Additional Problems For Self Practice (APSP)

PART-I : PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions :

1. The test is of **1 hour** duration and max. marks 120.
2. The test consists **30** questions, **4 marks** each.
3. Only one choice is correct **1 mark** will be deducted for incorrect response. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
4. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 3 above.

1. The radii of the two columns is U-tube are r_1 and r_2. When a liquid of density ρ (angle of contact is 0^0) is filled in it, the level difference of liquid in two arms is h. The surface tension of liquid is : (g = acceleration due to gravity) :

(1) $\frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$ (2) $\frac{\rho g h (r_2 - r_1)}{2 r_1 r_2}$ (3) $\frac{2(r_2 - r_1)}{\rho g h r_1 r_2}$ (4) $\frac{\rho g h}{2(r_2 - r_1)}$

2. If work done to make a bubble of volume V with soap solution is W, then using same solution work done to make a bubble of volume 2V is :

(1) W/2 (2) W (3) $\sqrt[3]{2}$ W (4) $\sqrt[3]{4}$ W

3. A thin metal ring of internal radius 8 cm and external radius 9 cm is 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 7.48 g is required to pull the ring out of water. The surface tension of water is

(1) 80×10^{-3} N/m (2) 75×10^{-3} N/m (3) 65×10^{-3} N/m (4) 70×10^{-3} N/m

4. The surface tension of a liquid is 0.5 newton per metre. If a film is held on a ring of area 0.03 metres^2, its surface energy is about :

(1) 5×10^{-2} J (2) 2.5×10^{-2} J (3) 2×10^{-1} J (4) 3×10^{-2} J

5. Water rises in a capillary tube to a height h. it will rise to a height less than h

(1) on the surface of sun (2) in a lift moving down with an acceleration
(3) at the poles (4) in a lift moving up with an acceleration.

6. The force required to drag a circular ring plate of radius 5 cm on the surface of water is (ST of water is 75 dyne/cm).

(1) 30 dyne (2) 60 dyne (3) 750π dyne (4) 1500π dyne

7. The work done in increasing the size of a rectangular soap film with dimensions 8 cm × 3.75 cm to 10 cm × 6 cm is 3×10^{-4} J. The surface tension of the film in N/m is :

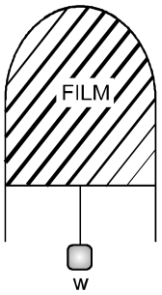
(1) 1.65×10^{-2} (2) 5×10^{-2} (3) 6.6×10^{-2} (4) 8.25×10^{-2}

8. A capillary tube is filled with liquid up to a height of 40 cm. The reading when the capillary tube is tilted to an angle of 60^0 is :

(1) 80 cm (2) $50\sqrt{2}$ cm (3) zero (4) none of these

9. Radius of a capillary is 2×10^{-3} m. A liquid of weight 9.42×10^{-4} N may remain in the tube if surface tension of the liquid will be :
(1) 5×10^{-3} N/m (2) 5×10^{-2} N/m (3) 7.5×10^{-2} N/m (4) 50 N/m

10. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of 2.0×10^{-2} N (see figure). The length of the slider is 10 cm and its weight negligible. The surface tension of the liquid film is :
(1) 0.0125 Nm^{-1}
(2) 0.1 Nm^{-1}
(3) 0.05 Nm^{-1}
(4) 0.025 Nm^{-1}



11. Two parallel glass plates are dipped partly in the liquid of density 'd'. keeping them vertical. If the distance between the plates is 'x', Surface tension for liquid is T & angle of contact is θ then rise of liquid between the plates due to capillary will be :
(1) $\frac{T\cos\theta}{xd}$ (2) $\frac{2T\cos\theta}{xdg}$ (3) $\frac{2T}{xdg\cos\theta}$ (4) $\frac{T\cos\theta}{xdg}$

12. The work done to get n smaller equal size spherical drops from a bigger size spherical drop of water is proportional to :
(1) $\left(\frac{1}{n^{2/3}}\right)-1$ (2) $\left(\frac{1}{n^{1/3}}\right)-1$ (3) $n^{1/3}-1$ (4) $n^{4/3}-1$

13. Two unequal soap bubbles are formed one on each side of a tube closed in the middle by a tap. What happens when the tap is opened to put the two bubbles in communication ?
(1) No air passes in any direction as the pressure are the same on two sides of the tap
(2) Larger bubble shrinks and smaller bubble increases in size till they become equal in size
(3)Smaller bubble gradually collapses and the bigger one increases in size
(4) None of the above

14. A cylinder with a movable piston contains air under a pressure p_1 and a soap bubble of radius 'r'. The pressure p_2 to which the air should be compressed by slowly pushing the piston into the cylinder for the soap bubble to reduce its radius by half will be : (The surface tension is σ, and the temperature T is maintained constant)
(1) $\left[8p_1+\frac{24\sigma}{r}\right]$ (2) $\left[4p_1+\frac{24\sigma}{r}\right]$ (3) $\left[2p_1+\frac{24\sigma}{r}\right]$ (4) $\left[2p_1+\frac{12\sigma}{r}\right]$

15. In a vessel equal masses of alcohol (sp. gravity 0.8) and water are mixed together. A capillary tube of radius 1 mm is dipped vertically in it. If the mixture rises to a height 5 cm in the capillary tube, the surface tension of the mixture is :
(1) 217.9 dyne/cm (2) 234.18 dyne/cm (3) 107.9 dyne/cm (4) 10.79 dyne/cm

16. Three surfaces of liquids are shown here. Find the correct statements :

(1) the surface tension of liquid A is infinite and such a surface is not possible practically.
(2) in case of liquid B, the resultant force on a molecule on the surface would be downward, and the surface is concave.
(3) in case of liquid C, the resultant force due to surface tension is directed downwards
(4) the surfaces of all three liquids A, B and C are in equilibrium and so the net force due to surface tension in the same

17. A water drop of diameter 8 mm is formed in air. The surface tension of liquid is 30 dyne/cm. The excess pressure inside the water drop is :
(1) 150 dyne/cm^2 (2) 300 dyne/cm^2 (3) 3×10^{-3} dyne/cm^2 (4) 12 dyne/cm^2

18. Two water droplets combine to form a large drop. In this process energy is :
(1) liberated (2) absorbed
(3) neither liberated nor absorbed (4) sometimes liberated and sometimes absorbed

19. A spherical liquid drop of radius R is divided into 8 equal droplets. If the surface tension is T, then work done in the process will be :
(1) $2\pi R^2T$ (2) $3\pi R^2T$ (3) $4\pi R^2T$ (4) $2\pi RT^2$

20. A soap bubble in vacuum has a radius of 3 cm and another soap bubble in vacuum has a radius of 4 cm. If the two bubbles coalesce under isothermal conditions then the radius of the new bubble is :
(1) 2.3 cm (2) 4.5 cm (3) 5 cm (4) 7 cm

21. The shape of a liquid drop becomes spherical due to its :
(1) surface tension (2) density (3) viscosity (4) temperature

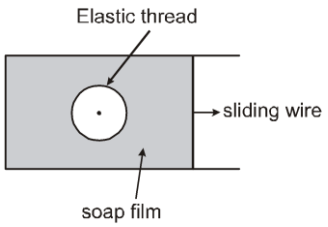
22. The energy required to blow a bubble of radius 8 cm and 5 cm in the same liquid is in the ratio of :
(1) 4 : 3 (2) 8 : 5 (3) 64 : 25 (4) 64 : 27

23. When a large bubble rises from the bottom of a lake to the surface. Its radius triples. If atmospheric pressure is equal to that of column of water height H, then the depth of lake is :
(1) 7H (2) 8H (3) 26H (4) 27 H

24. Surface tension of liquid is 5×10^{-2} N/m. If its surface area is increased by 2 cm^2, then the increase in surface energy will be :
(1) 10^{-3} J (2) 5×10^{-3} J (3) 10^{-2} J (4) 10 J

25. In a capillary tube, water rises to a height of 2 cm. The height of water that will rise in another capillary tube of radius one-fourth that of first is :
(1) 2 cm (2) 3 cm (3) 6 cm (4) 8 cm

26. 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 of the circle formed by elastic thread will
(1) increase (2) decrease
(3) remain same (4) data insufficient



27. 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 xylum tube in a 10 m high coconut tree so that water can rise to the top. (surface tension of water = 0.1N/m, Angle of contact of water with xylem tube= 60°)
(1) 1 cm (2) 1 mm (3) 10 µm (4) 1 µm

28. A vertical capillary tube with inner radius 0.5 mm, is submerged into water so that the length of its part above the water surface is h = 25 mm. Radius of curvature of meniscuses formed will be (surface tension of water = 0.075 N/m. Density of water = 10^3 kg/m^3, angle of contact = 0^o)
(1) 0.5 mm (2) 0.6 mm (3) 0.7 mm (4) 0.8 mm

29. A long capillary tube of radius r = 0.288 mm open at both ends is filled with water and placed vertically. What will be the height of the column of water left in the capillary (in cm). The thickness of the capillary

walls is negligible. (surface tension of water is 72 dyne/cm, g = 1000 cm/sec^2 and density of water is 1 g/cm^3)

(1) 4 (2) 6 (3) 8 (4) 10

30. A vertical glass tube of small radius open at both ends contains some water. Which of the following shapes is not possible for the water in the tube (angle of contact between water and glass is acute) :

(1)  (2)  (3)  (4) 

Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

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

PART - II : PRACTICE QUESTIONS

1. A thin wire is bent in the form of a ring of diameter 3.0 cm. The ring is placed horizontally on the surface of soap solution and then raised up slowly. Upward force necessary to break the vertical film formed between the ring and the solution is –

(1) 6πT dyne (2) 2πT dyne (3) 4πT dyne (4) 3πT dyne

2. A soap bubble of diameter 8 mm is formed in air. The surface tension of liquid is 30 dyne/cm. The excess pressure inside the soap bubble is :

(1) 150 dyne/cm^2 (2) 300 dyne/cm^2 (3) 3×10^{-3} dyne/cm^2 (4) 12 dyne/cm^2

3. The energy required to blow a bubble of radius 4 cm and 3 cm in the same liquid is in the ratio of :

(1) 4 : 3 (2) 3 : 4 (3) 16 : 9 (4) 64 : 27

4. A number of small drops of mercury adiabatically coalesce to form a single drop. The temperature of the drop will

(1) increase (2) remain same (3) decrease (4) depend on size.

5. A spherical soap bubble of radius 1.0 cm is formed inside another of radius 2 cm. If a single soap bubble is formed which maintains the same pressure difference as inside the smaller and outside the larger bubble, the radius of this bubble is

(1) 0.005 m (2) 0.05 m (3) 0.0067 m (4) 0.067 m

6. When a large bubble rises from the bottom of a lake to the surface. Its radius doubles. If atmospheric pressure is equal to that of column of water height H, then the depth of lake is :

(1) H (2) 2H (3) 7H (4) 8 H

7. Surface tension of liquid is T. If its surface area is increased by A, then the increase in surface energy will be :

(1) AT (2) A/T (3) A^2T (4) A^2T^2

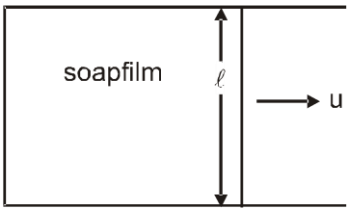
8. When a capillary tube is immersed in water, then it rises up to height of 3cm. If the surface tension of water is 75×10^{-3} N/m. Then the diameter of capillary tube will be :
(1) 0.1 mm (2) 0.5 mm (3) 1 mm (4) 2 mm

9. In a capillary tube, water rises to a height of 2 cm. The height of water that will rise in another capillary tube of radius one-third that of first is :
(1) 2 cm (2) 3 cm (3) 6 cm (4) 0.67 cm

10. The diameter of one drop of water is 0.2 cm. The work done in breaking one drop into 1000 droplets will be (surface tension of water is $T = 7 \times 10^{-2}$ N/m) :
(1) 7.9×10^{-6} J (2) 5.92×10^{-6} J (3) 2.92×10^{-6} J (4) 1.92×10^{-6} J

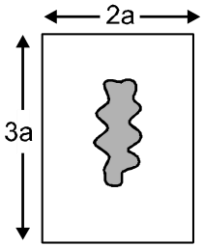
11. If η represents the coefficient of viscosity and T the surface tension, then the dimension of $\frac{T}{\eta}$ is same as that of :
(1) length (2) mass (3) time (4) speed

12. A soap film is created in a small wire frame as shown in the figure. The sliding wire of mass m is given a velocity u to the right and assume that u is small enough so that film does not break. Plane of the film is horizontal and surface tension is T. Then time to regain the original position of wire is equal to :



(1) $\frac{um}{T\ell}$
(2) $\frac{T\ell}{um}$
(3) $\frac{mu^2}{\ell T}$
(4) It will never regain original position

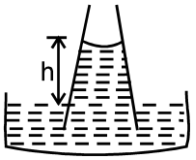
13. A rectangular massless blade (as shown in figure) is placed on a water surface (surface tension $T = \frac{1}{7} \times 10^{-1}$ N/m). Perimeter of the middle opening is 4a. Minimum force needed to lift this blade–up is (a = 5cm)



(1) 0.01 (2) 0.04 (3) 0.05 (4) 0.15

14. There is a uniform rectangular wire frame having a thin film of soap solution. A massless thin wire of radius R and area of cross section A is placed on the surface of film, and inside portion of the film is pricked. If surface tension of soap solution is S and Young's modulus of wire is Y then change in radius of the wire is:
(1) $\frac{SR^2}{AY}$ (2) $\frac{2SR^2}{AY}$ (3) $\frac{SR^2}{3AY}$ (4) $\frac{4SR^2}{AY}$

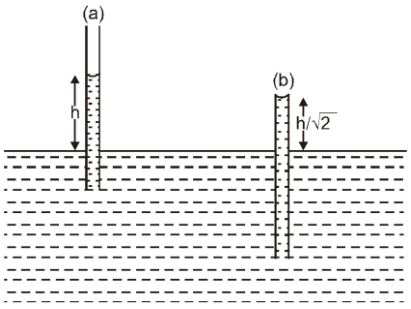
15. A capillary of the shape as shown is dipped in a liquid. Contact angle between the liquid and the capillary is 0^0 and effect of liquid inside the meniscus is to be neglected. T is surface tension of the liquid, r is radius of the meniscus, g is acceleration due to gravity and ρ is density of the 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) of any value depending upon act

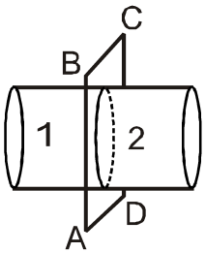
16. Two different vertical positions (a) & (b) of a capillary tube are shown in figure with the lower end inside water. For position (a), contact angle is $\frac{\pi}{4}$rad & water rises to height h above the surface of water while for position (b) height of the tube outside water is kept insufficient & equal to $\frac{h}{\sqrt{2}}$ then contact angle becomes :



(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{3}$

(3) $\frac{\pi}{4}$ (4) $\frac{3\pi}{4}$

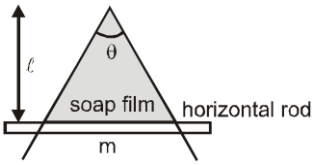
17. A waterjet of radius R is shown in the figure. The force between the parts1 and part 2 at the section ABCD due to the surface tension is : (Assume that, T is surface tension)



(1) $2\pi RT$ (2) πR^2T

(3) $2\pi RT+\pi R^2T$ (4) $4\pi RT$

18. A wire is bend at an angle θ. A rod of mass m can slide along the bended wire without friction as shown in figure. If a soap film is maintained in the frame and frame is kept in a vertical position and rod is in equilibrium. If rod is displaced slightly in vertical direction. The time period of small oscillation is $a\pi\sqrt{\frac{b\ell}{g}}$ sec. where a and b are constant number then a+b is

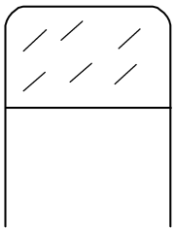


(1) 2 (2) 3 (3) 5 (4) 8

19. A metallic wire of density d floats horizontally in water. The maximum radius of the wire such that it may not sink will be (surface tension of water = T) (Neglect buoyant force)

(1) $\sqrt{\frac{2T}{\pi dg}}$ (2) $\sqrt{2\pi Tdg}$ (3) $\sqrt{\frac{2\pi T}{dg}}$ (4) $\sqrt{\frac{dg}{2\pi T}}$

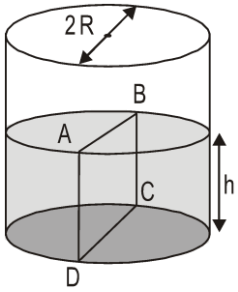
20. Consider a U–shaped frame with a sliding wire of length ℓ and mass 'm' on its arm. It is dipped in a soap solution, takenout and placed in vertical position as shown in figure. Choose minimum value of m so that wire does not descend : (Surface tension of soap solution is S)



(1) $\frac{2S\ell}{g}$ (2) $\frac{S\ell}{g}$

(3) $\frac{S\ell}{2g}$ (4) $\frac{S\ell}{4g}$

21. 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 other side 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) $\left|P_0\pi R^2+R\rho gh^2+2RT\right|$

APSP Answers

PART-I

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

PART -II

1.	(1)	**2.**	(2)	**3.**	(3)	**4.**	(1)	**5.**	(3)	**6.**	(3)	**7.**	(1)
8.	(3)	**9.**	(3)	**10.**	(1)	**11.**	(4)	**12.**	(1)	**13.**	(1)	**14.**	(2)
15.	(2)	**16.**	(2)	**17.**	(1)	**18.**	(2)	**19.**	(1)	**20.**	(4)	**21.**	(2)