

2017

(CBCS)

(1st Semester)

CHEMISTRY

FIRST PAPER

(Inorganic Chemistry—I)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(Marks : 50)

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

1. (a) State and explain Heisenberg's uncertainty principle. 3
- (b) Explain briefly the significance of principal quantum number and magnetic quantum number. 4

- (c) Discuss the radial probability distribution curves for electrons in 3s, 3p and 3d orbitals. 3

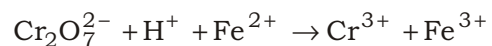
OR

2. (a) Write Schrödinger wave equation for hydrogen atom in Cartesian coordinates and explain the terms involved in it. 2
- (b) What is an atomic orbital? Give diagrammatic representation of the shape of p_x and $d_{x^2-y^2}$ orbitals. 3
- (c) State Aufbau principle. Use this principle to explain the filling of electrons in 4s orbital before 3d orbital. 2
- (d) What is meant by effective nuclear charge? Calculate the effective nuclear charge for a 3d electron and a 4s electron of a Cu atom. 3
3. (a) Explain how the change in effective nuclear charge affects covalent radius of elements. 2
- (b) Give reasons why the first ionization energy of nitrogen is higher than that of oxygen. 2

(3)

(c) Define ionisation energy. Explain by giving reasons how the ionisation energies of elements vary in a group. 1+2=3

(d) Balance the following redox reaction by ion-electron method : 3



OR

4. (a) What is meant by diagonal relationship? 2

(b) Define electron affinity. Explain why the electron affinity of fluorine is less than that of chlorine. 1+2=3

(c) Explain why a cation has higher value of electronegativity while an anion has lower value of electronegativity than the parent atom. 2

(d) Define equivalent weight of an oxidizing agent. Calculate the equivalent weight of KMnO_4 in acidic medium. Given that the molar mass of $\text{KMnO}_4 = 158$. 1+2=3

5. (a) Write the differences between a covalent bond and a coordinate bond. 2

(b) Discuss the hybridization of the central atom in SF_4 . 3

(4)

(c) Calculate the percentage of ionic character in HF molecule. Given that the electronegativity of fluorine and hydrogen are $\chi_F = 4.0$ and $\chi_H = 2.2$. 2

(d) Explain intermolecular hydrogen bonding giving suitable example. 3

OR

6. (a) Discuss how a polar covalent bond is intermediate between a pure covalent bond and a pure ionic bond. 3

(b) Using VSEPR theory, predict and draw the shape of the following molecules : 3

(i) ClF_3

(ii) PCl_3

(c) Explain why the boiling point of water is higher than that of other hydride of the elements of Group 16. 2

(d) Both BH_3 and NH_3 are tetra-atomic. The dipole moment of BH_3 is zero but NH_3 is having 1.49D. Give reason. 2

7. (a) Define the following terms with examples : $1\frac{1}{2} + 1\frac{1}{2} = 3$

(i) Ambidentate ligand

(ii) Coordination number

(5)

- (b) What is meant by geometrical isomerism? Write the geometrical isomers of $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$. 1+2=3
- (c) Why do square planar complexes rarely show optical isomerism? 2
- (d) Write the formula of the following coordination compounds : 1+1=2
- (i) Dichlorobis (ethylenediamine) cobalt (III)sulphate
- (ii) Sodium dicyanoaurate(I)

OR

8. (a) State effective atomic number (EAN) rule. Calculate the EAN for the central metal ion in $[\text{Co}(\text{NH}_3)_6]^{3+}$. 1+1=2
- (b) What do you mean by chelate? Give an example. 2
- (c) What are the necessary conditions for a molecule to show optical isomerism? Write the optical isomers given by the ion, $[\text{Pt}(\text{NH}_3)_2(\text{py})_2\text{Cl}_2]^{2+}$. 2+2=4

(6)

- (d) Write the IUPAC name of the following complexes : 1+1=2
- (i) $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$
- (ii) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

9. (a) Define curie. 1
- (b) What is meant by half-life period of a radioactive element? Show that half-life is independent of the amount of the substance. 1+2=3
- (c) Complete the following nuclear reactions : 2
- (i) ${}^{14}_7\text{N} + \dots \rightarrow {}^{17}_8\text{O} + {}^1_1\text{H}$
- (ii) ${}^{27}_{13}\text{Al} + \dots \rightarrow {}^{24}_{11}\text{Na} + {}^4_2\text{He}$
- (d) What are nuclear fission reactions? Write a short note on the release of energy in these reactions. 2+2=4

OR

10. (a) How is half-life period related with average life period of that element? 1
- (b) What do you mean by magic number nuclei? Give example of single magic number nuclei and double magic number nuclei. 1+2=3

(7)

(c) Explain the term 'binding energy'. How is binding energy per nucleon related to nuclear stability? 1+2=3

(d) Write a brief note on fast breeder reactors. 3

Subject Code : CHEM/I/EC/01

To be filled in by the Candidate

CBCS
DEGREE 1st Semester
(Arts / Science / Commerce /
.....) Exam., **2017**

Subject

Paper

INSTRUCTIONS TO CANDIDATES

1. **The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
2. **This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.**
3. **While answering the questions of this booklet, any cutting, erasing, overwriting or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

Booklet No. A

Date Stamp

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To be filled in by the Candidate

CBCS
DEGREE 1st Semester
(Arts / Science / Commerce /
.....) Exam., **2017**

Roll No.

Regn. No.

Subject

Paper

Descriptive Type

Booklet No. B

*Signature of
Scrutiniser(s)*

*Signature of
Examiner(s)*

*Signature of
Invigilator(s)*

/18

CHEM/I/EC/01

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(CBCS)

(1st Semester)

CHEMISTRY

FIRST PAPER

(Inorganic Chemistry—I)

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

SECTION—I

(Marks : 10)

Put a Tick (✓) mark against the correct answer in the
brackets provided : 1×10=10

1. The orbital with $n = 3$ and $l = 2$ is

(a) $3s$ ()

(b) $3p$ ()

(c) $3d$ ()

(d) $3f$ ()

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(2)

2. Which quantum number is not obtained from the solution of Schrödinger wave equation?

(a) Principal quantum number ()

(b) Spin quantum number ()

(c) Azimuthal quantum number ()

(d) Magnetic quantum number ()

3. Among the following species, the smallest is

(a) M ()

(b) M ()

(c) M ()

(d) M^2 ()

4. The oxidation state of C in NaHCO_3 is

(a) + 4 ()

(b) + 3 ()

(c) + 2 ()

(d) + 1 ()

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(3)

5. In sp^3d^2 hybridization, how many atomic orbitals are involved in the hybridization?

(a) 3 ()

(b) 4 ()

(c) 5 ()

(d) 6 ()

6. Among the following, the molecule having the highest dipole moment is

(a) HF ()

(b) HBr ()

(c) HCl ()

(d) HI ()

7. The number of ions produced when $K_4[Ni(CN)_4]$ dissolves in water is

(a) 3 ()

(b) 5 ()

(c) 6 ()

(d) 9 ()

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(4)

8. In the IUPAC nomenclature of coordination compounds, the symbol μ represents

(a) ambidentate ligand ()

(b) terminal ligand ()

(c) bridging ligand ()

(d) chelating ligand ()

9. When a radioactive element emits one α -particle, the newly-formed element gets shifted _____ in the Periodic Table.

(a) one place to the left ()

(b) one place to the right ()

(c) two places to the left ()

(d) two places to the right ()

10. The energy produced in the sun is due to

(a) photochemical reactions ()

(b) redox reactions ()

(c) nuclear fission reactions ()

(d) nuclear fusion reactions ()

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(5)

SECTION—II

(Marks : 15)

Answer the following questions :

3×5=15

1. What do you mean by dual character of matter?
Write de Broglie's equation.

OR

2. Differentiate between an orbit and an orbital.

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(6)

3. Differentiate between covalent radius and van der Waals' radius.

OR

4. Give reasons why the electronegativity of element increases on moving from left to right in a period.

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(7)

5. What are the favourable conditions for the formation of an ionic bond?

OR

6. Discuss sp^3 hybridization taking suitable example.

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(8)

7. Differentiate between double salt and coordination compounds giving examples.

OR

8. Explain polymerization isomerism giving suitable example.

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(9)

9. Write a short note on mass defect.

OR

10. What is meant by radioactive equilibrium? How does it differ from chemical equilibrium?

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