Acids and Bases

121 (a) Aluminium ion

Explanation:
When $AlCl_3$ dissolves in water:
Al^{3+} ion has a high positive charge.
It attracts water molecules and polarizes them, causing release of H^+ ions.
This makes the solution acidic.
Chloride ion (Cl^-) does not hydrolyze — it is the conjugate base of a strong acid (HCl), so it does not affect pH.
Hydrolysis (Word-Friendly Equation):
$Al^{3+} + 6H_2O \rightarrow [Al(H_2O)_6]^{3+} \rightarrow [Al(H_2O)_5OH]^{2+} + H^+$
→ H^+ released → acidic solution

122. (d) Because it is a weak electrolyte.

123. (b) Adsorption indicator

Explanation:
In precipitation titrations, certain dyes (like eosin) get adsorbed on the precipitate near the endpoint → colour change occurs → called adsorption indicators

124. (a) Starch

Explanation:
Starch forms a deep blue complex with iodine → used to detect the endpoint in iodometric titrations.

125. (b) $H_2C_2O_4$ and $KMnO_4$

Explanation:
This titration is redox titration, not acid-base.

$KMnO_4$ is self-indicator → purple colour disappears at endpoint.
Hence phenolphthalein is not needed and not suitable.

126. (c) $AlCl_3$ and SO_2 both are example of Lewis theory.

127. (c) $Na_2CO_3 + 2H_2O \rightleftharpoons 2NaOH + H_2CO_3$. It is a strong base and weak acid so it is a basic.

128. (d) Conjugate acid of the base

Explanation (Word-friendly):
When a base accepts a proton (H^+), it becomes its conjugate acid.
This is based on the Brønsted–Lowry acid-base theory, which states:
Acid → proton donor
Base → proton acceptor
After accepting a proton, base → conjugate acid
After donating a proton, acid → conjugate base

129. (c) $\underset{\text{Acid}}{H_2O} + \underset{\text{base}}{NH_3} \rightleftharpoons NH_4^+ + OH^-$.

In this reaction H_2O acts as acid because it donate a proton.

130. (b) $H_2SO_4 + H_2O \rightleftharpoons H_3O^+ + HSO_4^-$
Conjugate acid and base pair

131. (b) $Al_2(SO_4)_3 \rightleftharpoons 2Al^{3+} + 3SO_4{}^{2-}$

$\underset{\text{Weakbase}}{Al(OH)_3} + \underset{\text{Strongacid}}{H_2SO_4}$

132. (c) $NaOH + HCl \xrightarrow[\text{Reaction}]{\text{Neutralization}} \underset{\text{Salt}}{NaCl} + H_2O$

133. (a) Conjugate acid is obtained from the base by gain of H^+.

134. (c)$KCl$is a ionic compound .

135. (a)$H_3BO_3 + H_2O \rightleftharpoons [B(OH)_4]^- + H^+$

H_3BO_3 is a weak monobasic acid if does not act as a H^+ donor but behaves as a Lewis acid.

136. (c) Because it is not accept the proton.

137. (c) NH_4Cl is a salt of weak base (NH_4OH)and strong acid (HCl).

138. (b) Because it accept electron pair from the PH_3

139. (b) $NH_4^+ \rightleftharpoons NH_3 + H^+$

140. (d) NF_3

Explanation (Word-Friendly):
Basicity of nitrogen halides depends on the availability of the lone pair on nitrogen.
Fluorine is highly electronegative, so in NF_3, it pulls electron density away from nitrogen.
This makes the lone pair on nitrogen less available for donation, reducing basicity.
Therefore, NF_3 is the least basic nitrogen halide.
Order of basicity:
$NBr_3 > NCl_3 > NI_3 > NF_3$ (least basic)