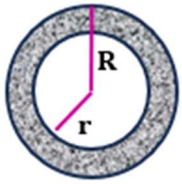
4. a. What do you understand by angle of contact? On what factors does it depend? When is the angle of contact obtuse, acute or zero degree?
   b. What causes the liquid fall or rise in a capillary tube? Derive an expression for the rise or fall of a liquid in a capillary tube.
   c. A capillary tube of 0.3 m diameter is placed vertically inside a liquid of density 800 kgm^{-3} surface tension 5 x 10^{-4} Nm^{-1} and angle of contact 30°. Calculate the height to which the liquid rises in the capillary tube. [Ans: 7.2 × 10^{-7} m]
   d. What should be the pressure inside air bubble of 0.1 mm radius situated just below the water surface? Surface tension of water =7.2×10^{-2} Nm^{-1} and atmospheric pressure = 1.013× 10^5 Nm^{-2}. [Ans: 1.027 x 10^5 Nm^{-2}]



5. A disc made of paper having radius R has a hole of radius r. It is floating on a liquid of surface tension T. Calculate the force of surface tension.
6. Water rises in a capillary tube to a height of 2.5 cm. In another capillary tube whose radius is one-third of it, how much the water will rise? If the first capillary is inclined at an angle 30° With the vertical, then what will be the position of water in the tube? [Ans. 7.5 cm, 2.89 cm]
7. A soap bubble has a diameter of 4 mm. Calculate the pressure inside it if the atmospheric pressure is 10 Nm^{-2} (surface tension of soap solution = 2.8 x 10^{-2} Nm^{-1}] (ii) Estimate the total surface energy of million drops of water each of radius 1 x 10^{-4} m, if the surface tension of water is 7 x 10^{-2} Nm^{-1}. [Ans: 1.00056×10^5 Nm^{-2}, 8.8 x 10^{-3} J]
8. The bubbles in a bubble chamber are found with an average radius 1×10^{-6}m. They grow to a radius of 1×10^{-5} m in 2 μs. Calculate the mean rate at which the pressure in the bubble is changing during their growth. [Surface tension of liquid in chamber = 8x10^{-3} Nm^{-1}] [Ans: -7.2×10^9 $Nm^{-2}s^{-1}$]
9. A clean glass capillary tube of internal diameter 0.04 cm is held vertically with its lower end below the surface of clean water in a beaker and with 10 cm of the tube above the surface. To what height will the water rise in the tube? What will happen if the tube is now depressed until only 5 cm of its length is the above the surface. The surface tension of water is 7.2 x 10^{-2} Nm^{-1} [Ans: 0.072 m, 46^0]
10. Two soap bubbles, one of radius 50 mm and the other of radius 80 mm, are brought together so that they have a common interface. Calculate the radius of curvature of this interface. [Ans: 0.133 m]
    [Hint: Radius of interface, $R = \frac{R_1 R_2}{R_1 - R_2}$] [$R_1 is\ larger\ radius$]
11. The water rises to a height of 8 cm above the outside level when a long clean capillary tube is dipped into a beaker of clean water then withdrawn. Explain what happens when a capillary tube of the same diameter but length 4 cm is dipped into the water. [Ans: 60^0]

Stoke's formula

12. a. State and explain stroke's law and deduce it from dimensional analysis.
    b. Two spherical rain drops of equal size are falling vertically through air with a certain terminal velocity. If these two drops were to coalesce to form a single drop and fall with a new terminal velocity, explain how the terminal velocity of the new drop compares to the original terminal velocity.
    c. A solid ball of volume V, dropped in a viscous liquid experience a viscous force F, when moves with certain velocity. If the solid ball of volume 8V dropped in same liquid, moves with equal velocity then calculate the viscous force.