

SUBJECT - CHEMISTRY

CLASS - BSc (Hons) PART - I

PAPER : I

GROUP : A

TOPIC THE NOBLE GASES

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Electronic structures

Element	Symbol		Electronic structure
Helium	He		$1s^2$
Neon	Ne	[He]	$2s^2 2p^6$
Argon	Ar	[Ne]	$3s^2 3p^6$
Krypton	Kr	[Ar]	$3d^{10} 4s^2 4p^6$
Xenon	Xe	[Kr]	$4d^{10} 5s^2 5p^6$
Radon	Rn	[Xe]	$4f^{14} 5d^{10} 6s^2 6p^6$

NAME OF GROUP AND THEIR ELECTRONIC STRUCTURES

The elements of Group 18 have been called the 'inert gases' and the 'rare gases'. Both are misnomers. Since the discovery of the Xenon fluorides in 1962 shows that Xenon is not inert and argon makes up 0.9% by volume of the atmosphere. The name 'noble' gases implies that they tend to be unreactive, in the same way that the noble metals are often reluctant to react and are the least reactive metals.

Helium has two electrons which form a complete shell $1s^2$. The other noble gases have a closed octet of electrons in their outer shell $ns^2 np^6$. This electronic configuration is very stable and is related to their chemical inactivity. These atoms have an electron affinity of zero (or slightly negative) and have very high ionization energies - higher than any other elements.

Under normal Conditions the noble gas atoms have little tendency to gain or lose electrons. Thus they have little tendency to form bonds. and so they exist as single atoms.

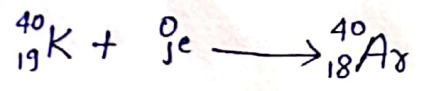
OCCURRENCE AND RECOVERY OF THE ELEMENTS

The gases He, Ne, Ar, Kr and Xe all occur in the atmosphere. A mixture of the noble gases was first obtained by Cavendish in 1784.

Cavendish removed N₂ from air by adding excess O₂ and sparking.

The NO₂ formed was absorbed in NaOH solution. The excess O₂ was removed by burning with S and absorbing the SO₂ in NaOH solution. This gave a small volume of unreactive gas.

Ar is quite abundant and can be recovered by fractional distillation of liquid air. Ar constitutes 0.93% by volume of air (i.e. 9300 ppm). It originates in the air mostly from electron capture (β⁺ decay) of potassium.



CHEMICAL PROPERTIES OF THE NOBLE GASES

The noble gases were isolated and discovered because of their lack of reactivity. for a long time it was thought that they really were chemically inert. Before 1962 the only evidence for compound formation by the noble gases was some molecular ions formed in discharge tubes. and clathrate compounds.