



2018/TDC/ODD/CHMC-101T/077

TDC (CBCS) Odd Semester Exam., 2018

CHEMISTRY

(1st Semester)

Course No. : CHMHCC-101T

(Atomic Structure and Chemical Bonding)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

SECTION—A

(Marks : 20)

Answer **ten** questions, taking **two** from each Unit

UNIT—I

1. Write the electronic configuration of (i) Cr^{3+} ion and (ii) Fe^{2+} ion. 1+1=2

(2)



<http://www.elearninginfo.in> 3)

2. Designate the orbitals bearing quantum numbers : 1+1=2

(i) $n=2, l=1$

(ii) $n=3, l=2$

3. Atomic number of an element is 30. To which group, period and block of periodic table will it belong? 2

UNIT—II

4. First ionization energy of N_2 is higher than that of O_2 . Explain. 2

5. Which of the following elements has the lowest and which has the highest negative electron-gain enthalpy? 1+1=2

F, Cl, P, S

6. What is the difference between electron affinity and electronegativity? 2

UNIT—III

7. Write two important properties of ionic bond. 1+1=2

8. What is meant by 'resonance'? 2

9. Which of the following species are paramagnetic? 2
 H_2, H_2^+ and H_2^-

UNIT—IV

10. Using Fajan's rule, explain that Ag_2S is much less soluble than Ag_2O . 2

11. What is semiconductor? Mention the two main types of semiconductor. 1+1=2

12. Define hydrogen bond. Name the types of hydrogen bond. 1+1=2

UNIT—V

13. Explain the terms 'oxidizing agent' and 'reducing agent'. 1+1=2

14. Arrange the following in decreasing order of oxidation number of nitrogen : 2

N_2O, N_2O_4, NO, N_2O_3

15. Name the redox indicators. 1+1=2



SECTION—B

(Marks : 30)

Answer five questions, taking one from each Unit

UNIT—I

16. (a) What is meant by atomic orbitals? Name various types of atomic orbitals. 1+1=2
- (b) Mention one important application of the de Broglie concept. 1
- (c) State Heisenberg's uncertainty principle. Calculate the product of uncertainty in position and velocity of an electron in SI unit. 1+2=3
17. (a) Calculate the radius of first Bohr's orbit and energy of the electron of He^+ in the ground state. (The absolute permittivity in vacuum is $8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$, Planck's constant = $6.625 \times 10^{-34} \text{ Js}$, mass of electron = $9.1 \times 10^{-31} \text{ kg}$ and charge of electron = $1.6 \times 10^{-19} \text{ C}$) 3
- (b) Why is the wave function ψ called orbital wave function? 1
- (c) State Hund's rule of maximum multiplicity. 2

J9/1117

(Continued)

UNIT—II

18. (a) What is meant by ionic radii? How do they differ from atomic radii? 1+2=3
- (b) What do you mean by 'effective nuclear charge' of an atom? Calculate effective nuclear charge felt by a $2p$ electron of a nitrogen atom. 1+2=3
19. (a) Define electron affinity. Explain how it varies along a period and in a group. 1+2=3
- (b) Write a short note on Allred-Rochow electrostatic approach to electronegativity scale. 3

UNIT—III

20. (a) What is Born-Haber cycle? How can lattice energy of a solid be obtained with the help of it? 1+2=3
- (b) Write the MO electronic configuration of CO and draw the MO energy level diagram for CO molecule. 1+2=3
21. (a) Explain the concept of hybridization. Draw the shape of d^2sp^3 and dsp^2 hybrid orbitals. 1+1+1=3
- (b) What are bonding and antibonding molecular orbitals? 1+1=2

J9/1117

(Turn Over)



- (c) How do you express bond strength in terms of bond order? 1

UNIT—IV

22. (a) Explain the terms 'polarizing power' and 'polarisability' with suitable examples. 3
- (b) What are weak interactions? Explain different types of van der Waals' interaction with suitable examples. 3
23. (a) What is Fajans' rule? Use Fajans' rule to predict the salt having lower melting point from KI and CuI. 1+2=3
- (b) Calculate the percentage ionic character in HCl molecule if the observed dipole moment is $1.08D$ (bond length = 1.276 \AA and $1D = 3.336 \times 10^{-30} \text{ cm}$). 3

UNIT—V

24. (a) Define the term 'standard reduction potential'. 1
- (b) Balance the following equations by ion-electron method : $1\frac{1}{2} + 1\frac{1}{2} = 3$
- (i) $\text{Cr(OH)}_3 + \text{IO}_3^- + \text{OH}^- \rightarrow \text{I}^- + \text{CrO}_4^{2-} + \text{H}_2\text{O}$
- (ii) $\text{Br}_2 + \text{NaOH} \rightarrow \text{NaBr} + \text{NaBrO}_3 + \text{H}_2\text{O}$

- (c) What is stock notation? Give example. 2
25. (a) What are redox reactions? 1
- (b) Name the factors on which electrode potential depends. 2
- (c) Explain the principle involved in the estimation of Fe^{2+} ion by KMnO_4 . Write the necessary chemical reactions. 3
