Liquid State Questions

1. Define the surface tension of liquid. Describe the drop number method for the determination of the surface tension of a liquid.
2. What is the importance surface tension in daily life?
3. Addition of $NaNO_2$ increases the surface tension of water while the addition of detergent decreases it. Explain.
4. Explain why drop of a liquid is spherical.
5. Write short note on viscosity.
6. How does viscosity vary with temperature?
7. "While the viscosity of a gas increases with increase in temperature, that of a liquid decreases with increase in temperature". How would you account for it.
8. A capillary tube of internal diameter 0.21 mm is dipped into a liquid whose density is 0.79 g cm^{-3}. The liquid rises in this capillary to a height of 6.30 cm. Calculate the surface tension of the liquid. (g = 980 cm sec^{-2}).
9. How high will sap rise in a plant if the capillaries are 0.01 mm diameter, the density of the fluid is 1.3 g cm^{-3} and its surface tension 0.065 Nm^{-1}. (g = 981 cm s^{-2})
10. In the determination of surface tension of a liquid by the drop-number method, it gives 55 drops while water gave 25 drops for the same volume. The densities of the liquid and water are 0.996 and 0.800 g/cm^3 respectively. Find the surface tension of the liquid if that of water is 72.0 dynes/cm.
11. The surface tension of ethanol at 30 ºC is 2.189 X 10^{-2} N m^{-1} and its density = 0.780 g/cc. To what height will this liquid rise in a capillary tube of radius 0.002 cm? What pressure is needed to push the miniscus level back with the surrounding liquid?
12. The surface tension of water at 21ºC is 72.75 X 10^{-3} N m^{-1}. A 33.24% (vol./vol.) solution of ethanol has γ = 33.24 X 10^{-3} N m^{-1} at the same temperature. Given density (solution) = 0.9614 X 10^3 kg m^{-3} and density (water) = 0.9982 X 103 kg m^{-3}. How much less will the alcohol solution rise in the same capillary? Angle of contact, Θ= 0º.
13. In the determination of the surface tension of a liquid A by the drop number method, equal volumes of A and water gave 60 and 20 drops, respectively. Calculate the surface tension A if density of A and water are 0.896 and 0.964 g/cm^{-3} respectively. Given surface tension of water is 72.75X10^{-3} Nm^{-1}.
14. In an experiment with Ostwald viscometer, the times of flow of water and ethanol are 80 sec and 175 sec at 20ºC. The density of water = 0.998 g/cm^3 and that of ethanol = 0.790 g/cm^3. The viscosity of water at 20 ºC is 0.01008 poise. Calculate the viscosity of ethanol.
15. In an experiment with Ostwald viscometer, pure water took 1.52 minutes to flow through the capillary at 20ºC. For the same volume of another liquid of density 0.80 g cm^{-3} the flow time was 2.25 minutes. Find the relative viscosity of the liquid and its absolute viscosity in centipoise. Density of water at 20 ºC is 0.9982 and absolute viscosity of water is 1.005 centipoise.
16. The water flow time for an Ostwald viscometer is 59.2 sec at 25 ºC. If 46.2 sec are required for the same volume of ethyl benzene (density = 0.867 g cm^{-3}) to flow through the capillary, calculate its viscosity at 25 ºC, that of water being 0.00895 poise at the same temperature.
17. With the given viscometer, the times of flow at 20ºC for water and an unknown liquid (d = 1.22 g/cm^3) were found to be 155 sec and 80 sec respectively. Calculate the absolute viscosity of the unknown liquid at 20ºC if viscosity and density of water are 1.005 centipoise and 1g/cm^3 respectively.
18. Benzene takes 46 sec to flow through an Ostwald's viscometer while water takes 68 sec at the same temperature. If the densities are 0.8 g/mL and 0.998 g/mL respectively and the coefficient of viscosity of water is 1.008 X 10^{-3} Pa s, calculate the coefficient of viscosity of benzene.