7.12.18 (M)

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Roll No. | | | | | | | | | | | |

S. No. of Question Paper : 39

Unique Paper Code : 32171101 I

Name of the Paper : Inorganic Chemistry—I

Name of the Course : B.Sc. (H) Chemistry

Semester : I

Duration : 3 Hours Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *six* questions in all.

Question No. 1 is compulsory.

1. Explain any *five* of the following with suitable reason : 5×3

(*a*) Which is more covalent : NaCl *or* NaI ?

(*b*) Which has the greater bond dissociation energy : O_2 *or* O_2^+ ?

(*c*) All the three N-O bonds in NO_3^- are equal.

(*d*) Shape of dz^2 orbital is different from other *d*-orbitals.

(*e*) $BeCl_2$ has zero dipole moment while H_2S has some value.

(*f*) Which has greater melting point : *o*-nitrophenol *or* *p*-nitrophenol ?

P.T.O.

2. (*a*) Calculate the lattice energy of MgO (in $kJmol^{-1}$) :

Given : A = 1.7475; $r\ (Mg^{2+}) = 0.65$ Å; $r\ (O^{2-}) = 1.40$ Å; $n = 7$; $e = 4.8 \times 10^{-10}$ e.s.u.; $N = 6.02 \times 10^{23}$.

(*b*) Define resonance energy and draw the resonating structures of NO_3^- and N_3^-.

(*c*) Are 5*g* and 6*h* sub-shells possible ? Give reasons. If they are possible, show how many orbitals can be present in each sub-shells ? 4,4,4

3. (*a*) Give Allred and Rochow's scale of electronegativity. Calculate the electronegativity of silicon atom using this scale. The covalent radius of Si atom is 1.175 Å.

(*b*) What are isoelectronic ions ? How effective nuclear charge affects the radii of isoelectronic ions : N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+} ?

(*c*) The dipole moment of LiH is 1.964×10^{-29} Cm and bond length for LiH is 1.596 Å. What is the percent ionic character in LiH ? (Charge on one electron = 1.6×10^{-19} C). 4,4,4

4. (*a*) How do you arrive at Schrodinger wave equation for H-atom starting with simple sine wave equation ?

(*b*) Using Slater's rule, calculate Z* for :

(*i*) 3*d*

(*ii*) 4*s* electron in Co atom (Z = 27).

(*c*) Explain the shapes of the following molecules/ions according to VSEPR theory :

I_3^-, H_2O, BrF_2^+, ICl_4^-. 4,4,4

5. (*a*) Draw the MO energy level diagram for N_2^+. Discuss its bond order and magnetic behaviour. Why is the bond order in N_2^+ less than in N_2 molecule ?

(*b*) What are the four special properties which an acceptable wave function must have ? Why these restrictions are reasonable ?

(*c*) Using Pauling's method, calculate the radii of Na^+ and F^- ions. The observed internuclear distance in NaF crystal is 213 pm. 4,4,4

6. (*a*) Taking Z-axis as nuclear axis, explain whether the following orbitals will overlap to form molecular orbitals or not ?

(*i*) $s + p_x$

(*ii*) $p_x + d_{xy}$

(*iii*) $p_y + d_{x^2-y^2}$.

(*b*) Calculate the limiting radius ratio for the ionic compound when the coordination number of the cation is 4.

(*c*) What is a radial distribution function ? Draw this function for 1*s*, 2*p* and 3*s* orbitals. 4,4,4

7. (*a*) Draw the Born-Haber cycle for the formation of $CaCl_2$ and explain the various terms involved.

(*b*) State Pauli's exclusion principle. Using this principle, calculate the number of electrons in L shell.

(*c*) Define electronegativity. How the electronegativity varies with *s*-character in different hybridisation of organic compounds ? 4,4,4

8. Write short notes on any *three* of the following :

(*i*) Bent's Rule

(*ii*) Band theory of metallic bonding

(*iii*) Hund's rule of maximum multiplicity

(*iv*) Polarisation and polarisabilty. 3×4