A Few Questions…

1) In a metal :
   a) $1/T_1$ is constant
   b) $1/T_1T$ is constant
   c) $1/T_1T$ is diverging at low T
   d) $1/T_1T$ is constant if the e^- are weakly correlated
   e) $1/T_1T$ is constant if the e^- are strongly correlated

2) The decay of the echo amplitude $E(2\tau)$ is observed to be gaussian. One concludes that the decay rate $1/T_2$:
   a) is proportional to $\chi(q=0,\omega=0)$
   b) is proportional to $\chi'(Q,\omega=0)$, where Q is a critical wave-vector
   c) is proportional to $\Sigma_q \chi'(q,\omega=0)$
   d) is related to the second moment of the hyperfine field distribution

3) In an S=1/2 antiferromagnet on a square-lattice one observes that above 100 K $1/T_1$ of ^{29}Si is constant and equal to 1000 s^{-1}. Knowing that ^{29}Si hyperfine coupling is a scalar and equal to 10 kOe, estimate the exchange coupling among S=1/2 spins (^{29}Si gyromagnetic ratio is 8.459 MHz/Tesla) .

4) A peak in the T dependence of $1/T_1$ indicates :
   a) a phase transition
   b) that the system is an insulator
   c) that the system is a strongly correlated metal
   d) a slowing down of the fluctuations to the MHz range and/or an increase in their amplitude
   e) a slowing down of the fluctuations and/or an increase in their amplitude

5) At a second order phase transition one always observe a peak in $1/T_1$
   a) Yes (why ?)
   b) No (why ?)

6) $1/T_1$ is sensitive only to spin fluctuations at frequencies in the radiofrequency range.
   a) Yes (why ?)
   b) No (why?)

7) Consider a crystal of a frustrated magnet. In general the paramagnetic shift ΔK of I nuclei is proportional to:
   a) The magnetic field
   b) The static uniform spin susceptibility
   c) The macroscopic magnetization
   d) The average magnetic moment of the spins coupled to the I nuclei

8) A compound upon chemical doping shows a crossover from an AF insulator to a Fermi gas regime. Assuming that the hyperfine coupling is only slightly affected by doping, say if $1/T_1$ at RT ($>> J_{AF}$) should:
    a) increase
    b) decrease

9) A reduction of $1/T_1T$ upon decreasing T is not compatible with:
    a) A spin gap
    b) A long-range magnetic order
    c) Extreme slowing down of the fluctuations
    d) A one-dimensional S=1/2 AF

10) A peak in the T dependence of $1/T_2$, the echo decay rate, indicates :
    a) a phase transition
    b) that the system is an insulator
    c) that the system is a strongly correlated metal
    d) a slowing down of the fluctuations and/or an increase in their amplitude
    e) a slowing down of the fluctuations to well below the MHz range and/or an increase in their amplitude