SINGLE CORRECT OPTION TYPE

1. Calculate the work done in blowing a soap bubble of radius 10 cm, surface tension being 0.03 N/m. What additional work will be performed in further blowing it so that its radius is doubled?
(A) 7.45×10^{-3}Nm (B) 22.62×10^{-3}Nm (C) 30.16×10^{-3}Nm (D) 37.61×10^{-3}Nm

2. Find the work done in spraying a spherical drop of 1 mm radius into 10^6 droplets of equal size, σ of water $=0.072\text{N/m}$.
(A) 8.96×10^{-5}J (B) 3.96×10^{-4}J (C) 2.69×10^{-5}J (D) 6.23×10^{-5}J

3. Find the difference in air pressure between inside and outside of a soap bubble 5 mm in diameter: $\sigma(\text{soap solution})=1.6\text{N/m}$.
(A) 2116N/m^2 (B) 2120N/m^2 (C) 1296N/m^2 (D) 2560N/m^2

4. The pressure of air in a soap bubble of diameter 0.7 cm is 8 mm of water above atm. Calculate the surface tension of soap solution.
(A) 0.0686 N/m (B) 0.686 N/m (C) 0.00686 N/m (D) 6.86 N/m

5. What would be the pressure inside a small air bubble of 10^{-4}m radius situated just below water surface? $\sigma\text{water}=0.072\text{N/m};\ 1\text{atm}=1.013\times10^5\text{N/m}^2$.
(A) $1.992\times10^5\text{N/m}^2$ (B) $2.369\times10^5\text{N/m}^2$ (C) $1.0274\times10^5\text{N/m}^2$ (D) $2.009\times10^5\text{N/m}^2$

6. A ring is cut from a platinum tube 8.5 cm internal and 8.7 cm external diameter supported horizontally from the pan of a balance so that it comes in contact with water in a glass vessel. It is found that an extra weight of 3.97 gm is required to pull the ring out of water. Find σ of water.
(A) 0.36 N/m (B) 0.72 N/m (C) 0.92 N/m (D) none

7. A soap is formed on a rectangular frame of length 7 cm dipped into soap solution. The frame work hangs from a balance and an extra weight of 0.4 gm is placed to balance the pull of the film. Find the surface tension.
(A) 0.012 N/m (B) 0.036 N/m (C) 0.028 N/m (D) 0.067 N/m

8. Water rises to a height of 10 cm in a certain capillary tube. In the same tube, the level of Hg is depressed by 3.42 cm. Find the ratio of surface tensions of water and Hg. The angle of contact for water is zero and that for Hg is 135°.
(A) 0.1522 (B) 0.321 (C) 1.29 (D) 1.672

9. A glass tube of 1 mm diameter bore is dipped with its lower end 2 cm below the surface of mercury. What must be the gauge pressure of air to blow a hemispherical bubble at its lower end? $(\sigma \text{ for Hg}=0.49\text{N/m})$.
(A) 4625.6N/m^2 (B) 3216.7N/m^2 (C) 2166.7N/m^2 (D) 9216.2N/m^2

10. A glass vessel has a minute hole of diameter 0.1 mm at the bottom. What is the maximum depth of water which the vessel can hold without leakage. $(\sigma=72\text{dynes/cm})$
(A) 12.3 cm (B) 29.4 cm (C) 42.1 cm (D) 67.9 cm

11. A square metallic plate having 5 cm length is placed on a layer of oil having a thickness of 0.1 cm. Calculate the value of the tangential force required to move the plate with a velocity of 5 cm/s. The coefficient of viscosity η is $0.8\,\text{N}-\text{s/m}^2$ (MKS units).
0.1 N (B) 0.2 N (C) 0.3 N (D) 0.01 N

12. In a certain to study the flow of liquid out of a capillary, following data were obtained: Volume of liquid coming out of tube per sec = 15 cc; head of liquid (h) = 30 cm; length of tube = 25 cm; radius of tube = 1.0 mm, density of liquid = 2.3 g/ml. Find the coefficient of viscosity of the liquid flowing in the tube.
(A) 0.1126 CGS units (B) 0.2346 CGS units (C) 0.4247 CGS units (D) 0.6728 CGS units

13. Water flows in a horizontal tube of length 13.6 cm and radius 0.1 mm. The pressure difference between the two ends of the tube is balanced by 10 cm of Hg column. $d_{kg} = 13.6 \times 10^3\, kg/m^3$. $\eta(\text{water}) = 0.1$ MKS units, find the volume of water flowing out of the tube in 1 min.
(A) $23.1 \times 10^{-10} m^3$ (B) $12.3 \times 10^{-10} m^3$ (C) $31.4 \times 10^{-10} m^3$ (D) $42.6 \times 10^{-10} m^3$

14. Find the terminal velocity obtained by a rain drop of radius 3 mm through air of viscosity. 8×10^{-8} S.I. units. Neglect density of air:
(A) 0.016×10^6 m/s (B) 0.216×10^6 m/s (C) 2.62×10^5 m/s (D) 1.088×10^6 m/s

15. Find the terminal velocity of steel ball, 2 mm in diameter, falling through glycerine $\left(\sigma_{\text{glycerine}} = 1.3 g/cc\right)$ $\rho_{\text{steel}} = 8.3 g/cc$, $\eta(\text{glycerine}) = 8.3$ poise
(A) 2.92 cm/s (B) 2.5 cm/s (C) 1.00 cm/s (D) 1.83 cm/s

16. An air bubble of radius 1 cm rises steadily through water of density 1 g/cc at the rate of 0.2 cm/s. Calculate the coefficient of viscosity of water. (Neglect the density of air) $\left[g = 981 cm/s^2\right]$
(A) 1.09×10^3 poise (B) 2.06×10^3 poise (C) 1.29×10^2 poise (D) 2.06×10^2 poise

17. Two drops of water of the same size are falling through air with terminal velocities of 10 cm/s. If the two drops combine to form a single drop, what will be the terminal velocity?
(A) 2.69 cm/s (B) 5.16 cm/s (C) 7.23 cm/s (D) 15.9 cm/s

18. Two separate soap bubbles (radii = 0.002 m and 0.004 m) formed of same liquid ($\sigma = 0.07 N/m$) come together to form a double bubble. Find the radius.
(A) 0.004 m (B) 0.026 m (C) 0.056 m (D) 0.126 m

19. A fine rubber band which is in its un-stretched condition forms a circle of diameter 7.5 cm is dropped on a soap film formed over a wire frame. When the film inside the band is broken, its stretches into a circle of diameter 8.1 cm. If the band when cut and used as a single strand can be stretched to double its length by a 3 gm wt, calculate the surface tension of soap film.
(A) 12 dyne/cm (B) 14 dyne/cm (C) 29 dyne/cm (D) 42 dyne/cm

20. Calculate the force required to separate two glass plates of area $0.01 m^2$ with film of water 0.05 mm thick between them. Given: $\sigma = 0.07 N/m$. (Assume angle of contact is zero)
(A) 28 N (B) 14 N (C) 21 N (D) 35 N

NUMERICAL BASED

21. A drop of water volume $0.05 cm^3$ is pressed between two glass-plates, as a consequence of which, it spreads and occupies an area of $40 cm^2$. If the surface tension of water is 70 dyne/cm, find the normal force required to separate out the two glass plates in newton.

22. A glass U-tube is such that the diameter of one limb is 3.0 mm and that of the other is 6.00 mm Tue tube is inverted vertically with the open ends below the surface of water in a beaker. What is the difference between the heights to which water rises in the two limbs? Surface tension of water is 0.07 N/m. Assume that the angle of contact between water and glass is $0°$.

23. A conical glass capillary tube of length 0.1 m has diameters 10^{-3} and 5×10^{-4}m at the ends. When it is just immersed in a liquid at $0°C$ with larger diameter in contact with it, the liquid rises to 8×10^{-2}m in the tube. If another cylindrical glass capillary tube B is immersed in the same liquid at $0°C$, the liquid rises to 6×10^{-2}m height. The rise of liquid in the tube B is only 5.5×10^{-2}m when the liquid is at $50°C$. Find the rate at which the surface tension changes with temperature considering the change to be linear. The density of the liquid is $(1/14)\times10^4\,kg/m^3$ and angle of contact is zero Effect of temperature on density of liquid and glass is negligible.

24. A metal plate $0.04m^2$ in area is lying on liquid layer of thickness 10^{-3}m and co-efficient of viscosity 140 poise. Calculate the horizontal force needed to move the plate with a speed of 0.040 m/s.

25. A large wooden plate of area $10m^2$ floating on the surface of a river is made to move horizontally with a speed of 2 m/s by applying a tangential force. If the river is 1 m deep and the water in contact with the bed is stationary, find the tangential force needed to keep the plate moving. Coefficient of viscosity of water at the temperature of the river $=10^{-2}$ poise.

KEY

1.	B	**2.**	A	**3.**	D	**4.**	A	**5.**	C
6.	B	**7.**	C	**8.**	A	**9.**	A	**10.**	B
11.	A	**12.**	C	**13.**	A	**14.**	D	**15.**	D
16.	A	**17.**	D	**18.**	A	**19.**	C	**20.**	A
21.	45 N	**22.**	4.76 mm	**23.**	$0.014N/m\,°C$	**24.**	22.4 N	**25.**	0.02 N

✣ *Wish You all the Best* ✣