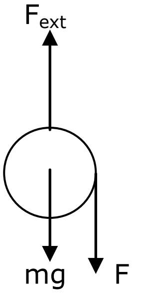
Q- Calculate the force required to pull a copper ball of radius 2.00cm upward through a fluid at the constant speed 9.00 cm/s. Take the drag force to be proportional to the speed, with proportionality constant 0.950 kg/s. Ignore the buoyant force.

The drag force is proportional to the speed and hence given by



F = k*v [here k is constant of proportionality]

At a speed of 9.00 cm/s = 0.09 m/s the drag force will be

F = 0.950*0.09 = 0.0855 N

Let the external force with which the ball is pulled up is F_{ext} then the forces acting on the ball are

(1) The external force F_{ext} upward

(2) The weight mg of the ball downward and

(3) the drag force F downward.

The mass of the ball is given by the product of its volume and the density hence

$$m = \frac{4}{3}\pi R^3 * \rho = \frac{4}{3} * 3.1416 * (2.0 * 10^{-2} m)^3 * 8.96 * 10^3 kgm^{-3} = 0.300 \text{ kg}$$

[$(4\pi/3)R^3$ is the volume of sphere and the density of copper can be found in the tables given in the books or search table on www.widipedia.org]

Hence the weight of the ball mg = 0.300*9.8 = 2.94 N

Now under these three forces the ball is moving with constant velocity means that the forces are balanced and hence

F_{ext} - mg - F = 0

Or F_{ext} = mg + F = 2.94 + .0855 = 3.0255 N upward.