4.1 - Surface Tension

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- (1999) Explain in terms of surface energy, what is meant by the surface tension, γ of a liquid.
- (1999) What energy is required to form a soap bubble of radius 1.00 mm if the surface tension of the soap solution is $2.5 \times 10\ E - 4\ \ \mathrm{N/m^2}$?
- (2000) Find the work done required to break up a drop of water of radius 0.5 cm into drops of water each having radius of 1.0 mm, assuming isothermal condition.
- (2010) State surface tension In terms of energy.
- (2010) The Surface tension of water at 20°C is $7.28 \times 10^{-2} N/m^2$. The vapor pressure of water at this temperature is 2.33×10^3 Pa Determine the radius of smallest spherical water droplet which it can form without evaporating
- (2010) A circular ring of thin wire 3 cm in radius is suspended with its plane horizontal by a thread passing through the 10 cm mark of a metre rule pivoted at its centre and is balanced by 8 g weight suspended at the 80 cm mark. When the ring is just brought in contact with the surface of a liquid, the 8 g weight has to be moved to the 90 cm mark to just detach the ring from the liquid. Find the surface tension of the liquid (assume zero angle of contact.)
- (2013) Using the method of dimensions, indicate which of the following equations are dimensionally correct and which are not, given that, f = frequency, γ = surface tension, ρ = density, r = radius and k = dimensionless constant.
  - $\rho^2 = k\sqrt{r^3 f/\gamma}$
  - $f = (kr^3\sqrt{\gamma})/(\rho^{1/2})$
  - $f = (k\gamma^{1/2})/(\sqrt{\rho}r^{3/2})$
- (2013) Distinguish surface tension from surface energy.
- (2013) Explain the phenomenon of surface tension in terms of the molecular theory.
- (2013) A clean open ended glass U-tube has vertical limbs one of which has a uniform internal diameter of 4.0 mm and the other of 20.0 mm. Mercury is poured into the tube; and observed that the height of mercury column in the two limbs ts different.
  - Explain this observation
  - Calculate the difference in levels
- (2016) Define the following terms:

  - Free surface energy
  - Capillary action
  - Angle of contact

- (2016) Briefly explain the following observations:
  - Soap solution is a better cleansing agent than ordinary water.
  - When a piece of chalk is put into water, it emits bubbles in all directions.

- (2016) Two spherical soap bubbles are combined. If v is the change in volume of the contained air, A is the change in total surface area, show that $3P_AV + 4AT = 0$. Where T is the surface tension and P_A is the atmospheric pressure.

- (2016) There is a soap bubble of radius 3.6×10^{-4} m in air cylinder which is originally at a pressure of 10^5 N/m^2 . The air in the cylinder is now compressed isothermally until the radius of the bubble is halved. Calculate the pressure of air in the cylinder.

- (2017) Define free surface energy in relation to the quid surface.
  - Explain what will happen if two bubbles of unequal radii are joined by a tube without bursting.

- (2017) A spherical drop of mercury of radius 5 mm falls on the ground and breaks into 1000 droplets. Calculate the work done in breaking the drop.

- (2018) Mention any two factors which affect the surface tension of the liquid and in each case explain two typical examples.

- (2018) Why molecules on the surface of a liquid have more potential energy than those within the liquid? Briefly explain.

- (2018) Derive an expression for excess pressure inside a soap bubble of radius R and surface tension γ when the pressures inside and outside the bubble are P_2 and P_1 respectively.

- (2018) A soap bubble has a diameter of 5 mm. Calculate the pressure inside it if the atmospheric pressure is 10^5 Pa and the surface tension of a soap solution is 2.8×10^{-2} N/m.

- (2018) Water rises up in a glass capillary tube up to a height of 9.0 cm while mercury falls down by 3.4 cm in the same capillary. Assume angles of contact for water-glass and . mercury-glass as $0°$ and $135°$ respectively. Determine the ratio of surface tensions of mercury and water.