

Nitrogen Oxidation States and Allotropy

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Response: An analysis of each statement regarding the chemistry of nitrogen:

- **(a) True** — Nitrogen (N_2) is a non-polar, diatomic gas with low solubility in water under standard atmospheric conditions. According to Henry's Law, the solubility of a gas in a liquid is directly proportional to its partial pressure above the liquid, so increasing pressure increases its solubility.
- **(b) True** — Nitrogen exhibits a full range of oxidation states from -3 to $+5$ in its various compounds:
 - -3 in NH_3
 - -2 in N_2H_4 (hydrazine)
 - -1 in NH_2OH (hydroxylamine)
 - 0 in N_2
 - $+1$ in N_2O
 - $+2$ in NO
 - $+3$ in HNO_2 / N_2O_3
 - $+4$ in NO_2 / N_2O_4
 - $+5$ in HNO_3 / N_2O_5
- **(c) False** — Unlike other Group 15 elements (such as phosphorus), elemental nitrogen under ambient conditions exists almost exclusively as stable dinitrogen gas (N_2) due to the extremely strong $\text{N} \equiv \text{N}$ triple bond, and does not exhibit classical allotropy.
- **(d) False** — High energy provided by lightning causes atmospheric nitrogen (N_2) to react with oxygen (O_2) to form nitric oxide (NO), which is further oxidized to NO_2 , not ammonia (NH_3).

Correct statements: (a) and (b)
