Sample Question Set 4.

1. For each of the atomic term symbols ^{1}S, ^{2}P, ^{3}P, ^{3}D, ^{4}D, write down:

a) The associated values of the total spin and orbital angular momentum quantum numbers, *S* and *L*;

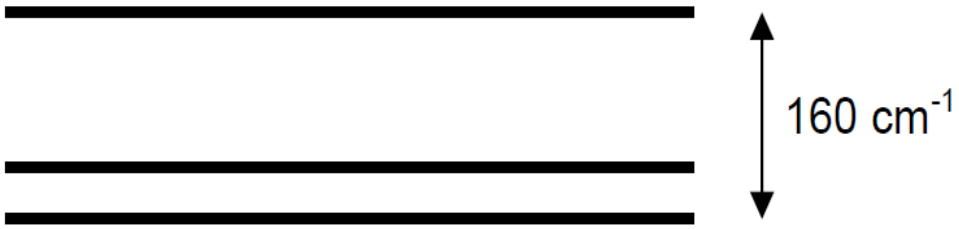
b) the possible values of *J*, the total angular momentum quantum number; and

c) the number of states associated with each value of *J*.

2. Derive the structure of a molecule A_2B_2 for which the Infra-Red and Raman lines are given below. Assign the vibrational modes for each spectral lines.

Frequency (cm-1)		
2976	Raman (str)	
2703		IR(str, PR contour)
1285	Raman (v str)	
526		IR (v str, PQR)
400		IR (w)

3.. The $3s^2 3p^1 4p^1$ configuration of an excited state of the Si atom leads to a state with orbital angular momentum $L = 1$ and which is split by spin-orbit coupling into the levels shown below.



b. Deduce possible term symbols for the three levels and indicate the dipole allowed transitions which would arise in absorption from these levels when the 4*p* electron is excited into a 5*s* orbital.