

TYBSC Physics Paper III ( Atomic Physics) Sample Questions

1 Which of the statement is incorrect in case of Raman Effect?

- a) Raman shift is a characteristic of the substance
- b) Raman shift is dependent on the frequency of the incident radiation
- c) Raman lines are polarized
- d) Raman Effect is seen in homonuclear molecules also

2) For Carbon dioxide which of the statement is incorrect ?

- a) vibrational mode  $\nu_2$  is Raman active
- b) vibrational mode  $\nu_2$  is IR active
- c) vibrational mode  $\nu_3$  is IR active
- d) vibrational mode  $\nu_1$  is IR inactive

3) A Stokes line of wavelength 5540A was observed in a Raman Spectra when radiation of wavelength 5460 A was scattered by a medium . The frequency shift is\_\_\_\_\_

- a)  $7.93 \times 10^{14}$ Hz
- b)  $7.93 \times 10^{12}$ Hz
- c)  $79.3 \times 10^{12}$ Hz
- d)  $793 \times 10^{12}$ Hz

4) Which of these properties must change for a mode to be Raman active?

- a) Volume
- b) Dipole moment
- c) Polarisability
- d) Mass

5) One of them is not a spherical top molecule:

- a) Carbon Tetrachloride

- b) Sulphur Hexafluoride
- c) Methane
- d) Carbon dioxide

1) The rotational energy levels in a rigid rotator model of diatomic molecules are \_\_\_\_\_

- a) Equispaced energy levels
- b) random difference in the energy levels
- c) Not equispaced energy levels
- d) difference in the energy levels = 2 times a constant

2) If the rotational energy of the rigid rotator model of diatomic molecule is  $E_J = \frac{6\hbar^2}{2I}$ , then the value of rotational quantum number  $J =$  \_\_\_\_\_

- a) 0
- b) 1
- c) 2
- d) 3

3) \_\_\_\_\_ will exhibit rotational spectrum

- a) CO
- b) O<sub>2</sub>
- c) N<sub>2</sub>
- d) H<sub>2</sub>

4) Transitions between vibrational levels in diatomic molecules as SHO are restricted by the following \_\_\_\_\_ Selection rule :

- a)  $\Delta v = 0$
- b)  $\Delta v = \pm 1$
- c)  $\Delta v = \pm 2$
- d)  $\Delta v = \pm 3$

5) The frequency spacing between adjacent lines in P and R branches of Vibration-Rotation Spectra is \_\_\_\_\_

- a)  $\frac{2\hbar}{4\pi^2 I}$
- b)  $\frac{\hbar}{4\pi^2 I}$

c)  $\frac{h}{2\pi^2 I}$

d)  $\frac{h}{4\pi^2}$

- 1) The interaction between  $\vec{L}$  and  $\vec{S}$  is \_\_\_\_\_ in nature.
- Electrostatics
  - Neutral
  - Magnetic
  - Gravitational
- 2) For  $^3P_1$  state, the angle between  $\vec{L}$  and  $\vec{S}$  is \_\_\_\_\_ degrees.
- 122
  - 121
  - 120.5
  - 120
- 3) Electrons having same \_\_\_\_\_ and same \_\_\_\_\_ are called equivalent electrons.
- n and  $l$
  - n and  $m_l$
  - n and J
  - $m_l$  and J
- 4) The splitting of a spectral line, usually into four or more components in a \_\_\_\_\_ magnetic field is called Anomalous Zeeman effect .
- Strong
  - Very strong
  - Weak
  - Moderate
- 5) For state  $3^2S_{1/2}$  , the value of Lande's g-factor is \_\_\_\_\_
- 2
  - 5

c)1

d)1.23

1) The  $\Phi$ -part solution of the schrodinger's equation for hydrogen atom is \_\_\_\_\_

- a)  $\Phi = Ae^{im_l\phi}$
- b)  $\Phi = Ae^{i2\pi\phi}$
- c)  $\Phi = Ae^{m_l\phi}$
- d)  $\Phi = Ae^{i2\pi m_l\phi}$

2) The Orbital angular momentum of a hydrogen atom is \_\_\_\_\_

- a) Quantized in magnitude
- b) Quantized in direction
- c) Quantized in magnitude as well as direction
- d) Is not quantized

3) In Stern- Gerlach experiment, the magnetic field used was \_\_\_\_\_

- a) Homogenous
- b) Non homogenous
- c) Function of time
- d) Parallel to beam of silver atoms

4) The gyromagnetic ratio for an electron's orbital motion is given by \_\_\_\_\_

- a)  $g_l = \left(\frac{e}{2m}\right)$
- b)  $g_l = -\left(\frac{e}{2m}\right)$
- c)  $g_l = -\left(\frac{e}{m}\right)$
- d)  $g_l = \left(\frac{e}{m}\right)$

5) Which of the statement is incorrect ?

- a) The zenith probability density varies with angle  $\Theta$  for all states with non zero orbital quantum number
- b) The probability densities for all states are spherically symmetric
- c) The zenith probability density for zero orbital quantum number is  $\frac{1}{2}$
- d) The azimuthal probability density is a constant

