PHYSICS:

31. There is a horizontal 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 the tension in the thread will be

1) $\pi R^2 / T$ 2) $\pi R^2 T$

3) $2\pi RT$ 4) $2RT$

32. A container, whose bottom has round holes with diameter 0.1 mm is filled with water. The maximum height in cm upto which water can be filled without leakage will be what?
Surface tension of water $= 75\times10^{-3}\, N/m$ and $g = 10\, m/s^2$:

1) 20 cm 2) 40 cm

3) 30 cm 4) 60 cm

33. If two soap bubbles of different radii are connected by a tube,

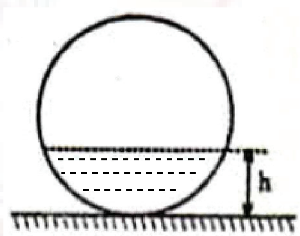
1) Air flows from the bigger bubble to the smaller bubble till the sizes become equal

2) Air flows from bigger bubble to the smaller bubble till the sizes are interchanged

3) Air flows from the smaller bubble to the bigger

4) There is no flow of air

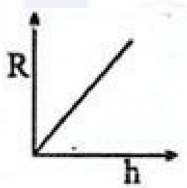
34. A liquid is filled in a spherical container of radius R till a height h. At this positions the liquid surface at the edges is also horizontal. The contact angle is

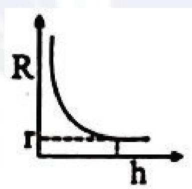


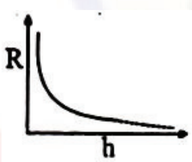
1) 0 2) $\cos^{-1}\left(\frac{R-h}{R}\right)$

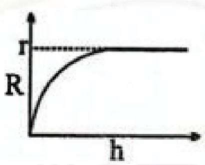
3) $\cos^{-1}\left(\frac{h-R}{R}\right)$ 4) $\sin^{-1}\left(\frac{R-h}{R}\right)$

35. A long capillary tube of radius ‘r’ is initially just vertically completely immersed inside a liquid of angle of contact $0°$. If the tube is slowly raised then relation between radius of curvature of meniscus inside the capillary tube and displacement (h) of tube can be represented by

1) 

2) 

3) 

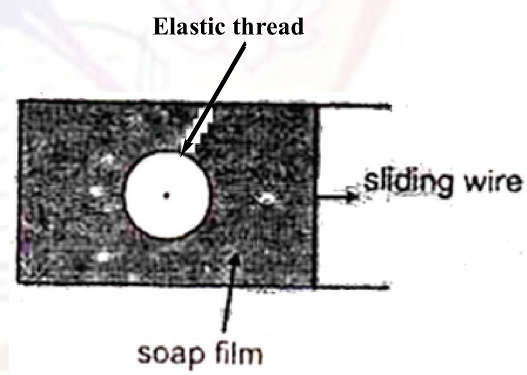
4) 

36. A mosquito with 8 legs stands on water surface and each leg makes depression of radius ‘a’. If the surface tension and angle of contact are ‘T’ and zero respectively, then the weight of mosquito is:

1) 8 T a 2) $16 \pi T a$

3) $\frac{T a}{8}$ 4) $\frac{T a}{16 \pi}$

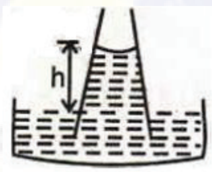
37. The figure shows a soap film in which a closed elastic thread is lying. The film inside the thread is pricked. Now the sliding wire is moved out so that the surface area increases. The radius circle of the circle formed by elastic thread will



1) Increase 2) decrease

3) Remains same 4) data insufficient

38. 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 meniscus 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



1) Greater than $\frac{2T}{r\rho g}$

2) Equal to $\frac{2T}{r\rho g}$

3) Less than $\frac{2T}{r\rho g}$

4) $\frac{4T}{r\rho g}$

39. Shape of the meniscus formed by two liquids when capillaries are dipped in them are shown. In I it is hemispherical where as in II it is flat. Pick correct statement regarding contact angles formed by the liquids in both situations

1) It is $180°$ in I and $90°$ in II

2) It is $0°$ in I and $90°$ in II

3) It is $90°$ in I and $0°$ in II

4) It is greater than $90°$ in I and equal to $90°$ in II

40. A uniform rod of density ρ, and length 'l' is having square cross-section of side 'a'. It is placed in a liquid of equal density ρ vertically along length in a tank having sufficient height of liquid. The surface tension of liquid is 'T' and angle of contact is $120°$. Then:

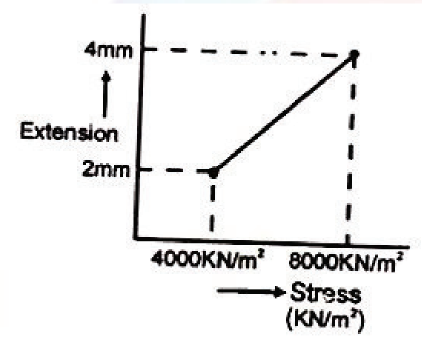
1) rod will float completely immersed inside the liquid

2) rod will sink to bottom of tank

3) rod will float partially submerged with height $\frac{4T}{a\rho g}$ above liquid

4) rod will float partially submerged with height $\frac{2T}{a\rho g}$ above liquid

41. In determination of young modulus of elasticity of wire, a force is applied and extension is recorded. Initial length of wire is '1m'. The curve between extension and stress is depicted then young modulus of wire will be:



1) $2\times10^{9}\ N/m^{2}$ 2) $1\times10^{9}\ N/m^{2}$

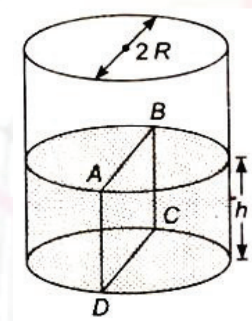
3) $2\times10^{10}\ N/m^{2}$ 4) $1\times10^{10}\ N/m^{2}$

42. A uniform rod of mass m and length l is rotating with constant angular velocity ω about an axis which passes through its one end and perpendicular to the length of rod. The area of cross-section of the rod is A and its young's modulus is Y. Neglect gravity. The strain at the midpoint of the rod is:

1) $\frac{m\omega^{2}l}{8AY}$ 2) $\frac{3m\omega^{2}l}{8AY}$

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

43. Water is filled up to a height h in a beaker of radius R as shown in the figure. The density of water is ρ, the surface tension of water is T and the atmospheric pressure is p_0. Consider a vertical section ABCD of the water column through a diameter of the beaker. The force on water on one side of this section by water on the underside of this section has magnitude.



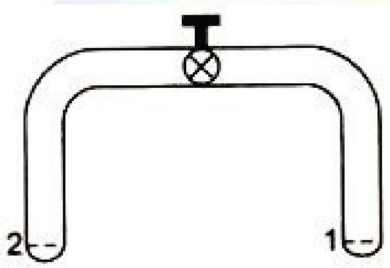
1) $\left|2p_0Rh+\pi R^{2}\rho gh-2RT\right|$

2) $\left|2p_0Rh+R\rho gh^{2}-2RT\right|$

3) $\left|p_0\pi R^{2}+R\rho gh^{2}-2RT\right|$

4) $\left|p_0\pi R^{2}+R\rho gh^{2}+2RT\right|$

44. A glass tube of uniform internal radius (r) has a valve separating the two identical ends. Initially, the valve is in a tightly closed position. End 1 has a hemispherical soap bubble or radius r. End 2 has sub-hemispherical soap bubble as shown in figure.



Just after opening the valve.

1) air from end 1 flows towards end 2. No change in the volume of the soap bubbles

2) air from end 1 flows towards end 2. Volume of the soap bubble at end 1 decreases

3) no change occurs

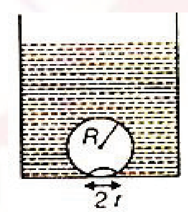
4) air from end 2 flows towards end 1. Volume of the soap bubble at end 1 increases

45. The density of water at the surface of ocean is ρ. If the bulk modulus of water is B, then the density of ocean water at a depth, where the pressure is αp_0 (where p_0 is the atmospheric pressure) is

1) $\frac{\rho B}{B-(\alpha-1)P_0}$ 2) $\frac{\rho}{B-(\alpha-1)P_0}$

3) $\frac{\rho B}{B+(\alpha-1)P_0}$ 4) $\frac{\rho B}{B+(\alpha+1)P_0}$

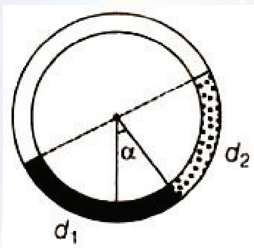
46. On heating water, bubbles beings formed at the bottom of the vessel detach and rise. Take the bubbles to be spheres of radius R and making a circular contact of radius r with the bottom of the vessel. If $r << R$ and the surface tension of water is T, value of r just before bubbles detach is (density of water is ρ)



1) $R^2\sqrt{\frac{2\rho_w g}{3T}}$ 2) $R^2\sqrt{\frac{\rho_w g}{6T}}$

3) $R^2\sqrt{\frac{\rho_w g}{3T}}$ 4) $R^2\sqrt{\frac{3\rho_w g}{T}}$

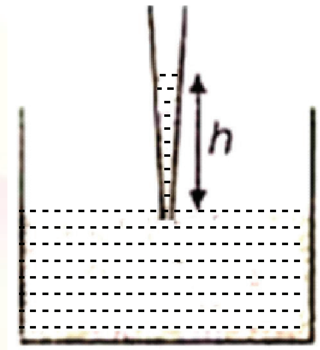
47. There is a circular tube in a vertical plane. Two liquids which do not mix and of densities d_1 and d_2 are filled in the tube. Each liquid subtends $90°$ angle at centre. Radius joining their interface makes an angle α with vertical. Ratio d_1/d_2 is



1) $\frac{1+\sin\alpha}{1-\sin\alpha}$ 2) $\frac{1+\cos\alpha}{1-\cos\alpha}$

3) $\frac{1+\tan\alpha}{1-\tan\alpha}$ 4) $\frac{1+\sin\alpha}{1-\cos\alpha}$

48. A glass capillary tube is of the shape of truncated cone with an apex angle α so that its two ends have cross-sections of different radii. When dipped in water vertically, water rises in it to a height h, where the radius of its cross-section is b. If the surface tension of water is S, its density is ρ, and its contact angle with glass is θ, the value of h will be (g is the acceleration due to gravity)



1) $\frac{2S}{b\rho g}\cos(\theta-\alpha)$

2) $\frac{2S}{b\rho g}\cos(\theta+\alpha)$

3) $\frac{2S}{b\rho g}\cos(\theta-\alpha/2)$

4) $\frac{2S}{b\rho g}\cos(\theta+\alpha/2)$

49. If T is surface tension of soap solution, the amount of work done in blowing a soap bubble from a diameter D to a diameter 2D is

1) $2\pi D^2T$ 2) $4\pi D^2T$

3) $6\pi D^2T$ 4) $8\pi D^2T$

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

1) Will be the same as for smaller droplet

2) Will be half of that for smaller droplet

3) Will be one-fourth of that for smaller droplet

4) Will be twice of that for smaller droplet

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

1) 1 : 0.15 2) 1 : 3

3) 1 : 6.5 4) 1.5 : 1

52. Two soap bubbles, one of radius 50 mm and the other of radius 80 mm, are brought in contact so that they have a common interface. The radius of the curvature of the common interface is

1) 0.003 m 2) 0.133 m

3) 1.2 m 4) 8.9 m

53. A glass rod of radius r_1 is inserted symmetrically into a vertical capillary tube of radius r_2 such that their lower ends are at the same level. The arrangement is now dipped in water. The height to which water will rise into the tube will be (σ = surface tension of water, ρ = density of water and angle of contact is zero)

1) $\dfrac{2\sigma}{(r_2 - r_1)\rho g}$ 2) $\dfrac{\sigma}{(r_2 - r_1)\rho g}$

3) $\dfrac{2\sigma}{(r_2 + r_1)\rho g}$ 4) $\dfrac{2\sigma}{(r_2^2 + r_1^2)\rho g}$

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

1) 0.16 J 2) 0.016 J

3) 1.6 J 4) 16 J

55. A solid sphere of radius R, made up for a material of bulk modulus K is surrounded by a liquid in a cylindrical container. A massless piston of area A floats on the surface of the liquid. When a mass M is placed on the piston to compress the liquid, the fractional change in the radius of the sphere is

1) $\frac{Mg}{AK}$ 2) $\frac{Mg}{3AK}$

3) $\frac{3Mg}{AK}$ 4) $\frac{Mg}{2AK}$

56. When the tension in a metal wire is T_1, its length is l_1. When the tension is T_2, its length l_2. The natural length of wire is

1) $\frac{T_2}{T_1}(l_1+l_2)$ 2) $T_1l_1+i_2l_2$

3) $\frac{l_1T_2-l_2T_1}{T_2-T_1}$ 4) $\frac{l_1T_2+l_2T_1}{T_2+T_1}$

57. A small but heavy block of mass 10kg is attached to a wire 0.3m long. Its breaking stress is $4.8\times10^7\ N/m^2$. The area of the cross section of the wire is $10^{-6}\ m^2$. The maximum angular velocity with which the block can be rotated in the horizontal circle is

1) 4 rad/s 2) 8 rad/s

3) 10 rad/s 4) 32 rad/s

58. A massive stone pillar 20 m high and of uniform cross section rests on a rigid base and supports a vertical load of $5.0\times10^{5}\,N$ at its upper end. If the compressive stress in the pillar is not to exceed $1.6\times10^{6}\,N/m^{2}$, what is the minimum cross-sectional area of the pillar? (Density of the stone $=2.5\times10^{3}\,kg/m^{3}$ take $g=10\,N/kg$.)

1) $0.15\,m^{2}$ 2) $0.25\,m^{2}$

3) $0.35\,m^{2}$ 4) $0.45\,m^{2}$

59. A straw 6cm long floats on water. The water film on one side has surface tension of 50 dyn/cm. On the other slide, camphor reduces the surface tension to 40 dyn/cm. The resultant force acting on the straw is

1) $(50\times6-40\times6)$dyn

2) 10 dyn

3) $\left(\frac{50}{6}-\frac{40}{6}\right)$dyn

4) 90 dyn

60. Maximum excess pressure inside a thin-walled steel tube of radius r and thickness $\Delta r(<<r)$, so that the tube would not rupture would be (breaking stress of steel is σ_{max})

1) $\sigma_{max}\times\frac{r}{\Delta r}$ 2) $\sigma_{max}\times\frac{\Delta r}{r}$

3) σ_{max} 4) $\sigma_{max}\times\frac{\Delta 2r}{r}$

Sri Chaitanya IIT Academy., India.

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR - HYD

Sec: Jr.Super60 Date: 01-10-16

Time: 07:30AM to10:30AM WTM-22 Max. Marks: 360

KEY SHEET

MATHEMATICS:

1	2	2	3	3	1	4	3	5	4	6	2
7	2	8	2	9	1	10	4	11	4	12	1
13	4	14	2	15	3	16	2	17	3	18	4
19	2	20	1	21	3	22	1	23	1	24	1
25	2	26	2	27	2	28	1	29	3	30	2

PHYSICS:

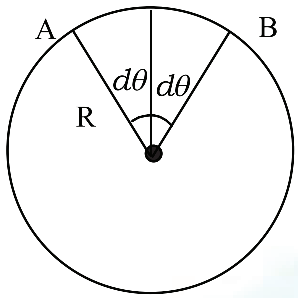
31	4	32	3	33	3	34	2	35	2	36	2
37	3	38	3	39	2	40	4	41	1	42	2
43	2	44	2	45	1	46	1	47	3	48	4
49	3	50	2	51	3	52	2	53	1	54	2
55	2	56	3	57	1	58	4	59	1	60	2

CHEMISTRY:

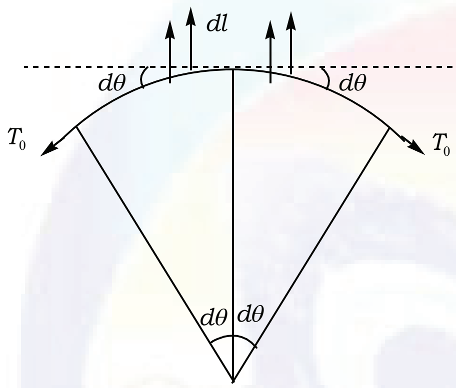
61	2	62	3	63	1	64	4	65	4	66	1
67	4	68	1	69	4	70	1	71	4	72	1
73	1	74	4	75	2	76	4	77	4	78	1
79	2	80	1	81	2	82	2	83	1	84	1
85	4	86	3	87	4	88	1	89	2	90	1

PHYSICS:

31.



Considering the equilibrium of a length element AB of string, the forces acting are

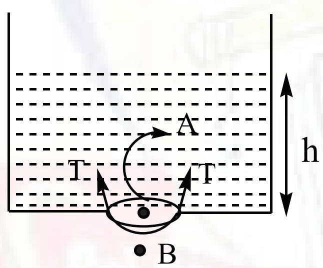


$2T_0 \sin d\theta = (2\,dl)T$

$2T_0\,d\theta = 2(2\,Rd\theta)T$

$T_0 = 2RT$

32.



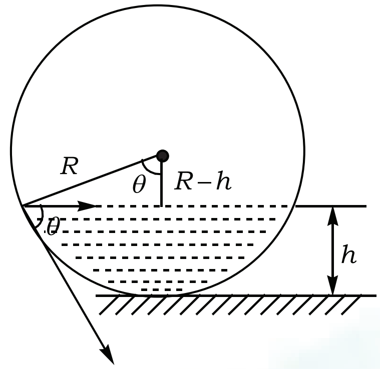
$$P_A - P_B = \frac{2T}{r}$$

$$P_A = P_B + \frac{2T}{r} = P_0 + \rho g h$$

as $P_B = P_0$; $\qquad h = \dfrac{2T}{r\rho g}$

33. We have $P = P_0 + \dfrac{4T}{r}$, the pressure inside the soap bubble. As pressure inside the smaller bubble is greater than that of bigger bubble air flows from smaller to bigger bubble.

34.



$\cos\theta = \dfrac{R-h}{R}$

From the figure

35. In the general expression $h = \dfrac{2T\cos\theta}{rdg}$

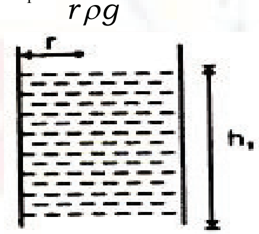
$\dfrac{r}{\cos\theta} =$ radius of curvature of meniscus formed so $h = \dfrac{2T}{Rdg}$ or $R \alpha \dfrac{1}{h}$.

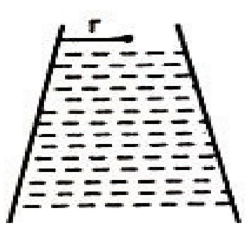
36. (2) Figure shows one of the legs of mosquito landing upon the water surface. Therefore, $T.2\pi a \times 8 = W =$ weight of the mosquito.

37. (3) The force exerted by film on wire or thread depends only on the nature of material of the film and not on its surface area. Hence the radius of circle formed by elastic thread does not change.

38. (3) As weight of liquid in capillary is balanced by surface tension, then $T \times 2\pi r = \pi r^2 h_1 \rho g$ (for uniform r radius tube)

$h_1 = \dfrac{2T}{r\rho g}$

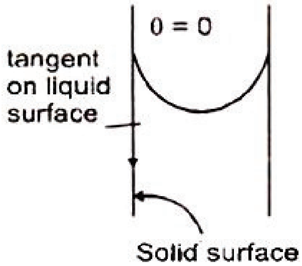


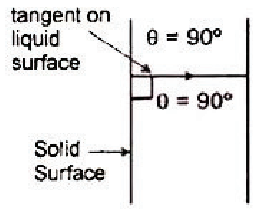


But weight of liquid in tapered tube is more than uniform tube of radius r, then in order to balance $h < h_1$

$h < \dfrac{2T}{r\rho g}$

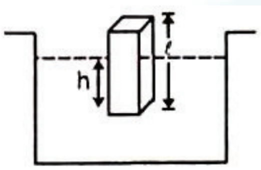
39. (2) For hemispherical shape for flat surface





40. (4) Balancing the force : $T.4a\cos 120^\circ + l\rho a^2 g = a^2 h\rho g$

$T.2a = a^2\,\rho\, g(l-h)$



$(l-h) = \frac{2T}{a\rho g}$

41. (1) $\Delta l = \frac{Fl}{Ay}$ $\frac{\Delta l}{(F/A)} = \frac{l}{y} =$ slope of curve

$\frac{l}{y} = \frac{(4-2)\times 10^{-3}}{4000\times 10^{3}}$

Given $1 = 1m \rightarrow$

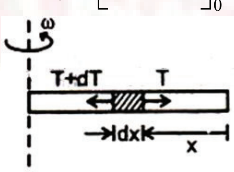
$1 = 1m \rightarrow y = \frac{4000\times 10^{3}}{2\times 10^{-3}}$ $= 2\times 10^{9}\ N/m^2$

42. (2) $dT = dm(l-x)\omega^2$

$dT = \frac{m}{l}.dx(l-x)\omega^2$

$\Rightarrow \int_0^T dT = \int_0^{l/2} \frac{m\omega^2}{l}(l-x)\,dx$

$= \frac{m\omega^2}{l}\left[lx - \frac{x^2}{2}\right]_0^{l/2} = \frac{m\omega^2}{l}\left[\frac{l^2}{2} - \frac{l^2}{8}\right]$



$\therefore$ Tension at midpoint is :

$T = \frac{3}{8}ml\omega^2$ $\Rightarrow stress = \frac{3ml\omega^2}{8A}$

$\Rightarrow strain = \frac{3ml\omega^2}{8AY}$

43. Force from right hand side liquid on left hand side liquid.

(i) Due to surface tension force $= 2RT$ (towards right)

(ii) Due to liquid pressure force

$= \int_{x=0}^{x=h} (p_0 + \rho g h)(2R.x)dx$

$= \left(2p_0Rh + R\rho g h^2\right)$ (towards left)

$\therefore$ Net force is $\left|2p_0Rh + R\rho g h^2 - 2RT\right|$

44. $\Delta p_1 = \dfrac{4T}{r_1}$ and $\Delta p_2 = \dfrac{4T}{r_2}$

$r_1 < r_2$

$\therefore \Delta p_1 > \Delta p_2$

$\therefore$ Air will flow from 1 to 2 and volume of bubble at end-1 will decrease.
Therefore, correct option is (2).

45. (1) From the definition of bulk modulus $B = -\dfrac{dp}{dV/V}$

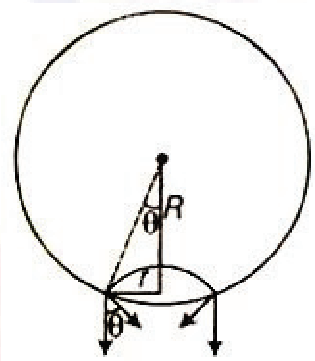
As we move from surface to placed where pressure changes to αp_0, let us assume volume changes by ΔV, then $B = \dfrac{V\Delta p}{\Delta V} = \dfrac{V(\alpha-1)p_0}{\Delta V}$

New volume, $V' = V - \Delta V = V\left[1 - \dfrac{(\alpha-1)p_0}{B}\right]$

Density at the given depth, $\rho' = \rho V/V'$. Where ρ is density at surface

$\rho' = \dfrac{\rho \times B}{B - (\alpha-1)p_0}$

46. The bubble will detach if, Buoyant force $\geq$ surface tension force



$\int \sin\theta\, T \times dl = T(2\pi r)\sin\theta$

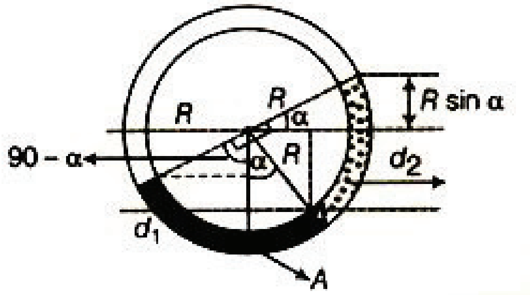
$\dfrac{4}{3}\pi R^3 \rho_w g \geq \int T \times dl \sin\theta$

$(\rho_w)\left(\dfrac{4}{3}\pi R^3\right) g \geq (T)(2\pi r)\sin\theta$

$\Rightarrow \qquad \sin\theta = \dfrac{r}{R}$

Solving, $r = \sqrt{\dfrac{2\rho_w R^4 g}{3T}} = R^2\sqrt{\dfrac{2\rho_w g}{3T}}$

47. Equating pressure at A, we get $R\sin\alpha\, d_2 + R\cos\alpha\, d_2 + R(1-\cos\alpha)d_1 = R(1-\sin\alpha)d_1$



$\left(\sin\alpha+\cos\alpha\right)d_2=d_1\left(\cos\alpha-\sin\alpha\right)$

$\Rightarrow\quad \dfrac{d_1}{d_2}=\dfrac{1+\tan\alpha}{1-\tan\alpha}$

48. Using geometry $\dfrac{b}{R}=\cos\left(\theta+\dfrac{\alpha}{2}\right)\Rightarrow R=\dfrac{b}{\cos\left(\theta+\dfrac{\alpha}{2}\right)}$

Using pressure equation along the path MNTK $p_0-\dfrac{2S}{R\rho g}=\dfrac{2S}{b\rho g}\cos=p_0$

Substituting the value of R, we get $h=\dfrac{2S}{R\rho g}=\dfrac{2S}{b\rho g}\cos\left(\theta+\dfrac{\alpha}{2}\right)$

49. (3) Work done = (increase in surface are1) x surface tension

$=2\times\left[4\pi\left(\dfrac{2D}{2}\right)^2-4\pi\left(\dfrac{D}{2}\right)^2\right]\times T$

(since for sap bubble, there are two free surfaces)

$=2\times\left(4\pi D^2-\pi D^2\right)T=6\pi D^2T$

50. (2) Suppose, R = radius of water drop and r = radius of droplets

$\therefore\quad \dfrac{4}{3}\pi R^3=8\times\dfrac{4}{3}\pi r^3$

(Since volume remains constant)

$\therefore r=\dfrac{R}{2}$

Since excess pressure inside drop $=\dfrac{2T}{R}$

(T – surface tension, R – radius)

Therefore, pressure difference between inner and outer surface of big drop will be half of that for smaller droplet.

51. (3) Height, $h=\dfrac{2T\cos\theta}{r\rho g}$

$\therefore$ For water, $h_w=\dfrac{2\times T_w\times\cos 0^\circ}{r\times 1\times g}$

And, for mercury, $h_m=-\dfrac{2\times T_m\times\cos 135^\circ}{r\times 13.6\times 8}$

$\therefore\dfrac{h_w}{h_m}=\dfrac{2\times T_w\times 1}{r\times 1\times g}\times\dfrac{r\times 1.36\times g\times\sqrt{2}}{2\times T_m\times 1}$

$\left[\because \cos 135^\circ=-1/\sqrt{2}\right]$

$\Rightarrow \dfrac{10}{3.42} = \dfrac{T_w}{T_m} \times 13.6 \times \sqrt{2}$

$\therefore \dfrac{T_w}{T_m} = \dfrac{10}{3.42 \times 13.6 \times 1.414} = \dfrac{1}{6.5}$

$\therefore T_w : T_m = 1 : 6.5$

52. (2) $\left[P_0 + \dfrac{4\sigma}{R_2}\right] - \left[P_0 + \dfrac{4\sigma}{R_1}\right] = \dfrac{4\sigma}{R}$

or $\dfrac{1}{R} = \dfrac{1}{R_2} - \dfrac{1}{R_1}$

or $R = \dfrac{R_1 R_2}{R_1 - R_2} = \dfrac{50 \times 80}{30} mm = \dfrac{400}{3} mm$

$= \dfrac{400}{3 \times 1000} m = \dfrac{4}{30} m = 0.133m$

53. (1) Total upward force due to surface tension $= \sigma(2r_1 + 2r_2)$. This supports the weight of the liquid column of height h. Weight of liquid column $= h\left[\pi r_2^2 - \pi r_1^2\right]\rho g$

Equating, we get $h\pi(r_2 + r_1)(r_2 - r_1)\rho g = 2\pi\sigma(r_1 + r_2)$

or $h(r_2 - r_1)\rho g = 2\sigma$ or $h = \dfrac{2\sigma}{(r_2 - r_1)\rho g}$

54. (2) Work done $= \dfrac{1}{2}$ x stretching force x extension. Therefore, net work done in increasing the length from 0.164 mm to 1.02 mm is

$w_2 - w_1 = \dfrac{1}{2} \times 5 \times 9.8 \times 1.02 \times 10^{-3} - \dfrac{1}{2} \times 3 \times 9.8 \times 0.61 \times 10^{-3} = 0.016J$.

55. (2) Change in pressure due to placing of mass on piston is $\Delta p = \dfrac{Mg}{A}$

From bulk modulus definition $K = \dfrac{-dp}{dV/V}$

$\left|\dfrac{dV}{V}\right| = \dfrac{\Delta p}{K} = \dfrac{Mg}{AK}$

From $V = \dfrac{4}{3}\pi r^3$

$\dfrac{dV}{V} = \dfrac{3dR}{R} \Rightarrow \dfrac{dR}{R} = \dfrac{1}{3}\dfrac{dV}{V} = \dfrac{Mg}{3AK}$

56. (3) $Y = \dfrac{Fl}{a\Delta l}$

Y, l and a are constant

$\therefore \dfrac{Fl}{\Delta l} =$ constant or $\Delta l = F$

Now, $l_1 - l = T_1$ and $l_2 - l = T_2$

Diving, $\dfrac{l_1 - l}{l_2 - l} = \dfrac{T_1}{T_2}$

or $l_1 T_2 - l T_2 = l_2 T_1 - l T_1$ or $l = \dfrac{l_1 T_2 - l_2 T_1}{T_3 - T_1}$

57. (1) $mr\omega^2 =$ Breaking stress x Cross-sectional area $10\times 0.3\omega^2 = 4.8\times 10^7 \times 10^{-6} = 48$

or $\omega^2 = \frac{48}{3} = 16$ or $\theta = 4\,rad/s$

58. (4) $\frac{20a\times 2.5\times 10^3 \times 10 + 5\times 10^5}{a} = 1.6\times 10^6$

or $500a + 500 = 1600a$

or $1100a = 500$ or $a = \frac{5}{11}m^2 = 0.45m^2$

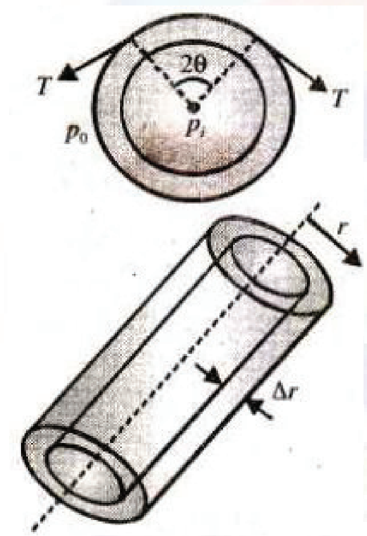
59. (1) $F = (\sigma_1 - \sigma_2)l$

60. Consider a small element of the tube of legth l.

$2T\sin\theta = \Delta p\times A$

Where $\Delta p = p_1 - p_0$ and A is the area of element. As θ is very small, $\sin\theta = \theta$ so,

$2T\times\theta = \Delta p\times l\times(2r\theta)$



$\Rightarrow \Delta p = \frac{T}{lr}$ σ (stress developed in tube) $= \frac{\Delta T}{\Delta r\times l}$

Where $\Delta r\times l$ is the cross-sectional area.

$\sigma = \frac{\Delta p\times lr}{\Delta r\times l} = \Delta p\times\frac{r}{\Delta r}$

For no rupturing, $\sigma \le \sigma_{max}$

So, $\Delta p\times\frac{r}{\Delta r} \le \sigma_{max}$

Δp (max value) $= \sigma_{max}\times\frac{\Delta r}{r}$

Final Key

S.NO	SUB	Q.NO	GIVEN KEY	FINALIZED KEY	EXPLANATION
3	PHY	38	3	2	In question r is given as radius of meniscus so by present method $h = \frac{2s}{r\delta g}$