GATE 2023 CH-58

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Question: A fresh catalyst is loaded into a reactor before the start of the following catalytic reaction:

$$A \rightarrow \text{Products}$$

The catalyst gets deactivated over time. The instantaneous activity $a(t)$, at time t, is defined as the ratio of the rate of reaction $-r_A(t)$ (mol.$(g_{\text{cat}})^{-1}\text{hr}^{-1}$) to the rate of reaction with fresh catalyst. Controlled experimental measurements led to an empirical correlation:

$$-r_A(t)' = -0.5t + 10$$

where t is in hours. The activity of the catalyst at $t = 10$ hours is given by (rounded off to one decimal place): (GATE 2023 CH)