Exercise - III

JEE PROBLEMS

1. When an air bubble rises from the bottom of a deep lake to a point just below the water surface, the pressure of air inside the bubble

(A) is greater than the pressure outside it
(B) is less than the pressure outside it
(C) increases as the bubble moves up
(D) decreases as the bubble moves up

2. Assertion : A helium filled balloon does not rise indefinately in air but halts after a certain height.
Reason : Viscosity opposes the motion of balloon.
Choose any one of the following four responses :
(A) if both (A) and (R) are true and (R) is the correct explanation of (A)
(B) if both (A) and (R) are true but (R) is not correct explanation of (A)
(C) if (A) is true but (R) is false
(D) if (A) is false and (R) is true

3. A tiny spherical oil drop carrying a net charge q is balanced in still air with a vertical uniform electric field of strength $\frac{81\pi}{7} \times 10^5\ Vm^{-1}$. When the field is switched off, the drop is observed to fall with terminal velocity $2 \times 10^{-3}\ ms^{-1}$ Given $g = 9.8\ ms^{-2}$, viscosity of the air = $1.8 \times 10^{-5}\ Ns\ m^{-2}$ and the density of oil = $900\ kg\ m^{-5}$, the magnitude of q is :

(A) $1.6 \times 10^{-19}C$ (B) $3.2 \times 10^{-19}C$
(C) $4.8 \times 10^{-19}C$ (D) $8.0 \times 10^{-19}C$

[JEE 2010]

Paragraph for questions 4 to 6

When liquid medicine of density ρ is to be put in the eye, it is done with the help of a dropper. As the bulb on the top of the dropper is pressed, a drop forms at the opening of the dropper. We wish to estimate the size of the drop. We first assume that the drop formed at the opening is spherical because that requires a minimum increase in its surface energy. To determine the size, we calculate the net vertical force due to the surface tension T when the radius of the drop is R. When this force becomes smaller than the weight of the drop, the drop gets detached from the dropper.

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4. If the radius of the opening of the dropper is r, the vertical force due to the surface tension on the drop of radius R (assuming r << R) is

(A) $2\pi r T$ (B) $2\pi R T$ (C) $\frac{2\pi r^2 T}{R}$ (D) $\frac{2\pi R^2 T}{r}$

5. If $r = 5 \times 10^{-4}m$, $\rho = 10^3\ kgm^{-3}$, $g = 10\ ms^{-2}$, $T = 0.11\ Nm^{-1}$, the radius of the drop when it detaches from the dropper is approximately.

(A) 1.4×10^{-3} m (B) 3.3×10^{-3} m
(C) 2.0×10^{-3} m (D) 4.1×10^{-3} m

6. After the drop detaches, its surface energy is :

(A) 1.4×10^{-6} J (B) 2.7×10^{-6} J
(C) 5.4×10^{-6} J (D) 8.1×10^{-6} J