

QUESTION BANK

CLASS:I - B.Sc., CHEMISTRY

SEMESTER:II

SUBJECT: INORGANIC CHEMISTRY-ISUB.CODE: CH203T

NAME OF THE STAFF: B.CHRISTINA, B.KANIMOZHI

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INORGANIC CHEMISTRY-I

UNIT – I

SECTION-A1 MARK

1. The general valency shell electronic configuration of Alkaline earth metals is _____.
2. An example of polar solvent is _____.
3. As the electro negativity of the central atom decreases the _____ decreases in the hydrides of group-15.
4. Shape of ammonia molecule is _____.
5. The tetrahedral bond angle decreases in water molecule due to _____.
6. As the size of cation becomes smaller covalency in ionic compound decreases. (T/F)
7. On moving down the group in periodic table size increases. Why?
8. The bond angle of H-O-H is _____.
10. The bond angle of I_3^- is _____.
11. Radius ratio=-----.
12. ----- is the permitted coordination number for planar trigonal.
13. Limiting radius ratio value for cubic structure is -----.
14. The energy related with conversion of chlorine atoms into chlorine ions is -----.
15. Dissociation energy of Cl_2 is -----
16. General valence shell configuration for group I is _____
17. $Na^{+} + e^{-} \rightarrow$
18. Periodic table contains _____ groups and _____ periods.
19. I_3^{3-} molecule is _____ in shape.
20. Bond order is given by the formula _____
21. Bond order for O_2 molecule is _____
22. The H_2 molecule is _____ magnetic in nature.
23. Which one of the following does not obey the octet rule? a) SF_6 b) N_3 c) I_2
24. The Lewis structure of ClO_2^- is _____

SECTION - B

2 MARKS

1. The bond angle of hydrides of group 15 decreases or increases down the group? Why?

2. The electro negativity difference of H-Br is 1.9. Calculate its percentage ionic character.
3. Calculate the bond distance of N-O. Covalent radii of N and O are 0.75 \AA and 0.76 \AA respectively.
4. What is polarization? Write short note on Inert pair effect.
5. Explain any two applications of electronegativity.
6. Define hybridisation and give any two applications of HSAB principle
7. The bond angles of hydrides of group 15 element decreases or increases down the group. Why?
8. What are the factors affecting the polarisation of ions ?
9. State radius ratio rule.
10. How will you classify the elements into their block?
11. Explain the Hund's rule of maximum multiplicity with examples
12. Discuss about Aufbau principle.
13. Write down the shapes or boundary of orbital.
14. Write the formula for calculating electro negativity of an element by Mulligan and Roschow's method.
15. What is the effective nuclear charge felt by a 2p electron of a nitrogen atom? What will be the nuclear charge felt by a 1s electron?
16. Calculate the electronegativity of fluorine from the following data. Electronegativity of hydrogen atom is 1.55. $E_{\text{H-H}} = 104.2 \text{ kcal/mol}$, $E_{\text{F-F}} = 36.6 \text{ kcal/mol}$, $E_{\text{H-F}} = 134.6 \text{ kcal/mol}$

SECTION – C

7 MARKS

1. Write the Born Landé equation and define the terms involved. (2)
2. Discuss the hybridization and structure of ClF_3 . (2)
3. Calculate the lattice energy of NaCl applying the Born Haber cycle to the following data:
(values in KJ/mol) (3)
- Ionisation energy of Na (I) = 425
- Dissociation energy of Cl_2 (ΔH_{D}) = 222
- Electron affinity of Cl (E) = -355
- Enthalpy of formation of NaCl (ΔH_{f}) = -438.
4. How the electronegativity and lone pair of electrons affect the bond angle and the structure of the molecule? (10)
5. Explain the structure of ClF_3 , IF_7 . (5)
6. Derive the limiting radius ratio value for tetrahedral site. (4)

UNIT – II

SECTION-A

1 MARK

Choose the correct answer:

1. Which of the following alkaline earth metal sulphate is the most soluble in water?

- a. BeSO_4 b. MgSO_4 c. CaSO_4 d. BaSO_4
2. Among the Alkali Metals, the metal with highest ionization potential is
a. Na b. Li c. Rb d. Cs
3. Which of the following statement is not correct?
a. Alkaline earth metals are harder and denser than alkali metal
b. The melting and boiling point of alkaline earth metals are higher than those of alkali metal
c. Alkaline earth metals are more reactive than alkali metals
d. The reactivities of alkaline earth metals increase down the group
4. Beryllium show a diagonal relationship with
a. Magnesium b. Aluminium c. Boron d. Sodium
5. A metal M readily forms water soluble sulphate MSO_4 , water insoluble M(OH)_2 and metal oxide is MO which becomes inter on heating. The hydroxide is soluble in NaOH . The metal is:
a. Mg b. Be c. Sr d. Ca
6. A drying reagent which absorbs CO_2 and reacts violently with water is:
a. Na_2CO_3 b. $\text{C}_2\text{H}_5\text{OH}$ c. Conc. H_2SO_4 d. CaO
7. Select the ionic compound in the following.
a. NaCl b. CH_4 c. CCl_4 d. C_6H_6
8. The electronic configuration $1s^2, 2s^2, 2p^4$ is corresponds to
a. B b. C c. N d. O
9. The number of alkaline earth metals is
a. 4 b. 5 c. 6 d. 7
10. Among the alkali metals, the metal with highest ionization potential is
a. Na b. Li c. Rb d. Cs
11. Which one is the correct order of increasing atomic radius
a. $\text{Al} < \text{Mg} < \text{Ca}$ b. $\text{Mg} < \text{Al} < \text{Ca}$
c. $\text{Ca} < \text{Al} < \text{Mg}$ d. $\text{Ca} < \text{Mg} < \text{Al}$
12. Which of the following alkaline earth metal hydroxide is the strongest best?
a. Be(OH)_2 b. Mg(OH)_2 c. Ca(OH)_2 d. Ba(OH)_2
13. The number of IA group elements is
a. 5 b. 6 c. 7 d. 8

I. Fill in the blanks

1. The number of alkaline earth metals is _____.
2. The oxidation state of Alkali metals is _____.
3. Second ionization energies of alkaline earth metals are _____ than that of corresponding alkali metals.
4. Alkali metas in liquid state are _____ conductor.
5. Ca^{2+} has a smaller ionic radius than K^+ , because it has _____

6. The oxidation state of Magnesium is _____.
7. The electronic configuration of sodium is _____.
8. The oxidation state of Calcium is _____.
9. Lithium Chloride is an _____ compound.
10. The shape of p orbital is _____
11. Electronic configuration of Cr is _____
12. The exchange energy of the electronic arrangement _____ is _____
13. The atomic radii of elements decreases in a period due to increase in _____
14. Sigma bond _____ than pi bond.
15. Charge density = _____

SECTION – B2 MARKS

1. How does lithium carbonate differ from potassium carbonate?
2. Give the reason for $\text{Be}(\text{OH})_2$ is amphoteric, $\text{Mg}(\text{OH})_2$ is weak base and $\text{Ba}(\text{OH})_2$ is a strong base.
3. Complete and balance the following equations.
 - a. $\text{K}_2\text{O} + \text{H}_2\text{O} \longrightarrow$
 - b. $\text{Li} + \text{CO}_2 \longrightarrow$
4. Give the reason for BeO is covalent while other oxides in group II A elements ionic.
5. Group I A elements are bigger in size than Group II A. Explain.
6. Water is a liquid; but, H_2S is a gas. Explain.
7. What are the reasons for diagonal relationship?
8. Give any two resemblances between magnesium and zinc.
9. Complete and balance the following equation.
 - a. $\text{Li}_2\text{O} + \text{H}_2\text{O} \longrightarrow$
 - b. $\text{NaOH} + \text{CO}_2 \longrightarrow$
9. Why calcium chloride exist as hydrated form, $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ while sodium chloride doesn't exist?
10. Give any two minerals of lithium with their composition.

SECTION –C 7 MARKS

1. Explain the diagonal relationship of Beryllium with Aluminium.
2. Complete and balance the following equation.
 - i. $\text{Li}_2\text{O} + \text{H}_2\text{O} \longrightarrow$
 - ii. $\text{NaOH} + \text{CO}_2 \longrightarrow$
 - iii. $\text{K}_2\text{O} + \text{H}_2\text{O} \longrightarrow$
3. What happens when magnesium is treated with dilute hydrochloric acid, dilute nitric acid and carbon dioxide? Write the corresponding equations.
4. Compare alkali metals with alkaline earth metals in respect of
 - (i) Atomic radii (ii) Reducing properties.
5. Complete and balance the following reactions
 - i. $\text{Mg}(\text{CO}_3) + \text{HCl} \longrightarrow$
 - ii. $\text{Ca} + \text{H}_2\text{O} \longrightarrow$
 - iii. $\text{Be}(\text{OH})_2 + \text{NaOH} \longrightarrow$
6. a) Why does it show anomalous behavior from the rest of the members of its group?
 b) Alkali metals give characteristic colour while burnt in a Bunsen burner. Explain.

- c) Discuss the stability of the carbonates of alkaline earth metals.
- Explain how Mg is acting as a bridging element between II A & II B groups.
 - Li forms normal oxide, Na form Peroxide and K, Rb & Cs form Superoxides. Why?
 - What is meant by diagonal relationship? In what respects does Li resembles Mg.
 - Write a note on hydroxides and sulphates of alkaline earth metals.
 - State any 3 points of similarities between Li and Mg.
 - Arrange the following in the order of acidic through amphoteric to basic: BaO, CO₂, B₂O₃, Al₂O₃, Cl₂O₇. Justify your answer.
 - State Aufbau principle.
 - Compare alkali metals with alkaline earth metals in terms of their reducing properties and solubilities of their compounds.
 - Explain intermolecular Hydrogen bonding with examples.
 - Write any three methods of preparation of lithium chloride.
 - How does Mg behaves as a bridge element between II A and II B group elements? Explain.
 - Complete and balance the following equations.
 - $\text{NaOH} + \text{CO}_2 \longrightarrow$
 - $\text{Ca} + \text{H}_2\text{O} \longrightarrow$
 - $\text{Be}(\text{OH})_2 + \text{NaOH} \longrightarrow$
 - Write each two preparation methods for Lithium chloride and Lithium carbonate.
 - Explain the half-filled and completely filled orbitals are more stable.

UNIT – III

SECTION-A

1 MARK

Choose the correct answer:

- The bond angle of Cl-B-Cl in BCl₃ is
 - 60°
 - 109°7'
 - 120°
 - 90°
- In the following, which one is non-metal?
 - B
 - Al
 - Ga
 - In
- Treatment of concentrated solution of Borax with calculated quantity of H₂SO₄ give
 - H₃BO₃
 - H₂B₄O₇
 - HBO₂
 - B₂O₃
- Which of the following is electron deficient?
 - NH₃
 - BCl₃
 - PCl₃
 - None of these

The oxidation number of boron in H₃BO₃ is

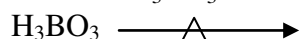
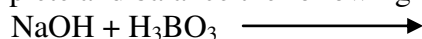
 - +1
 - +2
 - +3
 - 3
- Boron compounds behave as Lewis acid because of their
 - Acidic Nature
 - Electron deficiency
 - Ionic property
 - Smaller size
- AlCl₃ on hydrolysis give
 - Al(OH)₃
 - Al₂O₃H₂O
 - Al₂O₃
 - AlCl₃6H₂O
- Which of the following order is correct for the first ionization energies of their elements?
 - B < Be < N < O
 - Be < B < N < O
 - B < Be < O < N
 - B < O < Be < N

Fill in the blanks

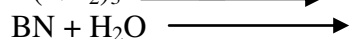
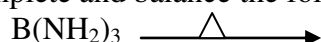
1. The number 3-centered bonds in diborane is _____.
2. Inorganic benzene is _____.
3. The basicity of orthoboric acid is _____.
4. _____ is called as 'Inorganic graphite'.
5. The bond angle of Cl-B-Cl in BCl_3 is _____.
6. Inorganic benzene is _____.

SECTION – B 2 MARKS

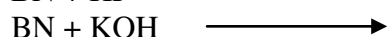
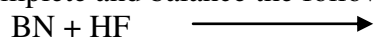
1. Complete and balance the following reactions.



2. Compare the structure of boron nitride with graphite.
3. How ortho boric acid is prepared from meta and tetra boric acids?
4. Complete and balance the following reactions.



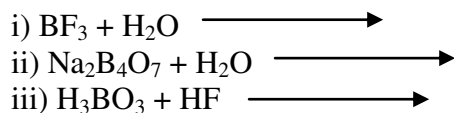
5. Why boron does not form B^{+3} ions?
6. What is the Borax bead test? Write any two uses.
7. Explain the bonding in diborane.
8. What is the action of heat on boric acid?
9. How is diborane converted into borazole?
10. Complete and balance the following reactions.



11. Give the reason for BeO is covalent while other oxides in group II A elements are ionic.
12. Why Boron compounds are behave as Lewis acids?
13. How is diborane converted into borazole?
14. Draw the structure of BO_3^{3-} and write the bond angle.

SECTION – C 7 MARKS

1. a) Discuss the structure of borazole.
b) Give the reason with example for boron trihalides are act as Lewis acids.
2. a) Discuss the structure of diborane on the basis of molecular orbital theory.
b) Give any two uses of boric acid.
3. a) Discuss the diagonal relationship of boron with silicon.
b) Explain intermolecular Hydrogen bonding with examples.
4. a) Arrange the trihalides of Boron in their increasing order of acidity. Justify your answer.
b) BCl_3 is monomeric while AlCl_3 is dimeric. Explain.
c) Why are boron hydrides electron deficient molecules?
5. Discuss the structure of borazole and compare it with that of benzene.
6. Discuss in detail the bridge structure of diborane.
7. a) Discuss the anomalous behavior of boron.
- b) Write the balanced equation for the following reactions
 - i) $\text{BF}_3 + \text{H}_2\text{O} \longrightarrow$
 - ii) $\text{Na}_2\text{B}_4\text{O}_7 + \text{H}_2\text{O} \longrightarrow$
 - iii) $\text{H}_3\text{BO}_3 + \text{HF} \longrightarrow$
8. Discuss the diagonal relationship of boron with silicon.
9. a) Discuss the structure of diborane on the basis of molecular orbital theory.
b) Give any two uses of Borax.
10. Write the balanced equation for the following reactions.



UNIT – IV

SECTION-A

1 MARK

- The general relationship between lattice energy and ionic bond strength
 - The weaker the lattice energy, the stronger the ionic bond
 - Greater lattice energy, weaker ionic bond
 - The greater the lattice energy, the stronger the ionic bond
 - There is no relationship
- Which of the following contains a covalent bonds?

a. NO_3	b. Li_2O	c. NaCl	d. Mg_3N_2
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- A molecule with a single covalent bond is

a. CO_2	b. CO	c. Cl_2	d. N_2
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- The most ionic compound among the following:

a. NaCl	b. KCl	c. MgCl_2	d. CaCl_2
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- What is the conjugate base of NH_3 ?

a. NH_2^-	b. NO_2^-	c. NO_3^-	d. NH_4^-
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- According to the Lewis definition, a base is

a. Proton donor	b. Electron pair acceptor
c. Electron pair donor	d. Hydroxide ion donor
- Which of the following compounds does not contain ionic bonding

a. Na_2O	b. Li_2^{2-}	c. Be_2	d. Li_2
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- What is the general relationship between lattice energy and ionic bond strength?
 - The weaker the lattice energy, the stronger the ionic bond
 - There is no relationship
 - The greater the lattice energy, the weaker the ionic bond
 - The greater the lattice energy, the stronger the ionic bond
- When compared to sigma and pi bonds, _____ is more stable.
- The boiling and melting points of ionic compounds are _____.

SECTION - B

2 MARKS

- Define hydration energy.
- What is polarization of ions?
- What is ionic bond? Give example.
- Define Fajan's rule.
- What is ionization energy?
- Write the limiting radius ratio for the tetragonal and octahedral arrangement.
- What is hydration energy?
- What are the requirements for the formation of a covalent bond?
- Draw the Born haber cycle.
- What is Lattice energy?
- Define lattice energy.

12. What is covalent bond? Given an example
13. Compare the lattice and hydration energies for the dissolution of ionic solids in polar solvents.

SECTION – C7 MARKS

14. a) Explain the Born-Haber cycle for the determination of lattice energy of an ionic solid.
b) What is hybridization?
15. Explain the relative strengths of acids and bases with examples on the basis of Bronsted-Lowry concept.
16. a) Discuss the Lewis concept of acids and bases with examples.
b) Calculate the percentage of ionic character in Cs-F bond in CsF molecule using Hanny smyth equation. The electro netgativity values of Cs and F are 0.7 and 4.0 respectively.
17. a) Write note on the Hanny – Smith equation.
b) Define the term polarizing power.
c) Explain Arhenius and Bronsted – Lowry concepts of acid and bases.
18. a) Ionic compound have high melting points. Explain.
b) SnCl_4 is soluble in non polar organic solvent while SnCl_2 is soluble in polar aqueous solvent. Explain.
19. Using Born-Haber cycle explain the formation of NaCl.
20. i) What do you mean by polarization?
ii) Explain the effects of polarization.
iii) What is HannySmithequation.
21. Calculate the percentage of ionic character in K-Cl bond in KCl molecule using Hanny Smyth equation. The electronegativity values of K and Cl are 0.8 and 4.0 respectively.
22. Discuss the conditions for the formation of ionic bond.

UNIT-V

SECTION – A 1MARK

1. MO's are _____
2. π_y and π_z (x axis is the molecular axis) are _____
3. The molecular orbital electron configuration of H_2 molecule is written as _____
4. A molecular orbital can accommodate only two electrons and these two electrons must have_----

5. The number of nodes in s orbital of any energy level is equal to _____
6. Bond order is _____
7. For a stable molecule the value of bond order should be _____
8. The energy of σ_{2s} is greater than σ_{1s} orbital because

SECTION – B

2 MARKS

1. Write the postulates of MOT Theory.

2. Differentiate π and σ bond.
3. H_2^+ and H_2^- have the same order, yet H_2^- is slightly less stable than H_2^+ ion. Give reason
4. N_2 has greater bond dissociation energy than N_2^+ whereas O_2^+ has greater bond dissociation energy than O_2 . Give reason
5. Bond in H_2^+ is larger than that in H_2 . Give reason
6. Superoxide ion is paramagnetic but peroxide is not. Give reason
7. Sigma bond in H_2 molecule is stronger than that in Li_2 molecule. Give reason
8. Mention any two exceptions of VSEPR THEORY.
9. O_2 paramagnetic but N_2 is diamagnetic. Give reason
10. Calculate bond order in NO_2^+ , NO_2^- ions

SECTION – C

7 MARKS

1. Construct MO diagram of CO molecule. (5M)
2. Explain VSEPR theory with suitable example. (6M)
3. Discuss the stability due to half filled, fully filled, and empty orbital with suitable examples. (5)
- (b). What conditions must be satisfied for an ionic bond to be formed between two elements A & B? (5)
- (c). On the basis of VSEPR theory give the complete description of geometry of ClF_3 . (5)
4. Distinguish two aspects of the following: i. Atomic and Molecular orbital
ii. Bonding and antibonding MO iii. Sigma and pi MO
5. Discuss the structures of I_2 , SO_4
6. Draw and explain the structures of BF_3 , SF_6 and XeF_6 on the basis of VSEPR theory
7. Give the salient features of VSEPR theory and discuss the shape of ICl_3 , XeF_4 , PCl_5 .
8. What is the basic difference between valence bond theory and molecular orbital theory?

Draw MO diagram and discuss stability, electronic configuration and characteristics of the following

- i. Be_2 ii. N_2 iii. O_2

CLASS: I-CHD., SEMESTER-II

SUBJECT: INORGANIC CHEMISTRY-I

SUBJECT CODE: CH203T

NAME OF THE STAFF :Mr S. IMMANUEL, Mr S. ALBERT NIKSON

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UNIT-I

PART – A

1. The properties of an element in the periodic table depends on its, _____.

1. atomic size
2. atomic mass
3. electronic configuration
4. number of protons

2. An element has configuration 2, 8, 1. It belongs to, _____.

1. 1 group and 3rd period
2. 3 group and 1st period
3. 1 group and 8th period
4. 17 group and 3rd period

3. The number of electrons in the valence shell is equal to its _____.

1. atomic mass
2. group number
3. period number
4. atomic volume

4. The non-metallic element present in the third period other than sulphur and chlorine is _____.

1. oxygen
2. fluorine
3. nitrogen
4. phosphorus

5. At the end of each period the valence shell is _____.

1. incomplete
2. half filled
3. singly occupied
4. completely filled

6. The family of elements having seven electrons in the outermost shell is _____.

1. alkali metals
2. alkaline earth metals
3. halogens
4. noble gases

7. Which of the following factors does not affect the metallic character of an element?

1. Atomic size
2. Ionisation potential
3. Electronegativity
4. Atomic radius

8. The family of elements to which potassium belongs is _____.

1. alkali metals

2. alkaline earth metals

3. halogens

4. noble gases

9. The modern periodic table is given by _____

1. Mendeleev

2. Einstein

3. Bohr

4. Mosley

10. Elements belonging to groups 1 to 17 are called _____.

1. noble gases

2. normal elements

3. transition elements

4. inner transition elements

11. A liquid non-metal is _____.

1. phosphorous

2. mercury

3. bromine

4. nitrogen

12. The first alkali metal is _____.

1. hydrogen

2. lithium
3. sodium
4. francium

13. A purple coloured solid halogen is _____.

1. chlorine
2. bromine
3. iodine
4. astatine

14. Lanthanides and actinides are also called _____.

1. normal elements
2. transition elements
3. noble gases
4. inner transition elements

15. The family of elements to which calcium belongs is _____.

1. alkali metals
2. alkaline earth metals
3. halogens
4. noble gases

16. The least reactive element in group 17 is _____.

1. fluorine
2. chlorine
3. bromine
4. iodine

17. The valency of chlorine with respect to oxygen is _____.

1.1

2.3

3.5

4.7

18. The number of shells in the elements of 3rd period is _____.

1.1

2.2

3.3

4.0

19. Four elements along a period have atomic number (11, 13, 16 and 17). The most metallic among these has an atomic number of _____.

1.11

2.12

3.16

4.17

20. Six elements A, B, C, D, E and F have the following atomic numbers (A = 12, B = 17, C = 18, D = 7, E = 9 and F = 11). Among these elements, the element, which belongs to the 3rd period and has the highest ionisation potential, is _____.

1. A

2. B

3. C

4. F

21. A factor that affects the ionisation potential of an element is _____.

1. atomic size

2. electron affinity

3. electro-negativity

4. neutrons

22. The element, which has the highest electron affinity in the 3rd period is _____.

1. Na

2. Mg

3. Si

4. Cl

23. The element, which has zero electron affinity in the 3rd period is _____.

1. Al

2. P

3. Ar

4. S

24. The statement that is not true about electron affinity is

1. It causes energy to be released

2. It causes energy to be absorbed

3. It is expressed in electron volts

4. It involves formation of an anion

25. Down a group, the electron affinity _____.

1. increases

2. decreases

3. remains same

4. increases and then decreases

PART-B

1. Explain the shape of S-orbital ?
2. State Hund's rule ?
3. Explain the shape of p-orbital ?
4. Draw all five structure of d-orbital ?
5. Calculate Hund's rule maximum multiplicity p^3 and d^4 metal ion ?
6. State Aufbau principle and give the energy order ?
7. Explain Pauli's exclusion principle ?
8. Write electronic configuration of Na atom ?
9. Write outermost electronic configuration of Cl atom ?
10. Give any two example of half filled and fully filled configurations ?
11. Explain atomic radii of periodic table ?
12. Explain ionic radii of neutral atom and its cation (Na) ?
13. Define ionization energy ?
14. Define electronegativity ?
15. Define electron affinity ?

PART-C

1. Explain inert pair effect ?
2. Account your answer for atomic radii and ionization energy ?
3. Explain electronegativity and electron affinity ?
4. Explain various electronegativity theory ?
5. d-block elements exhibit various oxidation state explain ?
6. Draw the shapes of s,p,d orbitals ?
7. Explain general property of periodic table ?

UNIT-II

PART-A

1. The electronic configuration of the atom of an element X is 2 , 8, 4 .In the modern periodic table , the element X is placed in :

A. 2 nd group

B. 4 th group

C. 14th group

D. 8th group

2. Which of the following element would lose an electron easily ?

A. Mg

B. Na

C. K

D. Ca

3. The elements A, B, C, D and E have atomic numbers 9, 11 , 17,12, and 13 respectively . The pair of elements which belongs to the same group of the periodic table is :

A. A & B

B. B & D

C. A & C

D. D & E

4. Which one of the following does not increase while moving down the group of the periodic table ?

A. Atomic radius

B. Metallic character

C. Valence electrons

D. Shells in the atoms

5. The Newlands Law of Octaves for the classification of elements was found to be applicable only up to the element :

A. Potassium

B. Calcium

C. Cobalt

D. Thorium

6. An element X forms an oxide X_2O_3 . In which group of Modern periodic table is this element placed?

A. Group 2

B. Group 3

C. Group 5

D. Group 13

7. The atomic numbers of the elements Na, Mg, K and Ca are 11, 12, 19, and 20 respectively. The element having the largest atomic radius is :

A. Mg

B. Na

C. K

D. Ca

8. Where would you locate the element with electronic configuration 2, 8 in the modern periodic table ?

A. Group 8

B. Group 18

C. Group 10

D. Group 16

9. Which of the following is the valence shell for the elements of second period of the modern periodic table ?

- A. M shell
- B. K shell
- C. L shell
- D. N shell

10. Which of the following statements is not a correct statement about the trends when going from left to right across the periods of the periodic table ?

- A. The elements become less metallic in nature
- B. The number of valence electrons increases
- C. The atoms lose their electrons more easily
- D. The oxides become more acidic

PART-B

1. Complete and balance the following reactions. a. $\text{BN} + \text{HF}$ b. $\text{BN} + \text{KOH}$?
2. Calculate the bond order of nitrogen molecule. ?
3. Give two properties of metals ?
4. Give any two resemblances between magnesium and zinc ?
5. Give a method to separate o – nitrophenol and p – nitrophenol. Explain the principle behind the method ?
6. Exceptional properties of Li ?
7. Diagonal relationship of Li and Mg ?
8. Diagonal relationship of Be and Al ?
9. Exceptional properties of Be ?
10. Explain hydrogen bonding ?

PART-C

1. Compare alkali metals with alkaline earth metals in terms of their reducing properties and solubilities of their compounds.
2. Explain intermolecular Hydrogen bonding with examples.
3. The Ge^{2+} is a reducing agent while Pb^{2+} is an oxidizing agent although they are present in the same group. Explain. Ge ($Z=32$) and Pb ($Z=82$)
4. Write any three methods of preparation of lithium chloride.
5. Write a note on hydroxides and sulphates of alkaline earth metals.
6. State any 3 points of similarities between Li and Mg ?
7. Diagonal relationship of Li and Mg ?
8. Diagonal relationship of Be and Al ?

UNIT-III

PART-A

- 1) The elements of group 13 to 18 of the periodic table are known as
a) s - block elements b) p - block elements c) d - block elements d) f - block elements
- 2) The general electronic configuration of group 18 elements is
a) ns^2 b) $ns^2 np^1$ c) $ns^2 np^{1-5}$ d) $ns^2 np^6$
- 3) The basic oxide among the following
a) Bi_2O_3 b) SnO_2 c) HNO_3 d) SO_3
- 4) The most stable hydride of the following
a) NH_3 b) PH_3 c) AsH_3 d) BiH_3
- 5) The formula of Borax is
a) NaBO_2 b) $\text{Na}_2\text{B}_4\text{O}_7$ c) H_3BO_3 d) None of the above
- 6) The general electronic configuration of carbon group elements is
a) $ns^2 np^6$ b) ns^2 c) $ns^2 np^1$ d) $ns^2 np^2$
7. The oxides of non-metals are usually
a) ionic b) coordinate c) covalent d) none of the above
8. Metallic oxides are generally
a) acidic b) basic c) amphoteric d) neutral
9. The electronic configuration $1s^2, 2s^2, 2p^4$ corresponds to
a. B b. C c. N d. O
10. Boron compounds behave as Lewis acid because of their
a. Acidic nature b. Electron deficiency c. Ionic property d. Smaller size
11. AlCl_3 on hydrolysis give
a. $\text{Al}(\text{OH})_3$ b. $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ c. Al_2O_3 d. $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$
12. The oxidation state of Magnesium is _____.
13. The bond angle of Cl-B-Cl in BCl_3 is _____.

14. Elements whose atoms have three outer most shells incomplete are called
a) s-block elements b) p-block elements c) d-block elements d) f-block elements
15. How many electrons are there in the third shell (principal energy level) of the atom with atomic number 23?
a) 3 b) 11 c) 10 d) 13 e) 8

PART-B

1. How is diborane converted into borazole?
2. What is the action of heat on boric acid?
3. Explain the oxidation states of p-block elements ?
4. Anomalous behavior of B ?
5. Diagonal relationship between B and Si ?
6. Explain the structure BF_3 ?
7. Explain STYX code of B_2H_6 (diborane) ?
8. Explain the property of boric acid ?
9. General property of p-block elements ?
10. P-block elements have low oxidation state explain why ?
11. Discuss inert pair effect ?
12. Explain the hybridization of NH_3 ?

PART-C

1. Discuss the anomalous behavior of boron ?
2. Write the balanced equation for the following reactions i. $\text{BF}_3 + \text{H}_2\text{O}$ ii. $\text{Na}_2\text{B}_4\text{O}_7 + \text{H}_2\text{O}$ iii. $\text{H}_3\text{BO}_3 + \text{HF}$?
3. Discuss the diagonal relationship of boron with silicon ?
4. Calculate the percentage of ionic character in K-Cl bond in KCl molecule using Hanny Smyth equation. The electronegativity values of K and Cl are 0.8 and 4.0 respectively ?
5. Discuss in detail the bridge structure of diborane ?
6. Explain the oxidation states of p-block elements ?
7. P-block elements have low oxidation state explain why ?

UNIT-IV

PART-A

1. According to the Lewis definition, a base is
a. Proton donor b. Electron pair acceptor c. Electron pair donor d. Hydroxide ion donor
2. Which of the following compounds does not contain ionic bonding
a. Na_2O b. F_2 c. Al_2O_3 d. NH_4Cl
3. The conjugate base of sulfuric acid is _____.
4. A compound is more likely to be covalent if the...
a) cation has a small size and a high charge b) anion has a small size and a high charge c) cation has a large size and a small charge d) anion has a small size and a small charge

5. According to Lux-Flood concept, a base is an _____

6. When atoms of different elements share electrons through covalent bonding, the electron will be drawn more toward the atom with the higher electronegativity, resulting in a ----- b

7. Elements belonging to groups 1 to 17 are called _____.

1. noble gases

2. normal elements

3. transition elements

4. inner transition elements

8. A liquid non-metal is _____.

1. phosphorous

2. mercury

3. bromine

4. nitrogen

9. A purple coloured solid halogen is _____.

1. chlorine

2. bromine

3. iodine

4. astatine

10. Lanthanides and actinides are also called _____.

1. normal elements
2. transition elements
3. noble gases
4. inner transition elements

11. The family of elements to which calcium belongs is _____.

1. alkali metals
2. alkaline earth metals
3. halogens
4. noble gases

PART-B

1. Define lattice energy.
2. What is covalent bond? Give an example
3. Differentiate ionic and covalent bond.
4. Ionic compounds melt at a higher temperature as compared to covalent compounds – why?
5. What is Lattice energy?
6. What is the shape of PF_5 ?
7. Explain ionic bonding ?
8. Discuss the formation of NaCl ?
9. Explain Born-Haber cycle ?
10. Explain ionic and covalent bonding with example ?
11. State Fajan' rule ?
12. Explain various acid –base concept ?

PART-C

1. Discuss Fajan's rules on the basis of charge and size of cations and anions ?
2. Explain the Bronsted-Lowry concept for the strength of acids and bases ?
3. Discuss the stability due to half filled, fully filled and fully empty orbitals with suitable examples ?
4. Define inert pair effect ?
5. Discuss the formation of NaCl ?
6. Explain Born-Haber cycle ?
7. Explain ionic and covalent bonding with example ?

8. State Fajan' rule with example?
9. Explain various acid –base concept ?
10. Explain Lewis, Bronsted, Luxflood, and Usanovich concept of acid-base ?

UNIT-V

PART-A

1. According to molecular orbital theory, which of the following is the most likely to exist?
a. He₂ b. Li₂ c. Be₂ d. Li₂
2. Use VSEPR theory to predict the molecular geometry of ClF₃
a. Square planar b. Octahedral c. Pentagonal d. distorted trigonal bipyramidal
3. The geometry of IF₇ is _____.
4. Based on VSEPR theory, which of the following would have a trigonal planar shape?
a) CH₃)₃N b) HCN c) NH₄ + d) CH₃ - E) CH₃ +
5. What is the maximum number of hydrogen bonds in which a water molecule can participate? a) 1 b) 2 c) 3 d) 4
6. Which is the electron configuration for a neutral atom in the ground (not energized) state?
a) ? 1s² 2s² 2p⁴ 3s¹ b) ? 1s² 2s² 3s¹ c) ? 1s² 2s² 2p⁶ 3s¹ d) ? 1s² 2s² 2p⁶ 2p¹
7. VSEPR basically states that:
a) The repulsion of atomic nuclei help determine the shapes of covalent molecules. b) The repulsion between electrons helps determine the shapes of covalent molecules. c) The repulsion between bonds helps determine the shapes of covalent molecules. d) None of these statements is correct.
8. MgSO₄ is soluble in water while BaSO₄ is insoluble in water. This is because
a) Lattice energy of BaSO₄ is greater than MgSO₄ b) BaSO₄ is more covalent than MgSO₄
c) Hydration energy of Mg²⁺ is greater than Ba²⁺ d) Lattice energy of MgSO₄ is greater than BaSO₄
9. The number of bond pairs and lone pairs of electrons present in ClF₃ are
a) 2,3 b) 1,3 c) 3,2 d) 3,1

PART-B

1. Mention any two exceptions of VSEPR theory.
2. Calculate the bond Order in O₂ + ion. Sl.No Number of electron groups Name of electron group geometry
16 2 trigonal-planar 17 3 linear 18 4 trigonal-bipyramidal 19 5 octahedral 20 6 tetrahedral
3. Mention Sidgwick Powell theory ?
4. Explain molecular orbital theory ?
5. Explain the concept of HOMO and LUMO ?
6. Discuss the geometries of IF₇ and XeF₆ ?
7. Explain the bond angles and geometry of NH₃ ?

8. List out how many lone pairs of electron present in the NH_3 and XeF_4 ?
9. Explain MOT of H_2 and N_2 molecule ?
10. Explain the bond order of O_2 molecule ?

PART-C

1. Draw and explain the energy level diagram of carbon monoxide ?
2. List out the conditions for effective combination of atomic orbitals ?
3. Using VSEPR theory, explain the geometry of IF_7 , XeF_6 and ClF_3 ?
4. Give any one criteria for orbital overlap to form a molecular orbital ?
5. Draw the molecular orbital diagram of N_2 and explain the magnetic property and bond order ?
6. a) Arrange the following in the order of acidic through amphoteric to basic: BaO , CO_2 , B_2O_3 , Al_2O_3 , Cl_2O_7 . Justify your answer ?
7. Discuss the geometries of IF_7 and XeF_6 and ClF_3 ?
8. Explain the bond angles and geometry of NH_4^+ ?
9. List out how many lone pairs of electron present in the NH_3 and XeF_4 ?
10. Explain MOT of O_2 and F_2 molecule ?
11. Explain the bond order of O_2 and CO molecule ?