• The circled H will appear downfield of all others and should be easy to pick out. What chemical shift do you anticipate for this H?
• Recall that the t-butyl group provides a conformational lock. Thus, axial H’s will remain axial, and equatorial H’s will remain equatorial.
• There’s a plane of symmetry that runs through the center of the molecule - passing through C-1 and C-4. Thus, the axial H’s at C-2 and C-6 are equivalent and will couple equally with the proton at C-1, producing a triplet. Similarly, the equatorial H’s at C-2 and C-6 are also equivalent, and will couple equally with the proton at C-1. Once again, a triplet will be observed.

Taken together, one ought to observe a douplet of triplets for the proton at C-1.

Now ... let’s refine our answer.

In A, one will find one large coupling (180° dihedral angle between axial H’s on adjacent C’s, and one smaller coupling (dihedral angle of 60°). Assume the larger is 10 Hz and the smaller is 4 Hz. Can you draw the expected pattern? Please do.

In B, one sees dihedral angles of 60° to the proton at C-1. Thus, one would expect to see two small coupling constants of nearly equal magnitude, leading to a pattern that would resemble a pentuplet.