

## Reflective Homework

(1) Consider the following statement: “The eigenstates of position are orthogonal to the eigenstates of energy”. Explain clearly why you agree or disagree with the statement.

(2) Consider the following statement: “If an electron in a one-dimensional infinite square well is initially in a position eigenstate, the expectation value of an observable  $Q$  will be time-independent if and only if  $[\hat{x}, \hat{Q}] = 0$ ” where  $\hat{x}$  is the position operator. Explain why you agree or disagree with the statement.

(3) Consider the following statement: “If the expectation value of an observable  $Q$  is zero in the initial state, then the expectation value  $\langle \hat{Q} \rangle$  cannot have any time-dependence.” Explain why you agree or disagree with the statement.

(4) A particle is interacting with a one-dimensional harmonic oscillator potential energy well. Under what conditions will the expectation value of an operator  $\hat{Q}$  (no explicit time dependence) depend on time if

(a) the particle is initially in a momentum eigenstate.

(b) the particle is initially in an energy eigenstate.

Justify your answer in both cases.