Classically, the rate of change of position of the particle is the velocity
ie $\frac{dx}{dt} = v = \frac{p}{m}$
which is consistent with the quantum mechanical $\frac{d}{dt}\langle x\rangle_\psi = \frac{\langle p\rangle_\psi}{m}$
(The rate of change of expectation position is equal to the expectation velocity)

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4) The concept of measurement is right at the heart of quantum mechanics. In many ways, quantum mechanics pinned down the philosophical basis of the concept of measurement.

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The one dimensional simple harmonic oscillator (SHM) is a source of particular interest, as it is simpler than and displays many of the characteristics of real physical systems. For example, energy is quantized, and the effect of measurement on the system is the same. If the system is in an energy eigenstate, so that we can write down the equation $H\psi = E\psi$, (where H is the Hamiltonian operator, ψ is the eigenfunction and E is the energy eigenvalue), and a measurement of the energy will return the energy eigenvalue E, with absolute certainty. The measurement will not disturb the system and after the measurement the system will remain in the eigenstate. A subsequent measurement of the energy will also return the same energy eigenvalue.

same as what?

need defining for S.H.O.

ie $E_n = (n+\frac{1}{2})\hbar\omega$
$\hat{H} = \ldots$

Generally however, at any time the system will exist in a superposition of possible eigenstates. The wavefunction will take the form $\Psi = \sum a_n \psi_n$, where the a_n are the quantum amplitudes satisfying $\sum |a_n|^2 = 1$. An energy measurement will disturb this system, for-