Problem R-312. Below are presented variable temperature 56.4 MHz $^{19}$F NMR spectra of SeF$_4$. From your knowledge of structure of compounds like SF$_4$ and SeF$_4$ interpret the NMR spectra.

What conclusion can be drawn form the observation that the +20 °C spectrum does not show the weak peaks flanking the low temperature triplets (see expansion)? (Z. Anorg. Allg. Chem. 1975. 416, 12).
**Problem R-312.** This type of hypervalent molecule has trigonal bipyramidal structure, with one site unoccupied. At -140 °C the molecule is static on the NMR time scale (slow Berry pseudorotation), giving an A₂X₂ pattern consisting of two triplets, with δₐ = 37.7 and δₓ = 12.1, Jₐₓ = 26 Hz.

The absence of ⁷⁷Se satellites in the high-temperature spectrum means that the exchange must be intermolecular (fluorine transfer between molecules), which would cause loss of Se-F coupling in addition to averaging of the chemical shifts. A Berry pseudorotation mechanism would retain the Se-F coupling, and the final coalesced singlet would have singlet ⁷⁷Se satellites on the fluorine NMR peak. Their separation would be the average of the two low-temperature J values.