Inclass 18.1. (a) For a free particle with $H = \frac{p^2}{2m}$, determine $\left[\hat{p}, \widehat{H}\right]$.

(b) For a simple harmonic oscillator with $H = \frac{p^2}{2m} + \frac{1}{2}kx^2$, determine $\left[\hat{p}, \widehat{H}\right]$.

Inclass 18.2. Given $\frac{d<A>}{dt} = \frac{i}{\hbar}\int dx\,[(\widehat{H}\psi)^*\hat{A}\psi - \psi^*\hat{A}\widehat{H}\,\psi)]$

Show that $\frac{d<A>}{dt} = \frac{i}{\hbar}\int \psi^*[\widehat{H},\hat{A}]\psi\,dx \equiv \frac{i}{\hbar} < [\widehat{H},\hat{A}] >$

(Hint: make use the Hermitian property of $\widehat{H}$.)

Inclass 18.3. For Hamiltonian $H = \frac{p^2}{2m} + V(x)$, show that

$$\frac{d < p >}{dt} = < -\frac{\partial V}{\partial x} >$$ (Ehrenfest's equation)

Inclass 18.4. For Hamiltonian $H = \frac{p^2}{2m} + V(x)$, show that

$$\frac{d < x >}{dt} = < p > /m$$