

Q1. Which element of Group 15 shows the strongest tendency to form multiple bonds?

- A. Phosphorus
- B. Arsenic
- C. Nitrogen
- D. Antimony

Answer: C

Explanation: Nitrogen has a small atomic size and high electronegativity, which favor strong  $p\pi-p\pi$  bonding like in  $N\equiv N$ , unlike heavier members.

Q2. Among Group 15 elements, which has the highest boiling point?

- A. Nitrogen
- B. Phosphorus
- C. Arsenic
- D. Bismuth

Answer: B

Explanation: Phosphorus (white/red allotropes) exists as solids with strong intermolecular forces, resulting in higher boiling points compared to gaseous  $N_2$ .

Q3. What is the trend of metallic character down Group 15?

- A. Increases
- B. Decreases
- C. First increases then decreases
- D. Remains same

Answer: A

Explanation: Metallic character increases due to increasing atomic size and decreasing ionization enthalpy down the group.

Q4. Which Group 16 element shows the highest tendency for catenation?

- A. Sulfur
- B. Oxygen
- C. Selenium

D. Tellurium

Answer: A

Explanation: Sulfur can form long S–S chains due to favorable S–S bond strength, unlike oxygen where lone pair repulsion weakens O–O bonds.

Q5. Which of the following Group 16 elements shows the most non-metallic behavior?

- A. Oxygen
- B. Sulfur
- C. Selenium
- D. Tellurium

Answer: A

Explanation: Oxygen has the highest electronegativity and smallest atomic size, making it the most non-metallic in the group.

Q6. Which element of Group 17 is a liquid at room temperature?

- A. Fluorine
- B. Chlorine
- C. Bromine
- D. Iodine

Answer: C

Explanation: Bromine exists as a reddish-brown liquid at room temperature due to its molecular size and moderate van der Waals forces.

Q7. Down the Group 17, the oxidizing power of halogens:

- A. Increases
- B. Decreases
- C. Remains constant
- D. First increases then decreases

Answer: B

Explanation: Fluorine is the strongest oxidizer. Down the group, oxidizing power decreases as atomic size increases and electron affinity decreases.

Q8. Which noble gas does not have any stable isotope?

- A. Neon
- B. Argon
- C. Krypton
- D. Radon

Answer: D

Explanation: Radon is radioactive and has no stable isotopes. It decays by emitting alpha particles.

Q9. Which of the following elements shows an oxidation state of +6?

- A. Sulfur
- B. Nitrogen
- C. Oxygen
- D. Fluorine

Answer: A

Explanation: Sulfur exhibits +6 oxidation state in compounds like  $\text{H}_2\text{SO}_4$ . Oxygen and fluorine do not commonly show +6 state.

Q10. The unique behavior of nitrogen among Group 15 elements is due to:

- A. Its higher atomic mass
- B. Its small size and high electronegativity
- C. Its metallic nature
- D. Its d-orbitals availability

Answer: B

Explanation: Nitrogen is unique due to its small size, high electronegativity, ability to form multiple bonds, and absence of d-orbitals.

Q11. The bond angle in  $\text{NH}_3$  is approximately:

- A.  $90^\circ$
- B.  $107^\circ$
- C.  $120^\circ$

D.  $109.5^\circ$

Answer: B

Explanation: Due to lone pair-bond pair repulsion, the bond angle in  $\text{NH}_3$  reduces from the tetrahedral  $109.5^\circ$  to  $\sim 107^\circ$ .

Q12. Which acid has the strongest oxidising property among the following?

A.  $\text{HNO}_3$

B.  $\text{H}_3\text{PO}_4$

C.  $\text{H}_2\text{SO}_4$

D.  $\text{HClO}_4$

Answer: A

Explanation: Nitric acid is a strong oxidizer due to the presence of the highly electronegative  $\text{NO}_3^-$  ion and the +5 oxidation state of N.

Q13. Which of the following forms interhalogen compounds of the type  $\text{AX}_5$ ?

A.  $\text{F}_2$

B.  $\text{Cl}_2$

C.  $\text{Br}_2$

D.  $\text{I}_2$

Answer: D

Explanation: Iodine has a large size and can expand its octet, forming compounds like  $\text{IF}_5$  and  $\text{ICl}_5$ .

Q14. The hybridisation of the central atom in  $\text{SF}_4$  is:

A.  $\text{sp}^3$

B.  $\text{sp}^3\text{d}$

C.  $\text{sp}^3\text{d}^2$

D.  $\text{sp}^2$

Answer: B

Explanation:  $\text{SF}_4$  has 5 regions of electron density  $\rightarrow \text{sp}^3\text{d}$  hybridisation, with one lone pair giving a seesaw shape.

Q15. What is the oxidation number of phosphorus in  $\text{PO}_4^{3-}$ ?

- A. +3
- B. +5
- C. +2
- D. +1

Answer: B

Explanation: Let oxidation state of P = x

$$x + 4(-2) = -3 \rightarrow x = +5$$

Q16. Calculate the mass of  $\text{SO}_2$  produced when 9.8 g of  $\text{H}_2\text{SO}_4$  is heated strongly. (H = 1, S = 32, O = 16)

- A. 4.8 g
- B. 5.6 g
- C. 6.4 g
- D. 7.2 g

Answer: C

Explanation:



$$9.8 \text{ g } \text{H}_2\text{SO}_4 = 0.1 \text{ mol}$$

$$0.1 \text{ mol} \rightarrow 0.1 \text{ mol } \text{SO}_2$$

$$\text{Mass} = 0.1 \times 64 = 6.4 \text{ g}$$

But  $\text{SO}_2$  forms from  $\text{SO}_3$ , so from  $0.1 \text{ mol } \text{H}_2\text{SO}_4 \rightarrow 0.1 \text{ mol } \text{SO}_3 \rightarrow 0.1 \text{ mol } \text{SO}_2$

$$\text{Mass} = 0.1 \times 64 = 6.4 \text{ g}$$

So correct answer: C

Note: We'll correct this option in the final sheet.

Q17. Which pair of Group 17 elements can form the most polar covalent bond?

- A. F–Cl
- B. F–I
- C. Cl–I
- D. F–Br

Answer: B

Explanation: The greatest difference in electronegativity is between F and I, leading to the most polar bond.

Q18. Identify the incorrect statement regarding noble gases.

- A. All are monoatomic
- B. They have low melting and boiling points
- C. They have variable oxidation states
- D. They have complete octet

Answer: C

Explanation: Noble gases are chemically inert and do not usually exhibit variable oxidation states (except Xe, under specific conditions).

Q19. Which of the following is a disproportionation reaction?

- A.  $\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{HCl} + \text{HOCl}$
- B.  $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$
- C.  $2\text{K} + \text{Cl}_2 \rightarrow 2\text{KCl}$
- D.  $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

Answer: A

Explanation: In  $\text{Cl}_2 \rightarrow \text{HCl}$  (Cl: 0 to -1) and  $\text{HOCl}$  (Cl: 0 to +1), the same element is both oxidized and reduced.

Q20. The number of unpaired electrons in ground state of oxygen atom is:

- A. 0
- B. 1
- C. 2
- D. 4

Answer: C

Explanation:  $\text{O} = 1s^2 2s^2 2p^4 \rightarrow$  two unpaired electrons in 2p orbitals.

Q21. Which has the maximum acidic strength?

- A. HF
- B. HCl

- C. HBr
- D. HI

Answer: D

Explanation: Acid strength increases down the group due to decreasing H–X bond strength. HI is the strongest acid.

Q22. Which of the following forms both +1 and +3 oxidation states?

- A. Nitrogen
- B. Phosphorus
- C. Thallium
- D. Iodine

Answer: C

Explanation: Thallium (Group 13) shows inert pair effect — common oxidation states are +1 and +3.

Q23. What is the molar mass of  $\text{XeF}_4$ ?

- A. 207 g/mol
- B. 187 g/mol
- C. 208 g/mol
- D. 241 g/mol

Answer: A

Explanation:  $\text{Xe} = 131$ ,  $\text{F} = 4 \times 19 = 76 \rightarrow 131 + 76 = 207 \text{ g/mol}$

So correct: A

(Adjust other options accordingly in final list)

Q24. Which is most basic among the following oxides?

- A.  $\text{N}_2\text{O}_3$
- B.  $\text{P}_2\text{O}_3$
- C.  $\text{Sb}_2\text{O}_3$
- D.  $\text{Bi}_2\text{O}_3$

Answer: D

Explanation: Basic character increases down Group 15.  $\text{Bi}_2\text{O}_3$  is the most metallic and most basic.

Q25. Why is  $\text{O}_2$  a gas but  $\text{S}_8$  a solid at room temperature?

- A. Oxygen is less reactive
- B.  $\text{O}=\text{O}$  bonds are weaker
- C.  $\text{O}_2$  has strong van der Waals forces
- D.  $\text{S}_8$  forms large ring structures

Answer: D

Explanation: Sulfur exists as  $\text{S}_8$  rings with higher molecular mass and stronger intermolecular forces, making it a solid.

Q26. Calculate the number of electrons involved in the reduction of  $\text{HNO}_3$  to  $\text{NO}_2$ .

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

Explanation:

$\text{HNO}_3$  (N = +5)  $\rightarrow$   $\text{NO}_2$  (N = +4), so reduction = gain of 1 electron.

Q27. Which of the following is used in air balloons?

- A. He
- B. Ne
- C. Ar
- D. Xe

Answer: A

Explanation: Helium is inert, non-flammable, and light  $\rightarrow$  safest for balloons.

Q28. The geometry of  $\text{IF}_5$  is:

- A. Square planar



- B. Square pyramidal
- C. Octahedral
- D. Trigonal bipyramidal

Answer: B

Explanation:  $\text{IF}_5 \rightarrow \text{sp}^3\text{d}^2$  with one lone pair  $\rightarrow$  square pyramidal geometry.

Q29. In  $\text{ClO}_4^-$  ion, the oxidation state of Cl is:

- A. +3
- B. +5
- C. +7
- D. +1

Answer: C

Explanation: Let  $x$  = Cl oxidation state:

$$x + 4(-2) = -1 \rightarrow x = +7$$

Q30. The reducing nature of hydrogen halides increases in the order:

- A.  $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$
- B.  $\text{HI} < \text{HBr} < \text{HCl} < \text{HF}$
- C.  $\text{HCl} < \text{HF} < \text{HI} < \text{HBr}$
- D.  $\text{HBr} < \text{HF} < \text{HCl} < \text{HI}$

Answer: A

Explanation: Reducing nature increases down the group as H–X bond strength decreases. HI is strongest reducing agent.

Q31. Which of the following elements does not form pentahalides?

- A. N
- B. P
- C. As
- D. Sb

Answer: A

Explanation: Nitrogen lacks d-orbitals, so it cannot expand its octet to form  $\text{NX}_5$ . Other group 15 elements can form pentahalides due to the availability of empty d-orbitals.

Q32. The most stable oxidation state of bismuth (Bi) is:

- A. +1
- B. +3
- C. +5
- D. +4

Answer: B

Explanation: Due to the inert pair effect, the +3 oxidation state of Bi is more stable than +5.

Q33. Among the following, the strongest acid is:

- A.  $\text{H}_3\text{PO}_4$
- B.  $\text{HNO}_3$
- C.  $\text{HClO}_4$
- D.  $\text{H}_2\text{SO}_4$

Answer: C

Explanation:  $\text{HClO}_4$  (perchloric acid) is a strong acid due to the highly electronegative Cl in the +7 oxidation state, which stabilizes the conjugate base.

Q34. Xenon forms compounds mainly with:

- A. Fluorine and oxygen
- B. Hydrogen and oxygen
- C. Fluorine and chlorine
- D. Oxygen and nitrogen

Answer: A

Explanation: Xenon forms stable compounds with highly electronegative elements like fluorine ( $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$ ) and oxygen ( $\text{XeO}_3$ ,  $\text{XeO}_4$ ).

Q35. Which of the following has the lowest boiling point?

- A. HF
- B. HCl
- C. HBr
- D. HI

Answer: B

Explanation: HCl has the lowest molecular mass and does not form strong hydrogen bonds like HF, resulting in a lower boiling point.

Q36. Assertion (A): ICl is more reactive than I<sub>2</sub>.

Reason (R): ICl bond is weaker than I-I bond.

- A. Both A and R are true, and R is the correct explanation
- B. Both A and R are true, but R is not the correct explanation
- C. A is true, R is false
- D. A is false, R is true

Answer: A

Explanation: The I-Cl bond is weaker due to the difference in electronegativities, making ICl more reactive than I<sub>2</sub>.

Q37. Which halogen shows positive oxidation states most commonly?

- A. F
- B. Cl
- C. Br
- D. I

Answer: D

Explanation: Iodine exhibits +1, +3, +5, and +7 oxidation states due to its large size and ability to expand its octet.

Q38. Which of the following is not true about nitric acid?

- A. It forms the nitronium ion
- B. It acts as an oxidising agent
- C. It reduces metals to their lower oxidation states
- D. It is tribasic

Answer: D

Explanation: Nitric acid ( $\text{HNO}_3$ ) is a monobasic acid and donates only one proton per molecule in aqueous solution.

Q39. Among the following, the one that does not exist is:

- A.  $\text{XeF}_2$
- B.  $\text{XeF}_4$
- C.  $\text{XeF}_6$
- D.  $\text{HeF}_2$

Answer: D

Explanation: Helium does not form stable compounds like  $\text{HeF}_2$  due to its extremely high ionization energy and closed-shell configuration.

Q40. The correct order of acidic strength is:

- A.  $\text{HNO}_3 > \text{H}_2\text{SO}_4 > \text{H}_3\text{PO}_4$
- B.  $\text{H}_3\text{PO}_4 > \text{HNO}_3 > \text{H}_2\text{SO}_4$
- C.  $\text{H}_2\text{SO}_4 > \text{H}_3\text{PO}_4 > \text{HNO}_3$
- D.  $\text{HNO}_3 > \text{H}_3\text{PO}_4 > \text{H}_2\text{SO}_4$

Answer: A

Explanation:  $\text{HNO}_3$  is a strong oxidising acid, followed by  $\text{H}_2\text{SO}_4$ ;  $\text{H}_3\text{PO}_4$  is a weaker acid due to its lower degree of ionisation.

Q41. Assertion (A): Noble gases are chemically inert.

Reason (R): They have complete octets.

- A. Both A and R are true, and R is the correct explanation
- B. Both A and R are true, but R is not the correct explanation
- C. A is true, R is false
- D. A is false, R is true

Answer: A

Explanation: Noble gases are stable due to their fully filled valence shells, making them chemically inert.

Q42. Which noble gas forms the compound  $\text{XO}_3$ ?

- A. Xe
- B. Ne
- C. Ar
- D. Kr

Answer: A

Explanation: Xenon can form stable oxides like  $\text{XeO}_3$  and  $\text{XeO}_4$  due to available d-orbitals. Other noble gases don't form such compounds easily.

Q43. Which of the following has a pyramidal shape?

- A.  $\text{PH}_3$
- B.  $\text{BCl}_3$
- C.  $\text{CO}_2$
- D.  $\text{BeCl}_2$

Answer: A

Explanation:  $\text{PH}_3$  has a lone pair on phosphorus, resulting in trigonal pyramidal geometry.

Q44. The compound used in smoke screens and tear gas is:

- A.  $\text{Cl}_2$
- B.  $\text{HCl}$
- C.  $\text{PCl}_5$
- D.  $\text{AsCl}_3$

Answer: D

Explanation: Arsenic trichloride is used in chemical warfare for its irritant properties in tear gas.

Q45. Which is the correct order of oxidation states of Cl in the following ions:  $\text{ClO}^-$ ,  $\text{ClO}_2^-$ ,  $\text{ClO}_3^-$ ,  $\text{ClO}_4^-$ ?

- A. +1, +3, +5, +7
- B. -1, +1, +3, +5
- C. +1, +2, +4, +6
- D. +3, +5, +7, +9

Answer: A

Explanation:

