6. CHEMICAL BONDING

VALENCY, KOSSEL-LEWIS THEORY, LEWIS SYMBOLS

SOLUTIONS

TEACHING TASK

JEE MAIN LEVEL QUESTIONS

1. Which of the following statements best describes the Kossel-Lewis Theory?

a) It explains the formation of ionic bonds between atoms.

b) It describes the sharing of electron pairs between atoms in covalent bonds.

c) It outlines the concept of metallic bonding.

d) It elucidates the concept of hydrogen bonding between molecules.

Answer:B

Solution:The Kossel–Lewis Theory of Chemical Bonding (also called the Octet Rule) states that:

Kossel explained ionic bonding (transfer of electrons to complete octet).

Lewis explained covalent bonding (sharing of electron pairs to complete octet).

So, the best description of the combined Kossel–Lewis Theory is:

(a) It explains the formation of ionic bonds between atoms. and

(b) It describes the sharing of electron pairs between atoms in covalent bonds.

Lewis symbols and octet concept mainly emphasize sharing of electron pairs (covalency), while ionic is considered a special case.

2. Which of the following statements best describes the concept of the octet rule in the Kossel-Lewis Theory?

a) Atoms tend to gain, lose, or share electrons to achieve a full outer shell of eight electrons.

b) Atoms tend to gain, lose, or share electrons to achieve a full outer shell of six electrons.

c) Atoms tend to gain, lose, or share electrons to achieve a full outer shell of ten electrons.

d) Atoms tend to gain, lose, or share electrons to achieve a full inner shell of eight electrons.

Answer:A

Solution:The octet rule states atoms stabilize by attaining 8 valence electrons (like noble gases), except for H/He (duet rule).

3. What is the relationship between the valency and the group number of an ele ment in the modern periodic table?

a. They are always equal. **b. Valency is half of the group number.**

c. There is no specific relationship. **d. It varies depending on the period.**

Answer:D

Solution: Valency often equals group number for Groups 1-2 but varies in higher groups (e.g., N in Group 15 has valencies 3 or 5)

4. What is the modern definition of valency in chemistry?

a. The number of electrons gained or lost by an atom

b. The combining capacity of an atom based on its outermost electron shell

c. The number of protons in the nucleus of an atom

d. The ability of an atom to form covalent bonds

Answer:B

Solution:Valency reflects an atom's ability to bond, determined by valence electrons (e.g., O has valency 2 due to 6 valence e^- needing 2 more)

5. Which of the following elements has the same valency as nitrogen (N) due to similar electronic configuration?

A) Oxygen (O) **B) Carbon (C)** **C) Phosphorus (P)** **D) Sulfur (S)**

Answer:C

Solution:Both N (2,5) and P (2,8,5) have 5 valence electrons, showing valencies 3 (e.g., NH_3) or 5 (e.g., PCl_5)

6. An element with the electronic configuration 2,8,1 belongs to which group of the periodic table and what is its valency?

A) Group 1, Valency 1 **B) Group 2, Valency 2**

C) Group 17, Valency 7 **D) Group 18, Valency 0**

Answer:A

Solution:This is sodium (Na), a Group 1 alkali metal with 1 valence electron (valency =

+1).

7. Which of the following statements is true regarding valency?

A) Valency is the combining capacity of an element

B) Valency is the number of protons in the nucleus

C) Valency is the number of electrons in the innermost shell

D) Valency is the atomic mass of an element

Answer:A

Solution: Valency indicates how many bonds an atom can form (e.g., carbon's valency is 4 in CH_4).

8. The valency of an element can be determined by:

a) Subtracting the number of valence electrons from the total number of electrons in the atom

b) Adding the number of protons and neutrons

c) Multiplying the atomic number by 2 d) None of the above

Answer:D

Solution:Valency is found from valence electrons (e.g., Group 1 = 1, Group 16 = 2) or 8 - valence e^- for nonmetals.

9. What is the valency of nitrogen in its compounds according to the modern definition?

a. 1 b. 2 c. 3 d. 4

Answer:C

Solution:N typically shows valency 3 (e.g., NH_3, NCl_3) but can be 5 in exceptions like HNO_3.

10. In the modern definition, what is the maximum valency of carbon in its compounds?

a. 2 b. 3 c. 4 d. 5

Answer:C

Solution:Carbon (2,4) forms 4 bonds (e.g., CH_4, CCl_4) due to 4 valence electrons.

11. The number of valency electrons and the valency with respect to

hydrogen are equal for

1. Sulphur 2. Silicon 3. Phosphorus 4. Chlorine

Answer:4

Solution:Chlorine has 7 valence electrons and valency 1 with hydrogen (HCl). Other options: S (6/2), Si (4/4), P (5/3)

12. The element having highest valency with respect to oxygen is

1. Sodium 2. Aluminium 3. Chlorine 4. Sulphur

Answer:4

Solution:Forms SO_3 (valency 6). Others: Na (1 in Na_2O), Al (3 in Al_2O_3), Cl (7 but forms Cl_2O_7 rarely).

13. Metal 'M' forms a peroxide of the type MO_2. Valency of the metal with respect to oxygen

1. 0 2. 1 3. 2 4. 4

Answer:4

Solution: In peroxides (O_2^{2-}), each O has -1. So $M^{4+} + 2O_2^{2-} \rightarrow MO_2$ (e.g., TiO_2 is common, not true peroxide).

14. An element A is tetravalent and another element B is divalent. The formula of the compound formed by the combination of these elements is

1. A_2B 2. AB 3. AB_2 4. A_2B_3

Answer:3

Solution:$A^{4+} + 2B^{2-} \rightarrow AB_2$ (cross-valency method).

15. An atom A has 2K, 8L and 3M electrons. Another atom B has 2 K and 6 L electrons. The formula of the compound formed between A and B is

1. AB 2. A_2B_3 3. A_3B_2 4. AB_2

Answer:2

Solution: A is Al^{3+}, B is $O^{2-} \rightarrow Al_2O_3$.

16. Two elements X and Y the have following electron configurations, X= $1s^2,2s^2$ $2p^6$, $3s^2$ $3p^6$, $4s^2$ and Y= $1s^2,2s^2$ $2p^6$, $3s^2$ $3p^5$. The formula of the compound formed by the combination of X and Y is

1. $X Y_2$ 2. $X_5 Y_2$ 3. $X_2 Y_5$ 4. $X Y_5$

Answer:1

Solution: X is Ca^{2+}, Y is $Cl^- \rightarrow CaCl_2$.

17. Which of the following exhibits variable valency

1. Na 2. H 3. Al 4. S

Answer:4

Solution:S shows -2, +2, +4, +6. Others have fixed valencies (Na=+1, H=±1, Al=+3).

18. In a short period, as the atomic number increases, the valency of elements with respect to oxygen

1. decreases 2. remains constant
3. first increases and then decreases 4. increases

Answer:4

Solution:

$$\text{From } Na_2O\ (+1) \rightarrow MgO\ (+2) \rightarrow Al_2O_3\ (+3) \rightarrow SiO_2\ (+4) \rightarrow P_4O_{10}\ (+5) \rightarrow SO_3\ (+6).$$

19. Electrovalency of non-metal atom is not equal to, that of the metal atom in

1. Sodium bromide 2. Magnesium oxide
3.Aluminium nitride 4. Potassium sulphide

Answer:4

Solution:K^+ (1) $\neq$ S^{2-} (2). Others match: Na^+/Br^- (1), Mg^{2+}/O^{2-} (2), Al^{3+}/N^{3-} (3).

20. Cation is isoelectronic with anion in

1. Sodium chloride 2. Potassium Bromide
3.Lithium fluoride 4. Rubedium bromide

Answer:4

Solution:Rb^+ and Br^- both have 36 electrons

21. The Lewis symbol for oxygen depicts:

A) Four valence electrons B) Six valence electrons

C) Two valence electrons D) Eight valence electrons

Answer:B

Solution: O (Group 16) has 6 valence e^- .

22. Which of the following elements would likely form an ion with a charge of +2 based on its Lewis symbol?

A) Group 15 element **B) Group 17 element**

C) Group 1 element **D) Group 2 element**

Answer:D

Solution:Group 2 elements (e.g., Mg) lose $2e^-$ to form M^{2+}

23. What does the Lewis symbol "F: ••" represent?

a) Fluorine atom **b) Fluorine molecule**

c) Fluorine ion **d) Fluorine radical**

Answer:A

Solution:Lewis symbol shows neutral F atom with 7 valence e^- (3 lone pairs + 1 unpaired e^-).

24. Which element has a Lewis symbol with three unpaired electrons?

a) Boron **b) Nitrogen** **c) Oxygen** **d) Fluorine**

Answer:B

Solution: N (Group 15) has •N• (3 unpaired e?). Boron has 1 unpaired (•B•), O has 2, F has 1.

JEE ADVANCED LEVEL QUESTIONS

MULTI CORRECT ANSWERS

1. Select all elements that commonly exhibit only one oxidation state:

A) Sodium (Na) **B) Potassium (K)** **C) Calcium (Ca)** **D) Magnesium (Mg)**

Answer:A,B,C,D

Solution:Alkali metals (Na, K) always show +1 oxidation state

Alkaline earth metals (Ca, Mg) always show +2 oxidation state

These elements don't exhibit variable valency due to their strong tendency to lose electrons and achieve noble gas configuration

2. According to the Kossel-Lewis Theory, which of the following statements re garding ionic compounds are correct? Select all that apply.

a) Ionic compounds typically have high melting and boiling points.

b) Ionic compounds conduct electricity well in the solid state.

c) Ionic compounds consist of positively and negatively charged ions held to gether by electrostatic forces.

d) Ionic compounds are typically soluble in nonpolar solvents.

Answer:A,C

Solution:Ionic compounds have strong electrostatic forces $\rightarrow$ high MP/BP

They conduct electricity only when molten/dissolved (not in solid state)

Generally soluble in polar solvents (like water), not nonpolar solvents

3. The common or group valency is equal to:

1. No. of valence electrons till group number 4.

2. 8 - no. of valence electrons after group number 4.

3. Only no. of electrons present in the valence shell.

4. None of the above.

Answer:1,2

Solution:For Groups 1-4: Valency = valence electrons (e.g., Group 2 $\rightarrow$ valency 2)

For Groups 5-7: Valency = 8 - valence electrons (e.g., Group 6 $\rightarrow$ valency 2)

4. Which of the following will try to achieve helium configuration?

1. Hydrogen 2. Lithium 3. Berylium 4 None of these

Answer:1,2,3

Solution:H gains $1e^-$ $\rightarrow$ He config ($1s^2$)

Li loses $1e^-$ $\rightarrow$ He config ($1s^2$)

Be loses $2e^-$ $\rightarrow$ He config ($1s^2$)

5. In the context of the Kossel-Lewis Theory, which of the following statements about Lewis dot structures are correct? (Select all that apply)

a) Lewis dot structures represent the valence electrons of atoms in a com pound.

b) Each dot in a Lewis dot structure represents a valence electron.

c) Lewis dot structures are used to predict the geometry of molecules.

d) Lewis dot structures can be drawn for both covalent and ionic compounds.

Answer:A,B,D

Solution:Lewis structures show valence e^- distribution

Molecular geometry requires VSEPR theory (not just Lewis dots)

Applicable to all bond types

6. Consider the Lewis symbols for elements in Group 17 (halogens). Which of the following statements are correct?

A. All halogens have seven valence electrons.

B. The Lewis symbols for halogens include two dots and five lines.

C. Halogens tend to gain one electron to achieve a noble gas configuration.

D. The Lewis symbol for fluorine includes one unpaired electron.

Answer:A,C,D

Solution:Halogens: ns^2np^5 configuration $\rightarrow$ 7 valence e^-

Lewis symbol: 6 dots (3 pairs) + 1 unpaired dot

Gain $1e^-$ to complete octet

REASON AND ASSERTION TYPE

A) Both (A) and (R) are true and (R) is the correct explanation of(A)

B) Both (A) and (R) are ture and (R) is not the correct explanation of (A)

C) (A) is true but (R) is false D) (A) is false but (R) is true

7. Assertion: Valency depends solely on the number of valence electrons in an atom.

Reason: Valency is determined by the ability of an atom to lose, gain, or share electrons to achieve a stable electron configuration.

Answer:D

Solution:Valency is related to valence electrons but is not solely determined by their number (variable oxidation states, transition metals, and covalent vs. ionic behaviour are exceptions). The Reason is a correct description of how valency arises

8. Assertion: Elements in the same group of the periodic table have the same valency.

Reason: Elements in the same group have the same number of valence elec trons.

Answer:A

Solution:Assertion (A): True (Group elements share valency, e.g., Group 1 = +1).

Reason (R): Correct explanation (Same valence electrons $\rightarrow$ same bonding behavior).

9. Assertion: Oxygen (O) has a valency of -2.

Reason: Oxygen needs to gain two electrons to achieve the stable configuration of the nearest noble gas.

Answer:A

Solution:Assertion (A): True (Oxygen commonly shows -2 valency, e.g., H_2O).

Reason (R): Correct explanation (Gains $2e^-$ to achieve Ne configuration).

10. Assertion: Elements with the electron configuration ns^2np^6 have a valency of 0.

Reason: Elements with a filled outer shell have a stable electron configuration and do not readily form ions.

Answer:A

Solution:Assertion (A): True (Noble gases have valency 0, e.g., Ne).

Reason (R): Correct explanation (Stable octet $\rightarrow$ no tendency to bond).

11. Assertion: In the Kossel-Lewis Theory, the octet rule states that atoms tend to lose, gain, or share electrons to achieve eight electrons in their outer shell.

Reason: Achieving an octet configuration provides atoms with greater stability, resembling the electron configuration of noble gases.

Answer:A

Solution:Assertion (A): True (Octet rule is central to Kossel-Lewis).

Reason (R): Correct explanation (Noble gas configuration provides stability).

12. Assertion: Metals tend to form positive ions.

Reason: According to the Kossel-Lewis Theory, metals readily lose valence electrons to achieve a stable electron configuration, resulting in the

formation of positively charged ions.

Answer:A

Solution:Assertion (A): True (Metals lose e^- $\rightarrow$ cations, e.g., Na^+).

Reason (R): Correct explanation (Losing e^- achieves stable configuration).

13. Assertion: According to the Kossel-Lewis Theory, elements in Group 17 (Halo gens) tend to form negatively charged ions.

Reason: Halogens have seven valence electrons and readily accept one electron to achieve a stable electron configuration, forming 1- ions.

Answer:A

Solution:Assertion (A): True (Halogens gain 1 e^- $\rightarrow$ 1- ions, e.g., Cl^-).

Reason (R): Correct explanation (7 valence e^- $\rightarrow$ need 1 more for octet).

14. Assertion: The Lewis symbol of an element represents its valence electrons.

Reason: Valence electrons are the outermost electrons in an atom and are in volved in chemical bonding.

Answer:A

Solution:Assertion (A): True (Lewis symbols depict valence e^- , e.g., •O•).

Reason (R): Correct explanation (Outermost e^- govern bonding).

15. Assertion: In Lewis symbols, the number of valence electrons is represented by dots or crosses around the symbol of the element.

Reason: Valence electrons are the outermost electrons involved in bonding and determine the chemical properties of an element.

Answer:A

Solution:Assertion (A): True (Dots/crosses = valence e^-, e.g., •N••).

Reason (R): Correct explanation (Valence e^- determine reactivity).

STATEMENT TYPE

1) Statement-I, Statement-II both are true
2) Statement-I, Statement-II both are false
3) Statement-I is true, Statement-II is false.
4) Statement-I is false, Statement-II is true.

16. Statement I : The lewis symbol for aluminium is $\bullet\dot{Al}\bullet$

Statement II : The outermost shell electronic configuration of Al is $3s^2\,3p^1$

Answer:1

Solution:Al's Lewis symbol is $\bullet\dot{Al}\bullet$ with three valence dots (one for each $3s^2 3p^1$ electron).

Outermost configuration $3s^2 3p^1$ is correct for A

17. Statement I : Elements which lose electrons are called electropositive elements.

Statement II: Elements which gain electrons are called electronegative elements.

Answer:1

Solution:Electropositive elements (metals like Na, K) readily lose e^- to form cations.

Electronegative elements (nonmetals like F, Cl) readily gain e^- to form anions.

COMPREHENSION TYPE

Valency can be defined as the number of hydrogen atoms which combine directly or indirectly with one atom of an element. Valency can also be defined ad double the number of oxygen atoms with which one atom of an element. Atoms attain stable electronic configuration(duplet and octet configuration) either by transfer (or) by sharing of electrons. The number of electrons transfered is called **Electrovalency** and bond resulted is called Electrovalent bond. The number of electrons shared is called **co-valency** and the bond resulted is called covalent bond.

18. The electrovalency of an element equals the number of electrons lost or gained by an atom during the formation of

1) Ionic Bond 2) Covalent Bond 3) Hydrogen Bond 4) None of the above

Answer:1

Solution: Electrovalency refers to the charge on an ion formed by losing/gaining electrons in ionic bonding.

19. What is the valency of Magnesium?

1) 1 2) 2 3) 3 4) 4

Answer:2

Solution:Magnesium (Mg) is in Group 2 of the periodic table.

Electronic configuration: 2,8,2 $\rightarrow$ 2 valence electrons.

It loses 2 e^- to achieve stability (Mg^{2+}), so valency = 2.

MATRIX MATCH TYPE

20. **Column-I** **Column-II**

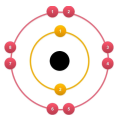
a) Neon	**1)** $:\dot{\underset{\cdot}{N}}\cdot$
b) Nitrogen	**2)** $:\ddot{\underset{\cdot\cdot}{Ne}}:$
c) Boron	**3)** $Be:$
d) Berylium	**4)** $\cdot\dot{B}\cdot$

Answer:a-2,b-1,c-4,d-3

Solution:

a) Neon	2) $:\ddot{\underset{\cdot\cdot}{Ne}}:$
b) Nitrogen	1) $:\dot{\underset{\cdot}{N}}\cdot$
c) Boron	4) $\cdot\dot{B}\cdot$
d) Berylium	3) $Be:$

INTEGER TYPE

21.  **Look at the given Bohr diagram and assume that it represents a neutral atom. What is the atomic number of the element to which this neutral atom belongs?**

Answer:10

Solution:

Inner shell (K) has 2 electrons

Next shell (L) has 8 electron

Atomic number = 2+8=10

22. The electronic configuration of Lithium is (2,1). What is its valency?

Answer:1

Solution:Lithium (Li) has 1 valence electron (outer shell).

It loses 1 electron to achieve stability (like helium), forming Li^+.

Thus, its valency is +1 (e.g., in Li_2O or LiCl).

LEARNERS TASK

Conceptual Understanding Questions (CUQ's)

1. The combining capacity of an element is known as its

1) Valency 2) Oxidation Number 3) Valence Electron 4) None of the above

Answer:1

Solution:Valency refers to an element's ability to combine with other elements, determined by its valence electrons.

2. Which of the following has wholly filled the outermost shell?

1) Noble Gases 2) Metals 3) Nonmetals 4) None of the above

Answer:1

Solution: Noble gases have complete octets (or duplets for He), making them chemically inert.

3. Valency generally expresses

1) Total electrons in an atom 2) Atomicity of an element

3) Oxidation Number of an element 4) Combining capacity of an element

Answer:4

Solution:Valency indicates how many atoms of hydrogen (or other reference element) an atom can combine with or displace.

4. The maximum valency of an element with atomic number 7 is

1. 2 2. 5 3. 4 ` 4. 3

Answer:2

Solution: Nitrogen (2,5) can show valency up to 5 (e.g., in HNO3), though commonly exhibits 3 (NH_3).

5. Valency of sulphur in sulphuric acid is

1.2 2.4 3.6 4.8

Answer:3

Solution:In H_2SO_4, sulfur forms 6 bonds

6. The maximum valency of sulphur is

1. 4 2. 6 3. 8 4. 7

Answer:2

Solution:Sulfur (Group 16) can expand its octet to show +6 valency (e.g., SF_6, H_2SO_4).

7. Duplet configuration is not found in

1. hydride ion 2. hydrogen molecule 3. Lithium cation 4. Be^{3+}

Answer:4

Solution:Hydride ion (H^-) and Li^+ achieve duplet ($2e^-$).

H_2 has shared duplet.

Be^{3+} would have just $1e^-$ (impossible under normal conditions).

8. In Lewis structures, the valence electrons are represented by _____.

1. Dots 2. Lines 3. Lines 4. Dashes

Answer:1

Solution: Dots (•) around the element symbol denote valence electrons.

9. How many electrons should Boron have around its Lewis dot model?

1. 1 2. 2 3. 3 4. 4

Answer:3

Solution: Boron (Group 13) has 3 valence electrons ($2s^2 2p^1$), shown as $\cdot\underset{\cdot}{B}\cdot$

10. What is the goal of the Lewis Dot Structure?

1. To determine the electron position.

2. To show the element's valence electrons & bonding capabilities.

3. To find the atomic mass of an element.

4. To find the atomic mass of an element.

Answer:2

Solution:Lewis structures visualize valence electrons and predict bonding patterns (single/double bonds).

JEE MAINS LEVEL QUESTIONS

---

1. In the Kossel-Lewis Theory, the bond strength in an ionic compound primarily depends on:

a) The difference in electronegativity between the atoms.

b) The number of atoms involved in the bond.

c) The size of the atoms involved. **d) The mass of the atoms involved.**

Answer:A

Solution:Greater electronegativity difference $\rightarrow$ stronger ionic bond (e.g., NaF > NaCl).

2. In the Kossel-Lewis Theory, an ionic bond is formed when:

a) Electrons are shared between atoms.

b) Electrons are transferred from one atom to another.

c) Electrons are donated from both atoms.

d) Electrons are distributed evenly around the atoms.

Answer:B

Solution:Metals lose e^- to nonmetals (e.g., Na $\rightarrow$ $Na^+ + Cl^- \rightarrow$ NaCl).

3. According to the Kossel-Lewis Theory, what determines the number of covalent bonds an atom can form?

a) The number of valence electrons in the atom.

b) The number of protons in the atom.

c) The atomic mass of the atom.

d) The electronegativity of the atom.

Answer:A

Solution:Unpaired valence e^- form bonds (e.g., N with 3 unpaired e^- forms 3 bonds).

4. Which of the following is a reason that Lewis electron dot diagrams only ` show electrons in the outmost orbital of an atom?

1. Outer-shell electrons have less energy than inner-shell electrons.

2. Lewis electron-dot diagrams would get too complicated if each atom showed all of its electrons.

3. Inner-shell electrons cannot be proven to exist and thus should not be in cluded in a Lewis electron dot structue.

4. Only outer shell electrons can be involved in chemical bonds.

Answer:4

Solution: Inner-shell e^- don't participate in bonding (Kossel-Lewis principle).

5. Which of the following electronic configurations corresponds to an element having a valency of 3?

A) 2, 8, 3 B) 2, 7 C) 2, 8, 7 D) 2, 8, 8

Answer:A

Solution:3 valence $e^- \rightarrow$ loses 3 e^- (Al^{3+}) or shares 3 e^- ($AlCl_3$).

6. Which of the following elements is likely to have the highest valency?

a) Oxygen (O) b) Nitrogen (N) c) Carbon (C) d) Fluorine (F)

Answer:C

Solution: C shows max valency=4 (e.g., CH_4), while N=3, O=2, F=1.

7. The valency of an element is the:

A) Number of protons in its nucleus

B) Number of electrons in its outermost shell

C) Sum of protons and neutrons in its nucleus

D) Ratio of its atomic mass to its atomic number

Answer:B

Solution:Determines bonding capacity (e.g., O has 6 → valency=2).

8. In the diatomic molecule HCl, the H and Cl share a pair of electrons. By doing so, the hydrogen atom attains the electron configuration of _____ while chlorine attains the electron configuration of _____.

1. helium; argon 2. neon; neon 3. helium; neon 4. neon; argon

Answer:1

Solution:

In HCl molecule, H attains Helium configuration (2 electrons).

Cl attains Argon configuration (18 electrons)

9.  **This could be the dot diagram of**

1. Mg 2. Cl 3. C 4. O

Answer:4

Solution:O →atomic no. 8→ config: 2, 6 → valence electrons = 6

10. How many valence electrons should Lithium have in its Lewis dot model?

1. 1 2. 2 3. 3 4. 4

Answer:1

Solution: Li (Group 1) has 1 valence e^- (•Li)

11.  **By replacing the element symbol, this could be a diagram of which element?**

1. Li 2. Al 3. C 4. Be

Answer:2

Solution:Al → Atomic no. 13 → Config: 2,8,3 → Valence electrons = 3

12. What is the Lewis dot structure for a neutral atom of bromine ($_{35}$Br)

1. The element symbol Br with 7 dots around it.

2. The element symbol Br with 8 dots around it.

3. The element symbol Br with 5 dots around it.

4. The element symbol Br with 35 dots around it.

Answer:1

Solution: Br (Group 17) has 7 valence e^-

13. If stability were attained with 6 electrons rather than with 8 electrons. What would be the formula of the stable fluoride ion

1. F^{3+} 2. F^+ 3. F^- 4. F^2

Answer:2

Solution:If stability with 6 electrons (instead of 8), fluorine (2,7 $\rightarrow$ wants 1) would not gain but rather lose 1 $\rightarrow$ becomes F^+

14. Which of the following statement is correct

1. In a Chemical bond both attractive and repulsive forces exist in equilibrium.

2. "electronic theory of Valency" this was proposed on the basis of Bohr's Atomic theory.

3. group 18 elements have zero valency

4. All the above

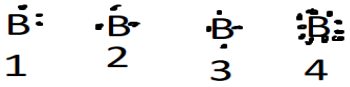
Answer:4

Solution:Bonds balance forces (A).

Kossel-Lewis theory built on Bohr's model (B).

Noble gases have valency=0 (C).

15.



Which of the elements in the picture has correct electron dot notation?

1. 1 2. 2 3. 3 4. 4

Answer:1,2

Solution:B with 3 dots $\rightarrow$ 3 valence electrons

16. How many electrons are there in the valence shell of the O^{2-} ion?

1.2 2. 8 3. 10 4. 6

Answer:2

Solution:O ($6e^-$) gains $2e^- \rightarrow O^{2-}$ with $8e^-$ (octet).

17. How many electrons are shared in a covalent bond represented by a Lewis dot structure?

A) 1 B) 2 C) 3 D) 4

Answer:B

Solution: Single bond = 2 shared e^- (e.g., H–H).

JEE ADVANCED LEVEL QUESTIONS

MULTI CORRECT ANSWERS

1. Select all elements that can form ions with a negative charge:

A) Oxygen (O) B) Fluorine (F) C) Chlorine (Cl) D) Bromine (Br)

Answer:A,B,C,D

Solution:These are all nonmetals that gain electrons to achieve stable octets:

O gains $2e^- \rightarrow O^{2-}$

F/Cl/Br gain $1e^- \rightarrow F^-/Cl^-/Br^-$

2. Which of the following statements are true according to the Kossel-Lewis Theory? Select all that apply.

a) Ionic bonds are formed by the transfer of electrons from one atom to an other.

b) Covalent bonds are formed by the sharing of electrons between atoms.

c) Metals tend to gain electrons to achieve a full outer shell.

d) Nonmetals tend to lose electrons to achieve a full outer shell.

Answer:A,B

Solution:

a) Ionic bonds = transfer of electrons.

b) Covalent bonds = sharing of electrons.

3. Which of the following statements is incorrect

1. Valency of Be & Mg are same 2. Valency of Sodium is 1

3. Valency of Li & Mg are same **4. Valency of He & Cl are same**

Answer:3,4

Solution:

Li (Group 1) valency=1; Mg (Group 2) valency=2

He valency=0 (noble gas); Cl valency=1

4. Which of the following statements is correct

1. The number of electrons transfered is called Electrovalency

2. The number of electrons shared is called co-valency

3. Covalency of carbon is 4 **4. Covalency of Sodium is 1**

Answer:1,2,3

Solution:

1. Electron transfer = Electrovalency

2. Electron sharing = Covalency

3. Carbon covalency=4 (e.g., CH_4)

Incorrect option:

4. Na forms ionic bonds (electrovalency=1, not covalency)

5. Consider the Lewis symbols for the following elements: Oxygen (O), Nitrogen (N), Carbon (C), and Fluorine (F). Which of the following pairs correctly repre sent elements with the same number of unpaired electrons in their Lewis symbols?

a) Oxygen and Carbon **b) Nitrogen and Fluorine**

c) Oxygen and Fluorine **d) Nitrogen and Carbon**

Answer:A

Solution:O (valence p^4) $\rightarrow$ 2 unpaired (two singly occupied p orbitals)

C (valence p^2) $\rightarrow$ 2 unpaired (two singly occupied p orbitals)

N $\rightarrow$ 3 unpaired

F $\rightarrow$ 1 unpaired

So Oxygen and Carbon have the same number of unpaired electrons.

REASON AND ASSERTION TYPE

A) Both (A) and (R) are true and (R) is the correct explanation of(A)

B) Both (A) and (R) are ture and (R) is not the correct explanation of (A)

C) (A) is true but (R) is false D) (A) is false but (R) is true

6. Assertion: Carbon (C) exhibits a valency of 4.

Reason: Carbon has four valence electrons available for bonding, allowing it to form four covalent bonds.

Answer:A

Solution:Assertion (A): True (Carbon forms 4 bonds, e.g., CH_4).

Reason (R): Correct explanation (4 valence e^- $\rightarrow$ 4 bonds).

7. Assertion: The valency of an element remains constant across periods in the periodic table.

Reason: The number of valence electrons in an element remains constant across a period.

Answer:D

Solution:Assertion (A): False (Valency changes across periods, e.g., Na=1, Mg=2, Al=3).

Reason (R): True (Valence e^- increase left to right, but valency depends on bonding behavior).

8. Assertion: Helium (He) has a valency of 0.

Reason: Helium has a fully filled outer shell, making it chemically inert and unlikely to form bonds.

Answer:A

Solution:Assertion (A): True (He is inert, valency=0).

Reason (R): Correct explanation (Full outer shell $\rightarrow$ stability).

9. Assertion: According to the Kossel-Lewis Theory, atoms tend to achieve a stable electron configuration.

Reason: This stability is achieved by gaining, losing, or sharing electrons to achieve a full outer shell.

Answer:A

Solution:Assertion (A): True (Atoms seek stability via octet/duplet).

Reason (R): Correct explanation (Achieved by e^- transfer/sharing).

10. Assertion: Ionic compounds generally have high melting and boiling points.

Reason: In ionic compounds, the strong electrostatic forces of attraction be tween oppositely charged ions require substantial energy to overcome.

Answer:A

Solution:Assertion (A): True (Ionic compounds have high MP/BP).

Reason (R): Correct explanation (Strong electrostatic forces require high energy).

11. Assertion: According to the Kossel-Lewis Theory, atoms of noble gases do not form chemical bonds readily.

Reason: Noble gases already have a stable electron configuration with a full valence shell, making them chemically inert.

Answer:A

Solution:Assertion (A): True (Noble gases rarely bond).

Reason (R): Correct explanation (Full valence shell $\rightarrow$ stability).

12. Assertion: In Lewis structures, elements follow the octet rule to achieve a stable electron configuration.

Reason: The octet rule states that atoms tend to gain, lose, or share electrons to achieve a full outer shell with eight electrons.

Answer:A

Solution:Assertion (A): True (Lewis structures follow octet rule).

Reason (R): Correct explanation (Atoms aim for 8 valence e^-).

13. Assertion: Hydrogen typically forms only one bond in compounds.

Reason: Hydrogen has only one valence electron.

Answer:A

Solution:Assertion (A): True (H forms 1 bond, e.g., H_2O).

Reason (R): Correct explanation (1 valence $e^- \rightarrow$ 1 bond).

14. Assertion: The Lewis symbol for an element represents its valence electrons.

Reason: Valence electrons are the outermost electrons in an atom and are involved in chemical bonding.

Answer:A

Solution:Assertion (A): True (Lewis symbols show valence e^-).

Reason (R): Correct explanation (Outermost e^- participate in bonding).

15. Assertion: The Lewis symbol for carbon consists of two electrons represented by dots on one side.

Reason: Carbon has four valence electrons.

Answer:D

Solution:Assertion (A): False (Carbon's Lewis symbol has 4 dots)

Reason (R): True (Carbon has 4 valence e^-).

STATEMENT TYPE

1) Statement-I, Statement-II both are true
2) Statement-I, Statement-II both are false
3) Statement-I is true, Statement-II is false.
4) Statement-I is false, Statement-II is true.

17. Statement-I: The combining capacity of an element is called valency

Statement-II: The elements in the same group have the same valency.

Answer:1

Solution:

Statement-I: True. Valency is indeed the combining capacity of an element (e.g., O has valency 2 in H_2O).

Statement-II: True. Elements in the same group share the same valency (e.g., Group 1 elements all have valency 1).

18. Statement-I: Valency of Hydrogen is 1

Statement-II: Valency of Sodium is 1

Answer:1

Solution:Statement-I: True. Hydrogen has valency 1 (forms H^+ or H^-, but typically +1 in compounds like H_2O).

Statement-II: True. Sodium (Group 1) always has valency 1 (forms Na^+).

COMPREHENSION TYPE

The combining capacity of an atom is described by the total number of electrons lost, gained or shared to complete its octet and it also determines the valency of the atom.

19. The common or group valency is equal to:

1. No. of valence electrons till group number 4.

2. 8 - no. of valence electrons after group number 4.

3. Only no. of electrons present in the valence shell.

4. None of the above.

Answer:1,2

Solution:For Groups 1-4: Valency = Number of valence electrons.

For Groups 5-7: Valency = 8 - Number of valence electrons.

20. Valency of Calcium is

1. Same as Magnesium **2. Same as Argon**

3. Same as Nitrogen **4. All the above**

Answer:1

Solution:Calcium (Ca): Group 2, 2 valence e^- $\rightarrow$ valency = 2 (e.g., $CaCl_2$).

Magnesium (Mg): Group 2, 2 valence e^- $\rightarrow$ valency = 2 (e.g., MgO).

MATRIX MATCH TYPE

21.

Column-I (Atomic Number)	**Column-II (Valency)**
a) 10	1) 3
b) 13	2) 0
c) 8	3) 1
d) 29	4) 2

Answer:a-2,b-1,c-4,d-3

Solution:

a) 10 2) 0

b) 13 1) 3

c) 8 4) 2

d) 29 3) 1

INTEGER TYPE

22. Valency of Chlorine is _____

Answer:1

Solution:Chlorine (Group 17) has 7 valence electrons.

Gains 1 electron to achieve a stable octet (Cl^-).

Common compounds: NaCl (valency=1), HCl (valency=1).

23. How many valencies "Mn" Have _____

Answer:5

Solution:Atomic number = 25

Electronic configuration = [Ar] 3d5 $4s^2$

Manganese shows variable oxidation states because of unpaired d-electrons.

Common valencies: +2, +3, +4, +6, +7

(Sometimes also +5 in rare compounds)

So total 5 main valencies

KEY

				TEACHING TASK					
			JEE MAIN LEVEL QUESTIONS						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
B	A	D	B	C	A	A	D	C	C
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4	4	4	3	2	1	4	4	4	4
21	**22**	**23**	**24**						
B	D	A	B						
			JEE ADVANCED LEVEL QUESTIONS						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A,B,C,D	A,C	1,2	1,2,3	A,B,D	A,C,D	D	A	A	A
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
A	A	A	**A**	A	1	1	1	2	
20		**21**	**22**						
a-2,b-1,c-4,d-3		10	**1**						
				LEARNERS TASK					
			Conceptual Understanding Questions (CUQ's)						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1	**4**	**2**	3	2	4	1	3	2
			JEE MAINS LEVEL QUESTIONS						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	B	A	**4**	A	C	B	**1**	**4**	**1**
11	**12**	**13**	**14**	**15**	**16**	**17**			
2	**1**	**2**	**4**	1,2	**2**	B			
			JEE ADVANCED LEVEL QUESTIONS						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A,B,C,D	A,B	3,4	1,2,3	A	A	D	A	A	A
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	A	A	A	D		1	1	1,2	1
21		**22**	**23**						
a-2,b-1,c-4,d-3		1	5						