Question 1: Which single concept can capture all mechanisms of line broadening?
Answer 1: All line broadening mechanisms can be described in terms of a timescale, by virtue of the Fourier theorem. This timescale is generally the correlation time associated with coherent observation of the phase evolution of our system.

Question 2: When using the Ramsey method to do spectroscopy on an atomic beam, is the linewidth limited by the interaction time (set by the atomic velocity and the separation between interrogations L, t = L/v) or by the natural lifetime $1/\Gamma$?
Answer 2: The linewidth is limited by the interaction time. Spontaneous emission does not happen for every atom at $t=1/\Gamma$, indeed some live well into the exponential tail. It is possible to beat the linewidth set by Γ using the Ramsey method!

Question 3: Suppose we have a two-level atom (with an excited state ω_{ge} above the ground state) of mass M at rest. We then shine a single mode laser on the atom and scan its frequency ω until the atom is excited. Is $\omega = \omega_{ge}$? Why or why not?
Answer 3: No, since the laser must provide enough energy to account for both internal excitation of the atom, and the kinetic energy due to the photon recoil hbar*k, so that $\omega = \omega_{ge} + hbar*k^2/2M$.

Question 4: Suppose we have two mechanisms of line broadening acting on the same gas of atoms. Mechanism 1 (M1) is Gaussian distributed and 1 GHz wide, while M2 is Lorentzian distributed and 1 MHz wide. M1 therefore dominates the overall linewidth. Where can we ignore M2, and where must we be more careful?
Answer 4: It is safe to ignore M2 near the resonance, where the Gaussian is still the dominant source of line broadening. But a Lorentzian falls off much more slowly than a Gaussian does, so we must be careful about neglecting M2 once we look at the response far away from the resonance.