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(CBCS)

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)* Derive de Broglie's equation $\frac{h}{p}$. 2

(b) What do you understand by the dual character of matter? 1

(c) Calculate the wavelength of an electron of mass $9\;11\quad 10^{\;31}$ kg moving with a velocity of $2\;5\quad 10^{\;7}$ ms $^{\;1}$. (Given $h\quad 6\;63\quad 10^{\;34}$ J-s) 3

(d) Mention the significance of principal quantum number and azimuthal quantum number. 2+2=4

OR

2. *(a)* What values are assigned to quantum number n, l and m for *(i)* 1*s* and *(ii)* $2\,p_x$? 2

(b) What do you mean by radial probability distribution curve? Explain the radial probability curve for 1*s* and 2*s* orbitals. 1+2=3

(c) Give diagrammatic representations of the shape of *d*-orbitals. 2½

(d) Write a brief note on Hund's rule of maximum multiplicity and apply it to show the electronic configuration of nitrogen and oxygen. 2½

3. *(a)* Define ionization energy. Explain how it varies along a period in the periodic table. 1+2=3

(b) Explain how the radius of an anion is larger than that of its parent atom. 2

(c) Giving appropriate reasons, explain why the electron affinity value increases (more exothermic) from N O F in the periodic table. 2

(d) Calculate the oxidation number of sulphur in the following compounds : 1×3=3

$K_2S_2O_3$, $NaHSO_3$ and H_2SO_4

OR

4. *(a)* Explain how the atomic size and nuclear charge affect the electron affinity values of elements. 2

(b) Give reasons why the first ionization energy of tin is smaller than that of lead. 2

(c) Discuss the electronegativity of C-atom in CH_4, C_2H_4 and C_2H_2. 2

(d) Balance the following redox reaction by ion-electron method : 4

$MnO_4 \quad H \quad Fe^{2} \quad Mn^{2} \quad Fe^{3}$

5. *(a)* What are the factors on which the polarity of a polar covalent bond depends? 2

(b) How is an ionic bond different from a polar covalent bond? 2

(c) Explain the geometry of the following molecules on the basis of VSEPR theory : 1½+1½=3

ClF_3, $SnCl_2$

(d) Define dipole moment. Explain why the dipole moment of NH_3 is greater than that of NF_3. 1+2=3

OR

6. *(a)* Give reasons why H_2O boils at a much higher temperature than H_2S. 2

(b) What are the differences between a normal covalent bond and a coordinate bond? 2

(c) What is meant by hybridization? Discuss the hybridization of phosphorus in PCl_3. 1+3=4

(d) How is the concept of electronegativity used to predict the nature of a bond? 2

7. *(a)* Define the following : 1×2=2

(i) Coordination compound

(ii) Coordination sphere

(b) Mention the important postulates of Werner's theory of coordination compounds. Based on Werner's theory, draw the structure of $CoCl_3$ $5NH_3$ and predict its formula. 2+2=4

(c) Write the IUPAC name of the following complexes : 1×2=2

(i) $[Pt(NH_3)_4Cl_2][PtCl_4]$

(ii) $[Co(en)_2(ONO)Cl]NO_3$

(d) Which one of the complexes $[Pt(NH_3)_2Cl_2]$ or $[Pt(NH_3)_3Cl]$ will show geometrical isomerism? Write the possible geometrical isomers. 1+1=2

OR

8. (a) Give one example each of the following : ½×4=2

(i) Ambidentate ligand

(ii) Bidentate ligand

(iii) Tetradentate ligand

(iv) Hexadentate ligand

(b) What do you understand by chelate effect? 1½

(c) Why do tetrahedral complexes unable to exhibit geometrical isomerism? 1½

(d) Write the geometrical isomers of $[Co^3 (en)_2Cl_2]$ ion. Which of the isomers show(s) optical isomerism? Also write the possible optical isomers. 1+1+1=3

(e) Calculate EAN of the central metal ion in $[Fe(CN)_6]^4$ and $[Ni(en)_3]^2$. 1+1=2

9. (a) Differentiate between natural radio-activity and artificial radioactivity. 2

(b) Write a brief note on thermal nuclear reactors. 3

(c) What do you understand by packing fraction? Explain how the stability of a nuclide depends on the value of its packing fraction. 1+2=3

(d) State and explain the law of radioactive disintegration. 2

OR

10. (a) Balance the following nuclear transformations : 1×3=3

(i) $^{232}_{90}Th \quad ^{1}_{0}n \quad ^{233}_{91}Pa \quad \_\_\_\_$

(ii) $^{24}_{12}Mg \quad \_\_\_\_ \quad ^{27}_{14}Si \quad ^{1}_{0}n$

(iii) $^{22}_{11}Na \quad ^{22}_{10}Ne \quad \_\_\_\_$

(b) The half-life period of ^{226}Ra is 1580 years. How many grams will be left from 1·0 gram of the isotope after 4740 years? 2

(c) What are the differences between nuclear fission and nuclear fusion? 3

(d) How is the nuclear stability related to magic numbers? 2

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Subject Code :
CHEM/I/EC/01 (CBCS)

Booklet No. A

Date Stamp ....

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To be filled in by the Candidate

CBCS

DEGREE 1st Semester

(Arts / Science / Commerce /

.......................) Exam., **2016**

Subject ....

Paper ....

To be filled in by the Candidate

CBCS

DEGREE 1st Semester

(Arts / Science / Commerce /

.......................) Exam., **2016**

Roll No. ....

Regn. No. ....

Subject ....

Paper ....

Descriptive Type

Booklet No. B ....

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, over-writing 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.**

Signature of Scrutiniser(s)

Signature of Examiner(s)

Signature of Invigilator(s)

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CHEM/I/EC/01 (CBCS)

2 0 1 6

(CBCS)

CHEMISTRY

FIRST PAPER

(Inorganic Chemistry—I)

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 10)

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

1. The shape of *p*-orbital is

(a) spherical ( )

(b) dumbbell ( )

(c) oval ( )

(d) double dumbbell ( )

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2. Which of the following is not permissible arrangement of electrons in an atom?

(a) $n \quad 5, \; l \quad 3, \; m \quad 0, \; s \quad \frac{1}{2}$ ( )

(b) $n \quad 3, \; l \quad 2, \; m \quad 3, \; s \quad \frac{1}{2}$ ( )

(c) $n \quad 3, \; l \quad 2, \; m \quad 2, \; s \quad \frac{1}{2}$ ( )

(d) $n \quad 4, \; l \quad 0, \; m \quad 0, \; s \quad \frac{1}{2}$ ( )

3. The element with the highest electron affinity is

(a) fluorine ( )

(b) chlorine ( )

(c) oxygen ( )

(d) hydrogen ( )

4. Which of the following ions has the smallest ionic radius?

(a) Mg^{2} ( )

(b) Na ( )

(c) O^{2} ( )

(d) F ( )

5. The species having bond order different from that of CO is

(a) NO ( )

(b) NO ( )

(c) CN ( )

(d) N_2 ( )

6. The increasing order of the strength of hydrogen bond among HF, H_2O and NH_3 is

(a) O—H···O N—H···N F—H···F ( )

(b) F—H···F O—H···O N—H···N ( )

(c) N—H···N F—H···F O—H···O ( )

(d) N—H···N O—H···O F—H···F ( )

7. The coordination number of Co-ion in the complex $Na_3[Co(NO_2)_2Cl_2Br_2]$ is

(a) 6 ( )

(b) 5 ( )

(c) 4 ( )

(d) 3 ( )

8. The number of possible geometrical isomers for the complex $[Pt(NO_2)(py)(NH_2OH)(NH_3)]$ is

(a) 2 ( )

(b) 3 ( )

(c) 4 ( )

(d) 0 ( )

9. The SI unit of radioactivity is

(a) curie ( )

(b) becquerel ( )

(c) roentgen ( )

(d) gray ( )

10. Half-life period ($t_{0\ 5}$) and average life period (t_{av}) of a radioactive element are related as

(a) t_{av} $t_{0\ 5}$ $1\ 44$ ( )

(b) t_{av} $t_{0\ 5}$ $14\ 4$ ( )

(c) $t_{0\ 5}$ t_{av} $1\ 44$ ( )

(d) $t_{0\ 5}$ t_{av} $14\ 4$ ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. State and explain Pauli's exclusion principle.

OR

2. Calculate the following :

(a) The effective nuclear charge felt by the differentiating (last) electron of aluminium atom

(b) The equivalent weight of $H_2C_2O_4$

3. State the modern periodic law and explain the cause of periodicity in properties of elements.

OR

4. Why do noble gases show the biggest atomic radii in their respective periods?

5. Differentiate between polar covalent bond and non-polar covalent bond.

OR

6. Why is BeF_2 molecule linear while SF_2 is angular though both are triatomic?

7. Explain ionization isomerism giving suitable example.

OR

8. Write the formula of the following complexes :

(a) Sodium diaquadiiododinitrito-*N*-cobaltate(III)

(b) Diamminetetrachloroplatinum(IV)

(c) Tetraamminecobalt(III)- -amido- -hydroxo-tetraamminecobalt(III) nitrate

9. Write a brief note on the group displacement law with reference to—

(a) emission of alpha particle;

(b) emission of beta particle.

OR

10. Explain how the nuclear stability is related to the neutron-to-proton ratio in a nucleus.

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