Phosphazene (Phosphonitrilic halides) $[PNCl_2]_n$ (n = 3 to 7)

There are a large no. of compounds with P-N rings along with halide groups attached to phosphorous. are known as phosphazene.

The examples of phosphonitrilic halides are $[PNCl_2]_3$ and $[PNCl_2]_4$ etc.

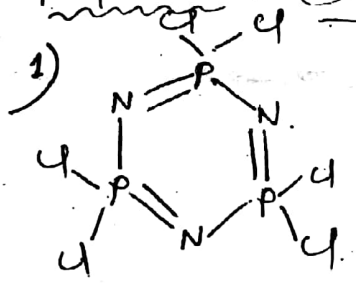
Preparation: $n PCl_5 + n NH_4Cl \xrightarrow{120-150°C} [NPCl_2]_n + 4n HCl$

Properties: physical

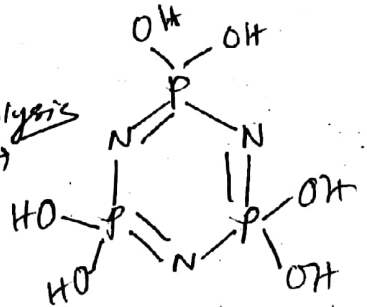
The lower polymers are insoluble in water but soluble but soluble in organic solvents like benzene, ether and CCl_4 etc. The higher polymers are insoluble in organic solvents and resemble vulcanised rubber in mechanical properties & are called Inorganic Rubber

Properties: Chemical

1)

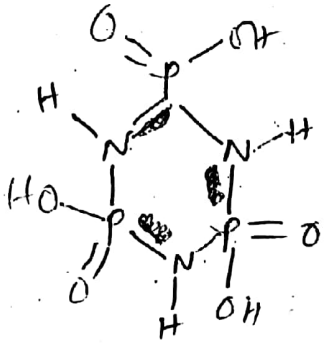


+ $6H_2O$ —Hydrolysis→

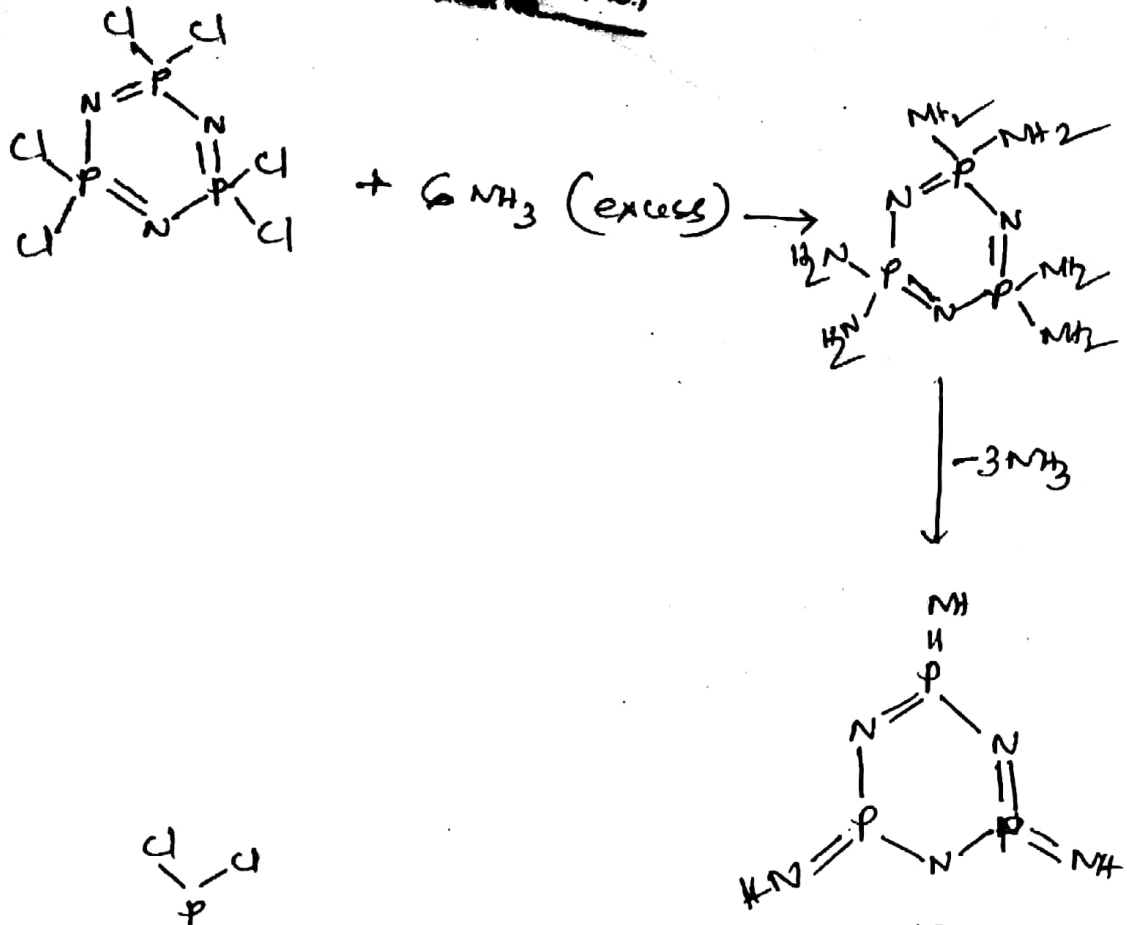


+ 6HCl

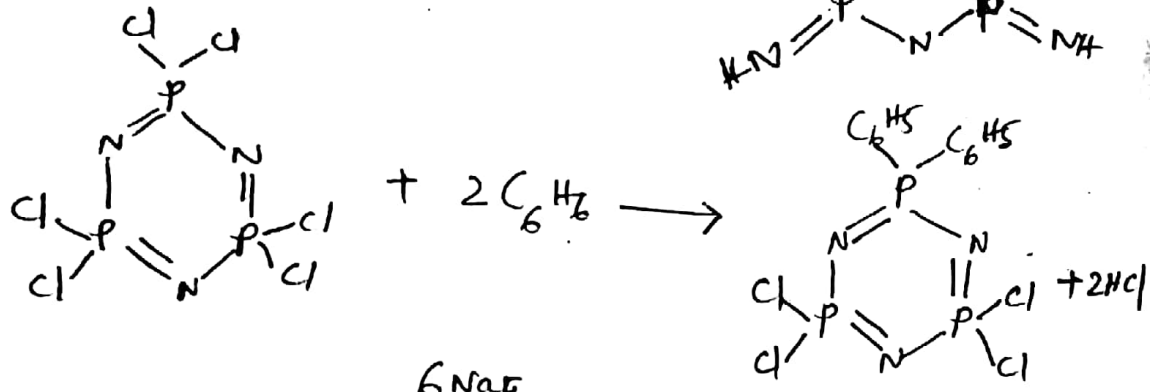
| Isomeric Change



2)



3)



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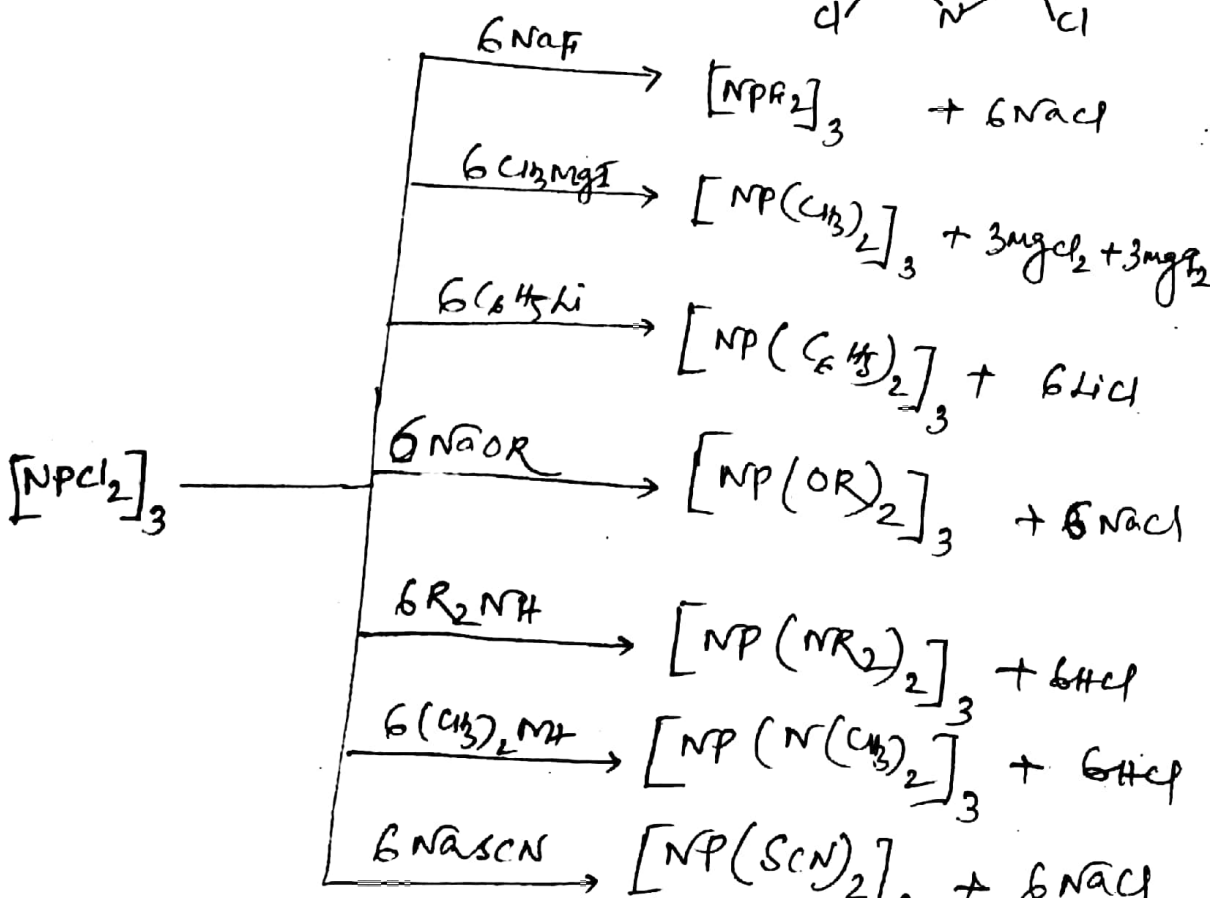
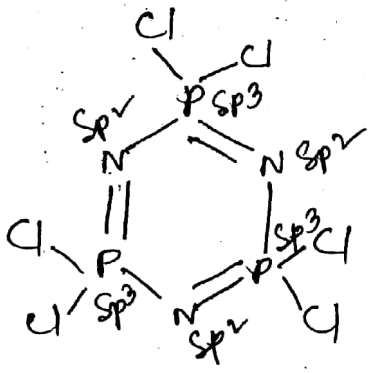
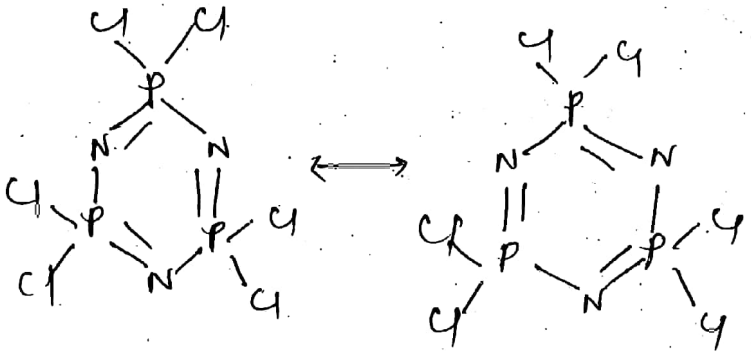


Structure:

i) $[NPF_2]_4$, $[NPCl_2]_3$ has planar structure.



Planar structure of $[NPCl_2]_3$

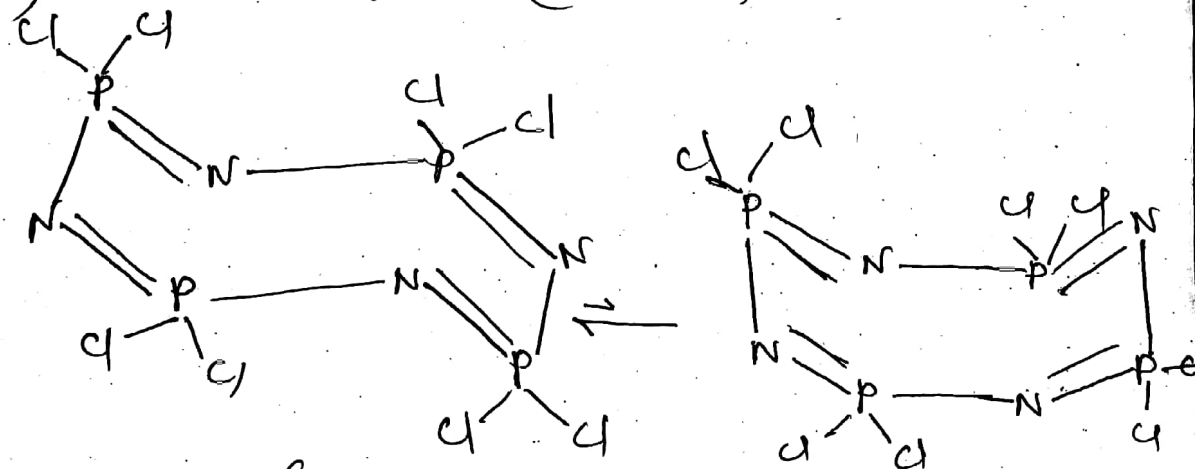


Resonating structure of $[NPCl_2]_3$

ii) $[NPCl_2]_4$ has tube like structure/puckered structure. It has two conformations —

a) Meta Stable κ form (boat form)

b) Stable τ form (Chair form)



Chair form

Boat form

Applications of phosphazenes:

i) The phosphonitrilic halides are used as rigid plastics, fibers because they are water proof & fire proof and are unaffected by oil & petrol.

ii) They are used as catalysts in manufacture of Silicones.

iii) Thin films of poly amino phosphazene are used to cover severe burns because they prevent the loss of body fluids and keep germs out.