

ASG-3

1. Show that in the momentum basis, the position operator takes the form $i\hbar \vec{\nabla}_p$.

2. Prove that $\frac{d\langle \vec{p} \rangle}{dt} = -\langle \vec{\nabla} V \rangle$ $V \equiv$ potential.

3. Consider a one-dimensional potential:

$$\begin{aligned} V(x) &= -V_0, & |x| < a \\ &= 0 & |x| > a. \end{aligned}$$

- Find the wave function for this system, for energy $-E_1$: $-V_0 < -E_1 < 0$.

- Can E_1 take any value in that range?

4. Consider another one dimensional potential:

$$\begin{aligned} V(x) &= 0, & x < 0 \\ &= V_0, & x > 0. \end{aligned}$$

- Find wave function for energy E : $0 < E < V_0$.

- Is there any constraint on E ?