

(ii) Predict, how many types of P - Cl bonds are present in PCl_5 ?

(b) BeF_2 molecule is linear while SF_2 is angular although both are triatomic, explain.

(c) Discuss Fajan's rules in detail with suitable examples. (5,5,5)

6. Write short notes on (any three) –

(a) Physical significance of ψ and ψ^2

(b) Bohr's atomic model

(c) Shapes of d-orbitals

(d) Orbit and orbitals

(e) Application of Schrödinger wave equation to the hydrogen atom. (5,5,5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3016

I

Unique Paper Code : 2174001001

Name of the Paper : Atomic Structure and Chemical Bonding

Name of the Course : B.Sc. (H) / B.Sc. Prog

Semester : I / III / V

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any four questions out of six.
3. All questions carry equal marks.

1. (a) What are quantum numbers? How do they arise in the wave mechanical model of the atom?

- (b) Why electronic configurations of chromium and copper do not follow the general trend? Explain,
- (c) Calculate the wavelength associated with an electron moving with a velocity of 10 m s^{-1} . (Mass of electron $9.1 \times 10^{-31} \text{ kg}$)
- (d) What do you understand by normalization and orthogonality? (5,5,3,2)
2. (a) What do you understand by dual character of matter? Derive mathematically, de-Broglie's relation.
- (b) What are the main rules for filling of orbitals? Explain your answer with two suitable examples.
- (c) (i) What is $(n+1)$ rule? How does it help in building up of the elements?
- (ii) Which of the following is diamagnetic or paramagnetic?
 Al^{3+} , Co^{3+} , Ni^{2+} (5,5,5)
3. (a) Draw molecular orbital energy level diagram for NO molecule. Predict the bond order and magnetic behavior of the molecule.

- (b) What is resonance? Discuss in detail by considering the example of CO_3^{2-} ion.
- (c) What is Born-Haber cycle? How is it useful to explain the stability of ionic compounds?
- (d) XeF_2 is a linear molecule but sp^3d hybridized. Explain. (5,4,3,3)
4. (a) (i) Arrange the following in the decreasing order of the bond angle in the molecules –
 NH_3 PH_3 AsH_3
- (ii) Give the shape and geometry of ClF_3 molecule.
- (iii) What are electron deficient compounds?
- (b) The molecules of CH_4 , NH_3 and H_2O involve the same type of hybridization yet they possess different geometries. Explain in detail.
- (c) Why do electrons refrain from pairing until each orbital of the same kind has one electron? (6,5,4)
5. (a) (i) Based on molecular orbital theory, predict the existence of H_2^- ion.