

EXPERIMENTS

This brief section will suggest a series of experiments that can be carried out using your spectrometer. This is by no means an encyclopedic list; rather a collection of experiments that will provide a challenging experience to undergraduate and graduate students. They all require reading of the literature for a thorough physical explanation.

A. T_1 and T_2 in water doped with paramagnetic ions.

Paramagnetic ions, with their large electronic magnetic moment, profoundly effect relaxation times of the protons in water. The materials are easy to obtain and reasonably safe to handle. Paramagnetic ions that dissolve in water are: CuSO_4 and $\text{Fe}(\text{NO}_3)_3$. Effects can be measured over a wide range of concentrations.

B. T_1 and T_2 in Glycerin and water mixtures

Glycerin and water mix in any ratio. The motion of the protons in glycerin is significantly changed by the change of the liquid viscosity with the addition of water. The relaxation times can be correlated with the viscosity of the liquid, as well as the water concentration.

C. T_1 and T_2 in mineral oil with solvents.

The relaxation times of protons in mineral oil diluted with organic solvents shows effects of diffusion and correlation's times.

D. T_1 and T_2 in Petroleum Jelly

Vaseline is not a solid. The two relaxation times indicate fast molecular motion which is characteristic of a liquid. Sample can be heated and T_1 , as well as T_2 can be estimated as the sample cools to room temperature. Other organic greases with sufficient proton concentrations can also be studied.

E. Biological Materials

Most biological materials have proton, usually in water molecules. Measurements of T_1 and T_2 in biological materials gives detailed information about the local environment of these water molecules. This area of exploration is wide open. This might be an area appropriate for an undergraduate research participation project.

F. Natural Products

All types of natural products contain water which can be studied by this spectrometer. Use your imagination.

G. Other Magnetic Nuclei

Should you have your own electromagnetic with sufficient stability, homogeneity, and field, you can use the PS1-A to study PNMR in other nuclei. The easiest is Fluorine, which requires a 6% higher field than our magnet, but the alkali metal (Na, K, Li, Rb) provide interesting systems. Other nuclei might also be attempted.