1. A spherical ball of salt is dissolving in water in such a manner that the rate of decrease of the volume at any instant is proportional to the surface. Prove that the radius is decreasing at a constant rate.

Sol. Let the radius of the spherical ball of the salt at any time t be r.

Then surface area at any time t is $S = 4\pi r^2$

According to the question,

$$\frac{dV}{dt} \propto S, \text{ where } V = \text{volume}$$

$$\Rightarrow \quad \frac{d}{dt}\left(\frac{4}{3}\pi r^3\right) \propto 4\pi r^2$$

$$\Rightarrow \quad \frac{4}{3}\pi \cdot 3r^2 \cdot \frac{dr}{dt} = k(4\pi r^2) \quad \text{[Where, } k \text{ is the proportional constant]}$$

$$\Rightarrow \quad \frac{dr}{dt} = k$$

$\Rightarrow$ the radius is decreasing at a constant rate.