HW10

1. A "smart" $T1$ contrast agent has an "on" state with relaxivity $R1_{on}$ and an "off" state with relaxivity $R1_{off}$, and is used at concentration c. Assuming a background $T1$ (in the absence of agent) of $T1_0$, what value of TR will maximize the $T1$-weighted gradient echo signal change produced by this agent, and what will the signal change be, as a percentage of the signal with the agent in its "off" state?

2. Explain with reference to the Solomon-Bloembergen-Morgan equations how and why the following physical parameters affect the *inner sphere* relaxivity of a $T1$ contrast agent:
    (a) molecular size of the agent
    (b) number of coordination sites available for water binding
    (c) exchange rate of water molecules off the paramagnetic metal
    (d) magnetic field at which $T1$ is measured