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Problem 30.65 (RHK)

Let the potential difference between the high potential inner shell of a Van de Graff accelerator and the point at which charges are sprayed onto the moving belt be $3.41\ \text{MV}$. *If the belt transfers charge to the shell at the rate of* $2.83\ \text{mC s}^{-1}$, *we have to calculate the minimum power that must be provided to drive the belt.*

Solution:

The potential difference between the high-potential inner shell of the Van de Graff accelerator and the point at which charges are sprayed is $3.41\ \text{MV}$. The belt transfers charge to the shell at the rate of $2.83\ \text{mC s}^{-1}$.

The amount of energy required per second in moving $2.83\ \text{mC}$ of charge across a potential difference of $3.41\ \text{MV}$ will be

$$P = 3.41\times10^{6}\times2.83\times10^{-3}\ \text{CV s}^{-1} = 9.65\times10^{3}\ \text{J s}^{-1} = 9.65\ \text{kW}.$$