J99Q.3—Electron Transition out of a Square Well

Problem

An electron is in the ground state of a finite but very deep one-dimensional square well,

$$V(x) = \begin{cases} -V_0 & \text{for } 0 < x < a \\ 0 & \text{otherwise,} \end{cases}$$

where V_0 and a are positive constants. A weak electric field $\vec{\varepsilon} = \varepsilon_0 \hat{x} sin(\omega t)$ is switched on at t=0, and the electron is excited out of the well.

a) What is the momentum p of the electron after the transition?

b) What is the transition rate?