Problem 1.

Estimate how close an H_3O^+ ion and a hydrated electron must be to interact

Solution

$$\begin{aligned} R_e &= 2.1\,\text{Å} \\ R_{H_3O^+} &= 0.3\,\text{Å} \\ R_{rxn} &= R_e + R_{H_3O^+} \\ &= 2.4\,\text{Å} \end{aligned}$$

Problem 2.

A $50\,\mathrm{cm}^3$ sample of water is given a dose of $50\,\mathrm{mGy}$ from $10\,\mathrm{keV}$ electrons. If the yield of H_2O_2 is $G = 1.81$ per $100\,\mathrm{eV}$, how many molecules of H_2O_2 are produced in the sample?

Solution

$$\frac{50\,\mathrm{J}}{1\times10^3\,\mathrm{kg}} \times 50\,\mathrm{cm}^3 \times \frac{1\,\mathrm{g H_2O}}{1\,\mathrm{cm^3 H_2O}} \times \frac{1\,\mathrm{kg}}{1\times10^3\,\mathrm{g}} \times \frac{1\,\mathrm{eV}}{1.6\times10^{-19}\,\mathrm{J}} = 2.82\times10^{14}$$

Problem 3.

During the chemical stage of radiolysis of water, what is the only chemical reaction to add reactivity to the system?

Solution

$$H_3O^+ + e^-_{aq} \rightarrow H_2O + \bullet H$$

Problem 4.

During what phase of the cell cycle is the genetic material replicated?

Solution

Interphase