1. VALENCY
SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1.What is the valency of oxygen in water (H_2O)?
A) 1 B) 2 C) 3 D) 4
Solution:The valency of an element is determined by the number of hydrogen atoms it can combine with or replace in a compound.
In water (H_2O), oxygen combines with 2 hydrogen atoms. This means oxygen has a valency of 2.
Answer: B

2.In magnesium oxide (MgO), what is the valency of magnesium?
A) 1 B) 2 C) 3 D) 4
Solution:In magnesium oxide (MgO), the magnesium (Mg) atom combines with one oxygen (O) atom.
Oxygen has a valency of 2 (since it typically gains 2 electrons to achieve stability).
To balance this, magnesium must have a valency of 2 (losing 2 electrons to form Mg^{2+}).
Thus, the valency of magnesium in MgO is 2.
Answer: B

3.What is the valency of nitrogen in ammonia (NH_3)?
A) 1 B) 2 C) 3 D) 4
Solution:In ammonia (NH_3), nitrogen (N) combines with 3 hydrogen (H) atoms.
Hydrogen has a valency of 1, so 3 hydrogen atoms contribute a total valency of 3.
To balance this, nitrogen must have a valency of 3 (forming three bonds with hydrogen).
Thus, the valency of nitrogen in NH_3 is 3.
Answer: C

4.When aluminum forms $AlCl_3$, what is its valency?
A) 1 B) 2 C) 3 D) 4
Solution:In aluminum chloride (AlCl3), aluminum (Al) bonds with 3 chlorine (Cl) atoms.
Chlorine has a valency of 1 (it gains 1 electron to achieve stability).
Since aluminum bonds with 3 chlorine atoms, its valency must be 3 (it loses 3 electrons to form Al^{3+}).
Thus, the valency of aluminum in $AlCl_3$ is 3.
Answer: C

5.In carbon tetrachloride (CCl_4), what is carbon's valency?
A) 2 B) 3 C) 4 D) 5
Solution: In carbon tetrachloride (CCl_4), carbon (C) bonds with 4 chlorine (Cl) atoms.
Chlorine has a valency of 1 (it gains 1 electron to achieve stability).
Since carbon forms bonds with 4 chlorine atoms, its valency must be 4 (sharing 4 electrons to complete its octet).
Thus, the valency of carbon in CCl_4 is 4.
Answer: C

6.What is the valency of sulfur in sulfuric acid (H_2SO_4)?
A) 2 B) 4 C) 6 D) 8

Solution:In sulfuric acid (H_2SO_4), the sulfur (S) atom is bonded to:
2 oxygen (O) atoms via double bonds (each O has a valency of 2),
2 hydroxyl (OH) groups (where each oxygen is single-bonded to sulfur and hydro gen).
To determine sulfur's valency:
Each double-bonded oxygen contributes 2 (total = 2 × 2 = 4).
Each single-bonded oxygen (in OH) contributes 1 (total = 2 × 1 = 2).
Total valency of sulfur = 4 (from double bonds) + 2 (from single bonds) = 6.
Thus, the valency of sulfur in H_2SO_4 is 6.
Answer: C
7.In potassium permanganate ($KMnO_4$), what is manganese's valency?
A) 2 B) 4 C) 6 D) 7
Solution:K=+1,O= -2,Mn= x

$KMnO_4$

$+1+4(-2)=0$

$x=+8-1=7$

Answer: D
8.What is the valency of chromium in potassium dichromate ($K_2Cr_2O_7$)?
A) 3 B) 4 C) 6 D) 7
Solution:K=+1,O= -2,Cr= x

$KCrO_{2\cdot7}$

$2(+1)+2x+7(-2)=0$

$2+2x-14=0$

$x=+12/2=6$

Answer:C
9.In ferric oxide (Fe_2O_3), what is iron's valency?
A) 2 B) 3 C) 4 D) 6
Solution:

$FexO_{\cdot3}$

$FeO_{2\cdot3}$

$2x+3(-2)=0$

$2x=+6$

$x=+6/2=3$

Answer:B
10.What is the valency of copper in cuprous oxide (Cu_2O)?
A) 1 B) 2 C) 3 D) 4
Solution:

Cu_2O

Cu_xO_{-2}

$2(x)+(-2)=0$

$2x=2$

$x=2/2=1$

Answer:A

11.In stannic chloride ($SnCl_4$), what is tin's valency?

A) 2 B) 3 C) 4 D) 5

Solution:For $SnCl_4$,

Sn_xCl_{-1}

$x+4(-1)=0$

$x=+4$

Answer:C

12.What is the valency of phosphorus in orthophosphoric acid (H_3PO_4)?

A) 3 B) 4 C) 5 D) 6

Solution:Structure of H_3PO_4

Phosphorus (P) is bonded to:

4 oxygen (O) atoms (3 via single bonds and 1 via a double bond).

The 3 single-bonded oxygens are each attached to a hydrogen (H).

Oxygen (O):

Single-bonded O (with H): Valency = 1 (contributes 1 to P).

Double-bonded O: Valency = 2 (contributes 2 to P).

Total for oxygen:

3(1)+1(2) = 5.

Phosphorus Valency:

To balance the total valency from oxygen (5), phosphorus must have a valency of 5.

Answer:C

13.In potassium chlorate ($KClO_3$), what is chlorine's valency?

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

Solution:

$KClO_3$

$K_{+1}Cl_x{}^{-2}{}_3$

$1+(x)+3(-2)=0$

$x-5=0$

$x=+5$

Answer:C

14.What is the valency of manganese in potassium manganate (K_2MnO_4)?

A) 4 B) 6 C) 7 D) 8

Solution:

$KMnO_4$

$K+Mn+4(-2)=0$

$2(1)+x+4(-2)=0$

$x = +6$

Answer:B

15.In ammonium dichromate ($(NH_4)_2Cr_2O_7$), what is chromium's valency?

A) 3 B) 4 C) 6 D) 7

Solution:

$NH_4+Cr+7(-2)=0$

$2(1)+2x+7(-2)=0$

$2+2x-14=0$

$x = 12/2 = 6$

Answer:C

JEE ADVANCED LEVEL QUESTIONS

Multiple correct answer questions:

1. Which alkaline earth metals show a valency of 2 in their oxides?

A) Beryllium B) Magnesium C) Calcium D) Barium

Solution:Alkaline Earth Metals (Group 2 elements) have 2 valence electrons in their outermost shell.

They lose these 2 electrons to achieve stability, forming +2 ions (e.g., Be^{2+}, Mg^{2+}, Ca^{2+}, Ba^{2+}).

Answer:A,B,C,D

2. Elements that can exhibit both 2 and 4 valency in different compounds include:

A) Carbon B) Silicon C) Lead D) Tin

Solution:Lead (Pb) and Tin (Sn) are Group 14 elements (Carbon family) and show variable valency:

Valency = 4: Common in most compounds (e.g., PbO_2, $SnCl_4$).

Valency = 2: Due to the inert pair effect (reluctance of the ns^2 electrons to participate in bonding), forming compounds like PbO and $SnCl_2$.

Answer:C,D

3. Which transition metals commonly show a valency of 2 in their compounds?

A) Iron (Fe) B) Copper (Cu) C) Zinc (Zn) D) Manganese (Mn)

Solution:Transition metals often exhibit variable valency, but +2 is a stable and common oxidation state for all four due to their electron configurations:

Iron (Fe):Fe^{2+} (Ferrous state)

Copper (Cu):Cu^{2+} (Cupric state)

Zinc (Zn):Zn^{2+} (Fixed valency = 2)

Manganese (Mn):

Mn^{2+} (Manganous state)

Answer:A,B,C,D

4. The following elements can have a valency of 5 in some compounds:
A) Nitrogen B) Phosphorus C) Arsenic D) Bismuth
Soution:Elements belong to Group 15 (Nitrogen family) and can show a valency of 5 due to their ability to expand their octet
Answer:A,B,C,D
5. Which of these elements show variable valency in their compounds?
A) Chromium (Cr) B) Mercury (Hg) C) Vanadium (V) D) Nickel (Ni)
Solution:All four are transition metals with incompletely filled d-orbitals, enabling them to exhibit multiple oxidation states (valencies) in compounds
Answer:A,B,C,D

Assertion and Reason Type:

6. Assertion: Carbon typically exhibits a valency of 4 in organic compounds like methane (CH_4).
Reason: Carbon has 4 valence electrons and forms 4 covalent bonds to complete its octet
Solution:Assertion: "Carbon typically exhibits a valency of 4 in organic compounds like methane (CH_4)."
True. In methane (CH_4), carbon forms 4 covalent bonds with hydrogen, confirming its valency of 4.
Reason: "Carbon has 4 valence electrons and forms 4 covalent bonds to complete its octet."
True. Carbon (atomic number 6) has an electron configuration of 2,4, giving it 4 valence electrons. By sharing these 4 electrons (e.g., in CH4), it achieves a stable octet (8 electrons in its outer shell).
Correct Explanation: The Reason directly explains why carbon shows a valency of 4 (it needs 4 more electrons to complete its octet, achieved via 4 covalent bonds).
Answer:A
7.Assertion: Transition metals like iron can show variable valency (Fe^{2+} and Fe^{3+}).
Reason: Transition metals can utilize electrons from both outer and penultimate shells for bonding.
Solutions:Assertion: "Transition metals like iron can show variable valency (Fe^{2+} and Fe^{3+})."
True. Iron commonly exhibits +2 (ferrous, e.g., $FeCl_2$) and +3 (ferric, e.g., $FeCl_3$) valencies due to electron loss from different orbitals.
Reason: "Transition metals can utilize electrons from both outer and penultimate shells for bonding."
True. Transition metals have partially filled d-orbitals (penultimate shell) alongside outer s-orbital electrons. This allows variable electron loss (e.g., Fe loses 2 electrons: $4s^2 \rightarrow Fe^{2+}$, or 3 electrons: $4s^23d6 \rightarrow Fe^{3+}$).
Correct Explanation: The Reason directly accounts for the Assertion. The ability to lose electrons from both 4s and 3d orbitals (e.g., Fe's $4s^23d6$ configuration) enables multiple oxidation states.

Answer:A

8. Assertion: Nitrogen shows a valency of 3 in ammonia (NH_3) but 5 in nitrogen pentoxide (N_2O_5).

Reason: Nitrogen can expand its octet by utilizing vacant d-orbitals in higher oxidation states.

Solution:

Assertion: "Nitrogen shows a valency of 3 in ammonia (NH_3) but 5 in nitrogen pentoxide (N_2O_5)."

This is true.

In NH_3, nitrogen forms 3 bonds (valency=3)

In N_2O_5, nitrogen forms 5 bonds (valency=5)

Reason: "Nitrogen can expand its octet by utilizing vacant d-orbitals in higher oxidation states."

This is false.

Nitrogen (second period element) cannot expand its octet because it lacks available d-orbitals (only has 2s and 2p orbitals)

The valency of 5 in N2O5 is achieved through coordinate covalent bonding (not d-orbital expansion)

Answer:C

9. Assertion: Aluminum always shows a valency of +3 in its compounds.

Reason: Being in Group 13, aluminum loses all 3 valence electrons to achieve noble gas configuration.

Solution:

Assertion: "Aluminum always shows a valency of +3 in its compounds."

True. Aluminum consistently forms compounds in the +3 oxidation state (e.g., Al_2O_3, $AlCl_3$). No stable +1 or +2 compounds exist under normal conditions.

Reason: "Being in Group 13, aluminum loses all 3 valence electrons to achieve noble gas configuration."

True. Aluminum (electron configuration: $[Ne]3s^2 3p^1$) loses all three valence electrons (2 from 3s and 1 from 3p) to attain the stable neon configuration.

Correct Explanation: The Reason perfectly explains why aluminum exclusively exhibits +3 valency - its Group 13 position and electron configuration necessitate losing all three valence electrons for stability.

Answer: A

10. Assertion: The valency of chromium varies from +2 to +6 in different compounds.

Reason: Transition metals can utilize different numbers of d-electrons for bonding depending on conditions.

Solution:

Assertion: "The valency of chromium varies from +2 to +6 in different compounds."

True. Chromium exhibits multiple oxidation states:+2, +3, +6

Reason: "Transition metals can utilize different numbers of d-electrons for bonding depending on conditions."

True. Chromium's $3d^5 4s^1$ configuration allows variable electron loss:

Loses $4s^1$ electron $\rightarrow Cr^+$

Loses $4s^1$ + 3d electrons $\rightarrow Cr^{2+}$ to Cr^{6+}

The energy difference between 4s and 3d orbitals enables this flexibility.
Correct Explanation: The Reason directly explains the Assertion. Transition metals like chromium show variable valency because:
Their (n-1)d and ns orbitals have similar energies
They can lose different combinations of s/d electrons
The d-electrons participate in bonding
Answer: A

Statement Type:

11. Statement I: Alkali metals have 1 valence electron
Statement II: All alkali metals show a valency of +1 in their compounds

Solution:Statement I: "Alkali metals have 1 valence electron."
True. All alkali metals (Group 1: Li, Na, K, etc.) have a single electron in their outermost s-orbital (ns^1 configuration).
Statement II: "All alkali metals show a valency of +1 in their compounds."
True. Alkali metals exclusively form +1 ions (e.g., Na^+, K^+) by losing their single valence electron.
Correct Explanation: Statement II directly follows from and explains Statement I. The presence of just one valence electron (Statement I) necessitates that alkali metals can only lose this one electron to achieve stability, resulting in a +1 valency (Statement II).
Answer: A

12. Statement I: Transition metals can exhibit multiple valencies
Statement II: Transition metals utilize electrons from both outer and penultimate shells for bonding

Solution:Statement I: "Transition metals can exhibit multiple valencies."
True. Transition metals (e.g., Fe, Cu, Mn) show variable oxidation states (e.g., Fe^{2+}/Fe^{3+}, Cu^+/Cu^{2+}, $Mn^{2+}/Mn^{4+}/Mn^{7+}$).
Statement II: "Transition metals utilize electrons from both outer and penultimate shells for bonding."
True. Their valence electrons come from:
Outer ns orbital (e.g., 4s for first-row transition metals)
Penultimate (n-1)d orbitals (e.g., 3d for first-row)
Correct Explanation: Statement II explains Statement I. The ability to lose:
Only ns electrons $\rightarrow$ lower oxidation state
Both ns and (n-1)d electrons $\rightarrow$ higher oxidation states This electron availability from two shells enables multiple valencies.
Answer:A

Comprehension - I

13.What determines the formula of a compound formed when elements combine?
A) The atomic masses of the elements
B) The capacities of elements to combine with each other
C) The number of protons in each element
D) The physical state of the elements at room temperature
Solution:Valency (combining capacity) is the decisive factor in compound formation.

Answer: B
14.Defines valency as:
A) The number of electrons in an atom
B) The capacity of an element to combine with other elements
C) The mass number of an element
D) The reactivity series of metals
Solution:Valency = Combining capacity, not electron count, mass, or reactivity.
Answer:B
Comprehension - II
15.What is the overall charge of the nucleus?
a) Negative b) Neutral c) Positive d) No charge
Solution:The nucleus is positively charged because of protons. Electrons balance this charge in a neutral atom.
Answer:C
16.Which subatomic particles are found in the nucleus?
a) Electrons and protons
b) Protons and neutrons
c) Neutrons and electrons
d) Only protons
Solution:Nucleus = Protons + Neutrons
Answer: b
17.What term refers to protons and neutrons collectively?
a) Electrons b) Quarks c) Nucleons d) Leptons
Solution:Nucleons = Protons + Neutrons (the heavy particles in the nucleus).
Answer: c
18.What is the approximate size (radius) of the nucleus?
a) 10^{-10} meters b) 10^{-15} meters c) 10^{-20} meters d) 10^{-5} meters
Solution:Nuclear radius: ~1 femtometer (1 fm = 10^{-15} m)
Answer:B
19.Which particle has no electrical charge?
a) Proton b) Neutron c) Electron d) Positron
Solution:Neutron: No charge (neutral)
Answer:B
20. Valency exhibited by Sulfur in H_2SO_4 is ____
Solution:For H_2SO_4

$HOSk,2,$

$2(1)4(2)0$

$x=826$

Answer:6
21. Valency exhibited by Aluminum in Al_2O_3 is ____

Solution:

AlO_{23}

$2(3)+3x=0$

$6+3x=0$

$x=3$

Answer:3

Matrix Matching Type:

22

SOLUTION:

Element	**Valency**
(A) Iron (Fe)	(R) 2, 3
(B) Phosphorus (P)	(S) 3, 5
(C) Copper (Cu)	(P) 1, 2
(D) Sulfur (S)	(Q) 2, 4

Answer: 1) A-R, B-S, C-P, D-Q

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ'S)

1.How many electrons can occupy the second energy level (L-shell) of an atom?
A) 2 B) 4 C) 6 D) 8
Solution:The L-shell holds up to 8 electrons when completely filled
Answer:D
2.The electronic configuration of Neon (atomic number 10) is:
A) 2, 8 B) 2, 6, 2 C) 2, 4, 4 D) 2, 7, 1
Solution:Neon's filled K and L shells exemplify the "octet rule" for stability.-->2,8
Answer:A
3.Which element has a valency of 1 in NaCl?
A) Sodium B) Chlorine C) Both D) Neither
Solution:Na and Cl both have a valency of 1 (with opposite charges) in NaCl.
Answr:C
4.The valency of Aluminum (Al) in Al_2O_3 is:
A) 1 B) 2 C) 3 D) 4

Solution: AlO_{23}

$2(3)+3x=0$

$6+3x=0$

$x=3$

Answer:C
5.The correct electronic configuration of Sulfur (atomic number 16) is:
A) 2, 8, 6 B) 2, 6, 8 C) 2, 10, 4 D) 2, 8, 4, 2
Solution:follows the $2n^2$ rule for energy levels (shells):
First shell (K-shell, n=1):
Maximum electrons = $2(1)^2 = 2$ electrons.

Second shell (L-shell, n=2):
Maximum electrons = $2(2)^2 = 8$ electrons.
Third shell (M-shell, n=3):
Holds the remaining 6 electrons (16 total - 2 - 8 = 6)
Answer:A
6.Valence electrons and valency of Oxygen (O) in H_2O are:
A) 6, 2 B) 2, 6 C) 8, 0 D) 4, 2
Solution:Valence Electrons of Oxygen (O):
Atomic number of oxygen = 8 $\rightarrow$ Electron configuration: 2, 6.
Valence electrons = 6 (electrons in the outermost shell, L-shell).
Valency of Oxygen in H_2O:
In water (H_2O), oxygen forms 2 covalent bonds with hydrogen atoms.
Valency = 2 (number of bonds formed to complete its octet).
Answer:A
7.The valency of Iron (Fe) in $FeCl_3$ is:
A) 2 B) 3 C) 4 D) 6
Solution:$FeCl_3$ is the ferric (iron(III)) form, where iron exhibits its +3 valency.
Answer:B
8.A neutral atom has 15 protons and 16 neutrons. Its stable ion (most common charge) will have:
A) 13 electrons B) 15 electrons C) 18 electrons D) 10 electrons
Solution:
Neutral Atom:
Protons = 15 (atomic number = 15 $\rightarrow$ Phosphorus, P).
Neutrons = 16 (mass number = 31).
Electrons = 15 (neutral atom has equal protons and electrons).
Stable Ion of Phosphorus:
Phosphorus is in Group 15 (5 valence electrons).
To achieve a stable octet, it gains 3 electrons, forming the phosphide ion (P^{3-}).
Total electrons in P^{3-} = 15 (original) + 3 (gained) = 18 electrons.
Answer:C
9.Which element (atomic number given) exhibits both +2 and +4 valency?
A) Carbon (6) B) Fluorine (9) C) Sodium (11) D) Argon (18)
Solution:Carbon's variable valency arises from its ability to form different numbers of covalent bonds (e.g., 4 in CH_4, 2 in CO).
Answer:A
10.An element X has the electronic configuration 2, 8, 18, 1. Its stable ion will have:
A) 0 electrons B) 28 electrons C) 18 electrons D) 36 electrons
Solution:The given electronic configuration is:2, 8, 18, 1
Let's analyze:
This corresponds to a total of 2 + 8 + 18 + 1 = 29 electrons, which means the atomic number of element X is 29.
Element 29 is Copper (Cu).
The outermost shell has 1 electron, and Cu commonly loses 1 electron to form a stable Cu^+ ion.
So:Neutral Cu atom = 29 electrons
Cu^+ ion (stable) = 29 - 1 = 28 electrons

Answer:B
11.The valency of Manganese (Mn) in $KMnO_4$ is:
A) 2 B) 4 C) 7 D) 1
Solution:K=+1,O= -2,Mn= x

$KMnO_4$

$+1 + 4(-2) = 0$

$x = +8 - 1 = 7$

Answer:C
12.The number of valence electrons in a neutral atom of Gold (Au, Z=79) is:
A) 1 B) 2 C) 3 D) 11
Solution:Au=[Xe] $4f^{14}$ $5d^{10}$ $6s^1$
Answer:A

JEE MAINS LEVEL QUESTIONS

1.In the compound water (H_2O), what is the valency of oxygen?
A) 1 B) 2 C) 3 D) 4
Solution:In water (H_2O):
Oxygen (O) has 6 valence electrons (atomic number 8 $\rightarrow$ electron configuration: 2,6).
To achieve a stable octet, oxygen shares 2 electrons (one with each hydrogen atom), forming 2 covalent bonds.
Thus, its valency = 2 (number of bonds formed).
Answer:B
2.What is the valency of phosphorus in phosphorus trichloride (PCl_3)?
A) 2 B) 3 C) 4 D) 5
Solution:Valency 5: PCl_5 (phosphorus pentachloride)
Answer:D
3.When sodium reacts with oxygen to form sodium oxide (Na_2O), what is the valency of oxygen?
A) 1 B) 2 C) 3 D) 4
Solutions:Oxygen's valency is consistently 2 in ionic and covalent compounds.
Answer:A
4.In the compound methane (CH_4), what is the valency of carbon?
A) 2 B) 3 C) 4 D) 6
Solution:Carbon always exhibits a valency of 4 in its compounds (e.g., CH_4, CO_2, CCl_4).
Answer:C
5.What is the valency of iron in ferric oxide (Fe_2O_3)?
A) 2 B) 3 C) 4 D) 6
Solution:Oxygen (O) has a fixed valency of 2 (forms O^{2-} ions).
The compound has 3 oxygen atoms, contributing a total valency of 3 × 2 = 6.
To balance this, the 2 iron atoms must have a total valency of 6, so each iron has:
Valency of Fe=6/2=3.
Answer:B
6.The valency of nitrogen in ammonia (NH_3) is 3. What is its valency in nitrogen

dioxide (NO_2)?
A) 2 B) 3 C) 4 D) 5
Solution:Let the oxidation number of nitrogen be x.
Each oxygen has an oxidation number of -2, and there are 2 oxygen atoms:

$x + 2(-2) = 0$

$x = 4$

Solution:C
7.What is the valency of chromium in potassium dichromate ($K_2Cr_2O_7$)?
A) +2 B) +3 C) +6 D) +7
Solution:K=+1,O= -2,Cr= x

$K_2Cr_2O_7$

$2(+1) + 2(x) + 7(-2) = 0$

$2 + 2x - 14 = 0$

$2x = 12$

$x = +6$

Answer:C
8.An element X has the electronic configuration 2, 8, 18, 7. What is its most likely valency?
A) 1 B) 2 C) 3 D) 7
Solution:Given electronic configuration of element X: 2, 8, 18, 7
Step 1: Total electrons
Total = 2 + 8 + 18 + 7 = 35 electrons Atomic number = 35, which is Bromine (Br)
Step 2: Determine valency
The valence shell has 7 electrons.
To achieve a stable octet, bromine tends to gain 1 electron.
So, valency = 8 - 7 = 1
Answer:A
9.The valency of sulphur in sulphur hexafluoride (SF_6) is:
A) 2 B) 4 C) 6 D) 8
Solution:In sulfur hexafluoride (SF_6):
Sulfur (S) forms 6 covalent bonds with fluorine atoms.
Each fluorine (F) has a valency of 1, so sulfur must balance 6 × 1 = 6.
Thus, sulfur's valency = 6 (number of bonds formed).
Answer:C
10.In which of the following compounds does nitrogen exhibit a valency of 4?
A) NH_3 B) NO_2 C) N_2O D) HNO_3
Solution:NO_2 Structure:
Nitrogen forms 2 covalent bonds with oxygens and has 1 unpaired electron (total bonds = 2.5 on average, but formal valency = 4).
Answer:B
11.An element has the electronic configuration 2, 8, 18, 1. What is its expected valency in its most stable compound?
A) 1 B) 2 C) 3 D) 4
Solution:The given electronic configuration is:2, 8, 18, 1
Step 1: Total electrons = 2 + 8 + 18 + 1 = 29
Atomic number = 29, which is Copper (Cu)

Step 2: Determine valency
Copper has one electron in its outermost shell ($4s^1$).
In compounds, copper commonly shows valency 1 (Cu^+) and valency 2 (Cu^{2+}).
However, the most stable and common oxidation state of Cu is +2, as in CuO or CuSO4.
This means copper loses 2 electrons (one from 4s and one from 3d), forming Cu^{2+}.
Answer:B
12.The valency of manganese in potassium permanganate ($KMnO_4$) is:
A) +2 B) +4 C) +6 D) +7
Solution:K=+1,O= -2,Mn= x

$KMnO_4$

$+1+4(-2)=0$

$x=+8-1=7$

Answer:D
13.In the compound XeF_6, what is the valency of xenon?
A) 2 B) 4 C) 6 D) 8
Solution:In xenon hexafluoride (XeF_6):
Xenon (Xe), a noble gas, forms 6 covalent bonds with fluorine atoms.
Each fluorine (F) has a valency of 1, so xenon must balance 6 × 1 = 6.
Thus, xenon's valency = 6 (number of bonds formed).
Answer:C
14.An element forms an oxide X_2O_5. What is the valency of X?
A) 2 B) 3 C) 5 D) 7
Solution:

XO

$2x+5(-2)=0$

$2x-10=0$

$x=5$

Answer:C
15.In the compound Fe_3O_4 (magnetite), the valency of iron is:
A) Only +2 B) Only +3 C) Both +2 and +3 D) +4
Solution:The compound Fe_3O_4 (magnetite) is a mixed oxide of iron.
Step 1: Total oxidation from oxygen
Each Oxygen (O) has an oxidation number of -2 There are 4 oxygen atoms, so total = 4 × (-2) = -8
Step 2: Let's find the oxidation states of Fe
Let the total oxidation number of the 3 Fe atoms = +8, to balance the -8 from oxygen.
Since Fe_3O_4 is known to contain both Fe^{2+} and Fe^{3+} ions, we assume:
1 Fe^{2+} ion $\rightarrow$ +2
2 Fe^{3+} ions $\rightarrow$ 2 × (+3) = +6
Total = 2 + 6 = +8
So this combination balances the -8 from oxygen.

Answer:C

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

1. Which of the following statements about valency are correct for the given compounds?

A) In peroxydisulfuric acid ($H_2S_2O_8$), the valency of sulfur is +6.
B) In dinitrogen pentoxide (N_2O_5), the valency of nitrogen is +5.
C) In xenon hexafluoride (XeF_6), the valency of xenon is +6.
D) In potassium superoxide (KO_2), the valency of oxygen is -½.

Solution:

A) In peroxydisulfuric acid ($H_2S_2O_8$), the valency of sulfur is +6.

Let's use 6 normal oxygen atoms (–2 each), and 2 peroxy oxygen atoms (–1 each):

$2(1)+2x+6(-2)+2(-1)=0$

$2+2x-12-2=0$

$x=+12/2$

B) In dinitrogen pentoxide (N_2O_5), the valency of nitrogen is +5.

$2x+5(-2)=0$

$2x-10=0$

$x=+10/2$

C) In xenon hexafluoride (XeF_6), the valency of xenon is +6.

$x+6(-1)=0$

$x=6$

D) In potassium superoxide (KO_2), the valency of oxygen is -½.

$1+2x=0$

$2x=-1$

$x=-\frac{1}{2}$

Answer:A,B,C,D

2.Which of the following elements exhibit variable valency in their common compounds?

A) Iron (Fe) in FeCl2 and FeCl3
B) Copper (Cu) in Cu2O and CuO
C) Manganese (Mn) in MnO2 and KMnO4
D) Zinc (Zn) in ZnCl2 and ZnO

Solution:A) Iron (Fe) in FeCl2 and FeCl3

In FeCl2, iron has a valency of +2 (ferrous).
In FeCl3, iron has a valency of +3 (ferric).
Iron shows variable valency.

B) Copper (Cu) in Cu2O and CuO

In Cu2O, copper has a valency of +1 (cuprous).
In CuO, copper has a valency of +2 (cupric).
Copper shows variable valency.
C) Manganese (Mn) in MnO2 and KMnO4
In MnO2, manganese has a valency of +4.
In KMnO4, manganese has a valency of +7.
Manganese shows variable valency.
D) Zinc (Zn) in ZnCl2 and ZnO
In both ZnCl2 and ZnO, zinc has a valency of +2.
Zinc does not show variable valency in these compounds
Answer:A,B,C

Assertion and Reason Type:

3. **Assertion (A): Oxygen exhibits a valency of -2 in most of its compounds.**
Reason (R): Oxygen has 6 valence electrons and tends to gain 2 electrons to achieve a stable octet.

Solution:Assertion (A) is true because oxygen commonly exhibits a -2 valency in most of its compounds (e.g., H_2O, CO_2, MgO).
Reason (R) is true because oxygen has 6 valence electrons and tends to gain 2 electrons to complete its octet (achieving a stable noble gas configuration like neon).
The Reason correctly explains why oxygen typically forms a -2 valency.
Answer:A

4.**Assertion (A): In peroxydisulfuric acid ($H_2S_2O_8$), sulfur has a valency of +6.**
Reason (R): Sulfur can expand its octet due to vacant 3d orbitals, allowing higher oxidation states.

Solution:Assertion (A) is true because in peroxydisulfuric acid ($H_2S_2O_8$), sulfur indeed has a +6 valency (oxidation state).
The structure of $H_2S_2O_8$ contains two peroxo (O-O) linkages, but the sulfur atoms are still in the +6 oxidation state (similar to sulfuric acid, H2SO4).
Each sulfur is bonded to 4 oxygen atoms (two single-bonded and two double-bonded, considering resonance).
Reason (R) is true because sulfur (in the 3rd period) can expand its octet by utilizing vacant 3d orbitals, allowing it to exhibit higher oxidation states (like +6).
The Reason correctly explains why sulfur can achieve a +6 oxidation state in compounds like $H_2S_2O_8$.
Answer:A

Comprehension Type:

Comprehension - I

5.The element can form a stable charged ion by
A) losing 1 electron B) losing 2 electrons
C) gaining 1 electron D) gaining 2 electrons
Solution:Identifying the Element:
The element with atomic number 17 is chlorine (Cl).
The given data corresponds to the isotope chlorine-35 ($^{3}5Cl$).
Electronic Configuration of Chlorine:
Chlorine (neutral atom) has 17 electrons.
Its electron configuration: $1s^2\ 2s^2\ 2p6\ 3s^2\ 3p5$.

It needs 1 more electron to complete its octet (stable noble gas configuration like argon).
Formation of Stable Ion:
Chlorine gains 1 electron to form a chloride ion (Cl^-).
Answer:C

Comprehension - II

6.What are the paths called in which electrons move around the nucleus?
A) Protons B) Orbits / Energy levels C) Neutrons D) Nucleons
Solution:Electrons move around the nucleus in specific paths called orbits (as per Bohr's model) or energy levels (modern term).
Answer:B

7.Which of the following is the correct sequence of energy levels moving outward from the nucleus?
A) M, L, K, N B) K, L, M, N C) N, M, L, K D) L, K, M, N
Solution:The energy levels are named in order from the nucleus outward:
K (n=1) $\rightarrow$L (n=2) $\rightarrow$ M (n=3) $\rightarrow$ N (n=4) and so on.
Answer:B

8.What is true about electrons in different energy levels?
A) All electrons have the same energy.
B) Electrons in higher energy levels are closer to the nucleus.
C) Electrons in one energy level differ in energy from those in another.
D) Energy levels do not have fixed energy values.
Solution:Each energy level has a fixed energy value, and electrons in different levels have different energies.
Answer:C

Integer type:

9. _____ group elements exhibit a valency of +1 when reacting with oxygen
Solution: Alkali metals (Li, Na, K, etc.) have 1 valence electron and form oxides like Li_2O, Na_2O, etc., where their valency is +1.
Answer:1

10. The maximum oxidation state (valency) exhibited by manganese (Mn) in its compounds is _____
Solution: Manganese shows a maximum oxidation state of +7
Potassium permanganate (KMnO4) $\rightarrow$ Mn has +7 state.
Other oxidation states of Mn include +2 (MnCl2), +4 (MnO2), +6 (K2MnO4).
Answer:7

11. The highest stable valency exhibited by uranium (U) in its compounds is _____
Solution: Uranium commonly shows a +6 oxidation state in stable compounds like:
Uranium hexafluoride (UF6) $\rightarrow$ U has +6 state.
Other possible states include +3, +4, +5, but +6 is the highest stable valency.
Answer:6

Matrix Matching Type:

12.

Column I **Element**		**Column II** **Valence electrons**	
(A)	Oxygen	(P)	6
(B)	Neon	(Q)	8
(C)	Aluminum	(R)	3
(D)	Chlorine	(S)	7

KEY

TEACHING TASK											
JEE MAINS LEVEL QUESTIONS											
1	2	3	4	5	6	7	8	9	10		
B	B	C	C	C	C	D	C	B	A		
11	12	13	14	15							
C	C	C	B	C							
JEE ADVANCED LEVEL QUESTIONS											
1	2	3	4	5	6	7	8	9	10		
A,B,C,D	C,D	A,B,C,D	A,B,C,D	A,B,C,D	A	A	C	A	A		
11	12	13	14	15	16	17	18	19	20		
A	A	B	B	C	B	C	B	B	6		
21	22										
3	1										
CUQ's											
1	2	3	4	5	6	7	8	9	10		
D	A	C	C	A	A	B	C	A	B		
11	12										
C	A										
JEE MAINS LEVEL QUESTIONS											
1	2	3	4	5	6	7	8	9	10		
B	D	A	C	B	C	C	A	C	B		
11	12	13	14	15							
B	D	C	C	C							
JEE ADVANCED LEVEL QUESTIONS											
1	2	3	4	5	6	7	8	9	10	11	12
A,B,C,D	A,B,C	A	A	C	B	B	C	1	7	6	A-P,B-Q,C