

- Q-1/ Explain Born - Openheimer approximation
- 1) Explain degree of freedom.
  - 2) How many translational, rotational and vibrational degree of freedoms are shown by  $\text{CO}_2$  and  $\text{H}_2\text{O}$  molecules.
  - 3) Diagrammatically represents the different normal modes of vibrations of  $\text{CO}_2$  and  $\text{H}_2\text{O}$  molecules.

1/ Show that moment of inertia ( $I$ ) of a diatomic molecule is given by  $I = \mu r_0^2$ , where  $\mu$  is the reduced mass and  $r_0$  is the internuclear distance between the two atoms of the molecule. (9)

2017

2/ Derive the expression for the rotational energy of a diatomic molecule, taking it as rigid rotator. Draw the rotational energy level diagram for such a molecule. (10)

2017 3/ Explain the relative intensities of the lines obtained in the pure rotational spectrum. (7)

2017 4/ How the study of pure rotational spectrum of a diatomic molecule helps in the calculation of bond length (3)

2015

1/ Derive expression for the frequency (or wave number) of the rotational lines in a pure rotational spectrum. (10)

2015 2/ Explain that the various lines in the rotational spectra are equally spaced. (3)

Teacher's Signature : \_\_\_\_\_

## Electronic spectrum

2018

- 1) Explain the theory of electronic band spectra.  
How does electronic band spectra help in the calculation of dissociation energy of the molecules?

8+3

2017

- 1) Explain the electronic transition in  $\sigma$ ,  $\pi$  and  $n$  molecular orbitals. Explain how the intensity of an electronic bands depend upon the extent of overlap between the wave functions of the ground state and excited states? (12)

2016

- 1) Explain the formation of electronic band spectrum on the basis of potential energy curves. (10)

# Raman Spectrum

① What is Raman spectroscopy? Name different types of lines present in it and explain the reason for observing such lines. What are the advantages of Raman spectroscopy over infrared spectroscopy?

② Explain the vibrational rotational-vibrational Raman spectrum of diatomic molecules.

③ Explain the selection rules for pure rotational Raman spectra of diatomic molecule.

Discuss and write down the difference between Raman spectra and IR spectra.