Sample Question Set 4.

1. For each of the atomic term symbols ^1S, ^2P, ^3P, ^3D, ^4D, 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.

160 cm^{-1}

   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 $4p$ electron is excited into a $5s$ orbital.