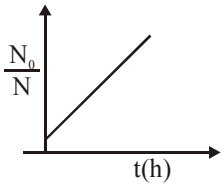
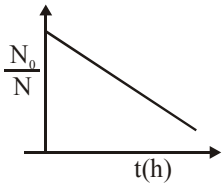
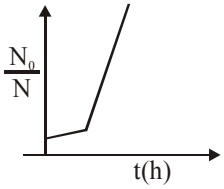
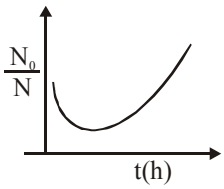
RADIOACTIVITY

1. A bacterial infection in an internal wound grows as $N'(t) = N_0 \exp(t)$, where the time t is in hours. A dose of antibiotic, taken orally, needs 1 hour to reach the wound. Once it reaches there, the bacterial population goes down as $\frac{dN}{dt} = -5N^2$. What will be the plot of $\frac{N_0}{N}$ vs. t after 1 hour ?

(1) 

(2) 

(3) 

(4) 

SOLUTION

1. Ans. (1)

Sol. From 0 to 1 hour, $N' = N_0 e^t$

From 1 hour onwards $\frac{dN}{dt} = -5N^2$

So at t = 1 hour, $N' = eN_0$

$$\frac{dN}{dt} = -5N^2$$

$$\int_{eN_0}^{N} N^{-2}\, dN = -5\int_{1}^{t} dt$$

$$\frac{1}{N} - \frac{1}{eN_0} = 5(t-1)$$

$$\frac{N_0}{N} - \frac{1}{e} = 5N_0\,(t-1)$$

$$\frac{N_0}{N} = 5N_0(t-1) + \frac{1}{e}$$

$$\frac{N_0}{N} = 5N_0 t + \left(\frac{1}{e} - 5N_0\right)$$

which is following y = mx + C