No. of Printed Pages : 4

Sem-I-Chem-CC-1(R&B)

2021

Time - 3 hours

Full Marks - 60

*Answer **all groups** as per instructions.*
Figures in the right hand margin indicate marks.
Candidates are required to answer
in their own words as far as practicable.

GROUP – A

1. Answer all questions and fill in blanks as required. [1 × 8

(a) Write the expression for de-Broglie wavelength.

(b) The general electronic configuration of transition elements is _____.

(c) _____ quantum number determines the shape of orbitals.

(d) Among the alkali metals, the metal with the highest ionisation potential is _____.

(e) If the I.E. of hydrogen is E, what is the I.E. of He^+ ?

(f) _____ series is formed when electron returns to 2nd shell.

P.T.O.

(g) Among the ions, Cl^-, S^{2-} and Ne^+, the largest ion is _____.

(h) Out of HF, HCl, HBr and HI, which is the weakest acid ?

GROUP – B

2. Answer any eight of the following questions within two to three sentences each. [1½ × 8

(a) State Heisenberg's uncertainty principle.

(b) What is eigen function ?

(c) State Pauli's exclusion principle.

(d) What is Hund's rule of maximum multiplicity ?

(e) What is shielding effect ?

(f) Van der Waal's radius is larger than covalent radius, explain.

(g) What is radius ratio ?

(h) Which one will show maximum covalent character ?

$AlCl_3$, $MgCl_2$, $FeCl_2$, $SnCl_2$

(i) What is hydrogen bonding ?

(j) Draw the M.O. diagram of N_2 molecule.

GROUP – C

3. Answer any eight of the following questions within 75 words each. [2 × 8

(a) Why 4s-orbital is filled first than 3d-orbital ?

(b) When the two wave functions are said to be orthogonal ?

(c) What is the energy in eV required to excite the electron from n = 1 to n = 2 state in hydrogen atom ?

(d) Write four characteristics of d-block elements.

(e) What is the hybridisation and shape of $XeOF_2$ and XeO_2F_2 ?

(f) What is electron-affinity ? Give an example.

(g) Give two limitations of Slater rule.

(h) Why CO is diamagnetic whereas NO is paramagnetic ?

(i) Calculate the effective nuclear charge for an electron of 1s-orbital of He atom.

(j) Write the significance of ψ.

GROUP – D

*Answer **any four** questions within 500 words each.*

4. Derive Schrodinger's time independent wave equation. [6

5. What is ionisation energy ? What are the factors affecting it ? How it varies along a period and down a group ? [6

6. Describe the long form of the periodic table. [6

7. Discuss Heitler-London treatment of hydrogen molecule. [6

8. State the postulates of VSEPR theory and predict the shape of the following molecules : [6

   H_3O^+, I_3^- and ClF_3.

9. Write down different theories to explain the metallic bond. [6

10. Write notes on : [3 × 2

    (a) Fajan's rule

    (b) Electro chemical series and its importance

No. of Printed Pages : 4

Sem-I-Chem-CC-2(R&B)

2021

Time - 3 hours

Full Marks - 60

*Answer **all groups** as per instructions.*
Figures in the right hand margin indicate marks.
Candidates are required to answer
in their own words as far as practicable.

GROUP – A

1. Answer all questions and fill in blanks as required. [1 × 8

(a) Most probable velocity is _____ times rms velocity.

(b) The temperature at which real gases behave as ideal gas is called _____ temperature.

(c) What is the number of possible vibrational modes of C_6H_6 and SO_2 molecules ?

(d) What is the relation between viscosity co-efficient and mean free path ?

(e) ZnS is a _____ type of crystal.

(f) What is the unit of Van der Waal's constant 'a' ?

(g) What is the average K.E. of gas molecule ?

(h) Solution of sodium acetate is _____ in nature.

P.T.O.

GROUP – B

2. Answer any eight of the following questions within two to three sentences each. [1½ × 8

(a) Why real gases deviate from ideality ?

(b) What is the effect of addition of solute on viscosity ?

(c) What are Miller's indices ?

(d) What is buffer capacity ?

(e) What is the effect of temperature on surface tension ?

(f) Under what conditions the real gases behave ideally.

(g) Why CH_3COONH_4 is a buffer ?

(h) Why degree of ionisation increases on dilution ?

(i) Define ionic product of water.

(j) What is acidic buffer ?

GROUP – C

3. Answer any eight of the following questions within 75 words each. [2 × 8

(a) Write the relationship between different molecular velocities.

(b) What are symmetry elements ?

(c) Find the $[OH^-]$ of a solution having pH = 12.

(d) What is the physical significance of Van der Waal's constants 'a' and 'b' ?

(e) Why an ideal gas can never be liquefied ?

(f) The solubility of CaF_2 is 2×10^{-4} mol/lt. What is its solubility product ?

(g) What is Henderson's equation ?

(h) What is the pH expression for salt of strong acid and weak base ?

(i) What is the difference between solubility and solubility product ?

(j) Give two characteristics of a good acid-base indicator.

GROUP – D

*Answer **any four** questions within 500 words each.*

4. Derive Kinetic gas equation, $PV = \frac{1}{3}MC^2$. [6

5. What is surface tension ? How it is determined ? Explain. [6

6. Calculate the hydrolysis constant and degree of hydrolysis of salts producing weak acid and weak base. [6

7. Derive Bragg's equation. [6

8. Discuss the crystal structure of NaCl and CsCl. [6

9. What is Ostwald's dilution law ? Why is it called dilution law ? What are the factors on which the degree of dissociation depends ? [6

10. Write notes on within 250 words each. [3 × 2

(a) Common-ion effect

(b) Theory of acid-base indicator

2021

Time - 3 hours

Full Marks - 60

*Answer **all groups** as per instructions.*
Figures in the right hand margin indicate marks.
Candidates are required to answer
in their own words as far as practicable.

GROUP – A

1. Answer all questions. [1 × 8

(a) Which type of radiation is not emitted by the electronic structure of atoms ?
(UV / Visible / X-ray / Gamma rays)

(b) Name the hybrid state of central atom of I_3^-.

(c) Name the pair of d-orbitals involved in d^2sp^3 hybridisation.

(d) Which is the least polarisable gas among the group-18 elements ?

(e) What is the shape of ethyl free radical ?

(f) Whether furan is aromatic or non aromatic ?

(g) Write an organic compound which contains chiral carbon atom ?

(h) How many π–bonds present in tetracyano ethylene ?

GROUP – B

2. Answer any eight of the following questions within two to three sentences each. [1½ × 8

(a) Find the number of orbitals in 3rd shell of an atom and name them.

(b) Write electronic configuration of Cu^{2+} ion.

(c) What is the shape and hybridisation of SF_4 molecule ?

(d) Define exchange energy.

(e) Explain why $BaSO_4$ is insoluble in water.

(f) Give a reaction in which –E effect is operating.

(g) Explain why cyclopropenyl cation is aromatic.

(h) Draw optical isomers of tartaric acid.

(i) How is methane prepared by using Grignard's reagent ?

(j) How can you distinguish between ethylene and acetylene by a chemical test ?

GROUP – C

3. Answer <u>any eight</u> of the following questions within 75 words each. [2 × 8

(a) State and explain uncertainty principle.

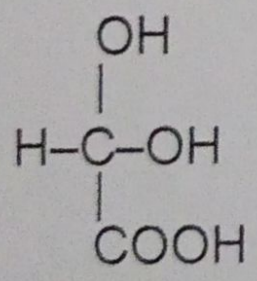
(b) Write significance of ψ and ψ^2.

(c) Write or draw MO diagram of O_2^+ ion and find its bond order.

(d) What are electrophiles and nucleophiles ? Give two examples of each.

(e) What are diastereo isomers ? Give an example.

(f) Assign R or S-configuration with explanation :



(g) Write a note on Wurtz reaction.

(h) Name the Saytzeff's and Hoffman's product when 2–bromo butane reacts with alc. KOH.

(i) What are vicinal and geminal dihalide ? Explain with example.

(j) What happens when acetylene is oxidised with ozone and followed by hydrolysis.

GROUP – D

*Answer **any four** questions within 500 words each.*

4. Discuss about different quantum numbers. [6

5. Write notes on within 250 words each. [3 + 3

   (a) Hydrogen spectrum

   (b) de-Brolie equation

6. State and explain Fajan's rule. [6

7. Write postulates of VSEPR theory. Explain the shape of ClF_3 molecule by using this theory. [4 + 2

8. Discuss about the types, structure and reactivity of alkyl carbocation. [6

9. How can you prepare ethylene from ethyl alcohol and ethyl bromide ? How does it react with alkaline $KMnO_4$ and Br_2 water ? [1½ + 1½ + 1½ + 1½

10. How can you prepare acetylene from calcium carbide and tetrabormo ethylene ? How does it react with : [1½ + 1½

    (a) Na / liq NH_3 [1½

    (b) Ammoniacal $AgNO_3$ solution [1½