A spherical iron ball of 10 cm radius is coated with a layer of ice of uniform thickness that melts at a rate of 50 cm^3/min. When the thickness of ice is 5 cm, then the rate (in cm/min.) at which of the thickness of ice decreases, is:

[Main Jan. 9, 2020 (I)]

[Main April 10, 2019 (II)]

(a) $\frac{5}{6\pi}$ (c) $\frac{1}{36\pi}$

(b) $\frac{1}{54\pi}$ (d) $\frac{1}{18\pi}$

(d) Let the thickness of ice layer be = x cm

Total volume $V = \frac{4}{3}\pi(10+x)^3$

$$\frac{dV}{dt} = 4\pi(10+x)^2\frac{dx}{dt} \quad \text{...(i)}$$

Since, it is given that

$$\frac{dV}{dt} = 50\ \text{cm}^3/\text{min} \quad \text{...(ii)}$$

From (i) and (ii), $50 = 4\pi(10+x)$

$\Rightarrow 50 = 4\pi(10+5)^2\frac{dx}{dt}$ [Q thickness of ice $x = 5$]

$\Rightarrow \frac{dx}{dt} = \frac{1}{18\pi}\text{cm/min}$