TDC Part I
Paper I, Group B
Inorganic Chemistry

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TOPIC:- Group 15,INTRODUCTION ,PHYSICAL PROPERTIES

Group 15

The elements in this group are nitrogen, phosphorous, arsenic, antimony and bismuth. Nitrogen is the most important component of the earth's atmosphere (78.1% by volume). Both nitrogen and phosphorous are essential constituents of plant and animal tissues. The last three elements had long been isolated and studied extensively by alchemists.

The elements span the range from non-metallic (nitrogen and phosphorous) to the metallic (bismuth). Arsenic and antimony have intermediate properties and are referred to as metalloids. The elements have five electrons in their outermost shell. Some selected physical properties are shown in table 1.

Table 1: Physical Properties of Group 15 Elements

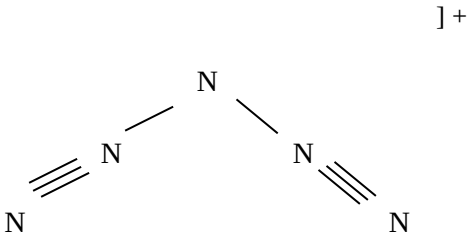
Property	**N**	**P**	**As**	**Sb**	**Bi**
Atomic Number	7	15	33	51	83
Electronic Configuration	$[He]2s^2 2p^3$	$[Ne]3s^2 3p^3$	$[Ar]3d^{10} 4s^2 4p^3$	$[Kr]4d^{10} 5s^2 5p^3$	$[Xe]4f^{14} 5d^{10} 6s^2 6p^3$
Covalent Radius (pm)	70	110	121	141	148
Ionization Energy (KJ mol^{-1})	1402	1012	947	834	703
Electron Affinity ($KJmol^{-1}$)	-7	72	78	103	91
Electronegativity	3.06	2.05	2.21	1.98	2.01
Melting Point (^0C)	-210	44	*	631	271
Boiling Point (^0C)	-195.8	280.5	*	1587	1564

* Sublimes at 615^0 C

Nitrogen is a colourless diatomic gas having a triple bond, which confers unusual stability. For more than a century the only isolable chemical species containing only nitrogen were N_2 and the azide ion, N_3^-. In 1999 the product N_5^+ was reported to be formed in the following reaction.

$$N_2F^+ [AsF_6]^- + HN_3 \longrightarrow N_5^+ [AsF_6]^- + HF$$

The N_5^+ ion is stable below -78^0C and has a V – shaped structure as shown



The N_2^{2-} ion has also been characterized in 2002.In SrN_2 the bond distance is 122.4 pm.