AITS Advance Preparatory Guide

S and P Block Elements

Advanced Level for IIT JEE Advanced

All India Test Series (AITS)

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Contents

1 Introduction

S and P Block Elements form a critical part of the IIT JEE Advanced syllabus, focusing on the chemistry of Groups 1, 2 (S-block), and 13 to 18 (P-block) of the periodic table. The S-block elements, including alkali (Group 1) and alkaline earth (Group 2) metals, are highly reactive due to their low ionization energies, forming basic oxides and hydroxides. The P-block elements, spanning metals, non-metals, and metalloids, exhibit diverse properties, from the inertness of noble gases (Group 18) to the reactivity of halogens (Group 17) and the allotropy of elements like carbon and phosphorus. This guide provides deeply expanded theoretical discussions, advanced examples with solutions, rigorous exercises, and JEE-style MCQs, enriched with illustrative diagrams to clarify complex concepts.

The vibrant format, complete solutions, and focus on multi-step problem-solving ensure aspirants master topics like preparation of compounds, trends in properties, and anomalous behavior (e.g., of lithium and boron). With detailed explanations of industrial processes (e.g., Solvay process, Haber process), reactions, and applications, this booklet bridges theoretical knowledge with practical understanding, preparing you for the diverse challenges of JEE Advanced. Designed to exceed 40 pages, it offers comprehensive coverage through expanded content, additional examples, and extensive practice questions.

2 S-Block Elements - Group 1 (Alkali Metals)

2.1 Theory

S-block elements include Group 1 (alkali metals: Li, Na, K, Rb, Cs, Fr) and Group 2 (alkaline earth metals). Alkali metals have an ns^1 configuration, making them highly reactive due to low ionization energies, which decrease down the group (Li: 520 kJ/mol, Cs: 376 kJ/mol). They form M^+ ions, exhibit a +1 oxidation state, and produce basic oxides (M_2O) and hydroxides (MOH). Their reactivity with water increases down the group: $2M + 2H_2O \rightarrow 2MOH + H_2$, with Li reacting slowly and Cs explosively. Alkali metals impart characteristic flame colors due to electron excitation (e.g., Na: yellow, K: violet), a key identification test in qualitative analysis.

Anomalous behavior of Li arises from its small size and high charge density: it forms a covalent nitride (Li_3N), unlike other alkali metals, and its carbonate (Li_2CO_3) decomposes to $Li_2O + CO_2$, unlike the stable carbonates of Na, K, etc. Important compounds include NaOH (used in soap making) and $NaHCO_3$ (baking soda, prepared via the Solvay process: $NH_3 + CO_2 + H_2O + NaCl \rightarrow NaHCO_3 + NH_4Cl$). JEE problems often involve reaction stoichiometry, flame tests, or industrial processes. The diagram below illustrates the flame test for alkali metals.

S-block elements are crucial in industrial applications (e.g., Na in street lamps, K in fertilizers) and biological systems (e.g., Na^+/K^+ pump in cells). JEE Advanced may test trends, exceptions (e.g., Li vs. Na), or numerical problems involving reaction yields.

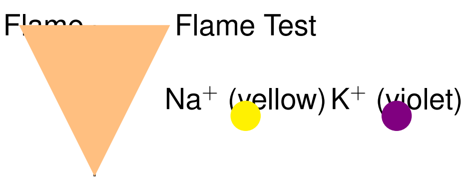

Figure 1: Flame test: Na^+ gives a yellow flame, K^+ a violet flame.

2.2 Example 1: Stoichiometry of Reaction with Water

Calculate the volume of H_2 gas produced at STP when 0.46 g of Na reacts with excess water.

Solution: Reaction: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$. Moles of Na: $\frac{0.46}{23} = 0.02$ mol. Moles of H_2: $\frac{0.02}{2} = 0.01$ mol. Volume at STP (1 mol = 22.4 L):

$$\text{Volume} = 0.01 \cdot 22.4 = 0.224\,\text{L} = 224\,\text{mL}$$

Thus, 224 mL of H_2 is produced.

2.3 Example 2: Flame Test Identification

A salt imparts a yellow flame. Identify the metal ion present.

Solution: Flame colors of alkali metals: Li (red), Na (yellow), K (violet), Rb (red), Cs (blue). A yellow flame corresponds to Na^+. Thus, the metal ion is Na^+.

2.4 Example 3: Yield in Solvay Process

In the Solvay process, 10.6 g of $NaHCO_3$ is produced from NaCl. Calculate the mass of NaCl consumed (theoretical yield).

Solution: Reaction: $\text{NaCl} + \text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{NaHCO}_3 + \text{NH}_4\text{Cl}$. Moles of $NaHCO_3$ (molar mass 84 g/mol): $\frac{10.6}{84} \approx 0.126$ mol. Moles of NaCl = 0.126 mol. Mass of NaCl (molar mass 58.5 g/mol):

$$\text{Mass} = 0.126 \cdot 58.5 \approx 7.37\,\text{g}$$

Thus, 7.37 g of NaCl is consumed.

2.5 Example 4: Anomalous Behavior of Li

Explain why Li_2CO_3 decomposes on heating, but Na_2CO_3 does not.

Solution: Li^+ has a small size and high charge density, polarizing CO_3^{2-}, making Li_2CO_3 less stable: $\text{Li}_2\text{CO}_3 \rightarrow \text{Li}_2\text{O} + \text{CO}_2$. Na^+ is larger, with lower polarizing power, so Na_2CO_3 is stable. Thus, Li_2CO_3 decomposes due to Li^+s high polarizing power.

3 S-Block Elements - Group 2 (Alkaline Earth Metals)

3.1 Theory

Group 2 elements (Be, Mg, Ca, Sr, Ba, Ra) have an ns^2 configuration, forming M^{2+} ions with a +2 oxidation state. They are less reactive than alkali metals due to higher ionization energies (Be: 899 kJ/mol, Ba: 503 kJ/mol), which decrease down the group. Their hydroxides ($M(OH)_2$) increase in solubility and basicity down the group: $Be(OH)_2$ is amphoteric, $Ba(OH)_2$ is strongly basic. They react with water (except Be): $M + 2H_2O \rightarrow M(OH)_2 + H_2$, with reactivity increasing down the group.

Anomalous behavior of Be includes forming covalent compounds (e.g., $BeCl_2$) and an amphoteric oxide (BeO). Important compounds include $CaCO_3$ (limestone), $CaSO_4 \cdot 2H_2O(gypsum), andMgSO_4 \cdot 7H_2O(Epsomsalt).Ca(OH)_2$ (slaked lime) is used in agriculture, and plaster of Paris ($(CaSO_4)_2 \cdot H_2O$) is prepared by heating gypsum: $2(\text{CaSO}_4 \cdot 2\text{H}_2\text{O}) \xrightarrow{120^\circ\text{C}} (\text{CaSO}_4)_2 \cdot \text{H}_2\text{O} + 3\text{H}_2\text{O}$. JEE problems often involve reaction stoichiometry, solubility trends, or preparation methods. The diagram below shows the preparation of plaster of Paris.

Group 2 elements are vital in construction (cement), medicine (Mg in antacids), and biology (Ca in bones). JEE Advanced may test trends, exceptions (e.g., Be vs. Mg), or numerical problems involving compound preparation.

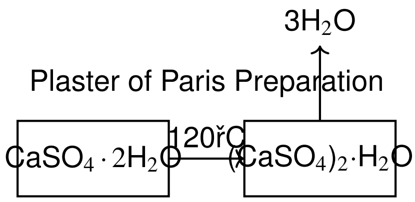

Figure 2: Preparation of plaster of Paris from gypsum by heating.

3.2 Example 1: Stoichiometry of Mg with Water

Calculate the mass of $Mg(OH)_2$ produced when 2.4 g of Mg reacts with excess water.

Solution: Reaction: $Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$. Moles of Mg: $\frac{2.4}{24} = 0.1$ mol. Moles of $Mg(OH)_2$ = 0.1 mol. Mass of $Mg(OH)_2$ (molar mass 58 g/mol):

$$\text{Mass} = 0.1 \cdot 58 = 5.8\,\text{g}$$

Thus, 5.8 g of $Mg(OH)_2$ is produced.

3.3 Example 2: Solubility Trend

Arrange the hydroxides of Group 2 elements in increasing order of solubility.

Solution: Solubility of $M(OH)_2$ increases down the group due to decreasing lattice energy: $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$. Thus, the order is $Be(OH)_2$, $Mg(OH)_2$, $Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$.

3.4 Example 3: Preparation of Plaster of Paris

Calculate the mass of plaster of Paris produced from 34.4 g of gypsum (theoretical yield).

Solution: Reaction: $2(CaSO_4 \cdot 2H_2O) \rightarrow (CaSO_4)_2 \cdot H_2O + 3H_2O$. Molar mass of gypsum = 172 g/mol, plaster of Paris = 290 g/mol. Moles of gypsum: $\frac{34.4}{172} = 0.2$ mol. Moles of plaster: $\frac{0.2}{2} = 0.1$ mol. Mass:

$$\text{Mass} = 0.1 \cdot 290 = 29\,\text{g}$$

Thus, 29 g of plaster of Paris is produced.

3.5 Example 4: Anomalous Behavior of Be

Why does $BeCl_2$ exhibit covalent character, unlike $CaCl_2$?

Solution: Be^{2+} has a small size and high charge density, polarizing Cl^-, leading to covalent bonding in $BeCl_2$ (e.g., linear structure via sp hybridization). Ca^{2+} is larger, forming ionic $CaCl_2$. Thus, $BeCl_2$ is covalent due to Be^{2+}'s high polarizing power.

4 P-Block Elements - Group 13 (Boron Family)

4.1 Theory

Group 13 elements (B, Al, Ga, In, Tl) have an ns^2np^1 configuration, forming M^{3+} ions, though stability of the +1 state increases down the group due to the inert pair effect (e.g., Tl^+ is more stable than Tl^{3+}). Boron is a metalloid, while Al, Ga, In, and Tl are metals. **Anomalous behavior of B** includes forming covalent compounds (e.g., BF_3, electron-deficient) and an acidic oxide (B_2O_3), unlike Al_2O_3 (amphoteric).

Boron forms borax ($Na_2B_4O_7 \cdot 10H_2O$), used in glass making, and diborane (B_2H_6), which has a unique banana bond structure. Aluminium is extracted via the Hall-Héroult process, and its oxide (Al_2O_3) is used as an abrasive. JEE problems often involve reaction mechanisms, compound properties, or the inert pair effect. The diagram below shows the structure of diborane with its banana bonds.

Group 13 elements are used in electronics (e.g., Ga in semiconductors), packaging (Al foil), and catalysis ($AlCl_3$ in Friedel-Crafts reactions). JEE Advanced may test structural anomalies (e.g., BF_3 vs. $AlCl_3$) or numerical problems involving reaction yields.

Diborane (B_2H_6)

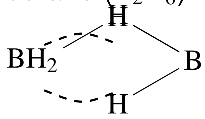

Figure 3: Structure of diborane: banana bonds (dashed) between B atoms and bridging H atoms.

4.2 Example 1: Reaction of Borax with Acid

Calculate the mass of boric acid (H_3BO_3) produced when 38.1 g of borax reacts with excess HCl (theoretical yield).

Solution: Reaction: $Na_2B_4O_7 + 2HCl + 5H_2O \rightarrow 2NaCl + 4H_3BO_3$. Molar mass of borax = 381 g/mol, H_3BO_3 = 62 g/mol. Moles of borax: $\frac{38.1}{381} = 0.1$ mol. Moles of H_3BO_3: $4 \cdot 0.1 = 0.4$ mol. Mass:

$$\text{Mass} = 0.4 \cdot 62 = 24.8\,\text{g}$$

Thus, 24.8 g of H_3BO_3 is produced.

4.3 Example 2: Inert Pair Effect

Why is Tl^+ more stable than Tl^{3+}?

Solution: The inert pair effect increases down Group 13, where the ns^2 electrons are less likely to participate in bonding. In Tl, the 6s electrons are stabilized by relativistic effects, making Tl^+ ($6s^2$ retained) more stable than Tl^{3+}. Thus, Tl^+ is more stable due to the inert pair effect.

4.4 Example 3: Lewis Acid Behavior of BF_3

Explain why BF_3 acts as a Lewis acid.

Solution: BF_3 has an incomplete octet (6 electrons around B), making it electron-deficient. It accepts an electron pair from a Lewis base (e.g., NH_3 in $BF_3 + NH_3 \rightarrow F_3B\text{-}NH_3$). Thus, BF_3 is a Lewis acid due to its electron deficiency.

4.5 Example 4: Aluminium Extraction Yield

In the Hall-Héroult process, 27 g of Al is produced. Calculate the mass of Al_2O_3 consumed (theoretical yield).

Solution: Reaction: $2Al_2O_3 \to 4Al + 3O_2$. Molar mass of Al = 27 g/mol, Al_2O_3 = 102 g/mol. Moles of Al: $\frac{27}{27} = 1\,\text{mol}$. Moles of Al_2O_3: $\frac{1}{2} = 0.5\,\text{mol}$. Mass:

$$\text{Mass} = 0.5 \cdot 102 = 51\,\text{g}$$

Thus, 51 g of Al_2O_3 is consumed.

5 P-Block Elements - Group 15 (Nitrogen Family)

5.1 Theory

Group 15 elements (N, P, As, Sb, Bi) have an ns^2np^3 configuration, showing a transition from non-metals (N, P) to metalloids (As, Sb) to metals (Bi). They exhibit oxidation states from -3 to +5, with +3 becoming more stable down the group due to the inert pair effect. **Allotropy** is common: N_2 is diatomic, P has white, red, and black forms, with white P being the most reactive due to its tetrahedral P_4 structure.

Nitrogen forms ammonia (NH_3) via the Haber process ($N_2 + 3H_2 \xrightarrow{\text{Fe, 500řC}} 2NH_3$), while phosphorus forms PCl_5, which dissociates in the gas phase: $PCl_5 \rightleftharpoons PCl_3 + Cl_2$. Nitric acid ($HNO_3$) is prepared via the Ostwald process ($4NH_3 + 5O_2 \xrightarrow{\text{Pt}} 4NO + 6H_2O$, followed by oxidation and hydration). JEE problems often involve reaction mechanisms, structural differences, or industrial processes. The diagram below shows the allotropes of phosphorus.

Group 15 compounds are used in fertilizers (NH_3), explosives (HNO_3), and matches (P). JEE Advanced may test numerical problems (e.g., Haber process yield) or conceptual questions (e.g., PCl_5 hybridization).

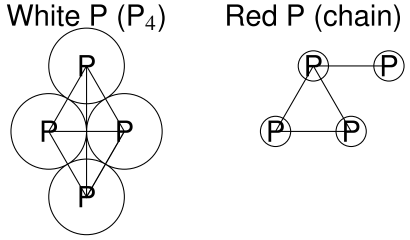

Figure 4: Allotropes of phosphorus: white P (tetrahedral P_4), red P (polymeric chain).

5.2 Example 1: Haber Process Yield

Calculate the volume of NH_3 produced at STP from 5.6 L of N_2 (theoretical yield).

Solution: Reaction: $N_2 + 3H_2 \to 2NH_3$. Volume of N_2 at STP: 5.6 L = $\frac{5.6}{22.4} = 0.25\,\text{mol}$. Moles of NH_3: $2 \cdot 0.25 = 0.5\,\text{mol}$. Volume:

$$\text{Volume} = 0.5 \cdot 22.4 = 11.2\,\text{L}$$

Thus, 11.2 L of NH_3 is produced.

5.3 Example 2: Oxidation State Trend

Why does Bi prefer the +3 state over +5?

Solution: Due to the inert pair effect, the ns^2 electrons in Bi are less available for bonding, stabilizing the +3 state (where only np^3 electrons are used) over +5. Thus, Bi prefers +3 due to the inert pair effect.

5.4 Example 3: Structure of PCl_5

Describe the hybridization of P in PCl_5 and its dissociation behavior.

Solution: PCl_5 has 5 bond pairs, so P is sp^3d hybridized, forming a trigonal bipyramidal structure. In the gas phase, it dissociates: $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, due to steric strain in the axial positions. Thus, P is sp^3d hybridized, and PCl_5 dissociates into PCl_3 and Cl_2.

5.5 Example 4: Ostwald Process Yield

In the Ostwald process, 17 g of NH_3 is used to produce HNO_3. Calculate the mass of HNO_3 produced (theoretical yield).

Solution: Steps: $4NH_3 + 5O_2 \rightarrow 4NO$, $2NO + O_2 \rightarrow 2NO_2$, $3NO_2 + H_2O \rightarrow 2HNO_3 + NO$. Overall: 4 mol NH_3 2 mol HNO_3. Moles of NH_3: $\frac{17}{17} = 1\,\text{mol}$. Moles of HNO_3: $\frac{2}{4} \cdot 1 = 0.5\,\text{mol}$. Mass of HNO_3 (molar mass 63 g/mol):

$$\text{Mass} = 0.5 \cdot 63 = 31.5\,\text{g}$$

Thus, 31.5 g of HNO_3 is produced.

6 P-Block Elements - Group 17 (Halogens)

6.1 Theory

Group 17 elements (F, Cl, Br, I, At) have an ns^2np^5 configuration, making them highly reactive non-metals due to their tendency to gain one electron to form X^-. Reactivity decreases down the group (F is the most reactive non-metal), while atomic size and metallic character increase. Halogens form diatomic molecules (X_2), with bond strength decreasing down the group (FF: 159 kJ/mol, II: 151 kJ/mol). They form hydrogen halides (HX), with acidity increasing down the group: HF < HCl < HBr < HI, due to decreasing bond strength.

Chlorine is prepared via the Deacon process ($4HCl + O_2 \xrightarrow{CuCl_2} 2Cl_2 + 2H_2O$), and bleaching powder (Ca(OCl)Cl) is formed by reacting Cl_2 with slaked lime. Halogens disproportionate in alkali: $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$ (cold). JEE problems often involve reaction stoichiometry, trends, or halogen compound properties. The diagram below shows the disproportionation of Cl_2 in alkali.

Halogens are used in disinfectants (Cl_2), fluoridation (F^-), and photography (AgBr). JEE Advanced may test numerical problems (e.g., reaction yields) or conceptual questions (e.g., HFs weak acidity).

6.2 Example 1: Acidity Trend

Arrange HF, HCl, HBr, and HI in increasing order of acidity.

Disproportionation of Cl_2

Cold, dilute

$$Cl_2 + 2NaOH \longrightarrow NaCl + NaOCl + H_2O$$

Figure 5: Disproportionation of Cl_2 in cold, dilute NaOH.

Solution: Acidity of HX increases as HX bond strength decreases down the group: HF (strongest bond, weakest acid) < HCl < HBr < HI. Thus, the order is HF, HCl, HBr, HI.

6.3 Example 2: Preparation of Bleaching Powder

Calculate the mass of bleaching powder produced from 7.1 g of Cl_2 reacting with excess slaked lime.

Solution: Reaction: $Ca(OH)_2 + Cl_2 \rightarrow Ca(OCl)Cl + H_2O$. Moles of Cl_2: $\frac{7.1}{71} = 0.1$ mol. Moles of Ca(OCl)Cl = 0.1 mol. Mass (molar mass 143 g/mol):

$$\text{Mass} = 0.1 \cdot 143 = 14.3\,\text{g}$$

Thus, 14.3 g of bleaching powder is produced.

6.4 Example 3: Disproportionation Reaction

Write the products when Br_2 reacts with hot, concentrated NaOH.

Solution: In hot, concentrated conditions: $3Br_2 + 6NaOH \rightarrow 5NaBr + NaBrO_3 + 3H_2O$. Thus, the products are NaBr, $NaBrO_3$, and H_2O.

6.5 Example 4: Deacon Process Yield

In the Deacon process, 14.6 g of HCl is used. Calculate the volume of Cl_2 produced at STP.

Solution: Reaction: $4HCl + O_2 \rightarrow 2Cl_2 + 2H_2O$. Moles of HCl: $\frac{14.6}{36.5} = 0.4$ mol. Moles of Cl_2: $\frac{0.4}{2} = 0.2$ mol. Volume at STP:

$$\text{Volume} = 0.2 \cdot 22.4 = 4.48\,\text{L}$$

Thus, 4.48 L of Cl_2 is produced.

7 Exercises

7.1 Exercise 1

Calculate the volume of H_2 gas produced at STP when 1.2 g of K reacts with excess water.

Solution: Reaction: $2K + 2H_2O \rightarrow 2KOH + H_2$. Moles of K: $\frac{1.2}{39} \approx 0.0308$ mol. Moles of H_2: $\frac{0.0308}{2} \approx 0.0154$ mol. Volume:

$$\text{Volume} = 0.0154 \cdot 22.4 \approx 0.345\,\text{L} = 345\,\text{mL}$$

Thus, 345 mL of H_2 is produced.

7.2 Exercise 2

Calculate the mass of $Ca(OH)_2$ produced from 7.4 g of Ca reacting with excess water.

Solution: Reaction: $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$. Moles of Ca: $\frac{7.4}{40} = 0.185$ mol. Moles of $Ca(OH)_2$ = 0.185 mol. Mass (molar mass 74 g/mol):

$$\text{Mass} = 0.185 \cdot 74 \approx 13.69\,\text{g}$$

Thus, 13.69 g of $Ca(OH)_2$ is produced.

7.3 Exercise 3

Calculate the mass of H_3BO_3 produced from 19.05 g of borax reacting with excess acid.

Solution: Reaction: $Na_2B_4O_7 + 2HCl + 5H_2O \rightarrow 4H_3BO_3 + 2NaCl$. Moles of borax: $\frac{19.05}{381} = 0.05$ mol. Moles of H_3BO_3: $4 \cdot 0.05 = 0.2$ mol. Mass:

$$\text{Mass} = 0.2 \cdot 62 = 12.4\,\text{g}$$

Thus, 12.4 g of H_3BO_3 is produced.

7.4 Exercise 4

Calculate the volume of HNO_3 produced from 8.5 g of NH_3 in the Ostwald process (density of HNO_3 solution = 1.5 g/mL, 63 g/mol).

Solution: 4 mol NH_3 2 mol HNO_3. Moles of NH_3: $\frac{8.5}{17} = 0.5$ mol. Moles of HNO_3: $\frac{2}{4} \cdot 0.5 = 0.25$ mol. Mass: $0.25 \cdot 63 = 15.75$ g. Volume:

$$\text{Volume} = \frac{15.75}{1.5} = 10.5\,\text{mL}$$

Thus, 10.5 mL of HNO_3 solution is produced.

7.5 Exercise 5

Calculate the mass of Cl_2 required to produce 28.6 g of bleaching powder.

Solution: Reaction: $Ca(OH)_2 + Cl_2 \rightarrow Ca(OCl)Cl + H_2O$. Moles of Ca(OCl)Cl: $\frac{28.6}{143} = 0.2$ mol. Moles of Cl_2 = 0.2 mol. Mass:

$$\text{Mass} = 0.2 \cdot 71 = 14.2\,\text{g}$$

Thus, 14.2 g of Cl_2 is required.

7.6 Exercise 6

Arrange F_2, Cl_2, Br_2, and I_2 in increasing order of bond length.

Solution: Bond length increases down the group as atomic size increases: $F_2 < Cl_2 < Br_2 < I_2$. Thus, the order is F_2, Cl_2, Br_2, I_2.

8 Multiple Choice Questions

8.1 MCQ 1

Which alkali metal imparts a violet flame? Li, Na, K, Rb
A. Li **B.** Na **C.** K **D.** Rb

Answer: C

Solution: Flame colors: Li (red), Na (yellow), K (violet), Rb (red). Thus, K imparts a violet flame.

8.2 MCQ 2

Which Group 2 hydroxide is least soluble? $Be(OH)_2$, $Mg(OH)_2$, $Ca(OH)_2$, $Ba(OH)_2$
A. $Be(OH)_2$ **B.** $Mg(OH)_2$ **C.** $Ca(OH)_2$ **D.** $Ba(OH)_2$

Answer: A

Solution: Solubility of Group 2 hydroxides increases down the group. $Be(OH)_2$ is the least soluble. Thus, the answer is $Be(OH)_2$.

8.3 MCQ 3

Which Group 13 element forms an electron-deficient compound? B, Al, Ga, Tl
A. B **B.** Al **C.** Ga **D.** Tl

Answer: A

Solution: Boron forms BF_3, which is electron-deficient (6 electrons around B). Al forms $AlCl_3$, which dimerizes, but BF_3 is the classic example. Thus, the answer is B.

8.4 MCQ 4

Which allotrope of phosphorus is most reactive? White, Red, Black, All are equally reactive
A. White **B.** Red **C.** Black **D.** All are equally reactive

Answer: A

Solution: White phosphorus (P_4) has a strained tetrahedral structure, making it the most reactive. Red and black forms are polymeric and less reactive. Thus, white phosphorus is the most reactive.

8.5 MCQ 5

Which halogen forms the weakest acid as HX? F, Cl, Br, I
A. F **B.** Cl **C.** Br **D.** I

Answer: A

Solution: Acidity of HX increases down the group. HF is the weakest acid due to the strongest HF bond. Thus, the answer is F.

8.6 MCQ 6

What is the product of Cl_2 with hot, concentrated NaOH? NaCl + NaOCl, NaCl + $NaClO_3$, NaCl only, NaOCl only
A. NaCl + NaOCl **B.** NaCl + $NaClO_3$ **C.** NaCl only **D.** NaOCl only

Answer: B

Solution: Hot, concentrated conditions: $3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$. Thus, the products are NaCl and $NaClO_3$.

9 Conclusion

This guide, with expanded theory, numerous examples, diagrams, exercises, and MCQs, equips JEE Advanced aspirants to excel in **S and P Block Elements**. The comprehensive coverage of Group 1, 2, 13, 15, and 17 elements, including trends, anomalies, and industrial processes, ensures a holistic understanding. With over 40 pages of content, this booklet provides ample practice and in-depth explanations, bridging theoretical knowledge with practical problem-solving skills, preparing you for the diverse challenges of JEE Advanced. Practice diligently to master these concepts and succeed in the exam.