Exercise - II (SUBJECTIVE PROBLEMS)

1. A film of water is formed between two straight parallel wires each 10 cm long and at separattion 0.5 cm. Calculate the work required to increase 1 mm distance between wires. Surface tension of water = 72×10^{-3} Nm^{-1}

2. Water rises in a capillary upto a certain height such that the upward force of surface tension balances the force of 75×10^{-4} N due to weight of the liquid. If the surface tension of water is 6×10^{-2} Nm^{-1}, what must be the internal circumfernece of the capillary ?

3. A ring cut from a platinum tube, 8.5 cm internal diameter and 8.7 cm exernal diameter, is supported horizonally from the pair of a balance so that it comes in contact with the water in a vessel. If an extra weight of 3.97 g is required to pull it away from water, calculate the surface tension of water.

4. There is a soap bubble of radius 2.4×10^{-4} m in air cylinder which is originally at the pressure of 10^5 Nm^{-2}. The air in the cylinder is now compressed isothermally until the radius of the bubble is halved. Calculate now the pressure of air in the cylinder. The surface tension of the soap solution is 0.08 Nm^{-1}

5. Two separate air bubbles (radii 0.002 m and 0.004 m) formed of the same liquid (surface tension 0.07 N/m) come together to form a double bubble . Find the radius and the sense of curvature of the internal film surface common to both the bubbles.

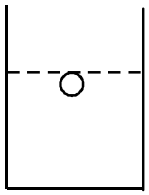
6. Two soap bubbles of radii a and b combine to form a single bubble of radius c. If the external pressure is P, then the surface tension of soap solution is

7. A long capillary tube of radius 2 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 ? The thickness of the capillary walls is negligible. Surface tension of water 73.5×10^{-3} Nm^{-1}

8. The limbs of a manometer consist of uniform capillary tubes of radii 1.44×10^{-3} m and 7.2×10^{-4} m. Find out the correct pressure difference if the level of the liquid (density 10^3 kgm^{-3}, surface tension 72×10^{-3} Nm^{-1}) in the narrower tube stands 0.2 m above that in the broader tube.

9. A glass capillary sealed at the upper end is of length 0.11 m and internal diameter 2×10^{-5} m. The tube is immersed vertically into a liquid of surface tension 5.06×10^{-2} Nm^{-1}. To what length the capillary has to be immersed so that the liquid level inside and outside and capillary becomes the same ? What will happen to liquid level inside the capillary if the seal is now broken ? Atmopsheric pressure is 1.012×10^5 Nm^{-2}.

10. A ball is given velocity v_0 (greater than the terminal velocity v_T) in downward direction inside a highly viscous liquid placed inside a large container. The height of liquid in the container is H. The ball attains the terminal velocity just before striking at the bottom of the container. Draw graph between velocity of the ball and distance moved by the ball before getting terminal velocity.



11. Two arms of a U-tube have unequal diameters d_1 = 1.0 mm and d_2 = 1.0 cm. If water (surface tension 7×10^{-2}N/m) is poured into the tube held in the vertical position, find the difference of level of water in the U-tube. Assume the angle of contact to be zero.

12. A spherical ball of radius 1×10^{-4} m and density 10^4 kg/m^3 falls freely under gravity through a distance h before entering a tank of water. If after entering the water the velocity of the ball does not change, find h. The viscosity of water is 9.8×10^{-6} N-s/m^2.

13. An expansible balloon filled with air floats on the surface of a lake with 2/3 of its volume submerged. How deep must it be sunk in the water so that it is just in equilibrium neither sinking further nor rising ? It is assumed that the temperature of the water is constant & that the height of the water barometer is 9 meters.