08 - SOLIDS AND FLUIDS

(Answers at the end of all questions)

1) If 'S' is stress and 'Y' is Young's modulus of material of a wire, the energy stored in the wire per unit volume is
(a) $S^2 / (2Y)$ (b) $2S^2Y$ (c) $S / 2Y$ (d) $2Y / S^2$ [AIEEE 2005]

2) A 20 cm long capillary tube is dipped in water. The water rises upto 8 cm. If the entire arrangement is put in a freely falling elevator, the length of water column in the capillary tube will be (a) 10 cm (b) 8 cm (c) 20 cm (d) 4 cm [AIEEE 2005]

3) A wire fixed at the upper end stretches by length l by applying a force F. The work done in stretching is
(a) F /2l (b) Fl (c) 2 Fl (d) Fl / 2 [AIEEE 2004]

4) Spherical balls of radius R are falling in a viscous fluid of viscosity η with a velocity v. The retarding viscous force acting on the spherical ball is
(a) directly proportional to R but inversely proportional to v
(b) directly proportional R and velocity v
(c) inversely proportional to both radius R and velocity v.
(d) inversely proportional to R but directly proportional to velocity v [AIEEE 2004]

5) If two soap bubbles of different radii are connected by a tube
(a) air flows from the bigger bubble to the smaller bubble till sizes become equal
(b) air flows from the bigger bubble to the smaller bubble till the sizes are interchanged
(c) air flows from the smaller bubble to the bigger
(d) there is no flow of air [AIEEE 2004]

6) A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to the lower end. The weight stretches the wire by 1 mm. The elastic energy stored in the wire is
(a) 0.1 J (b) 0.2 J (c) 10 J (d) 20 J [AIEEE 2003]

7) A spring of spring constant 5×10^3 N / m is stretched initially by 5 cm from the unstretched position. The work required to stretch it further by another 5 cm is
(a) 6.25 Nm (b) 12.50 Nm (c) 18.75 Nm (d) 25.00 Nm [AIEEE 2003]

8) Rain drops are spherical in shape because of
(a) surface tension (b) capillarity
(c) downward motion (d) acceleration due to gravity [AIEEE 2002]

9) Which of the following affects the elasticity of a substance ?
(a) hammering and annealing (b) change in temperature
(c) impurity in substance (d) all of these [AIEEE 2002]

10) The normal density of iron is ρ and its bulk modulus is K. The increase in the density of an iron lump, when a pressure P is applied uniformly on all sides, will be
(a) $P\rho / K$ (b) PK / ρ (c) $P / \rho K$ (d) $K / \rho P$ [AIEEE 2002]

(Answers at the end of all questions)

11) A vessel is filled with water upto a height of 3 m. There is a hole at a height of 52.5 cm from the bottom. Ratio of area of cross section of hole to vessel is 0.1. Then square of velocity of water coming out of hole in $(m/s)^2$ is

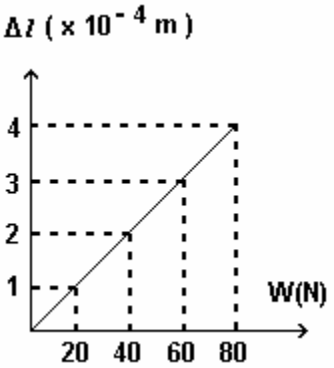
(a) 50 (b) 50.5 (c) 51 (d) 40 [IIT 2005]

12) The pressure of a medium is changed from 1.01×10^5 Pa to 1.165×10^5 Pa and change in volume is 10% keeping temperature constant. The Bulk modulus of the medium is

(a) 204.8×10^5 Pa (b) 102.4×10^5 Pa

(c) 51.2×10^5 Pa (d) 1.55×10^5 Pa [IIT 2005]

13) The adjacent graph shows the extension (Δl) of a wire of length 1 m 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, the Young's modulus of the material of the wire is

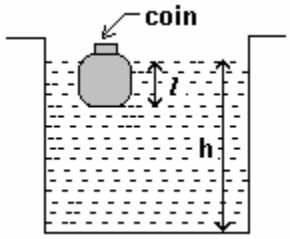


(a) 2×10^{11} N/m^2 (b) 2×10^{-11} N/m^2

(c) 3×10^{12} N/m^2 (d) 2×10^{13} N/m^2

[IIT 2003]

14) A wooden block, with a coin placed on its top, floats in water as shown in the figure. The distance l and h are shown there. After some time the coin falls into the water. Then



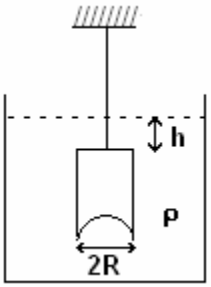
(a) l decreases and h increases

(b) l increases and h decreases

(c) both l and h increase

(d) both l and h decrease [IIT 2002]

15) A hemispherical portion of radius R is removed from the bottom of a cylinder of radius R. The volume of the remaining cylinder is V and mass M. It is suspended by a string in a liquid of density ρ where it stays vertical. The upper surface of the cylinder is at a depth h below the liquid surface. The force on the bottom of cylinder by the liquid is:



(a) Mg (b) Mg - $V\rho g$

(c) Mg + $\pi R^2 h \rho g$ (d) $\rho g (V + \pi R^2 h)$ [IIT 2001]

16) When a block of iron floats in mercury at 0° C, a fraction k_1 of its volume is submerged, while at the temperature 60° C, a fraction k_2 is seen to be submerged. If the coefficient of volume expansion of iron is γ_{Fe} and that of mercury is γ_{Hg}, then the ratio k_1 / k_2 can be expressed as

(a) $\frac{1 + 60\gamma_{Fe}}{1 + 60\gamma_{Hg}}$ (b) $\frac{1 - 60\gamma_{Fe}}{1 + 60\gamma_{Hg}}$ (c) $\frac{1 + 60\gamma_{Fe}}{1 - 60\gamma_{Hg}}$ (d) $\frac{1 + 60\gamma_{Hg}}{1 + 60\gamma_{Fe}}$

[IIT 2001]

(Answers at the end of all questions)

17) A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth 4y from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then, R is equal to

(a) $\frac{L}{\sqrt{2\pi}}$ (b) $2\pi L$ (c) L (d) $\frac{L}{2\pi}$ [IIT 2000]

18) Water from a tap emerges vertically downwards with an initial speed of 1.0 m / s. The cross-sectional area of tap is 10^{-4} m^2. Assume that the pressure is constant throughout the stream of water and that the flow is steady. The cross-sectional area of stream 0.15 m below the tap is

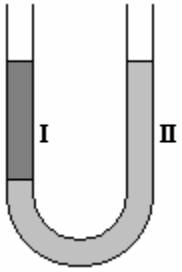
(a) 5.0×10^{-4} m^2 (b) 1.0×10^{-4} m^2 (c) 5.0×10^{-5} m^2 (d) 2.0×10^{-5} m^2

[IIT 1998]

19) A vessel contain oil (density = 0.8 gm / cm^3) over mercury (density = 13.6 gm / cm^3). A homogeneous sphere floats with half its volume immersed in mercury and the other half in oil. The density of the material of the sphere in gm / cm^3 is

(a) 3.3 (b) 6.4 (c) 7.2 (d) 12.8 [IIT 1988]

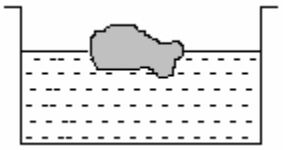
20) A U-tube of uniform cross section (see figure) is partially filled with a liquid I. Another liquid II which does not mix with liquid I is poured into one side. It is found that the liquid levels of the two sides of the tube are the same, while the level of liquid II has risen by 2 cm. If the specific gravity of liquid I is 1.1, the specific gravity of liquid II must be



(a) 1.12 (b) 1.1 (c) 1.05 (d) 1.0

[IIT 1983]

21) A body floats in a liquid contained in a beaker. The whole system is as shown in the figure falls freely under gravity. The upthrust on the body due to the liquid is



(a) zero (b) equal to the weight of the liquid displaced
(c) equal to the weight of the body in air
(d) equal to the weight of the immersed portion of the body [IIT 1982]

22) 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, diameter = 0.5 mm (b) length = 100 cm, diameter = 1 mm
(c) length = 200 cm, diameter = 2 mm (d) length = 300 cm, diameter = 3 mm [IIT 1981]

23) When pressure is applied through a hole in the top of a closed tube containing water, the pressure is transmitted to

(a) only to the bottom of the container (b) all directions
(c) only the side faces and the bottom of the container
(d) only the side of the container [NCERT 1990]

(Answers at the end of all questions)

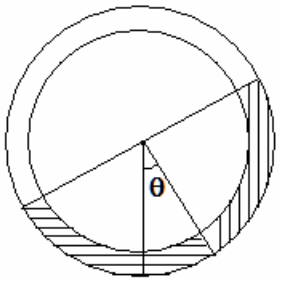
24) When a large bubble rises from the bottom of a lake to the surface, its radius doubles. The atmospheric pressure is equal to that of a column of water of height H. The depth of the lake is
(a) H (b) 2H (c) 7H (d) 8H [NCERT 1979]

25) A raft of wood, density 600 kg/m^3, of mass 120 kg floats in water. How much weight can be put on the raft to make it just sink ?
(a) 200 kg (b) 40 kg (c) 120 kg (d) 80 kg [NCERT 1979]

26) A body of volume 100 c.c. is immersed completely in water contained in a jar. The weight of water and jar before immersion of the body is 700 gm. After immersion, the weight of water and jar will be
(a) 500 gm (b) 700 gm (c) 100 gm (d) 800 gm [NCERT 1978]

27) Two rods of different materials having coefficients of linear expansion α_1 and α_2 and Young's modulii Y_1 and Y_2 respectively are fixed between two massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of the rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses developed in the two rods are equal provided $Y_1 : Y_2$ is equal to
(a) 2 : 3 (b) 1 : 1 (c) 3 : 2 (d) 4 : 9 [IIT 1989]

28) A small uniform tube is bent into a circle of radius r whose plane is vertical. Equal volumes of two immiscible liquids of densities d and d' fill half the circle. The angle between the radius passing through the interface and the vertical is given as
(a) $\tan^{-1}(d/d')$ (b) $\tan^{-1}(d'/d)$
(c) $\tan^{-1}\left(\frac{d-d'}{d+d'}\right)$ (d) $\tan^{-1}\left(\frac{d+d'}{d-d'}\right)$



29) Water squirts out of a small hole from a water-filled can. The hole is located at a distance y below the water surface. The height of the water in the can is h. The distance R from the base of the can, directly below the hole, where water strikes is given as
(a) $2\sqrt{yh}$ (b) $\sqrt{y}\,(h-y)$ (c) $\sqrt{2y\,(h-y)}$ (d) $2\sqrt{y\,(h-y)}$

30) The volume of an air bubble is doubled as it rises from the bottom of a lake to its surface. The atmospheric pressure is 75 cm of Hg and the ratio of density of mercury to that of lake water is 40/3. What is the depth of the lake?
(a) 10 m (b) 15 m (c) 20 m (d) 25 m

Answers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	c	d	b	c	a	c	a	d	a	a	d	a	d	d	a	a	c	b	b

21	22	23	24	25	26	27	28	29	30
a	a	b	c	d	d	a	c	b	a