Assignment 4

The student is required to complete assignment 4 and submit it by the deadline.

1. The probability of radioactive decay of an atom is given as

\[ P = \frac{1}{\lambda t} \]

where \( \lambda \) is the decay constant and \( t \) is the time. If the decay constant \( \lambda = 0.1 \) and time \( t = 5 \) seconds, what is the probability of decay?

2. The rate of a chemical reaction is given by \( R = k [A][B] \) where \( k \) is the rate constant, \( [A] \) and \( [B] \) are the concentrations of the reactants. If \( k = 0.01 \) M\(^{-1}\)s\(^{-1} \), \( [A] = 0.5 \) M, and \( [B] = 0.5 \) M, what is the rate of the reaction?

3. The efficiency of a solar cell is given by \( \eta = \frac{P_{out}}{P_{in}} \) where \( P_{out} \) is the power output and \( P_{in} \) is the power input. If the power output is 0.5 W and the power input is 1 W, what is the efficiency of the solar cell?

4. The magnetic field at a point is given by \( B = \frac{\mu_0 I}{2\pi r} \) where \( \mu_0 \) is the magnetic constant, \( I \) is the current, and \( r \) is the distance from the current. If \( \mu_0 = 4\pi \times 10^{-7} \) Tm/A, \( I = 1 \) A, and \( r = 1 \) m, what is the magnetic field at that point?

5. The electric field at a point is given by \( E = \frac{q}{4\pi \varepsilon_0 r^2} \) where \( q \) is the charge, \( \varepsilon_0 \) is the permittivity of free space, and \( r \) is the distance from the charge. If \( q = 1 \) C, \( \varepsilon_0 = 8.85 \times 10^{-12} \) F/m, and \( r = 1 \) m, what is the electric field at that point?