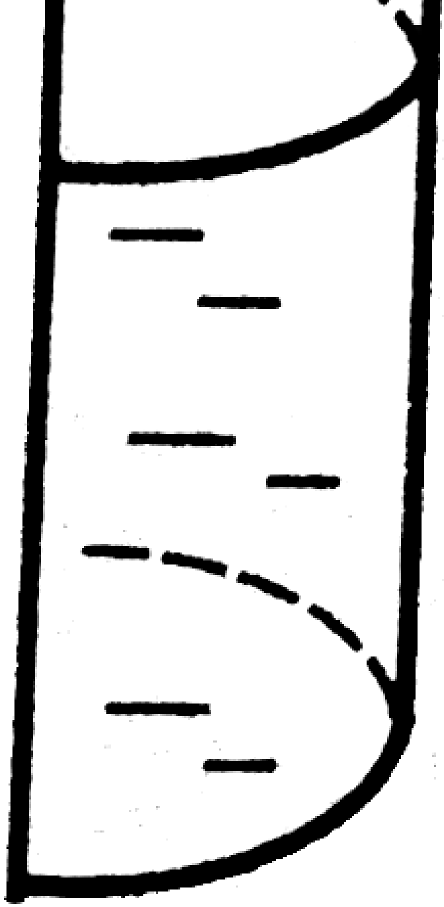
Answer: C

Watch Video Solution

Watch Video Solution

20. A liquid is containe in a vertical tube of semicircular cross section figure.The contact angle is zero. The force of surface tension on the curved part and on the flat part are in ratio





A. $1:\pi$

B. $3:\pi$

C. $2.7 : \pi$

D.

Answer: A

Watch Video Solution

21. A wire ring of diameter $14cm$ is gently lowered on to a liquid surface and then pulled up. When the film just breaks, the force required is $0.0616N$. The surface tension of the liquid is

A. $70Nm^{-1}$

B. $7Nm^{-1}$

C. $70dy \neq cm^{-1}$

D. None of these

Answer: C

Watch Video Solution

22. A square wire frame of length l is dipped in a solution. When the frame is taken out, a liquid film is formed. What is the algebraic sum of all the force acting on the frame due to surface tension of the liquid? (given $\sigma =$ surface tension of the liquid).

A. $4\sigma l$

B. $8\sigma l$

C. $10\sigma l$

D. $12\sigma l$

Answer: B

Watch Video Solution

23. A soap film measure $10cm \times 6cm$. It is increased to $10cm \times 12cm$. IF surface tension is 30×10^{-3} newtor per metre. Then the work done is

A. $3.6 \times 10^{0} J$

B. $3.6 \times 10^{-2} J$

C. $3.6 \times 10^{-4} J$

D. $3.6 \times 10^{3} J$

Answer: C

Watch Video Solution

24. If work W is done in blowing a bubble of radius R from a soap solution. Then the work done is blowing a bubble of radius $2R$ from the same solution is

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

B. $2W$

C. $4W$

D. $\frac{7}{3}W$

Answer: C

Watch Video Solution

25. The surface tension of a liquid is $5Nm^{-1}$. If a thin film formed on a loop of area $0.02m^{-2}$ then its surface energy will be

A. $5 \times 10^{-2}J$

B. $2.5 \times 10^{-2}J$

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

D. $3 \times 10^{-1}J$

Answer: C

Watch Video Solution

26. A soap bubble has radius r The work done in increasing its radius to three times its original radius, without any rise of temperature, is (Given Surface tension of soap solution is T)

A. $12\pi r^2 T$

B. $16\pi r^2 T$

C. $64\pi r^2 T$

D. $48\pi r^2 T$

Answer: C

Watch Video Solution

27. A mercury drop of radius R is sprayed into n droplets of equal size. Calculate the energy expended if surface tension of mercury is T.

A. $4\pi R^2 T\left(N^{\frac{1}{3}} - 1\right)$

B. $2R^2 T\left(N^{\frac{1}{3}} - 1\right)$

C. $4\pi R^2 T\left(N^{\frac{2}{3}} - 1\right)$

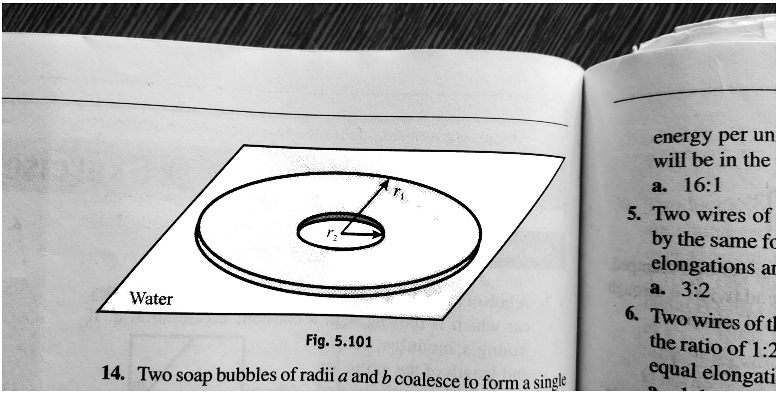
D. none of these

Answer: A

Watch Video Solution

28. An annular disc of radius $r_1 = 10cm$ and $r_2 = 5cm$ is placed on a water surface. Find the surface tension force on the disc if we want to pull it from water surface. Take coefficient of surface tension as

$\sigma = 7 \times 10^{-3} N/m, g = 10 m s^{-2}.$



A. $6782.4 du \neq$

B. $67.82 dy \neq$

C. $678.24 dy \neq$

D. none of these

Answer: A

Watch Video Solution

29. A film of water is formed between two straight parallel wires of length 10 cm each separated by $0.5 cm$ If their separation is increased by $1 mm$ while still maintaining their parallelism, how much work will have to be done (Surface tension of water $= 7.2 \times 10^{-2} \frac{N}{m}$)

A. $288 ergs$

B. $72 ergs$

C. $144 ergs$

D. $216 ergs$

Answer: C

Watch Video Solution

Pressure Difference And Capillarity

1. An open capillary tube is lowered in vessel with mercury. The difference between the levels of the mecury in the vessel and in the capillary tube $\triangle h = 4.6 mm$. What is the radius of curvature of the mercury meniscus in the capillary tube? Surface tension of mercury is $0.46 N / m$, density of mercury is $13.6 gm / cc$.

A. $\frac{1}{340} m$

B. $\frac{1}{680} m$

C. $\frac{1}{1020} m$

D. Information insufficient

Answer: B

Watch Video Solution

2. Water rises to a height of $10cm$ in a glass capillary tube. If the area of cross section of the tube is reduced to one fourth of the former value what is the height of water rise now?

A. 20 cm

B. 5 cm

C. 2.5 cm

D. 7 cm

Answer: A

Watch Video Solution

3. Two spherical soap bubbles of radii r_1 and r_2 in vacuume collapse under isothermal condition. The resulting bubble has radius R such that

A. $R = r_1 + r_2$

B. $R = (r_1 + r_2)^{\frac{1}{2}}$

C. $R = \sqrt{r_1^2 + r_2^2}$

D. $R = [(r_2 r_2 (r_1 + r_2))]$

Answer: C

Watch Video Solution

4. The execc pressure inside the first soap bubble is three times that inside the second bubble. Then the ratio of the volumes of the first and second bubbles is

A. $1:3$

B. $1:9$

C. $1:27$

D. $3:1$

Answer: C

Watch Video Solution

5. When a capillary tube is dipped in water, water rises upto $8cm$ in the tube. What happends when the tube is pushed down such that its end is only $5cm$ above outside water level?

A. The radius of the meniscus increases and therefore water does not overflow.

B. The radius of the water meniscus decreases and therefore does not overflow

C. The water forms a droplet on top of the tube but does not overflow

D. The water start overflowing.

Answer: A

Watch Video Solution

6. The excess pressure due to surface tension inside a spherical drop is $6 units$. If eight such drops combine, then the excess pressure due to surface tension inside the larger drop is

A. 3 units

B. 6 units

C. 12 units

D. 48 units

Answer: A

Watch Video Solution

7. Water rise in capillary tube when its one end is dipped vertically in it, is 3 cm. If the surface tension of water is $75 \times 10^{-3} \frac{N}{m}$, then the diameter of capillary will be (Take angle of contact $= 0^{\circ} C$)

A. $0.1mm$

B. $0.5mm$

C. $1.0mm$

D. $2.0mm$

Answer: B

Watch Video Solution

8. A capillary tube of radius r is immersed in a liquid. The liquid rises to a height h. The corresponding mass is m. What mass of water shall rise in the capillary if the radius of the tube is doubled?

A. m

B. $2m$

C. $3m$

D. $4m$

Answer: B

Watch Video Solution

9. A capillary tube of radius 0.20 mm is dipped verticaly in water. Find the height of the water column raised in the tube. Surface tensionn of water $= 0.075 Nm^{-1}$ and density of water $= 1000 kgm^{-3}$. $Take g = 10 ms^{-2}$.

A. $7.5 cm$

B. $6 cm$

C. $5 cm$

D. $3 cm$

Answer: A

Watch Video Solution

10. Two mercury drops each of radius r merge to form a bigger drop. Calculate the surface energy released.

A. $8\pi r^2\sigma - 4 \times 2^{\frac{2}{3}}\pi r^2\sigma$

B. zero

C. negative

D. $4\pi r^2\sigma - 8 \times 2^{\frac{1}{3}}r^2\sigma$

Answer: A

Watch Video Solution

11. A spherical drop of water as $1mm$ radius. If the surface tension of the the water is $50 \times 10^{-3}\frac{N}{m}$, then the difference of pressure between inside and outside the spherical drop is:

A. $25\frac{N}{m^2}$

B. $10000\frac{N}{m^2}$

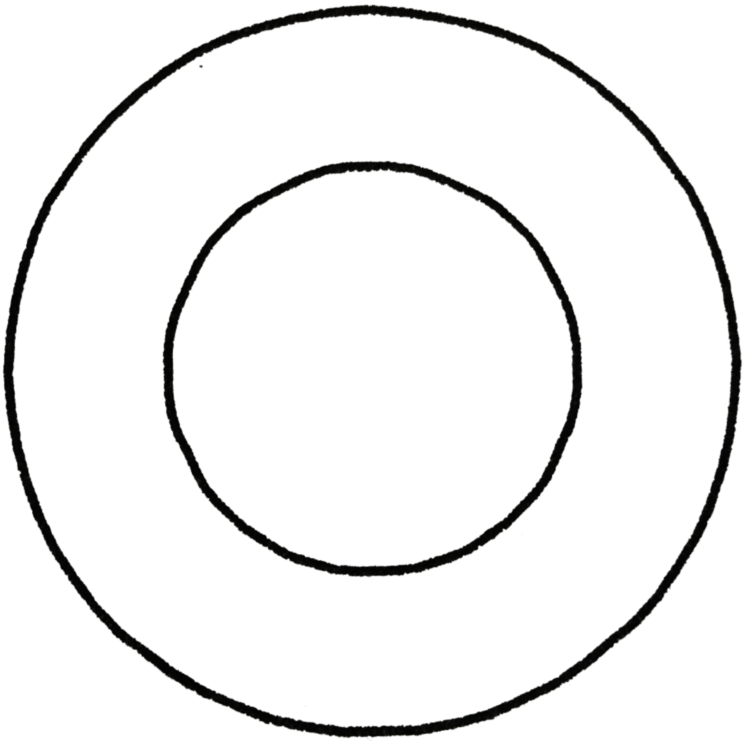
C. $100\frac{N}{m^2}$

D. $50\frac{N}{m^2}$

Answer: C

Watch Video Solution

12. A soap bubble of raidus R is surrounded by another soap bubble of radius $2R$, as shown. Take surface tension $= S$. Then the pressure inside the smaller soap bubble, in excess of the atmosphere presure will be



Atmosphere

A. $\frac{4S}{R}$

B. $\frac{3S}{R}$

C. $\frac{6S}{R}$

D. none of these

Answer: C

Watch Video Solution

13. A capillary tube of length

(i) $l = 60cm$,

(ii) $l = 50cm$

and radius $r = 1/4mm$ is immersed vertically

into water. Find the capillary rise in both cases.

Angle of contact $= 0^{\circ}$. Take coefficient of surface tension as $72\text{dyne}/cm, g = 1000cms^{-2}$.

A. $30cm$

B. $35cm$

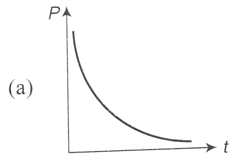
C. $40cm$

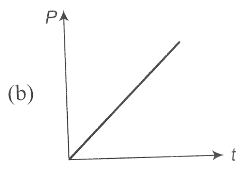
D. $50cm$

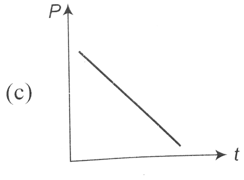
Answer: D

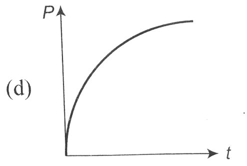
Watch Video Solution

14. A soap bubble is blown with the help of mechanical pump at the mouth of a tube. The pump produces a cartain increase per minute in the volume of the bubble, irrespective of its internal pressure. The graph between the pressure inside the soap bubble and time t will be

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

15. Pressure inside two soap bubbles are 1.01 and 1.02 atmospheres. Ratio between their volumes is

A. $102 : 101$

B. $(102)^2 : (101)^3$

C. $8 : 1$

D. $2 : 1$

Answer: C

Watch Video Solution

16. If pressure at half the depth of a lake is equal to 2//3 pressure at the bottom of the lake then what is the depth of the lake ?

A. $10m$

B. $20m$

C. $60m$

D. $30m$

Answer: B

Watch Video Solution

17. The pressure inside a small air bubble of radius 0.1mm situated just below the surface of water will be equal to [Take surface tension of water $70 \times 10^{-3} Nm^{-1}$ and atmospheric pressure $= 1.013 \times 10^{5} Nm^{-2}$]

A. $2.954 \times 10^{3} Pa$

B. $1.027 \times 10^{3} Pa$

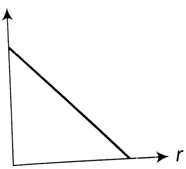
C. $1.027 \times 10^{5} Pa$

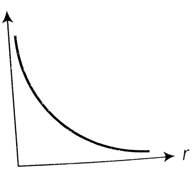
D. $2.054 \times 10^{5} Pa$

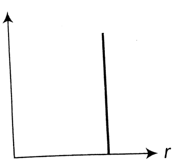
Answer: C

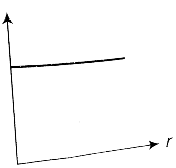
Watch Video Solution

18. The correct curve between the height or depression h of liquid in a capillary tube and its radius is

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: B

Watch Video Solution

19. Water rises to a height of $16.3cm$ in a capillary of height $18cm$ above the water level. If the tube is cut at a height of $12cm$

A. Water will come as a fountain from the capillary tube.

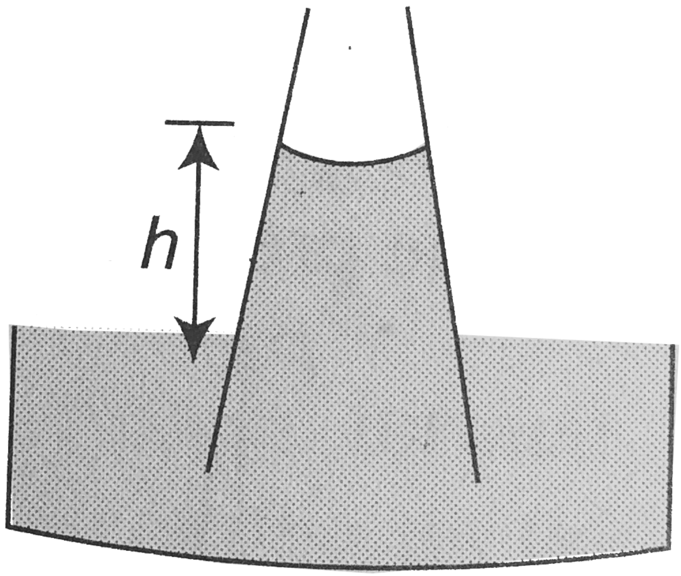
B. Water will stay at a height of $12cm$ in the capillary tube

C. The height of the water in the capillary will be $10.3cm$

D. Water will flow down the sides of the capillary tube

Answer: B

Watch Video Solution

20. 

A capillary of the shape as shown is dipped in a liquid. Contact angle between the liquid and the capillary is 0° and effect of liquid inside the mexiscus is to be neglected. T is surface tension of the liquid, r is radius of the meniscus, g is acceleration due to gravity and

ρ is density of the liquid then height h in equilibrium is:

A. greater than $\frac{2T}{r\rho g}$

B. equal to $\frac{2T}{r\rho g}$

C. less than $\frac{2T}{r\rho g}$

D. of any value depending upon act.

Answer: B

Watch Video Solution

21. Assuming the xylem tissues through which water rises from root to the branches in a tree to be of uniform cross-section find the maximum radius of xylem tube in a $10m$ high coconut tree so that water can rise to the top. (Surface tension of water $= 0.1\frac{N}{m}$, Angle of contact of water with xylem tube $= 60^{\circ}$)

A. $1cm$

B. $1mm$

C. $10\mu m$

D. $1\mu m$

Answer: D

Watch Video Solution

22. Water rises to a height of $2cm$ in a capillary tube. If the tube is tilted 60° from the vertical, water will rise in the tube to a length of

A. $4.0cm$

B. $2.0cm$

C. $1.0cm$

D. water will not ruse at all

Answer: A

Watch Video Solution

23. Water rises in a capillary tube to a certain height such that the upward force due to surface tension is balanced by 75×10^{-4} newton force due to the weight of the liquid. If the surface tension of water is $6 \times$ 10^-2`

newton/metre the inner circumference of the capillary must be:

A. $1.25 \times 10^{-3} metre$

B. $0.50 \times 10^{-2} metre$

C. $6.5 \times 10^{-2} metre$

D. $12.5 \times 10^{-2} metre$

Answer: D

Watch Video Solution

Viscosity

1. When the temperature increases the viscosity of

A. gases decreases and liquids increases

B. gases increases and liquids decreases

C. gases and liquids increases

D. gases and liquids decreases

Answer: B

Watch Video Solution

2. Eight drops of water, each of radius $2mm$ are falling through air at a terminal velcity of $8cms^{-1}$. If they coalesce to form a single drop, then the terminal velocity of combined drop will be

A. $32cms^{-1}$

B. $30cms^{-1}$

C. $28cms^{-1}$

D. $24cms^{-1}$

Answer: A

Watch Video Solution

3. A metal plate of area $2m^2$ is pulled horizontally with a velocity of $0.5m^{-1}$ on a liquid layer $1mm$ thick. The force required, if the viscosity of liquid is $12Nsm^{-2}$ is

A. $1.2N$

B. $12N$

C. $12000N$

D. $1200N$

Answer: C

Watch Video Solution

4. Find the minimum force required to drag a hard polythene plate of area $2m^2$ on a thin film of oil of thickness $0.25cm$ and $\eta = 15$ poise. Assume the speed of the plate is $10cms^{-1}$.

A. $2.4 \times 10^7 dyne$

B. $1.8 \times 10^7 dyne$

C. $1.2 \times 10^7 dyne$

D. $6.0 \times 10^6 dyne$

Answer: C

Watch Video Solution

5. A force of $3.14N$ is required to drag a sphere of radius $4cm$ with a speed of $5ms^{-1}$ in a medium in gravity free space. Find the coefficient of the viscosity of the medium.

A. $8.3 \times 10^{-5} poise$

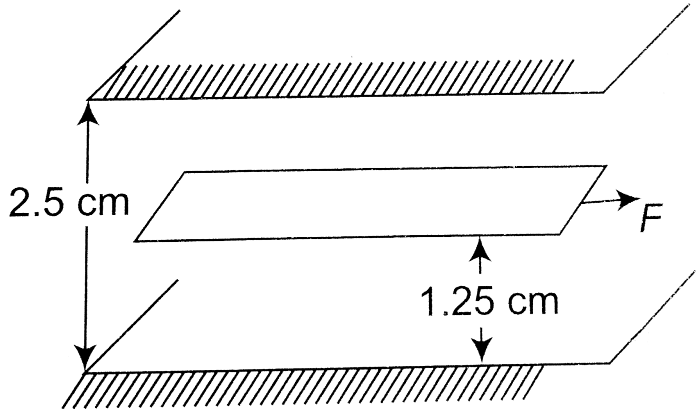
B. $4.3 \times 10^{-5} poise$

C. $7.4 \times 10^{-5} poise$

D. $2.3 \times 10^{-5} poise$

Answer: A

Watch Video Solution

6. 

A space $2.5cm$ wide between two large plane surfaces is filled with oil. Force required to drag a very thin plate of area $0.5m^2$ just midway the surfaces at a speed of $0.5\frac{m}{\sec}$ is $1N$. The coefficient of viscosity in $kg - \frac{s}{m^2}$ is:

A. 5×10^{-2}

B. 2.5×10^{-2}

C. 1×10^{-2}

D. 7.5×10^{-2}

Answer: B

Watch Video Solution

7. A rain drop radius $0.3mm$ falling vertically downwards in air has a terminal velocity of $1\frac{m}{s}$ The viscosity of air is 18×10^{-5} poise. The viscous force on the drop is

A. $101.73 \times 10^{-4} dene$

B. $101.73 \times 10^{-5} dyne$

C. $16.95 \times 10^{-5} dene$

D. $16.95 \times 10^{-4} dyne$

Answer: A

Watch Video Solution

8. A copper ball of radius r is moving with a uniform velocity u in the mustard oil. The dragging force acting on the ball is F. The dragging force on the copper ball of radius $2r$ moving with uniform velocity $2u$ in the mustart oil is

A. F

B. $2F$

C. $4F$

D. $8F$

Answer: C

Watch Video Solution

9. A small steel ball of mass m and radius r is falling under gravity through a viscous liquid of coefficient of viscosity η. If g is the value of acceleration due to gravity. Then the terminal velocity of the ball is proportional to (ignore buoyancy)

A. $\frac{mg(\eta)}{r}$

B. $mg(\eta)r$

C. $\frac{mgr}{\eta}$

D. $\frac{mg}{r\eta}$

Answer: D

Watch Video Solution

10. A small steel ball falls through a syrup at a constant speed of $10cms^{-1}$. If the steel ball is pulled upwards with a force equal to twice its effective weight, how fast will it move upwards?

A. $10cms^{-1}$

B. $20cms^{-1}$

C. $5cms^{-1}$

D. zero

Answer: A

Watch Video Solution

11. An air bubble of 1 cm radius is rising at a steady rate of $2.00ms^{-1}$ through a liquid of density $1.5gcm^{-3}$. Neglect density of air. If $g = 1000cms^{-2}$, then the coeffieciet of viscosity of the liquid is

A. 0.166×10^{3} Poise

B. 1.66×10^{-3} poise

C. 166×10^{3} poise

D. 16.6×10^{3} poise

Answer: B

Watch Video Solution

12. Two indetical spherical drops of water are falling (vertically downwards) through air with a steady velocity of $5\frac{cm}{\sec}$. If both the drops coalesce (combine) to form a new spherical drop, the terminal velocity of the new drop will be (neglect buoyant force on the drops.)

A. $5 \times 2\frac{cm}{\sec}$

B. $5 \times \sqrt{2}\frac{cm}{\sec}$

C. $5 \times (4)^{\frac{1}{3}}\frac{cm}{\sec}$

D. $\frac{5}{\sqrt{2}}\frac{cm}{\sec}$

Answer: C

Watch Video Solution

13. Uniform speed of 2 cm diameter ball is $20cm / s$ in a viscous liquid. Then, the speed of 1 cm diameter ball in the same liquid is

A. $80cms^{-1}$

B. $40cms^{-1}$

C. $20cms^{-1}$

D. $5cms^{-1}$

Answer: D

Watch Video Solution

14. Coefficient of vilocity of water $= 0.01$ poise, density of water $= 1gcm^{-3}$. Then the maximum velocity with which water can flow through a capillary tube of radius $0.05cm$, without turbulent flow setting in, is

A. $2cms^{-1}$

B. $20cms^{-1}$

C. $200cms^{-1}$

D. $2000cms^{-1}$

Answer: C

Watch Video Solution

15. A metal ball B_1 (density $3.2g / \text{cc}$) is dropped in water, while another metal ball B_2 (density $6.0g / \text{cc}$) is dropped in a liquid of density $1.6g / \text{cc}$. If both the balls have the same diameter and attain the same terminal velocity, the ratio of viscosity of water to that of the liquid is

A. 2.0

B. 0.5

C. 4.0

D. indeterminate due to insufficient data

Answer: B

Watch Video Solution

16. A rain drop starts falling from a height of $2km$. If falls with a continuously decreasing acceleration and attains its terminal velocity at a height of $1km$. The ratio of the work done by the gravitational force in the first halt to that in the second half of the drops journey is

A. $1:1$ and the times of fall of the drop in the two haves is $a:1$ (where $a > 1$)

B. $1:1$ and the times of fall of the drop in the two halves is $a:1$ (where $a < 1$)

C. $a:1$ (where $a > 1$) and the times of fall of the drop is the two halves is $1:1$

D. $a:1$ (where $a < 1$) and the times of fall of the drop in the two halves is $1:1$

Answer: A

Watch Video Solution

17. A drop of water of radius $0.0015mm$ is falling in air. If the coefficient of viscosity of air is $1.8 \times 10^{-3} kg/m^3$, what will be the terminal velocity of the drop? Density of water $= 1.0 \times 10^3 kg/m^3$ and $g = 9.8N/kg$. Density of air can be neglected.

A. $2.72 \times 10^{-4} \frac{m}{s}$

B. $4.72 \times 10^{-4} \frac{m}{s}$

C. $5.28 \times 10^{-4} \frac{m}{s}$

D. $1.36 \times 10^{-4} \frac{m}{s}$

Answer: A

Watch Video Solution

18. A metallic sphere of radius $1.0 \times 10^{-3} m$ and density $1.0 \times 10^{4} kg / m^{3}$ enters a tank of water, after a free fall through a distance of h in the earth's gravitational field. If its velocity remains unchanged after entering water, determine the value of h. Given: coefficient of viscosity of water $= 1.0 \times 10^{-3} Ns/m^2$, $g = 10 ms^{-2}$ and density of water $= 1.0 \times 10^3 kg/m^3$.

A. $10m$

B. $20m$

C. $12m$

D. $5m$

Answer: B

Watch Video Solution

19. Consider the following statements:

(i) Young's modulus is numerically equal to the stress which will double the length of a wire.

(ii) Viscosity of gases is greater than that of liquids.

(iii) The surface tension of a liquid decreases due to the presence of insoluble contamination.

The number of above statements that are true is

A. one

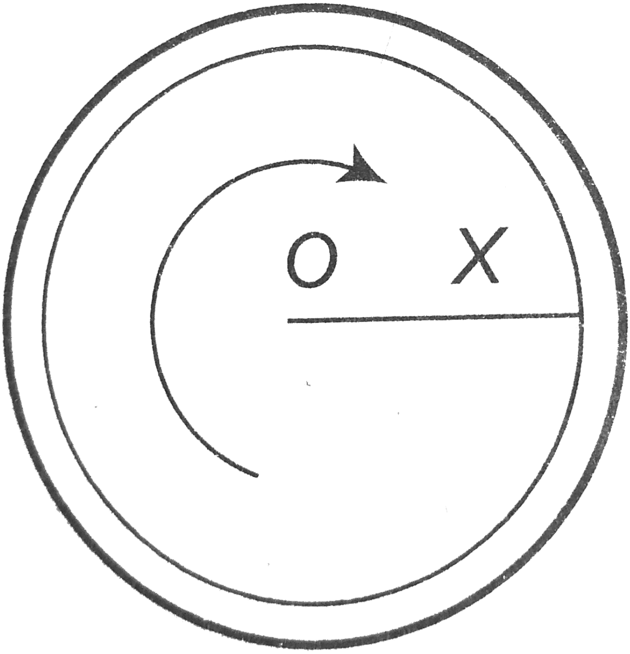
B. two

C. three

D. zero

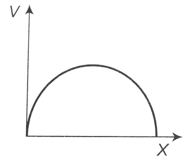
Answer: B

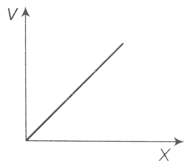
Watch Video Solution

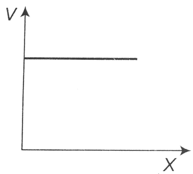


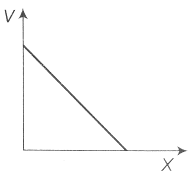
20.

The diagram shows a cup of tea seen from above. The tea has been stirred and is now rotating without turbulence. A graph showing the speed v with which the liquid is crossing points at a distance X from O along a radius OX would took like

A. (a)


B. (b)


C. (c)


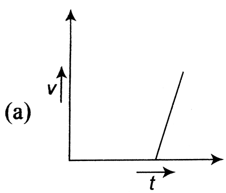
D. (d)


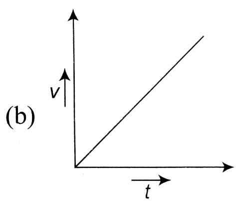
Answer: D

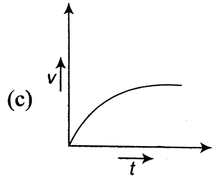
Watch Video Solution

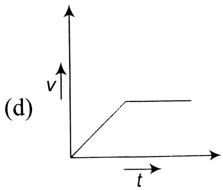
Watch Video Solution

21. A tall cylinder is filled with viscous oil. A round pebble is dropped from the top with zero initial velocity. From the plot shown in figure, indicate the one that represents the velocity (v) of the pebble as a function of time (t)

A. 

B. 

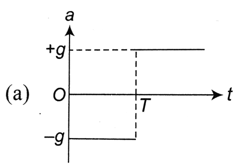
C. 

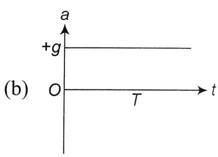
D. 

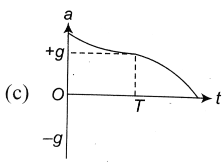
Answer: C

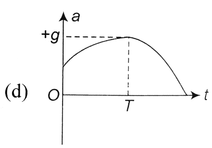
Watch Video Solution

22. A ball is thrown vetically upwards at time $t = 0$. Air resistance is not negligible and the acceleration of free fall is g. The ball reaches a maximum height at time $t = T$ and then descends, reaching terminal speed. Which graph best shows the variation with time t to the acceleration a of the ball

A. 

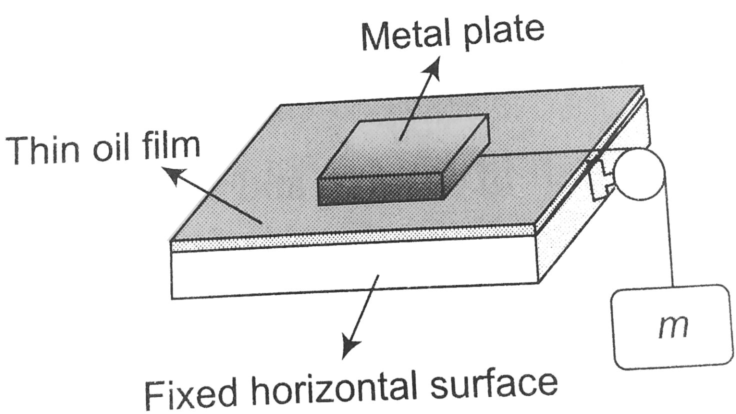
B. 

C. 

D. 

Answer: C

Watch Video Solution



(b) 25

(d) 50

23. 5

A rectangular metal plate has dimensions of $10cm \times 20cm$. A thin film of oil separates the plate from a fixed horizontal surface. The separation between the rectangular plate and the horizontal surface is $0.2mm$. An ideal string is attached to the plate and passes over an ideal pulley to a mass m. When $m = 125gm$, the metal plate moves at constant speed of $5\frac{cm}{s}$, across the horizontal surface. Then the coefficient of viscosity of oil in $\frac{dy \neq \; - s}{cm^2}$ is (Use $g = 1000\frac{cm}{s^2}$)

A. 5

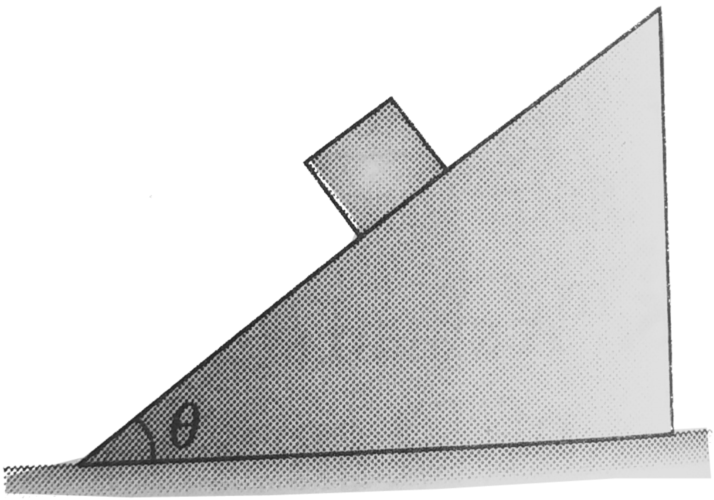
B. 25

C. 2.5

D. 50

Answer: C

Watch Video Solution

24. 

A cubical block of side a and density ρ slides over a fixed inclined plane with constant velocity v. There is a thin film of viscous fluid of thickness t between the plane and the block. Then the coefficient of viscosity of the thin film will be: (Acceleration due to gravity is g)

A. $\frac{\rho a > \sin\theta}{v}$

B. $\frac{\rho a >^{2} \sin\theta}{v}$

C. $\frac{v}{\rho a > \sin\theta}$

D. none of these

Answer: A

Watch Video Solution

25. When a ball is released from rest in a very long column of viscous. Liquid its downwards acceleration is a (just after release). Then its acceleration when it has acquired two third of the maximum velocity:

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

B. $\frac{2a}{3}$

C. $\frac{a}{6}$

D. none of these

Answer: A

Watch Video Solution

26. A uniform solid sphere of relative density 5 is released in water filled in a long vertical tube. Its terminal velocity achived is V. If another uniform solid sphere of same material but double the radius is released in the same water then the terminal velocity achived will be.

A. V

B. $4V$

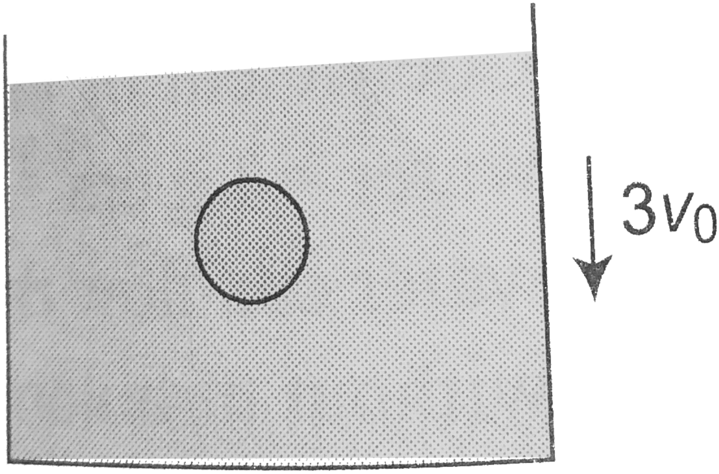
C. $\frac{V}{4}$

D. $2V$

Answer: B

Watch Video Solution

27.



A container filled with viscous liquid is moving vertically downwards with constant speed $3v_0$. At the instant shown, a sphere of radius r is moving vertically downwards (in liquid) has speed v_0. The coefficient of viscosity is η. There is no relative motion between the liquid and the container. Then at the shoen instant, The magnitude of viscous force acting on sphere is

A. $6\pi\eta r v_0$

B. $12\pi\eta r v_0$

C. $18\pi\eta r v_0$

D. $24\pi\eta r v_0$

Answer: B

Watch Video Solution

28. Two uniform solid balls of same density and if radii r and $2r$ are dropped in air and fall vertically downwards. The terminal velocity of the ball with radius r is $1cms^{-1}$, then the terminal velocity of the ball of radius $2r$ will be (neglect buoyant force on the balls.)

A. $0.5cms^{-1}$

B. $4cms^{-1}$

C. $1cms^{-1}$

D. $2cms^{-1}$

Answer: B

Watch Video Solution

29. A sphere of radius R and density ρ_1 is dropped in a liquid of density σ. Its terminal velocity is v_1. If another sphere of radius R and density ρ_2 is dropped in the same liquid, its terminal velocity will be:

A. $\left(\frac{\rho_2 - \sigma}{\rho_1 - \sigma}\right)v_1$

B. $\left(\frac{\rho_1 - \sigma}{\rho_1 - \sigma}\right)v_1$

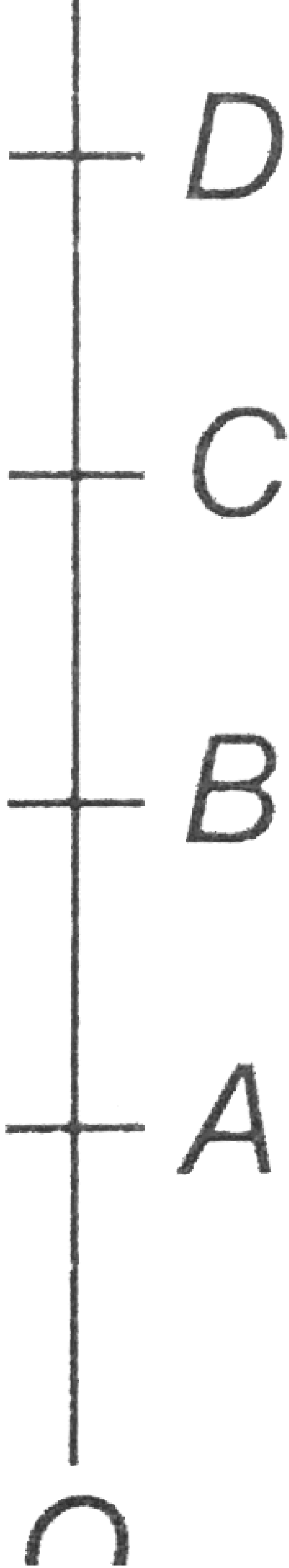
C. $\left(\frac{\rho_1}{\rho_2}\right)v_1$

D. $\left(\frac{\rho_2}{\rho_1}\right)v_1$

Answer: A

Watch Video Solution

Problems Based On Mixed Concepts


D
C
B
A

1.

The length of wire OE is divided into five equal parts OA, AB, BC, CD and DE The wire is hanging from E and its length is given by

$\frac{5}{4}\frac{\sigma}{\rho g}$, where σ is the breaking stress and ρ is the density of the material of the wire. Find the point at which wire will break

A. A

B. B

C. C

D. D

Answer: D

Watch Video Solution

2. A 40 kg boy whose leg are $4cm^2$ in area and $50cm$ long falls through a height of $2m$ without breaking his leg bones. If the bones can stand a stress of $1.0 \times 10^8 \frac{N}{m^2}$, calculate the Young's modulus for the material of the bone.

A. $25 \times 10^{9} \frac{N}{m^{2}}$

B. $2.5 \times 10^{9} \frac{N}{m^{2}}$

C. $5.0 \times 10^{9} \frac{N}{m^{2}}$

D. none of these

Answer: B

Watch Video Solution

3. A light rod of length $2m$ is suspended from the ceiling horizontally by means of two vertical wires of equal length tied to its ends. One of the wires is made of steel and is of cross section $0.1cm^2$. The other wire is a brass of cross section $0.2cm^2$. A weight is suspended from a certain point of the rod such that equal stress are produced in both the wires. Which of the following are correct?

A. $\frac{4}{3}m$

B. $\frac{3}{4}m$

C. $\frac{2}{3}m$

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

Answer: A

Watch Video Solution

4. A uniform rod of length l, mass m, cross-sectional area A and Young's modulus Y is rotated in horizontal plane about a fixed vertical axis passing through one end, with a constant angular velocity ω. Find the total extension in the rod due to the tension produced in the rod.

A. $\frac{m\omega^2 l^2}{3AY}$

B. $\frac{m\omega^3 l^3}{3AY}$

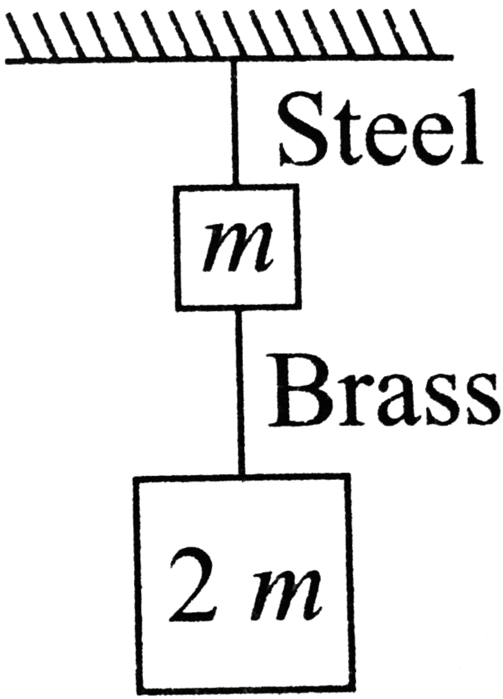
C. $\frac{m\omega^2 l^3}{4AY}$

D. $\frac{m\omega^3 l^2}{3AY}$

Answer: A

Watch Video Solution

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



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

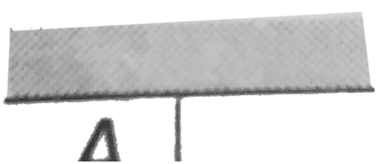
B. $\frac{3a}{2b^2c}$

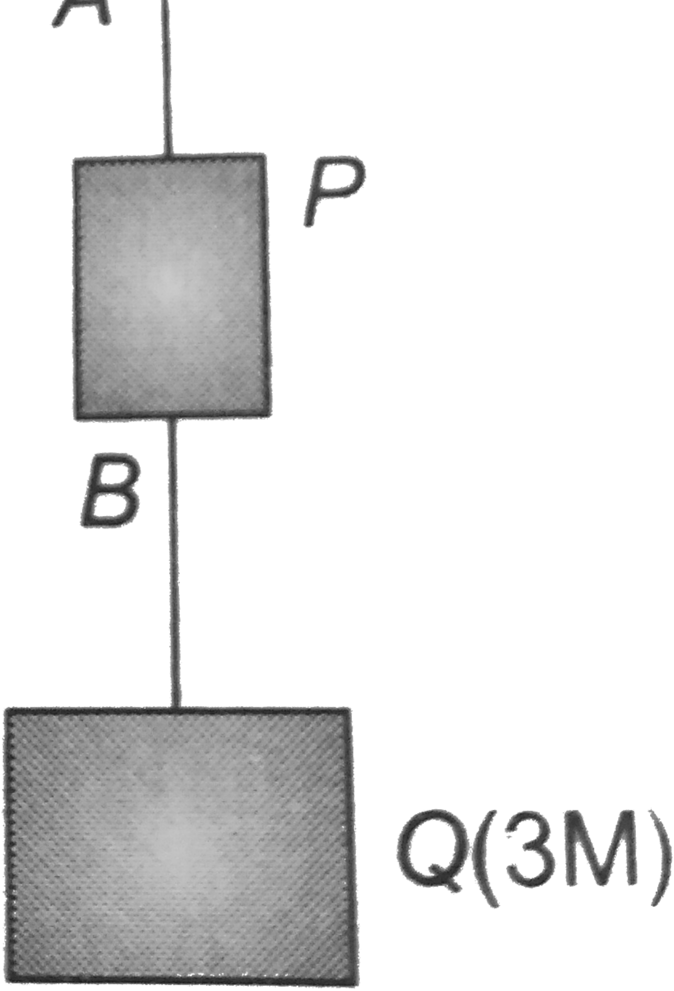
C. $\frac{2ac}{b^2}$

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

Answer: B

Watch Video Solution





6.

Wires A and B are connected with blocks P and Q, as shown, the ratio of lengths radii and Young's modulus of wires A and B are r, 2r and

3r respectively (r is a constant). Find the mass of block P if ratio of increase in their corresponding length is $\frac{1}{6r^2}$. The mass of the block Q is 3M

A. M

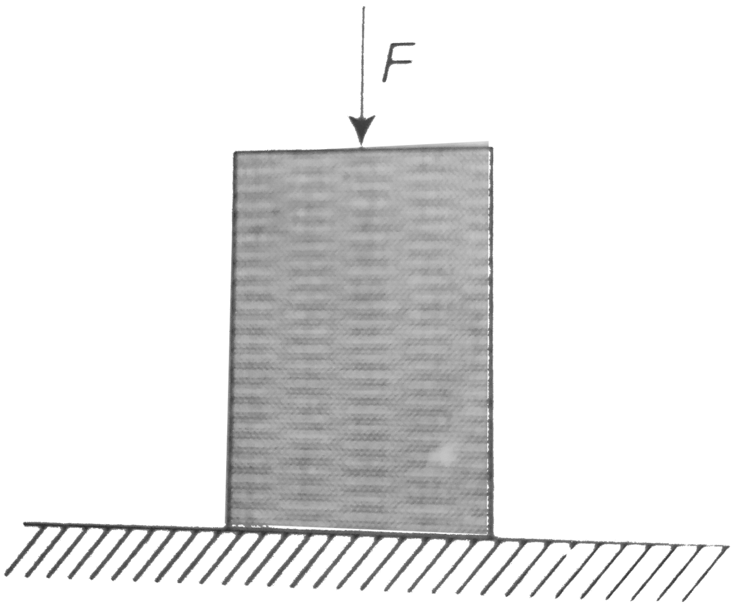
B. 3M

C. 6M

D. 9M

Answer: B

Watch Video Solution



7.

A metal cylinder of length L is subjected to a uniform compressive to a uniform compressive force F as shown in the figure.

The material of the cylinder has Young's modulus Y and poisson's ratio σ The change in volume of the cylinder is

A. $\dfrac{\sigma FL}{Y}$

B. $\dfrac{(1-\sigma)FL}{Y}$

C. $\dfrac{(1+2\sigma)FL}{Y}$

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

Answer: D

Watch Video Solution

8. A uniform rod of length l, mass m, cross-sectional area A and Young's modulus Y is rotated in horizontal plane about a fixed vertical axis passing through one end, with a constant angular velocity ω. Find the total extension in the rod due to the tension produced in the rod.

A. $\dfrac{m\omega^2 L^2}{AY}$

B. $\dfrac{m\omega^2 L^2}{2AY}$

C. $\dfrac{m\omega^2 L^2}{3AY}$

D. $\dfrac{2m\omega^2 L^2}{2AY}$

Answer: C

Watch Video Solution

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

A. $\frac{[(Y_1Y_2)A]}{[2(Y_1L_2+Y_2L_1)]}$

B. $([Y_1Y_2)A)\frac{]}{(L_1L_2)^{\frac{1}{2}}}$

C. $\frac{[(Y_1Y_2)A]}{(Y_1L_2+Y_2L_1)}$

D. $\frac{\left[(Y_1Y_2)^{\frac{1}{2}}A\right]}{(L_1L_2)^{\frac{1}{2}}}$

Answer: C

Watch Video Solution

10. A stone of mass m tied to one end of a wire of length L. the diameter of the wire is D and it is suspended vertically. The stone is now rotated in a horizontal plane and makes an angle 6 with the vertical. If Young's modulus of the wire is Y, Then the increase in the length of the wire is

A. $\frac{4mgL}{\pi D^2 Y}$

B. $\frac{4mgL}{\pi D^2 Y \sin\theta}$

C. $\frac{4mgL}{\pi D^2 Y \cos\theta}$

D. $\dfrac{4mgL}{\pi D^2 Y \tan\theta}$

Answer: C

Watch Video Solution

11. Assuming that shear stress at the base of a mountain is equal to the force per unit area due to its weight. Calculate the maximum possible height of a mountain on the earth if breaking stress of a typical rock is

$3 \times 10^8 Nm^{-3}$ and its density $3 \times 10^{-3} kgm^{-3}$. (Take $g = 10ms^{-2}$)

A. $4km$

B. $8km$

C. $10km$

D. $16km$

Answer: C

Watch Video Solution

12. Two strips of metal are riveted together at their ends by four rivets, each of diameter 6 mm. Assume that each rivet is to carry one quarter of the load. If the shearing stress on the rivet is not to exceed $6.9 \times 10^7 Pa$, the maximum tension that can be exerted by the riveted strip is

A. $2 \times 10^3 N$

B. $3.9 \times 10^3 N$

C. $7.8 \times 10^3 N$

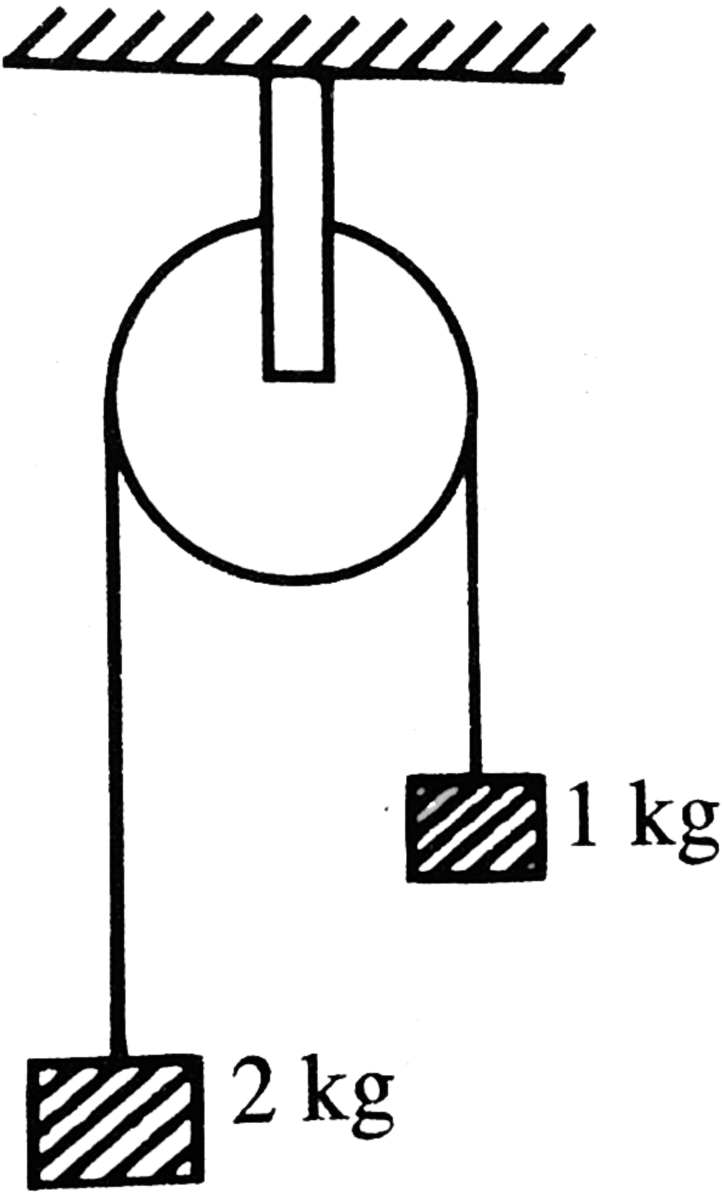
D. $15.6 \times 10^3 N$

Answer: C

Watch Video Solution

13. Two blocks of masses $1kg$ and $2kg$ are connected by a metal wire going over a smooth pulley as shown in figure.

The breaking stress of the metal is $(40/3\pi) \times 10^6 N/m^2$. If $g = 10ms^{-2}$, then what should be the minimum radius of the wire used if it is not to break?



A. $0.5mm$

B. $1mm$

C. $1.5mm$

D. $2mm$

Answer: B

Watch Video Solution

14. A uniform cylindrical wire is subjected to a longitudinal tensile stress of $5 \times 10^7 N/m^2$. Young's modulus of the material of the wire is

$2 \times 10^{11} N/m^2$. The volume change in the wire is 0.02%. The fractional change in the radius is

A. 0.25×10^{-4}

B. 0.510^{-4}

C. 1.0×10^{-4}

D. 1.5×10^{-4}

Answer: A

Watch Video Solution

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

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

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

C. $R_S = 4R_B$

D. $R_S = \frac{R_B}{4}$

Answer: B

Watch Video Solution

16. A material has normal density ρ and bulk modulus K. The increase in the density of the material when it is subjected to an external pressure P from all sides is

A. $\frac{P}{\rho K}$

B. $\frac{K}{\rho P}$

C. $\frac{\rho P}{K}$

D. $\frac{\rho K}{P}$

Answer: C

Watch Video Solution

17. A rubber rope of length $8m$ is hung from the ceiling of a room. What is the increase in length of the rope due to its own weight? (Given: Young's modulus of elasticity of rubber $= 5 \times 10^6 N/m^2$ and density of rubber $= 1.5 \times 10^3 kg/m^3$. Take $g = 10ms^{-2}$)

A. $1.5mm$

B. $6mm$

C. $24mm$

D. $96mm$

Answer: D

Watch Video Solution

18. The length of a metal wire is l_1 when the tensionin it is T_1 and $is l_2$ when the tension is T_2. The natural length of the wire is

A. $\frac{T_2}{T_1}(l_1 + l_2)$

B. $T_2 l_1 + T_2 l_2$

C. $\frac{l_1 T_2 - l_2 T_1}{T_2 - T_1}$

D. $\frac{l_1 T_2 + l_2 T_1}{T_2 + T_1}$

Answer: C

Watch Video Solution

19. A wire is suspended vertically from a rigid support. When loaded with a weight in air, the wire extends by $16 cm$. When the weight is completely immersed in Water, the extension is reduced to $14cm$. The relative density of the material of the weight is

A. $2gcm^{-3}$

B. $6gcm^{-3}$

C. $8gcm^{-3}$

D. $16gcm^{-3}$

Answer: C

Watch Video Solution

20. If the volume of a wire remains constant when subjected to tensile stress, the value of poisson's ratio of material of the wire is

A. $+\frac{1}{2}$

B. $-\frac{1}{2}$

C. $+\frac{1}{4}$

D. $-\frac{1}{4}$

Answer: B

Watch Video Solution

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

A. 0.6

B. 0.4

C. 0.2

D. zero

Answer: D

Watch Video Solution

22. A wire of cross section A is stretched horizontally between two clamps located $2lm$ apart. A weight Wkg is suspended from the mid-point of the wire. If the mid-point sags vertically through a distance $x < l$, the strain produced is

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

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

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

D. none of these

Answer: C

Watch Video Solution

23. In the above question the value of stress is:

A. $\dfrac{Wl}{2xA}$

B. $\dfrac{Wl}{4xA}$

C. $\dfrac{2Wl}{lA}$

D. $\dfrac{4xW}{lA}$

Answer: A

Watch Video Solution

24. If in the above question the Young's modulus of the material is Y, the value of extension x is:

A. $\left(\frac{Wl}{YA}\right)^{\frac{1}{3}}$

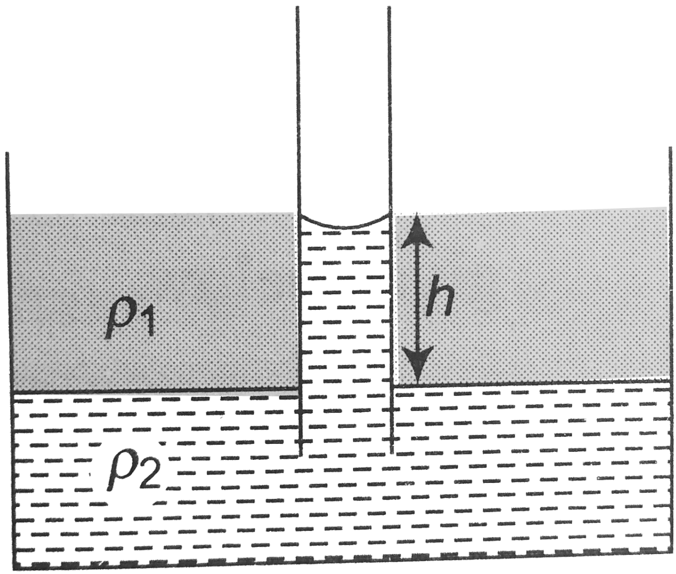
B. $\left(\frac{YA}{Wl}\right)^{\frac{1}{3}}$

C. $\frac{1}{l}\left[\frac{WA}{Y}\right]^{\frac{1}{3}}$

D. $l\left[\frac{W}{YA}\right]^{\frac{1}{3}}$

Answer: D

Watch Video Solution



25.

A container is partially filled with a liquid of density ρ_2 A capillary tube of radius r is vertically inserted in this liquid. Now another liquid of density $\rho_1 (\rho_1 < \rho_2)$ is slowly poured in the container to a height h as shown. There is only denser liquid in the capillary tube. The rise of denser liquid in the capillary tube is also h. Assuming zero contact angle, the surface tension of heavier liquid is

A. $r\rho_2 gh$

B. $2\pi r\rho_2 gh$

C. $\frac{r}{2}(\rho_2 - \rho_1)gh$

D. $2\pi r(\rho_2 - \rho_1)gh$

Answer: C

Watch Video Solution

26. The elongation in a metallic rod hinged at one end and rotating in a horizontal plane becomes four times of the intial value. The angular velocity of ratation becomes

A. two times the initial value

B. half of initial value

C. one third of initial value

D. four times the initial value

Answer: A

Watch Video Solution

27. Consider the following statements:

(i) Young's modulus is numerically equal to the stress which will double the length of a wire.

(ii) Viscosity of gases is greater than that of liquids.

(iii) The surface tension of a liquid decreases due to the presence of insoluble contamination.

The number of above statements that are true is

A. one

B. two

C. three

D. zero

Answer: B

Watch Video Solution

28. Two soap bubbles of radii a and b coalesce to form a single bubble of radius c. If the external pressure is P, find the surface tension of the soap solution.

A. $\frac{p_0\left(2r^2-R^3\right)}{4(r^2-2r^2)}$

B. $\frac{p_0\left(2r^3-R^3\right)}{4(R^2-2r^2)}$

C. $\frac{p_0\left(2r^3-R^3\right)}{2(R^2+2r^2)}$

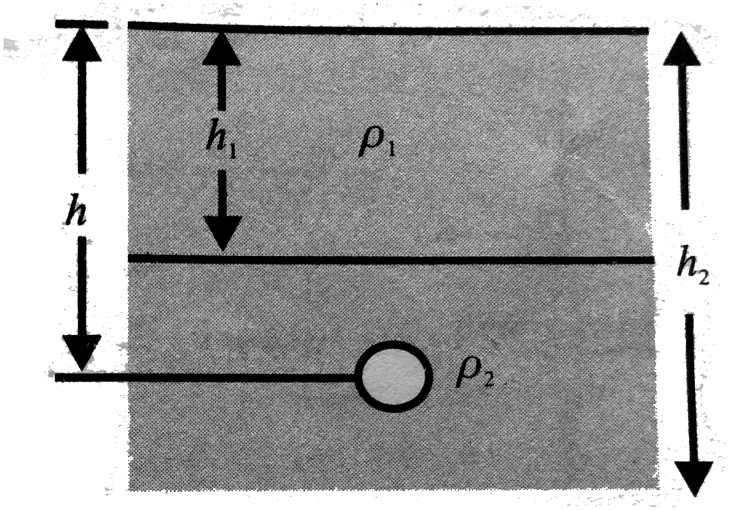
D. $\frac{p_0\left(2r^3+R^3\right)}{4(R^2+2r^2)}$

Answer: A

Watch Video Solution

29. Calculate the pressure inside a small air bubble of radus r situated at a depth h below the free surface of liquids of densities ρ_1 and ρ_2 and surface tennsions T_1 and T_2. The thickness of the first and second liquids are h_1 and h_2 respectively. Take atmosphere pressure

$= P_0.$



A. $P_0 + \rho_1 g h_1 + \rho_2 g(h - h_1) - \frac{2T}{r}$

B. $P_0 + \rho_1 g h_1 + \rho_2 g(h - h_1) + \frac{2T}{r}$

C. $P_0 + \rho_1 g h_2 + \rho_2 g(h - h_1) + \frac{2T}{r}$

D. none of these

Answer: B

Watch Video Solution

30. A glass plate of length $10cm$, breadth $1.54cm$ and thickness $0.20cm$ weigh $8.2g$ in air. It is held vertically with the long side horizontal and the lower half under water. Find the apparent weight of the plate. Surface tension of water $= 7.3 \times 10^{-2} N/m$ and $= 9.8ms^{-12}$

A. $40.16 \times 10^{-3} N$

B. $80.16 \times 10^{-3} N$

C. $30.12 \times 10^{-3} N$

D. $25.15 \times 10^{-3} N$

Answer: B

Watch Video Solution

31. A rubber cord has a cross -sectional area $1 mm^2$ and total unstretched length $10.0 cm$. It is streched to $12.0 cm$ and then released to project a missile of mass 5.0 g.Taking young's modulus Y for rubber as $5.0 \times 10^8 N/m^2$

.Calculate the velocity of projection .

A. $20\frac{m}{s}$

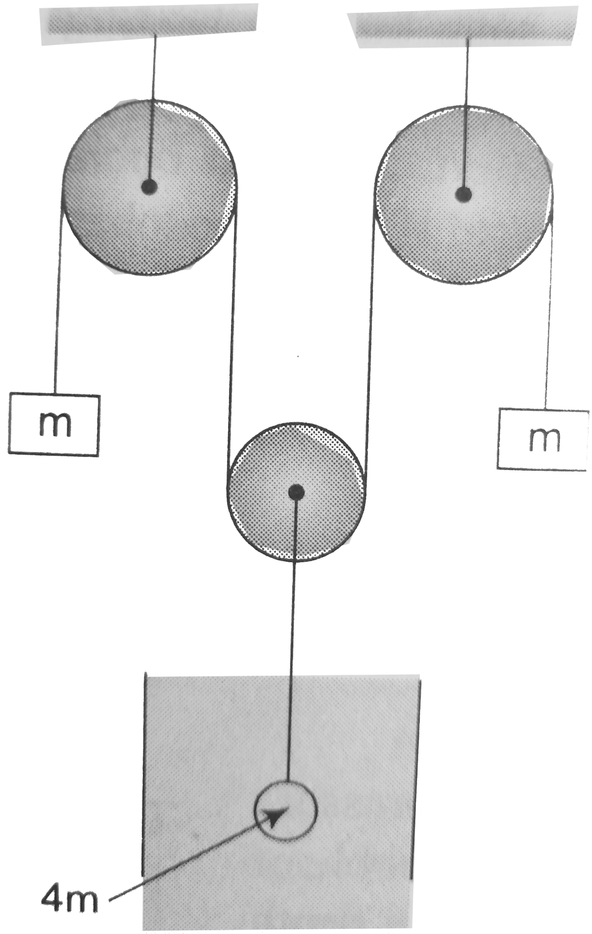
B. $15\frac{m}{s}$

C. $12\frac{m}{s}$

D. $6\frac{m}{s}$

Answer: A

Watch Video Solution



32.

A spherical ball of mass 4m, density σ and radius r is attached to a pulley-mass system as shown in figure. The ball is released in a liquid of coefficient of viscosity η and density $\rho\left(<\frac{\sigma}{2}\right)$. If the length of the liquid column is sufficiently long, the terminal velocity attained by the ball is given by (assume all pulleys to be massless and string as massless and inextensible):

A. $\frac{2}{9} \frac{r^2(2\sigma-\rho)g}{\eta}$

B. $\frac{2}{9} \frac{r^2(\sigma-2\rho)g}{\eta}$

C. $\frac{2}{9} \frac{r^2(\sigma-4\rho)g}{\eta}$

D. $\frac{2}{9} \frac{r^2(\sigma-3\rho)g}{\eta}$

Answer: B

Watch Video Solution

33. A man is rowing a boat with a constant velocity v_0 in a river. The contact area of boat is $'A'$ and coefficient of viscosity is η. The depth of river is $'D'$. Find the force required to row the boat.

A. $\dfrac{\eta A v_0}{2D}$

B. $\dfrac{2\eta A v_0}{D}$

C. $\dfrac{\eta A v_0}{D}$

D. $\frac{3\eta A v_0}{2D}$

Answer: C

Watch Video Solution

34. A metal ball B_1 (density $3.2 g / \text{cc}$) is dropped in water, while another metal ball B_2 (density $6.0 g / \text{cc}$) is dropped in a liquid of density $1.6 g / \text{cc}$. If both the balls have the same diameter and attain the same terminal velocity, the ratio of viscosity of water to that of the liquid is

A. 2.0

B. 0.5

C. 4.0

D. indeterminate due to insufficient data

Answer: B

Watch Video Solution

Assertion Reasoning

1. 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. Assertion: If length of a rod is doubled the breaking load remains unchanged.

Reason: Breaking load is equal to the elastic limit.

Watch Video Solution

2. 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. Assertion: Steel is more elastic than rubber.

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

Watch Video Solution

3. 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. Assertion: Bulk modulus of elasticity B represents incompressibility of the material

Reason: $B = -\frac{\triangle P}{\frac{\triangle V}{V}}$, where symbols have their usual meaning.

Watch Video Solution

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. Assertion: Lead is more elastic than rubber.

Reason: if the same load is attached to lead and rubber wires of the same cross-sectional area, the strain of lead is very much less than that of rubber.

Watch Video Solution

5. 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. Assertion: Stress is the internal force per unit area of a body.

Reason: Rubber is more elastic than steel:

Watch Video Solution

6. 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. Assertion: The modulus of bulk modulus of incompressible liquid is unity.

Reason: The value of an incompressible liquid changes by applying some force.

Watch Video Solution

7. 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. Assertion: The bridges are declared unsafe after long use.

Reason: Elastic strength of bridges losed with time.

Watch Video Solution

8. 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. Assertion: For small deformation, the stress and strain are proportional to each other.

Reason: A class of solids called elastomers does not obey Hooke's law.

Reason: A class of solids called elastomers does not obey Hooke's law.

Watch Video Solution

9. 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. Assertion: The materials which have very small range of plastic extension are called brittle materials.

Reason: if the stress is increased beyond the elastic limit, the material will break.

Watch Video Solution

10. 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. Assertion: The stress-strain behaviour varies from material to material.

Reason: A rubber can be pulled to several times its original length and still returns to its original shape.

Watch Video Solution

11. 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. A solid sphere placed in the fluid under high pressure is compressed uniformly on all sides.

Reason: The volume of solid sphere will decrease with change of geometrical shape.

Watch Video Solution

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

Reason: Rubber is more elastic than steel:

Watch Video Solution

13. 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 stoms of glassy solids get broken at the same temperature.

Watch Video Solution

14. 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. Assertion: Strain is a unitless quantity.

Reason: Strain is equivalent to force.

Watch Video Solution

15. 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. Assertion: It is easiar to spray water in which some soap is dissolved.

Reason: Soap is easier to spread.

Watch Video Solution

16. 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. Assertion: When height of a tube is less than liquid rise in the capillary tube, the liquid does not overflow.

Reason: Product of radius of meniscus and height of liquid in capullary tube always remains constant.

Watch Video Solution

17. 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. A needle placed carefully on the surface of water may float, whereas a ball of the same material will always sink.

Reason: The buoyancy of an object depends both on the material and shape of the object.

Watch Video Solution

18. 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. Assertion: A large force is required to draw apart normally two glass plates enclosing a thin water film.

Reason: Water works as glue and sticks two glass plates.

Watch Video Solution

19. 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. Assertion: At critical temperature, surface tension of a liquid becomes zero. ltbr. Reason: At this temperature intermolecular forces for liquids and gases become equal. Liquid can expand without any restriction.

Watch Video Solution

20. 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. Assertion: A large soap bubble expands while a small bubble shrinks, when they are connected to each other by a capillary tube.

Reason: The excess pressure inside bubble (or drop) is inversely proportional to the radius.

Watch Video Solution

NEET Questions

1. 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. $0.005m$

B. $0.01m$

C. $0.02m$

D. $0.002m$

Answer: A

Watch Video Solution

2. When water droplets merge to form a bigger drop

A. energy is liberated

B. energy is absorbed

C. neither liberated nor absorbed

D. Some mass is converte into energy

Answer: A

Watch Video Solution

3. In a capillary tube, water rises by $1.2mm$. The height of water that will rise in another capillary tube having half the radius of the first, is

A. $1.2mm$

B. $2.4mm$

C. $0.6mm$

D. $0.4mm$

Answer: B

Watch Video Solution

4. A capillary tube of radius r is immersed in a liquid. The liquid rises to a height h. The corresponding mass is m. What mass of water shall rise in the capillary if the radius of the tube is doubled?

A. m

B. $2m$

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

D. $4m$

Answer: B

Watch Video Solution

5. Air is pushed inot a soap bubble of radius r to duble its radius. If the surface tension of the soap solution is S, the work done in the process is

A. $24\pi R^2 S$

B. $48\pi R^2 S$

C. $12\pi R^2 S$

D. $36\pi R^2 s$

Answer: A

Watch Video Solution

6. The wattability of a surface by a liquid depends primarily on

A. Viscosity

B. Surface tension

C. Density

D. Angle of contact between the surface and the liquid.

Answer: D

Watch Video Solution

7. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied?

A. length $= 50cm, diameter$=0.5mm`

B. length $= 100cm$, diameter $= 1mm$

C. length $= 200cm$ diameter $= 2mm$

D. length $= 300cm$, diameter $= 3mm$

Answer: A

Watch Video Solution

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

A. $\triangle l$ versus $\frac{1}{l}$

B. $\triangle l$ versus l^2

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

D. $\triangle l$ versus l

Answer: B

Watch Video Solution

9. A certain number of spherical drops of a liquid of radius r coalesce to form a single drop of radius R and volume V. If T is the surface tension of the liquid, then

A. energy $= 4VT\left(\frac{1}{r} - \frac{1}{R}\right)$ is released

B. energy $= 3VT\left(\frac{1}{r} - \frac{1}{R}\right)$ is absorbed

C. energy $= 3VT\left(\frac{1}{r} - \frac{1}{R}\right)$ is released

D. energy is neither released nor absorbed

Answer: C

Watch Video Solution

Watch Video Solution

10. The approximate depth of an ocean is $2700m$. The compressibility of water is $45.4 \times 10^{-11} Pa^{-1}$ and density of water is $10^3 \frac{kg}{m^3}$. What fractional compression of water will be obtained at the bottom of the ocean?

A. 0.8×10^{-2}

B. 1.0×10^{-2}

C. 1.2×10^{-2}

D. 1.4×10^{-2}

Answer: C

Watch Video Solution

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

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: C

Watch Video Solution

12. Water rises to height h in capillary tube. If the length of capillary tube above the surface of water is made less than h then

A. water does not rise at all.

B. water rises up to the tip of capillary tube and then starts overflowing like a fountain.

C. water rises up to the top of capillary tube and stays there without overflowing.

D. water rises up to a point a little below the top and stays there.

Answer: C

Watch Video Solution

13. A rectangular film of liquid is extended from $(4cm \times 2cm)$ to $(5cm \times 4cm)$. If the work done is $3 \times 10^{-4} J$, the value of the surface tension of the liquid is

A. $0.2 Nm^{-1}$

B. $8.0 Nm^{-1}$

C. $0.250 Nm^{-1}$

D. $0.125 Nm^{-1}$

Answer: D

Watch Video Solution

14. Three liquids of densities ρ_1,ρ_2 and ρ_3 (with $\rho_1 > \rho_2 > \rho_2$) having the same value of surface tension T, rise to the same height in three identical capillaries. The angles of contact θ_1,θ_2 and θ_3 obey

A. $\frac{\pi}{2} < \theta_1 < \theta_2 < \theta < \pi$

B. $\pi > \theta_1 > \theta_2 > \theta_3 > \frac{\pi}{2}$

C. $\frac{\pi}{2} > \theta_1 > \theta_2 > \theta_3 \geq 0$

D. $0 \leq \theta_1 < \theta_2 < \theta_3 < \frac{\pi}{2}$

Answer: D

Watch Video Solution

15. The bulk modulus of a spherical object is B if it is subjected to uniform pressure p, the fractional decrease in radius is:

A. $\frac{B}{3p}$

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

C. $\frac{p}{3B}$

D. $\frac{p}{B}$

Answer: C

Watch Video Solution

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

A. F

B. $9F$

C. $4F$

D. $6F$

Answer: B

Watch Video Solution

17. A small sphere falls from rest in a viscous liquid. Due to friction, heat is produced. Find the relation between the rate of production of heat and the radius of the sphere at terminal velocity.

A. r^4

B. r^3

C. r^5

D. r^2

Answer: C

Watch Video Solution

AIIMS Questions

1. If in a wire of Young's moduls Y, longitudinal strain X is produced then the potential energy stored in its unit volume will be:

A. xy^2

B. $2xy^2$

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

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

Answer: D

Watch Video Solution

2. 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

3. A spherical drop of water has $1mm$ radius. If the surface tension of water is 70×10^{-3} N//m, then the difference of pressure between inside and outside of the spherical drop is:

A. $35Nm^2$

B. $14\frac{N}{m^2}$

C. $140\frac{N}{m^2}$

D. none of these

Answer: C

Watch Video Solution

4. 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

5. The bulk of modulus of a metal is $10^{10} \frac{N}{m^2}$ and Poisson's ratio 0.20. If average distance between the molecules is 3Å the the interatomic force constant is

A. $30\frac{N}{m}$

B. $75\frac{N}{m}$

C. $7.5\frac{N}{m}$

D. $5.4\frac{N}{m}$

Answer: A

Watch Video Solution

6. A soap bubble in vacuum has a radius $3cm$ and another soap bubble in vacuum has radius $4cm$. If two bubbles coalesce under isothermal condition, then the radius of the new bubble will be:

A. $7cm$

B. $5cm$

C. $2.3cm$

D. $4.5cm$

Answer: B

Watch Video Solution

7. Two small drop of mercury, each of radius R coalesce in from a simple large drop. The ratio of the total surface energies before and after the change is

A. $1:2^{\frac{1}{3}}$

B. $2:1$

C. $2^{\frac{1}{3}}:1$

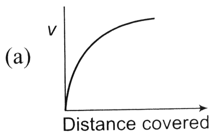
D. $1:2$

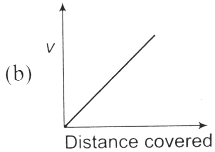
Answer: C

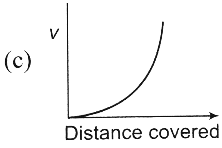
Watch Video Solution

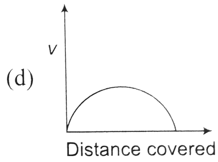
Watch Video Solution

8. A lead shot of a 1mm diameter falls through a long column of glycerine.The variation of its velocity v with distance covered is represented by,

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

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

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

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

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

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

Answer: A

Watch Video Solution

10. A sphere of mass M and radius R is falling in a viscous fluid. The terminal velocity attained by the falling object will be alphaortional to :

A. R

B. R^2

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

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

Answer: B

Watch Video Solution

11. 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. $\frac{\triangle V}{V} \propto B$

B. $\frac{\triangle V}{V} \propto \frac{1}{B^{-2}}$

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

D. $\frac{\triangle V}{V} \propto \frac{1}{B}$

Answer: D

Watch Video Solution

12. The mass and length of a wire are M and L respectively. The density of the material of the wire is d. On applying the force F on the wire, the increase in length is l, then the Young's modulus of the material of the wire will be

A. $\frac{Fdl}{Ml}$

B. $\frac{FL}{Mdl}$

C. $\frac{FMl}{dl}$

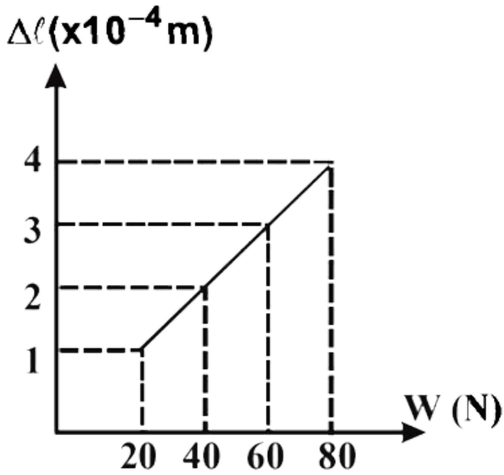
D. $\frac{FdL^2}{Ml}$

Answer: D

Watch Video Solution

13. 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. $3 \times 10^{-12} \frac{N}{m^2}$

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

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

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

Answer: C

Watch Video Solution

14. If the terminal speed of a sphere of gold (density $= 19.5 kg / m^3$) is $0.2 m / s$ in a viscous liquid (density $= 1.5 kg / m^3$), find the terminal speed of a sphere of silver (density $= 10.5 kg / m^3$) of the same size in the same liquid

A. $0.1 m / s$

B. $0.4 m / s$

C. $0.133 m / s$

D. $0.2m / s$

Answer: A

Watch Video Solution

15. The work done in increasing the size of a soap film from $10cm \times 6cm$ to $10cm \times 11cm$ is 3×10^{-4} Joule. The surface tension of the film is

A. `1.5xx10^-2(N)/(m)

B. `3.0xx10^-2(N)/(m)

C. `6.0xx10^-2(N)/(m)

D. `11.0xx10^-2(N)/(m)

Answer: B

Watch Video Solution

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

Answer: B

Watch Video Solution

17. If work done in increasing the size of a soap film from $10cm \times 6cm \times$ to $10cm \times 11xm$ is $2 \times 10^{-4}H$, then the surface tension is

A. $2 \times 10^{-2} (Nm^{-1})$

B. $2 \times 10^{-4} Nm^{-1}$

C. $2 \times 10^{-6} Nm^{-1}$

D. $2 \times 10^{-8} Nm^{-1}$

Answer: A

Watch Video Solution

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

A. 75joule

B. 60joule

C. 50joule

D. 100joule

Answer: A

Watch Video Solution

19. When the temperature increased the angle of contact of a liquid

A. increses

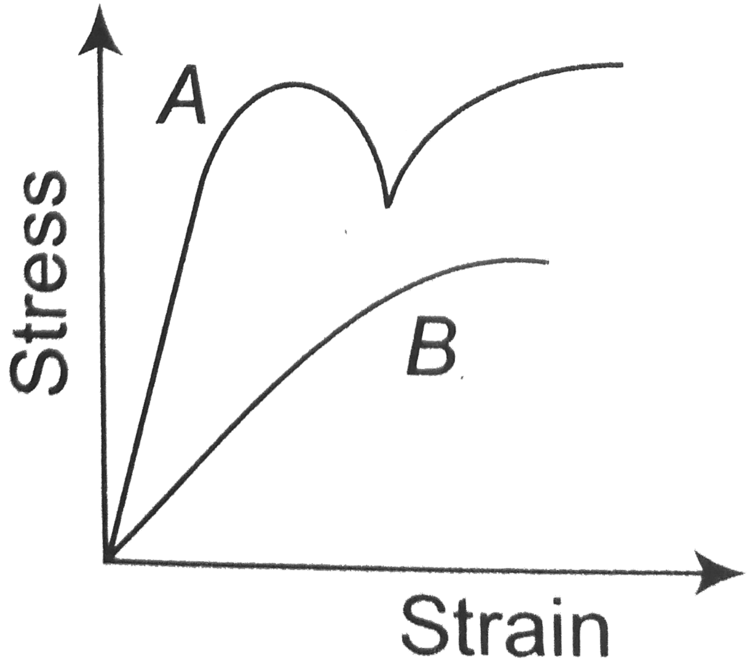
B. decreases

C. remains the same

D. first increases and then decreases

Answer: B

Watch Video Solution



20.

The diagram shoes 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

Watch Video Solution

21. The surface of soap solution is $25 \times 10^{-3} Nm^{-1}$. The excess pressure inside a soap bubble of diameter 1 cm is

A. 10 Pa

B. 20 Pa

C. 5 Pa

D. none of the above

Answer: B

Watch Video Solution

22. If the radius of a soap bubble is four times that of another, then the ratio of their pressures will be

A. $1:4$

B. $4:1$

C. $16:1$

D. $1:16$

Answer: A

Watch Video Solution

23. A spherical drop of water has $1mm$ radius.

If the surface tension of water is 70×10^{-3}

N/m, then the difference of pressure between inside and outside of the spherical drop is:

A. $35 \frac{N}{m^{-2}}$

B. $70 \frac{N}{m^2}$

C. $140 \frac{N}{m^2}$

D. zero

Answer: C

Watch Video Solution

24. A wire of length L and radius r is fixed at one end. When a stretching force F is applied at free end, the elongation in the wire is l. When another wire of same material but of length $2L$ and radius $2r$, also fixed at one end is stretched by a force $2F$ applied at free end, then elongation in the second wire will be

A. l

B. $2l$

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

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

Answer: A

Watch Video Solution

25. A concrete sphere of radius R has cavity of radius r which is packed with sawdust. The specific gravities of concrete and sawdust are respectively 2.4 and 0.3 for this sphere to float with its entire volume submerged under water. Ratio of mass of concrete to mass of sawdust will be:

A. 8

B. 4

C. 3

D. zero

Answer: B

Watch Video Solution

26. 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

Watch Video Solution

27. The radius of a soap bubble is increased from $\frac{1}{\sqrt{\pi}}$ cm to $\frac{2}{\sqrt{\pi}}$ cm. If the surface tension of water is 30dynes per cm, then the work done will be

A. 180 ergs

B. 360 ergs

C. 720 ergs

D. 960 ergs

Answer: C

Watch Video Solution

28. 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. Assertion: Steel is more elastic than rubber.

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

Watch Video Solution

29. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

Q. Assertion: The size of hydrogen bolloon increases as it rises in air.

Reason: The material of the bolloon can easily stretched.

Watch Video Solution

30. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

Q. Assertion: in a pressure cooker the water is brought to boil. The cooker is then removed from the stove. Now on removing the lid of the pressure cooker, the water starts boiling again.

Reason: The impurities in water bring down its boiling point.

Watch Video Solution

31. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

Q. Assertion: Smaller drops of liquid resist deforming forces better than the larger drops.

Reason: Excess pressure inside a drop is directly proportional to its surface area.

Watch Video Solution

32. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

Q. Assertion: The melting point of ice decreases with increase of pressure.

Reson: ice contracts on melting.

Watch Video Solution

33. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

Q. Assertion: For Reynold's number $R_e > 2000$, the flow of fluid is turbulent.

Reason: Inertial forces are dominant compared to the viscoud forces at such high Reynold's number

Watch Video Solution

34. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

Q. Assertion: A thin stainless steel needle can lay floating on a still water surface.

Reason: Any object floats when the buoyance force balances the weight of the object.

Watch Video Solution

35. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

assertion.

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

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

(d) If both the assertion and reason are false.

Q. Assertion: A bubble comes from the bottom of a lake to the top.

Reason: Its radius increases.

Watch Video Solution

36. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

Q. Assertion: Railway tracks are laid on small-sized wooden sleepers.

Reason: Small sized wooden sleepers are used so that rails exert more pressure on the railway track. due to which rail does not leave the track.

Watch Video Solution

37. These questions consist two statements each, printed as Assertion and reason, while

answering these question you are required to choose any one of the following four responsis:

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

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

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

(d) If both the assertion and reason are false.

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

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

Watch Video Solution

38. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

assertion.

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

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

(d) If both the assertion and reason are false.

Q. Assertion: A ship floats higher in the water on a high pressure day than on a low pressure day

Reason: Floating of ship in the water is not possible because of buoyancy force which is present due to pressure difference.

Watch Video Solution

39. 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. Assertion: Bulk modulus of elasticity B represents incompressibility of the material

Reason: $B = -\frac{\Delta P}{\frac{\Delta V}{V}}$, where symbols have their usual meaning.

Watch Video Solution

40. 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. Assertion: A large soap bubble expands while a small bubble shrinks, when they are connected to each other by a capillary tube.

Reason: The excess pressure inside bubble (or drop) is inversely proportional to the radius.

Watch Video Solution

41. These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

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

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

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

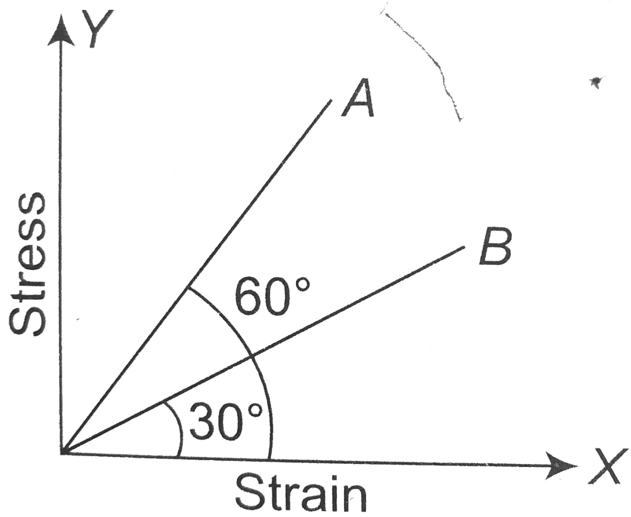
(d) If both the assertion and reason are false.

Q. Assertion: Surface tension decreases with increase in temperature.

Reason: On increasing temperature kinetic energy increases and intermolecular forces decreases.

Watch Video Solution

Chapter Test

1. 

The stress versus strain graphs for wires of two materials A and B are as shown in the figure. If YA and YB are the Young's moduli of the materials then

A. $Y_B = 2Y_A$

B. $Y_A = Y_B$

C. $Y_B = 3Y_A$

D. $Y_A = 3YB$

Answer: D

Watch Video Solution

2. A wire of length L and radius r is fixed at one end. When a stretching force F is applied at free end, the elongation in the wire is l. When another wire of same material but of length $2L$ and radius $2r$, also fixed at one end is stretched by a force $2F$ applied at free end, then elongation in the second wire will be

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

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

C. l

D. $2l$

Answer: C

Watch Video Solution

3. The area of a cross section of steel wire is $0.1 cm^2$ and Young's modulus of steel is $2 \times 10^{11} Nm^{-2}$. The force required to strech by 0.1% of its length is

A. $1000N$

B. $2000N$

C. $4000N$

D. $5000N$

Answer: B

Watch Video Solution

Watch Video Solution

4. The bulk modulus of water if its volume changes from $100 litres$ to 99.5 litre under a pressure of $100 atm$ is (Take $1 atm = 10^5 Nm^{-2}$)

A. $2 \times 10^7 Nm^{-2}$

B. $2 \times 10^8 Nm^{-2}$

C. $2 \times 10^9 Nm^{-2}$

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

Answer: C

Watch Video Solution

5. A steel cable with a radius $2cm$ supports a chairlift at a ski area. If the maximum stress is not to exceed $10^8 Nm^{-2}$, the maximum load the cable can support is

A. $4\pi \times 10^5 N$

B. $4\pi \times 10^4 N$

C. $2\pi \times 10^5 N$

D. $2\pi \times 10^5 N$

Answer: C

Watch Video Solution

6. A steel wire of length $4.5m$ and cross-sectional area $3 \times 10^{-5} m^2$ stretches by the same amount as a copper wire of length $3.5m$ and cross sectional area of $4 \times 10^{-5} m^2$ under a given load. The ratio of the Young's modulus of steel to that of copper is

A. 1.3

B. 1.5

C. 1.7

D. 1.9

Answer: C

Watch Video Solution

7. 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. $\frac{Y}{2}$

B. Y

C. $2Y$

D. $4Y$

Answer: B

Watch Video Solution

8. A steel wire can support a maximum load of W before reaching its elastic limit. How much load can another wire, made out of identical steel, but with a radius one half the radius of the first wire, support before reaching its elastic limit?

A. W

B. $\frac{W}{2}$

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

D. $4W$

Answer: C

Watch Video Solution

9. How does Young's modulus change with rise in temperature?

A. increases

B. decreases

C. remains unchanged

D. none of these

Answer: B

Watch Video Solution

10. A sphere contracts in volume by 0.01% when taken to the bottom of sea $1km$ keep. The bulk modulus of the material of the sphere is (Given density of sea water may be taken as $1.0 \times 10^3 kgm^{-3}$).

A. $4.9 \times 10^{10} Nm^{-2}$

B. $9.8 \times 10^{10} Nm^{-2}$

C. $4.9 \times 10^{9} Nm^{-2}$

D. $9.8 \times 10^{9} Nm^{-2}$

Answer: B

Watch Video Solution

11. The metal cube of side 10 cm is subjected to a shearing stress of $10^{4} Nm^{-2}$. The modulus of rigidiy if the top of the cube is displaced by 0.05 cm with respect to its bottom is

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

B. $105 Nm^{-2}$

C. $1 \times 10^7 Nm^{-2}$

D. $4 \times 10^5 Nm^{-2}$

Answer: A

Watch Video Solution

12. A mercury drop of radius 1 cm is broken into 10^6 droplets of equal size. The work done is $\left(T = 35 \times 10^{-2} \frac{N}{m}\right)$

A. $4.35 \times 10^{-2} J$

B. $4.35 \times 10^{-3} J$

C. $4.35 \times 10^{-6} J$

D. $4.35 \times 10^{-8} J$

Answer: A

Watch Video Solution

13. A spherical liquid drop of radius R is divided into eight equal droplets. If the surface tension is T, then the work done in this process will be

A. $2\pi R^2 T$

B. $3\pi R^2 T$

C. $4\pi R^2 T$

D. $2\pi R T^2$

Answer: C

Watch Video Solution

Watch Video Solution

14. Air is pushed inot a soap bubble of radius r to duble its radius. If the surface tension of the soap solution is S, the work done in the process is

A. $2\pi D^2 T$

B. $4\pi D^2 T$

C. $6\pi D^2 T$

D. $8\pi D^2 T$

Answer: C

Watch Video Solution

15. A water drop is divided into eight equal droplets. The pressure difference between inner and outer sides of big drop is

A. will be the same as for smaller droplet

B. will be half of that for smaller droplet

C. will be one fourth of that for smaller droplet

D. will be twice of that for smaller droplet.

Answer: B

Watch Video Solution

16. A liquid drop of radius R is broken into 1000 drops each of radius r. If T is surface tension, change in surface energy is

A. $4\pi R^2 T$

B. $72\pi R^2 T`$

C. $16\pi R^2T$

D. $36\pi R^2T$

Answer: D

Watch Video Solution

17. A vessel whose bottom has round holes with diameter $0.1mm$, is filled with water. The maximum height up to which water can be filled without leakage is

A. $100cm$

B. $75cm$

C. $50cm$

D. $30cm$

Answer: D

Watch Video Solution

18. Water rises to a height of $10cm$ in a capillary tube and mercury falls to a depth of $3.42cm$ in the same capillary tube. If the density of mercury is $13.6g/c.c.$ and the angles of contact for mercury and for water are 135° and 0°, respectively, the ratio of surface tension for water and mercury is

A. $1:0.15$

B. $1:3$

C. $1:6.5$

D. $1.5:1$

Answer: C

Watch Video Solution

19. The radii and Young's moduli of two uniform wires A and B are in the ratio $2:1$ and $1:2$ respectively. Both wires are subjected to the same longitudinal force. If the increase in leangth of the wire A is one percent, the percentage increae in length of the wire B is

A. 1.0

B. 1.5

C. 2.0

D. 3.0

Answer: C

Watch Video Solution

20. 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 $100cm$, Diameter $1mm$

B. length $200cm$, diameter$2mm$

C. length $300cm$, Diameter $3mm$

D. length $50cm$, diameter $0.5mm$

Answer: D

Watch Video Solution

21. One end of 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 ($3L/4$) from its lower end is

A. $\frac{WW_1}{S}$

B. $\dfrac{W_1 + \left(\frac{W}{4}\right)}{S}$

C. $\dfrac{W_1 + \left(\frac{3W}{4}\right)}{S}$

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

Answer: C

Watch Video Solution

22. 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. $0.1J$

B. $0.2J$

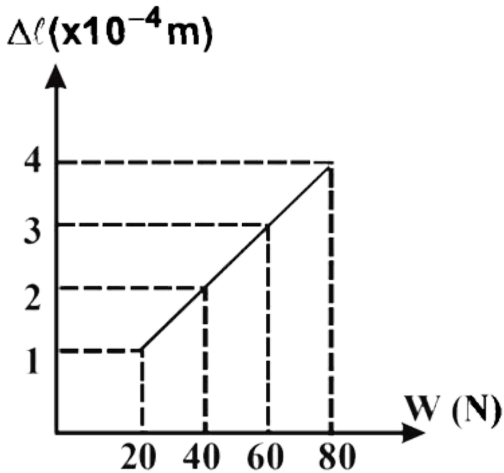
C. $10J$

D. 20

Answer: A

Watch Video Solution

23. 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. $2 \times 10^{11} \frac{N}{m^2}$

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

C. $2 \times 10^{-12} \frac{N}{m^2}$

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

Answer: A

Watch Video Solution

24. A cord of mass m length L, area of cross section A and Young's modulus y is hanging from a ceiling with the help of a rigid support.

The elogation developed in the wire due to its own weight is

A. zero

B. $\frac{mgL}{AY}$

C. $\frac{mgL}{2AY}$

D. $\frac{2mgL}{AY}$

Answer: C

Watch Video Solution

25. 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. $\frac{Yax}{2L}$

B. $\frac{Yax^2}{L}$

C. $\frac{Yax^2}{2L}$

D. $\frac{2YAx^2}{L}$

Answer: C

Watch Video Solution

Watch Video Solution

26. If the volume of a wire remains constant when subjected to tensile stress, the value of poisson's ratio of material of the wire is

A. $+0.50$

B. -0.50

C. $+0.25$

D. -0.25

Answer: B

Watch Video Solution

27. In the following question, a statement of assertion is followed byb 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 both assertion and reason are false. Q.

Assertion: Steel and brass are more elastic than copper and aluminium.

Reason: That's why they are preferred in heavy-duty machines and in structural designs.

Watch Video Solution

28. In the following question, a statement of assertion is followed byb 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 both assertion and reason are false. Q. Assertion: The compressibility of solids is less than that of gases and liquids.

Reason: There is tight coupling between the neighbouring atoms in solids.

Watch Video Solution

29. In the following question, a statement of assertion is followed byb 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 both assertion and reason are false. Q. Assertion: The angle of contact of a liquid with a solid increase with increase in temperature of liquid.

Reason: With increase in temperature, the surface tension of the liquid increase.

Watch Video Solution