

2017

1st Semester

CHEMISTRY

PAPER—C1

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Inorganic Chemistry-I

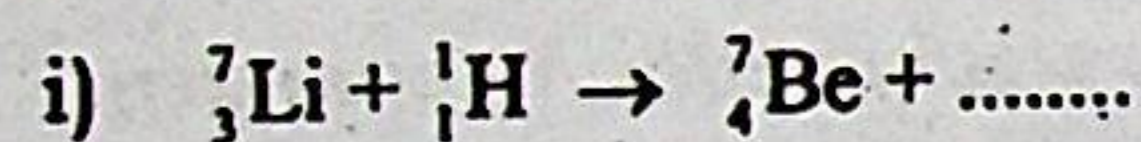
- 1. Answer any five questions : 5×1**
- (a) Which ion in the family Li^+ , Na^+ , K^+ , Be^{2+} and Mg^{2+} has smallest radius?
 - (b) Which liquid is expected to have higher boiling point — Br_2 or ICl ?
 - (c) Select the elements having highest ionisation potential among He, Ne and Ar.
 - (d) 'C' is tetrahedral in methane but planar in benzene" — Why?
 - (e) Count the bond order in NO^+ .

(Turn Over)

- (f) When β -emission will take place?
 (g) What is the shape of H_3O^+ ion?
 (h) What is the value of t_{av} of a radioactive element?

2. Answer any five questions : 5×2

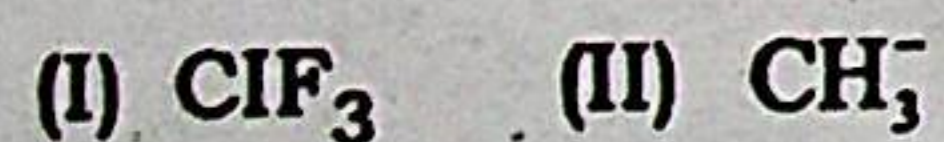
- (a) " He_2 molecule does not exist" — Explain.
 (b) Differentiate $3c - 2e$ and $2c - 2e$ bond with suitable example.
 (c) Compare the bond angle between $\text{NH}_3(107^\circ)$ and $\text{PH}_3(93^\circ)$.
 (d) Why oxygen molecule is paramagnetic?
 (e) Why 'Ga' has more electronegative than 'Al', although it is placed below in the periodic table?
 (f) Complete the following nuclear reaction.



- (g) "Tetra coordinated boron compounds are always tetrahedral but never square planar" — Why?
 (h) What is Rydberg constant? Relate Rydberg constants of hydrogen atom and monocationic helium ion.

3. Answer any three of the following questions : 3×5

- (a) i) Apply the VSEPR concept to determine the structure of the following species.



- ii) Why Niobium and tantalum have almost same atomic radii ? (2+2)+1

- (b) i) Define electronegativity.
 ii) The nature of the hybridisation of the bonding atom has strong influence on its electronegativity— Illustrate.
 iii) Write down the electronic configuration of Ti^{3+} ion. 1+3+1

- (c) i) The first Bohr radius of hydrogen atom is 0.529 \AA . Find the same for He^+ ion.

- ii) The principal quantum number, the azimuthal quantum number and the magnetic quantum number respectively signify size, shape and orientation of orbitals of an atom — comment. 2+3

- (d) i) The $O - O$ bond length varies in the species as : $\text{O}_2^+ < \text{O}_2 < \text{O}_2^- < \text{O}_2^{2-}$ — Justify.

- ii) " PbCl_2 is white while PbI_2 is coloured" — Why? 3+2

- (e) i) The amount of ${}^{14}_6\text{C}$ isotope in a piece of wood is found to be one-sixth present in a fresh piece of wood. Calculate the age of wood. Half life of ${}^{14}_6\text{C} = 5577 \text{ yr}$.

- ii) Calculate the number α and β particle lost when ${}^{238}_{92}\text{U}$ changes to ${}^{206}_{82}\text{Pb}$. 3+2

4. Answer any one of the following questions : 1×10

- (a) i) Define ionisation energy. Ionisation energy of elements having ns^2np^1 and ns^2np^4 configuration.

do not follow regular trend. - Explain with example.

ii) Using molecular orbital diagram find out the bond order of CO and O₂.

iii) The colours of the halogens (X₂) are : F₂ (pale Yellow), Cl₂ (Yellow), Br₂ (raddish brown), I₂ (Violet). — Justify the statement with the help of M. O. diagram $\{(1+3) + 3 + 3\} = 10$.

(b) i) Calculate the binding energy of nucleus, given that

mass of proton = 1.00814 u

mass of neutron = 1.00893 u

mass of lithium nucleus = 7.01822 u.

ii) State pauli exclusion principle, Hund's rules and Aufbau principle. Utilise them in predicting ground state electron distribution of Si, and S.

iii) What is artificial radioactivity? 4+4+2

(c) i) "The dipole mement of NH₃ is larger than that of NF₃—Why?

ii) "NH₃, BCl₃ and BrF₃ have comparable molecular formulae But their shapes are different"—Explain.

iii) The structural geometries of NO₂⁺, NO₂ and NO₂⁻ are different—Comment.

iv) "Both sp³ and d³s may lead to tetrahedral geometry"—Give Example. 2+3+3+2