

①

a) False

$$H\psi_1 = E_1\psi_1 \quad \& \quad H\psi_2 = E_2\psi_2 \quad (E_1 \neq E_2)$$

If $\psi = c_1\psi_1 + c_2\psi_2$ $H\psi = E_1c_1\psi_1 + E_2c_2\psi_2 \neq \lambda\psi$

b) True

$$i\hbar \frac{\partial \psi_1}{\partial t} = H\psi_1 \quad i\hbar \frac{\partial \psi_2}{\partial t} = H\psi_2$$

Multiply the two equations by c_1 and c_2 and add them together. Then it is easy to see that $\psi = c_1\psi_1 + c_2\psi_2$ is a solution, too.

②

The transition probability from any state of this system to any other state is zero at any t (including $t = +\infty$). This is because matrix element $f'_f_i = \langle f | f'_i | i \rangle = V_0 \langle f_i | i \rangle = 0$ vanishes for our f'_i (which is a constant).