7. VALENCY & ELECTROPOSITIVE IONS

SOLUTIONS

Teaching Task

1.Valency of Neon (Ne) is:

A) 1 B) 0 C) 2 D) 8

Answer:B

Solution: Neon is a noble gas with a complete octet, so its valency is 0 (it does not form compounds under normal conditions).

2.A sodium ion (Na^+) has the same electrons as:

A) Fluorine (F) B) Neon (Ne) C) Oxygen (O) D) Magnesium (Mg)

Answer:B

Solution: Na^+ has 10 electrons (Na loses 1 electron from its 11), which is the same as Neon (atomic number 10).

3.The valency of chlorine in NaCl is:

A) 1 B) 2 C) 7 D) 0

Answer:A

Solution: In NaCl, chlorine gains 1 electron to form Cl^-, so its valency is 1.

4.Iron shows two valencies: 2 and 3. Which compound has Fe^{3+}?

A) FeO B) Fe_2O_3 C) $FeCl_2$ D) FeS

Answer:B

Solution:Fe_2O_3 has iron in the +3 state (Fe^{3+}), while FeO, $FeCl_2$, and FeS have Fe^{2+}.

5.Copper forms two ions: Cu^+ (Cuprous) and Cu^{2+}(Cupric). Which is correct?

A) $CuCl \rightarrow Cu^{2+}$

B) $CuO \rightarrow Cu^+$

C) $Cu_2O \rightarrow Cu^+$

D) $CuSO_4 \rightarrow Cu^+$

Answer:C

Solution:In Cu_2O, copper is in the +1 state (Cuprous, Cu^+).

(A) CuCl has Cu^+, not Cu^{2+}.

(B) CuO has Cu^{2+}, not Cu^+.

(D) $CuSO_4$ has Cu^{2+}, not Cu^+.

6.If an element 'X' forms X^{3+} and X^{4+} ions, it is likely:

A) Oxygen

B) Carbon

C) Tin (Sn)

D) Sodium

Answer:C

Solution:Tin (Sn) is a metal that can exhibit multiple oxidation states, including +3 and +4.

7.An element has 15 protons. Its stable ion will have:

A) 18 electrons (P^{3-}, gains $3e^-$)

B) 15 electrons (Neutral atom)

C) 12 electrons (Al^{3+}, loses $3e^-$)

D) 10 electrons (Not possible for P)

Answer:A

Solution:Phosphorus (P, atomic number 15) gains 3 electrons to achieve a stable octet, forming P^{3-} (15 + 3 = 18 electrons).

8.Which element can never form a positive ion?

A) Aluminum (Al)

B) Fluorine (F) (Correct - Only gains electrons)

C) Iron (Fe)

D) Calcium (Ca)

Answer: B

Solution:Fluorine is a highly electronegative halogen that only gains electrons to form F^- (negative ion), never a positive ion.

9.The valency of phosphorus in PH_3 and P_2O_5 is:

A) 3, 5 B) 5, 3 C) 3, 3 D) 5, 5

Answer:A

Solution:In PH_3, phosphorus shows a valency of 3 (bonds with 3 H atoms).

In P_2O_5, phosphorus shows a valency of 5 (each P bonds with 5 O atoms in the overall structure).

10.A metal ion M^{3+} has 10 electrons. The atomic number of M is:

A) 7 B) 13 C) 10 D) 16

Answer:B

Solution:M^{3+} has 10 electrons $\rightarrow$ Neutral M has 10 + 3 = 13 electrons (and 13 protons, so atomic number = 13). This is Aluminum (Al).

MULTIPLE CORRECT ANSWER TYPE

11.Which of the following statements about sodium (Na) are incorrect?

A) Sodium forms a Na^{2+} ion

B) Sodium has 1 valence electron

C) Na^+ has more electrons than a neutral Na atom

D) Sodium is a noble gas

Answer:A,C,D

Solution: A) Sodium (Na) loses 1 electron to form Na?, not Na^2? (Incorrect).
B) Sodium has 1 valence electron (Correct).
C) Na^+ has fewer electrons (10) than a neutral Na atom (11)
D) Sodium is an alkali metal, not a noble gas

12.Which statements about oxygen (O) are correct?

A) Oxygen gains 2 electrons to form O^{2-}

B) O^{2-} has the same electrons as neon (Ne)

C) Oxygen shows a valency of 6 in H_2O

D) O^{2-} is larger than a neutral O atom

Answer:A,B,D

Solution:A) Oxygen gains 2 electrons to form O^{2-} (Correct).

B) O^{2-} has 10 electrons (8 + 2), same as Neon (Ne) (Correct).

C) Oxygen shows a valency of 2 in H_2O, not 6 (Incorrect).

D) O^{2-} is larger than neutral O because added electrons increase electron-electron repulsion (Correct).

13.Which elements can exhibit variable valency?

A) Iron (Fe) **B) Copper (Cu)** **C) Magnesium (Mg)** **D) Phosphorus (P)**

Answer:A,B,D

Solution:A) Iron (Fe) shows +2 (Fe^{2+}) and +3 (Fe^{3+}) valencies.

B) Copper (Cu) shows +1 (Cu^+) and +2 (Cu^{2+}) valencies.

C) Magnesium (Mg) always shows +2 (No variable valency).

D) Phosphorus (P) shows +3 (PCl_3) and +5 (PCl_5) in covalent compounds.

14.Which statements about rust (Fe_2O_3) are wrong?

A) Iron has a valency of 2 in rust

B) Rust forms when Fe loses 3 electrons

C) Fe_2O_3 is called ferrous oxide

D) Oxygen's valency is 1 in rust

Answer:A,C,D

Solution:A) In Fe_2O_3 (rust), iron has a +3 valency (Fe^{3+}), not +2 (Incorrect).

B) Rust forms when Fe loses 3 electrons to become Fe^{3+} (Correct).

C) Fe_2O_3 is ferric oxide, not ferrous oxide (Ferrous oxide is FeO) (Incorrect).

D) Oxygen's valency is always 2 (Incorrect).

STATEMENT TYPE

1. Both statement I and II are correct and statement II is correct explanation of statement I.
2. Both statement I and II are correct and statement II is not correct explanation of statement I.
3. Statement I is correct and statement II is incorrect.
4. Statement I is incorrect and statement II is correct.

15.Statement-I: Sodium (Na) has 1 valence electron.

Statement-II: Sodium forms a Na^+ ion by losing 1 electron.

Answer:1

Solution:Statement-I is correct because sodium (atomic number 11) has an electron configuration of 2,8,1, meaning it has 1 valence electron.

Statement-II is correct because sodium loses its single valence electron to achieve a stable octet, forming Na?.

Statement-II is the correct explanation for Statement-I because the reason sodium has a +1 charge is directly due to its single valence electron.

16.Statement-I: Iron (Fe) can form both Fe^{2+} and Fe^{3+} ions.

Statement-II: Iron loses electrons from both valence and penultimate shells.

Answer:2

Solution:Statement-I is correct because iron exhibits variable valency (Fe^{2+} and Fe^{3+}) due to its electronic configuration ([Ar] $3d^6$ $4s^2$).

Fe^{2+}: Loses two 4s electrons.

Fe^{3+}: Loses two 4s electrons + one 3d electron.

Statement-II is correct because Fe^{3+} involves losing an electron from the penultimate (3d) shell, not just the valence shell.

However, Statement-II does not fully explain Statement-I because while it describes electron loss, it doesn't explicitly connect to why iron has two common oxidation states.

COMPREHENSION TYPE

COMPREHENSION-1

Nucleus is situated in the centre of an atom. All the **protons & neutrons are situated in the nucleus,** therefore, the entire mass of an atom is almost concentrated in the nucleus. The overall **charge of nucleus** is positive due to the **presence of positively charged protons** (neutrons have no charge). The **protons & neutrons** are collectively called **nucleons.** The **radius** of the nucleus of an atom is of the order of 10^{-15} m.

17.Why is almost the entire mass of an atom concentrated in the nucleus?

A) Electrons are very heavy

B) Protons and neutrons are much heavier than electrons

C) The nucleus is very large

D) Electrons have no mass

Answer:B

Solution: The nucleus contains all the protons and neutrons, which are collectively called nucleons.

The mass of protons and neutrons (~1 atomic mass unit each) is much larger than that of electrons (~1/1836 amu).

Since electrons contribute negligible mass, the nucleus holds >99.9% of the atom's mass.

18.What is the charge of the nucleus of an atom?

A) Negative B) Positive C) Neutral D) Sometimes positive, sometimes negative

Answer:B

Solution:The nucleus contains protons (+) and neutrons (0).

Protons are positively charged, while neutrons are neutral.

Thus, the nucleus has a net positive charge due to protons.

COMPREHENSION-II

As per the modern defnition, The number of electrons gained, lost or contributed for sharing by an atom of the element to acquire the stable configuration of the nearest noble gas element gives us directly the combining capacity or valency of the element.

19.Carbon wants to be stable like neon). How many electrons must it gain or lose to achieve this?

A) Gain 2 electrons B) Lose 4 electrons

C) Share 4 electrons D) Gain 6 electrons

Answer:C

Solution:Carbon's atomic number = 6 $\rightarrow$ Electron configuration: 2, 4 (needs 4 more electrons to achieve Neon's stable 2,8 configuration).

Carbon cannot easily gain 4 electrons (too energetically unfavorable) or lose 4 electrons (too much energy required).

Instead, it shares 4 electrons via covalent bonds (e.g., in CH_4 or CCl_4) to complete its octet.

20.A sodium atom loses one electron to become stable. Which noble gas configuration does it achieve?

A) Neon **B) Argon**

C) Helium **D) It doesn't match any noble gas**

Answer:A

Solution:Sodium's atomic number = 11 $\rightarrow$ Electron configuration: 2, 8, 1.

When it loses 1 electron, it becomes Na^+ (2, 8), which matches Neon's stable configuration (2, 8).

INTEGER TYPE

21. Valency exhibited by oxygen in H_2O is _____

Answer:2

Solution:In H_2O (water), oxygen (O) forms 2 covalent bonds with hydrogen (H).

Oxygen has 6 valence electrons (needs 2 more to complete its octet).

It shares 2 electrons (one with each H atom), so its valency = 2.

22. Valency exhibited by phosphorus in PH_3 is _____

Answer:3

Solution:In PH_3 (phosphine), phosphorus (P) forms 3 covalent bonds with hydrogen (H).

Phosphorus has 5 valence electrons (needs 3 more to complete its octet).

It shares 3 electrons (one with each H atom), so its valency = 3.

MATRIX MATCHING TYPE

23. Column I (Element)	**Column II (Valency)**
(A) Sodium (Na)	**(P) 1**
(B) Iron (Fe)	**(Q) 2, 3**
(C) Sulfur (S)	**(R) 2, 4, 6**
(D) Copper (Cu)	**(S) 1, 2**

1.A-P, B-Q, C-R, D-S **2.A-Q, B-P, C-S, D-R**

3.A-R, B-S, C-Q, D-P **4.A-S, B-R, C-P, D-Q**

Answer:1

Solution:

(A) Sodium (Na)	(P) 1
(B) Iron (Fe)	(Q) 2, 3
(C) Sulfur (S)	(R) 2, 4, 6
(D) Copper (Cu)	(S) 1, 2

Learners Task

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)

1.Na^+ is pronounced as:

A) Sodous B) Sodium C) Sodide D) Natric

Answer:B

Solution:The "+" just indicates it's a positive ion of sodium. We don't change the name for simple positive ions in English.

2.Which of these is a negative ion?

A) Oxide (O^{2-}) B) Aluminum (Al^{3+}) C) Potassium (K^+) D) Neon (Ne)

Answer:A

Solution: The superscript "-" indicates a negative chargeOxide (O^{2-})

3.The valency of chlorine in NaCl is:

A) 1 B) 7 C) 0 D) 2

Answer:A

Solution:Chlorine gains 1 electron to form Cl^- in NaCl

4.Iron shows two valencies. In $FeCl_3$, its valency is:

A) 2 B) 3 C) 1 D) 0

Answer:B

Solution:The formula shows 3 chlorine atoms, each with valency 1, so iron must be +3

5.Phosphorus (P) can have a valency of 3 in:

A) PCl_5 B) PH_3 C) PO_4^{3-} D) P_2O_5

Answer:B

Solution:In PH_3 , Phosphorus shares 3 electrons with 3 hydrogen atoms

6.The valency of carbon in CH_4 is:

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

Answer:C

Solution:Carbon forms 4 bonds with hydrogen atoms

7.An element with atomic number 12 (Mg) has the configuration:

A) 2, 8, 2 B) 2, 10 C) 2, 8, 1, 1 D) 2, 6, 4

Answer: A

Solution:2, 8, 2 (Magnesium has 12 electrons: 2 in first shell, 8 in second, 2 in outer shell)

8.Why does copper (Cu) show valency 1 and 2?
A) It loses electrons from both 4s and 3d orbitals
B) Its nucleus changes charge
C) It gains protons
D) It becomes a noble gas
Answer:A
Solution:Copper can:Lose one electron (from 4s) $\rightarrow$ Cu^{+} $\rightarrow$Valency = 1
Lose one from 4s and one from 3d $\rightarrow$$Cu^{2+}$ Valency = 2
So, the variation in valency is due to loss of electrons from both 4s and 3d orbitals.

9.In H_2SO_4, the valency of sulfur is:
A) 2 B) 4 C) 6 D) 1
Answer: C
Solution:Each oxygen has valency 2 (total 8 for 4 oxygens), balanced by 2 hydrogens (valency 1 each), so sulfur must be +6

10.Which element's valency is always zero?
A) Oxygen B) Neon (Ne) C) Nitrogen D) Fluorine
Answer: B
Solution:Neon (Ne) $\rightarrow$Noble gases have complete outer shells and don't form compounds under normal conditions

JEE MAIN LEVEL QUESTIONS

1.Number of electrons in a neutral oxygen atom (O) is:
A) 6 B) 8 C) 10 D) 16
Answer: B
Solution:Atomic number of oxygen is 8, which equals its electron count in neutral state

2.The valency of magnesium (Mg) is:
A) 1 B) 2 C) 3 D) 0
Answer: B
Solution:Mg has 2 valence electrons and always loses both to form Mg^{2+}

3.Which ion is formed when chlorine gains 1 electron?
A) Cl^{+} B) Cl^{-} C) Cl^{2-} D) C
Answer: B
Solution:Cl^{-} $\rightarrow$Chlorine gains 1 electron to achieve stable octet
4.In H_2O, the valency of hydrogen is:

A) 1 B) 2 C) 0 D) 3

Answer: A

Solution:In H_2O, the valency of hydrogen is 1 (Each hydrogen forms one bond with oxygen)

5.The formula for aluminum oxide is:

A) AlO B) Al_2O C) Al_2O_3 D) AlO_2

Answer: C

Solution:The formula for aluminum oxide is Al_2O_3 (Al^{3+} and O^{2-} ions combine in 2:3 ratio for neutrality)

6.An element with electronic configuration 2,8,3 will form ions with charge:

A) +1 B) +2 C) +3 D) -3

Answer: C

Solution: It will lose all 3 valence electrons to become stable

7.Iron in Fe_2O_3 has a valency of:

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

Answer: B

Solution: Iron in Fe2O3 has a valency of 3 (2 Fe^{3+} ions balance 3 O^{2-} ions)

8.Phosphorus (P) shows valency 5 in:

A) PH_3 B) PCl_5 C) P_2O_3 D) H_3PO_3

Answer: B

Solution:In PCl_5 ,Phosphorus shares 5 electrons with chlorine atoms

9.The anion F^- is _____ than the neutral F atom.

A) Smaller B) Larger C) Same size D) Heavier

Answer: B

Solution:The anion F^- is Larger than the neutral F atom because Added electron increases electron-electron repulsion.

10.An element X forms X^{2+} and X^{3+} ions. It is likely:

A) Sodium (Na) B) Iron (Fe) C) Neon (Ne) D) Carbon (C)

Answer: B

Solution: Iron (Fe) $\rightarrow$ Common transition metal with variable valency

11.Which noble gas has the same electrons as Ca^{2+}?

A) He B) Ne C) Ar D) Kr

Answer: C

Solution:Ca^{2+} has 18 electrons, same as argon

12.The valency of nitrogen in N_2O_5 is:

A) 1 B) 3 C) 5 D) 7

Answer: C

Solution:The valency of nitrogen in N_2O_5 is 5 (Each nitrogen forms 5 bonds in this oxide)

13.Why can't helium (He) form ions like hydrogen (H^+ or H^-)?

A) It's too heavy B) Its outer shell is already full

C) It's a metal D) It has no protons

Answer: B

Solution:Helium has complete duplet configuration

ADVANCED LEVEL QUESTIONS

MULTIPLE CORRECT ANSWER TYPE

14.Which statements about sodium (Na) are correct?

A) It loses 1 electron to form Na^+

B) Its valency is equal to its valence electrons

C) It gains electrons to achieve stability

D) Na^+ has the same size as a neutral Na atom

Answer:A,B

Solution:A) It loses 1 electron to form Na^+ → Correct. Sodium (Na) has 1 valence electron and loses it to achieve stability, forming Na^+.

B) Its valency is equal to its valence electrons → Correct. Sodium has 1 valence electron, and its valency is 1 (it loses 1 electron).

15.Iron (Fe) can exhibit:

A) Valency 2 in FeO B) Valency 3 in Fe_2O_3

C) Valency 4 in $FeCl_2$ D) The same valency as oxygen

Answer:A,B

Solution:A) Valency 2 in FeO → Correct. Fe^{2+} (ferrous) forms FeO (Iron(II) oxide).

B) Valency 3 in Fe_2O_3 → Correct. Fe^{3+} (ferric) forms Fe_2O_3 (Iron(III) oxide).

C) Valency 4 in $FeCl_2$ → Incorrect. $FeCl_2$ contains Fe^{2+} (valency 2), not 4.

D) The same valency as oxygen → Incorrect. Oxygen has a valency of 2, while iron shows 2 or 3.

16.Which statements about anions are incorrect?

A) Anions are larger than their parent atoms

B) Cl^- has the same electrons as argon

C) Anions are always negatively charged

D) O^{2-} is smaller than neutral oxygen

Answer: D

Solution:D) O^{2-} is smaller than neutral oxygen $\rightarrow$ Incorrect. O^{2-} is larger than neutral O due to added electrons.

COMPREHENSION TYPE

COMPREHENSION-1

When an atom looses one or more electrons to get stability, The number of electrons lost by an atom of an element is its Positive valency and the ion is called Cation or Electropositive ion. (or) Radical or ion having positive charge on them is called Electropositive ion (or) Cation.

17.What happens when a sodium (Na) atom loses 1 electron?

A) It becomes a negatively charged ion (Na^-)

B) It becomes a neutral helium atom

C) It becomes a positively charged ion (Na^+)

D) It disappears

Answer:C

Solution:Sodium (Na) has 11 protons (+) and 11 electrons (-) in its neutral state.

When it loses 1 electron, it retains 11 protons but now has 10 electrons.

This results in a net +1 charge, forming the Na^+ ion.

18.Why is the size of a calcium ion (Ca^{2+}) SMALLER than a neutral calcium (Ca) atom?

A) It gains extra electrons

B) The nucleus attracts fewer electrons

C) Losing electrons reduces electron-electron repulsion

D) Protons are lost

Answer:C

Solution:Neutral calcium (Ca) has 20 electrons arranged in shells.

When it loses 2 electrons to form Ca^{2+}, it has 18 electrons.

The reduced electron count:

Decreases electron-electron repulsion, allowing the remaining electrons to be pulled closer to the nucleus.

The same nuclear charge (20+) now attracts fewer electrons more strongly.

COMPREHENSION-II

Compound ion : It consists of two or more atoms of different elements forming a single unit.

19.Which of these is a compound ion?

A) Na^+ B) Cl^- C) SO_4^{2-} D) Mg^{2+}

Answer:C

Solution:A compound ion (polyatomic ion) consists of multiple atoms of different elements bonded together and carrying a net charge.
SO_4^{2-} (sulfate) = 1 sulfur (S) + 4 oxygen (O) atoms with a 2– charge.

20.What is the charge of the compound ion "carbonate" (CO_3)?
A) +1 B) -1 C) -2 D) 0
Answer:C
Solution: $CO_3 = 4 + 3(-2) = 4 - 6 = -2$

INTEGER TYPE
21.Valency of Potassium ion (K^+) is _____
Answer:1
Solution:Potassium (K) loses 1 electron to form K^+, so its valency is +1.

22.Valency of Oxide ion is_____
Answer:2
Solution:Oxygen gains 2 electrons to form O^{2-}, so its valency is -2.

23.Valency of Ferric ion is _____
Answer:3
Solution:Ferric = Iron(III), which loses 3 electrons $\rightarrow$ Fe^{3+} (valency = +3).

24.Valency of Stannous ion is _____
Answer:2
Solution:Stannous = Tin(II), which loses 2 electrons $\rightarrow$ Sn^{2+} (valency = +2).

25.Valency exhibited by Manganese in $KMnO_4$ is _____
Answer:7
Solution:

$KMnO_4 = 0$
$1 + Mn + 4(-2) = 0$
$Mn = 8 - 1 = 7$

26.Valency of Chromium in $K_2Cr_2O_7$ is _____
Answer:6
Solution:

$K_2Cr_2O_7 = 0$
$2(1) + 2Cr + 7(-2) = 0$
$2Cr = 14 - 2 = 12$
$Cr = 12/2 = +6$

MATRIX MATCHING TYPE

27. Column I (Element) **Column II (Property)**

(A) Aluminum (Al) **(P) Valency = 3**

(B) Oxygen (O) **(Q) Forms O^{2-} ions**

(C) Chlorine (Cl) **(R) Needs 1 electron to complete octet**

(D) Calcium (Ca) **(S) Valency = 2**

1. A-P, B-Q, C-R, D-S

2. A-Q, B-P, C-S, D-R

3. A-R, B-S, C-P, D-Q

4. A-S, B-R, C-Q, D-P

Answer:1

Solution:

(A) Aluminum (Al) → (P) Valency = 3 → Aluminum (atomic number 13) has 3 valence electrons (2,8,3) and loses all 3 to form Al^{3+}.

(B) Oxygen (O) → (Q) Forms O^{2-} ions → Oxygen (atomic number 8) gains 2 electrons to achieve a stable octet, forming O^{2-}.

(C) Chlorine (Cl) → (R) Needs 1 electron to complete octet → Chlorine (atomic number 17) has 7 valence electrons and needs 1 more to complete its octet (forms Cl^-).

(D) Calcium (Ca) → (S) Valency = 2 → Calcium (atomic number 20) has 2 valence electrons (2,8,8,2) and loses both to form Ca^{2+}.

KEY

				Teaching Task					
1	2	3	4	5	6	7	8	9	10
B	B	A	B	C	C	A	B	A	B
11	12	13	14	15	16	17	18	19	20
A,C,D	A,B,D	A,B,D	A,C,D	1	2	B	B	C	A
21	22	1							
2	3								
				Learners Task					
				CUQ'S					
1	2	3	4	5	6	7	8	9	10
B	A	A	B	B	C	A	A	C	B
			JEE MAINS& ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	B	B	A	C	C	B	B	B	B
11	12	13	14	15	16	17	18	19	20
C	C	B	A,B	A,B	D	C	C	C	C
21	22	23	24	25	26	27			
1	2	3	2	7	6	1			