PRAYAG PUBLIC SCHOOL
Winter Vacation Homework (2023-24)
Subject: Physics
Class -11th

Short Answer Type Questions

1. The sap in trees, which consists mainly of water in summer, rises in a system of capillaries of radius $r = 2.5\times10^{-5}$ m. The surface tension of sap is $T = 7.28 * 10^{-2}$ Nm^{-1} and the angle of contact is 0°. Does surface tension alone account for the supply of water to the top of all trees?
2. The free surface of oil in a tanker, at rest, is horizontal. If the tanker starts accelerating the free surface will be titled by an angle θ. If the acceleration is a m s^{-2}, what will be the slope of the free surface?.
3. Two mercury droplets of radii 0.1 cm. and 0.2 cm. collapse into one single drop. What amount of energy is released? The surface tension of mercury $T= 435.5 \times 10^{-3}$ N m^{-1}.
4. If a drop of liquid breaks into smaller droplets, it results in lowering of temperature of the droplets. Let a drop of radius R, break into N
   small droplets each of radius r. Estimate the drop in temperature.
5. The surface tension and vapour pressure of water at 20°C is 7.28×10^{-2} Nm^{-1} and 2.33×10^{3} Pa, respectively. What is the radius of the smallest spherical water droplet which can form without evaporating at 20°C?

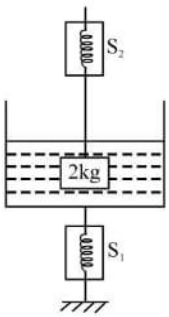
Long Answer Type Questions

1. (a) Pressure decreases as one ascends the atmosphere. If the density of air is ρ, what is the change in pressure dp over a differential height dh?
   (b) Considering the pressure p to be proportional to the density, find the pressure p at a height h if the pressure on the surface of the earth is p_0.
   (c) If $p_0 = 1.03 \times 10^5$ N m^{-2}, $\rho_0 = 1.29$ kg m^{-3} and g = 9.8 m s^{-2}, at what height will the pressure drop to (1/10) the value at the surface of the earth?
   (d) This model of the atmosphere works for relatively small distances. Identify the underlying assumption that limits the model.

3. A U-tube is partially filled with water. Oil is poured in to one side until its stands at a height of 0.5cm above the water level, on the other side. On water side the level rises by 6.5 cm from its original level. Density of oil is

1) 650 kg/m^3 2) 425 kg/m^3 3) 800 kg/m^3 4) 960 kg/m^3

4. A beaker containing water is kept on a spring balance. The mass of water and beaker is 5kg. A block of mass 2kg and specific gravity 10 is suspended by means of thread from a spring balance as shown. The reading of scales S_1 and S_2 are respectively. (Take $g = 10\frac{m}{s^2}$).



1) 52N and 20N 2) 50N and 18N 3) 52N and 18N 4) 52N and 22N

SURFACE TENSION

5. A film of water is formed between two straight parallel wires of length 10cm each separated by 0.5cm. If the separation is increased by 1mm, while the wires maintain their parallelism, how much work will have to be done $\left(\text{S.T.of water} = 7.2\times10^{-2}\frac{N}{m}\right)$

1) $7.22\times10^{-6}J$ 2) $1.44\times10^{-5}J$

3) $2.88\times10^{-5}J$ 4) $5.76\times10^{-5}J$

6. The surface tension of a liquid is $5Nm^{-1}$. If a thin film is formed on a loop of area 0.02 m^2, then its surface energy will be

1) $5\times10^{-2}J$ 2) $2\times10^{-1}J$ 3) $2.5\times10^{-2}J$ 4) $3\times10^{-1}J$

7. Surface tension of soap solution is $25\times10^{-3}\frac{N}{m}$. The excess pressure inside a soap bubble of diameter 1cm is:

1) 20 Atmosphere 2) 20 Pa

3) 20N 4) 10 Atmosphere

8. If the surface tension of water is $0.061Nm^{-1}$, then the capillary rise in a glass tube of diameter 1mm is:

1) 1.22 cm 2) 2.44 cm 3) 3.12 cm 4) 3.86 cm

9. The surface tension of soap solution is 0.03 Nm^{-1}. The work done in blowing a soap bubble of surface area 40 cm^2 is:

1) $1.2\times10^{-4}J$ 2) $2.4\times10^{-4}J$

3) $12\times10^{-4}J$ 4) $24\times10^{-4}J$

10. The mass of water which rises in a capillary tube of radius r is M. Then the mass of water which rises in a capillary tube of radius 3r will be:

1) $\frac{M}{3}$ 2) M 3) 3M 4) 6M