

Q 3. An object falling through a fluid is observed to have acceleration given by $a = g - bv$ where $g =$ gravitational acceleration and b is constant. After a long time of release, it is observed to fall with constant speed. What must be the value of the constant speed?

Sol: Key concept: If a spherical body of radius r is dropped in a viscous fluid, it is first accelerated and then its acceleration becomes zero and it attains a constant velocity called terminal velocity.

According to the problem, acceleration of object is given by the relation

$$a = g - bv$$

When speed becomes constant acceleration $a = dv/dt = 0$ (uniform motion),

where, $g =$ gravitational acceleration

Clearly, from above equation as speed increases acceleration will decrease. At a certain speed say v_0 , acceleration will be zero and speed will remain constant. Hence, $a = g - bv_0 = 0 \Rightarrow v_0 = g/b$