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Synthesis and biological study of some transition metal(II) complexes containing (di phenyl phosphines and tri phenyl phosphines)

**Submitted to the department of (chemistry) in partial fulfillment of
the requirements for the degree of **BSc.** in (chemistry)**

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I support the student Nabaz Najmadin the he completes all the requirements of her
research project under the title of

**{Synthesis and biological study of some transition metal(II) complexes
containing (di phenyl phosphines and tri phenyl phosphines)}**

— **N.H** —

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SUPERVISOR

Dedication:

I would like to give special thanks to my family and friends, for the incredible support and love they offered.

Nabaz

Acknowledgement:

I would like to sincerely thank for my Supervisor Ms. Nhiyat who helped and supported me greatly throughout this project. Also, my thanks are extended to my academic colleges and family who also assisted me throughout this process.

ABSTRACT:

This is research about synthesis some transition metal (II) with di phenyl phosphines and tri phenyl phosphines. Phosphine ligands have continued to play a major role in transition metal (d-block) coordination and organometallic chemistry over several decades, forming a wide range of complexes with different metal oxidation states, and transition metal phosphine complexes are also widely used in catalysis.

It is including of five parts: -

Introduction, transition metal, coordination compound, metal complexes of di phenyl phosphines and tri phenyl phosphines, application, and reference.

Keywords: transition metal (II), Phosphine

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1.1 Introduction:

1.1.1 Transition Metal

The transition elements comprise groups 3 to 10 and are found in the central region of the standard periodic table, the first row (the elements scandium to zinc), the second row (the elements yttrium to cadmium) and the third row (the elements lanthanum to mercury). The term 'transition' arises from the elements' supposed transitional positions between the metallic elements of groups 1 and 2 and the predominantly non-metallic elements of groups 13 to 18. The elements occur at that point in the periodic table where the d orbitals are being filled. The first-row transition elements coincide with the filling of the 3d, the second row with the filling of the 4d, and the third row with the filling of the 5d orbitals. (Gerloch, 1994)

There are four series of transition elements:

- i) The first transition series: Scandium (Sc, $Z = 21$) to Zinc (Zn, $Z=30$): addition of electrons in 3d orbitals.
- ii) The second transition series: Yttrium (Y, $Z = 39$) to Cadmium (Cd, $Z = 48$): addition of electrons in 4d orbitals.
- iii) The third transition series: Lanthanum (La, $Z=57$) to Hafnium (Hf, $Z=72$) through Mercury (Hg, $Z = 80$): addition of electrons in 5d orbitals.
- iv) The fourth transition series: Actinium (Ac, $Z=89$) to Rutherfordium (Rf, $Z=104$) through Ununbium (Uub, $Z=112$): addition of electrons in 6d orbitals. The transition elements have several characteristic properties.

- All are metals with high tensile strength and good conductor of heat and electricity.
- All, except mercury lustrous solids. Most of them show more than one oxidation state.
- They have tendency to form coordination compounds with Lewis bases.
- Many form colored compounds. (Khandelwal, 2007)

TRANSITION ELEMENTS

1 H Hydrogen																	2 He Helium																												
3 Li Lithium	4 Be Beryllium	Transition elements										5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon																												
11 Na Sodium	12 Mg Magnesium											13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon																												
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton																												
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon																												
55 Cs Cesium	56 Ba Barium	57 La Lanthanum	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon																												
87 Fr Francium	88 Ra Radium	89 Ac Actinium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson																												
<table border="1"> <tr> <td>58 Ce Cerium</td> <td>59 Pr Praseodymium</td> <td>60 Nd Neodymium</td> <td>61 Pm Promethium</td> <td>62 Sm Samarium</td> <td>63 Eu Europium</td> <td>64 Gd Gadolinium</td> <td>65 Tb Terbium</td> <td>66 Dy Dysprosium</td> <td>67 Ho Holmium</td> <td>68 Er Erbium</td> <td>69 Tm Thulium</td> <td>70 Yb Ytterbium</td> <td>71 Lu Lutetium</td> </tr> <tr> <td>90 Th Thorium</td> <td>91 Pa Protactinium</td> <td>92 U Uranium</td> <td>93 Np Neptunium</td> <td>94 Pu Plutonium</td> <td>95 Am Americium</td> <td>96 Cm Curium</td> <td>97 Bk Berkelium</td> <td>98 Cf Californium</td> <td>99 Es Einsteinium</td> <td>100 Fm Fermium</td> <td>101 Md Mendelevium</td> <td>102 No Nobelium</td> <td>103 Lr Lawrencium</td> </tr> </table>																		58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium
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Inner transition elements																																													

Fig. 1.0: periodic table of transition element

1.1.2 Application of transition metal

The transition elements play important roles in our daily life and in keeping the living organisms alive. Many materials that we encounter each day contain transition elements such as iron, copper, chromium, nickel etc. in one form or the other. Production of various materials using chemical processes invariably involves catalysts which are mostly transition metals and their compounds. (Khandelwal, 2007)

The transition elements are the most industrially important metals and this is due mainly to the presence of strong inter-atomic bonding which results in their having high melting points and good mechanical properties, their ions are usually colored and they form a wide variety of complexes. The complexes formed by these elements have attracted intense research efforts, because of their scientific interest and wide applications in various fields. (Abbas, 2000)

1.1.3 Group 15 Elements

Group 15 constitutes the third column of the p-block of the periodic table and comprises the elements nitrogen, phosphorus, arsenic, antimony and bismuth (together they are called pnictogens or pnictides).[1-8] For all of these elements, the ground state electronic configuration is ns^2np^3 which results in common oxidation states of +3(III) and +5(V) although the relative stabilities of these differ for the various elements. Despite being in the same group, however, the properties of the elements vary a considerable degree as the group is descended. Thus, whereas nitrogen and phosphorus are typical non-metals, arsenic and antimony are more usually described as metalloids or semi-metals, and bismuth has many properties associated with metallic behavior. (Alhanash, 2012)

1.1.4 Phosphorus and phosphine ligands

Many of these compounds are based on structures possessing three or four bonds of the type shown in Fig. 1.0 (e.g. tertiary phosphines, 1 and phosphates, 2; trialkyl phosphates, 3 phosphonic acids, 4 and quaternary phosphonium salts, 5 .(Alhanash, 2012)

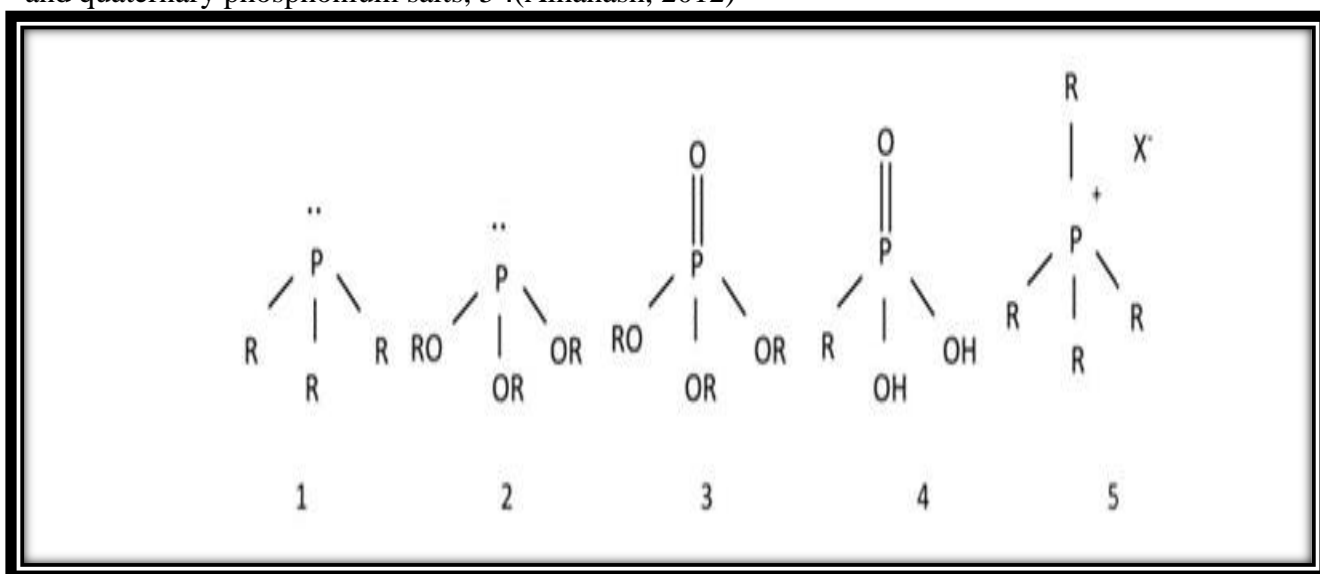


Fig.2.0: Some structures of phosphorus compounds

Phosphorus is a non-metallic chemical element, which is essential for all living organisms. This element does not naturally exist alone on Earth, but is always found combined with other elements such as oxygen.

Hennig Brandt was the first person to have discovered phosphorus; he obtained it by the process of distilling urine.

It got the name “phosphorus” from the Greek language; the word consists of two parts; 'Phos' that means “the light” and 'phorus' that means “it bears when it appears before the sunrise”.

The element Phosphorus has an atomic number which is 15, and a relative atomic weight of 30.97376. (Ejgandi, 2016)

Among various types of enantiomerically pure ligands used for catalytic asymmetric reactions, tertiary phosphines have established their positions as the most effective ligands for most homogeneous transition-metal catalysts. The phosphine-metal complexes have found broad application to catalytic reactions, especially for the reactions which involve, in the catalytic cycle, oxidative addition and/or insertion of an organic substrate, and reductive elimination of a product. Tertiary phosphine ligands coordinate to transition-metal complexes throughout the catalytic cycle because of their high affinity, especially with late transition metals. (Hayashi,etal. 2000)

Phosphine ligands have continued to play a major role in transition metal (d-block) coordination and organometallic chemistry over several decades, forming a wide range of complexes with different metal oxidation states, and transition metal phosphine complexes are also widely used in catalysis. (Kamer et al., 2001)

1.1.5 Diphenyl phosphine

In recent years, significant focus has been given to the production and study of various diphenyl phosphine compounds. Blending two or more compounds of diphenyl phosphine improves the service properties of the organic/inorganic materials. Diphenyl phosphine compounds have considerably enhanced optical, electrical and thermal-mechanical characterization relative to organic/inorganic or conventional nanocomposites. Over the last few decades, extensive research works on organic-inorganic matrix composites interfaces with different nanoparticles are being carried out by the researchers from all over the world to develop an eco-friendly, biodegradable material to find its wide applications in industrial sectors.

Diphenyl phosphine compound have many properties that make them an attractive alternative to organic-inorganic solar cell devices. [DPP]TF is a smart diphenyl phosphine derivative that showcases the excellent Behaviors of film-forming of thermal nanocomposite diode and phosphine inorganic solar cell. Beside previous behavior of diphenyl phosphine nanocomposites, the structure matrices which contain the diphenyl phosphine moiety have unique properties, such as a novel optical metal ion sensor microporous and excellent transparency. (Almutlaq & Al-Hossainy, 2021)

1.1.6 Triphenyl phosphine

Phosphorus, like nitrogen, is able to form trivalent compounds, PH_3 or PR_3 , where R = alkyl or aryl. These phosphines, as a class, are Lewis bases; they can form complexes with metal derivatives by donation of the non-bonding electron pair on the phosphorus atom to a metal ion. Triaryl phosphines make especially good donors toward transition metal ions. (Hopp et al., 1970)

A straightforward method for the preparation of tris phosphinite ligands in one step, using only commercially available reagents (1,1,1-tris(4-hydroxyphenyl) ethane and chloro phosphines) is described. (Miranda-Pizarro et al., 2020)

the convenient, single-stage synthesis of numerous tri-phenyl phosphine derivatives of the platinum metals containing carbonyl, or hydride ligand. (Ahmad et al., 1972)

the molecular geometry is that of a distorted square pyramidal compound was prepared from the reaction of $[\text{Rh}(\text{NO})\text{Cl}_2(\text{PPh}_3)_2]$ with sodium nitrite. (Wilkinson, G., 1968)

The reactions of NaBH_4 , with Co(II) compounds in the presence of triphenylphosphine (PPh₃) have been studied in ethanol and benzene solutions. The conditions for the isolation of the Co(I) complexes, $\text{Co}(\text{BH}_4)_n$, (n = 2, 3), have been established. (Holah et al., 1978)

1.2 Coordination chemistry:

Coordination Chemistry involves the study of coordination compounds, their structures, properties and applications. The term 'Coordination' used to describe these compounds stems from the nature of chemical bond that leads to the formation of these compounds. This chemical bond called coordinate covalent bond involves donation of electron pair(s) by a molecule or negatively charged ion, a Lewis base, to a neutral metal or positively charged ion, a Lewis acid. (Herrera & Gimeno, 2021)

The transition metals form a large number of complex compounds in which the metal atoms are bound to a number of anions or neutral molecules by sharing of electrons that called a ligand. In modern terminology such compounds are called coordination compounds.(Goswami & Kostova, 2022)

Theories that explain bonds in coordination compounds are valence bond theory (VBT), crystal field theory (CFT), and ligand field theory (LFT). (Altaf et al., 2018)

The chemistry of coordination compounds is an important and challenging area of modern inorganic chemistry. Coordination Compounds are the backbone of modern inorganic and bio-inorganic chemistry and chemical industry. It is also finding many applications in electroplating, textile dyeing and medicinal chemistry.(Goswami & Kostova, 2022)

1.2.1 Manganese chemistry

Symbol Mn; atomic number 25; atomic weight 54.938; a Group VIIB (Group 7) transition metal; electron configuration $[\text{Ar}]4s^2 3d^5$; atomic radius 1.27Å; valence 0, +1, +2, +3, +4, +5, +6, +7; most common oxidation states +2, +4 and +7. , (Pradyot, 2002)

1.2.2 Iron Chemistry

Symbol: Fe; atomic number 26; atomic weight 55.847; a Group VIII (Group 8) metallic element; transition metal; atomic radius 1.24Å; electron configura- tion $[\text{Ar}]3d^6 4s^2$; most common valence states +2 and +3; other oxidization states -1, 0, +1, +4 and +6 are known. (Pradyot, 2002)

1.2.3 Cobalt chemistry

Symbol: Co; atomic number 27; atomic weight 58.933; a transition metal, Group VIII (Group 9) element; electron configuration $[\text{Ar}]3d^7 4s^2$; valence +2 and +3 also, valences 0, +1, +4, and +5 are known. (Pradyot, 2002)

1.2.4 Nickel chemistry

Symbol: Ni; atomic number 28; atomic weight 58.693; a transition metal element in the first triad of Group VIII(Group 10) after iron and cobalt; electron configuration $[\text{Ar}]3d^8 4s^2$; valence states 0, +1, +2, and +3; most common oxidation state +2. (Pradyot, 2002)

1.2.5 Molybdenum chemistry

Symbol: Mo; atomic number 42; atomic weight 95.94; a Group VIB (Group 6) transition metal element; atomic radius 1.36Å (coordination number 8); ionic radius 0.92Å and 0.62Å for Mo^{3+} and Mo^{6+} , respectively; atomic volume 9.41 cm³/mol; electron configuration $[\text{Kr}]4d^5 5s^1$; oxidation states 0, +2, +3, +4, +5, and +6; most stable oxidation state +6. (Pradyot, 2002)

1.2.6 Ruthenium chemistry

Symbol: Ru; atomic number 44; atomic weight 101.07; a Group VIII (Group 9) noble metal; electron configuration $[\text{Kr}]4d^7 5s^1$; valence states 0, +1, +2, +3, +4, +5, +6, +7, +8; most stable valence states +2, +3, +4. (Pradyot, 2002)

1.2.7 Rhodium chemistry

Symbol Rh; atomic number 45; atomic weight 102.906; a Group VIII (Group 9) noble metal placed between cobalt and iridium; electron configuration $[\text{Kr}]4d^8 5s^1$; valence states +2, +3, +4, +5, +6; most stable valence state +3. (Pradyot, 2002)

1.2.8 Palladium chemistry

Symbol: Pd; atomic number 46; atomic weight 106.42; a Group VIII (Group 10) platinum-group metal; electron configuration $[\text{Kr}]4d^{10}$; atomic radius 1.375Å; ionic radius, Pd²⁺ (coordination number 4, square planar) 0.64Å; valence states +2, +3, +4; most common valence state +2 .(Pradyot, 2002)

1.2.9 Silver chemistry

Symbol Ag; atomic number 47; atomic weight 107.87; a Group 1B (Group 11) coinage metal positioned between copper and gold; electron configuration $[\text{Kr}]4d^{10}5s^1$ valence +1, +2; most common valence +1(Pradyot, 2002)

1.2.10 Rhenium chemistry

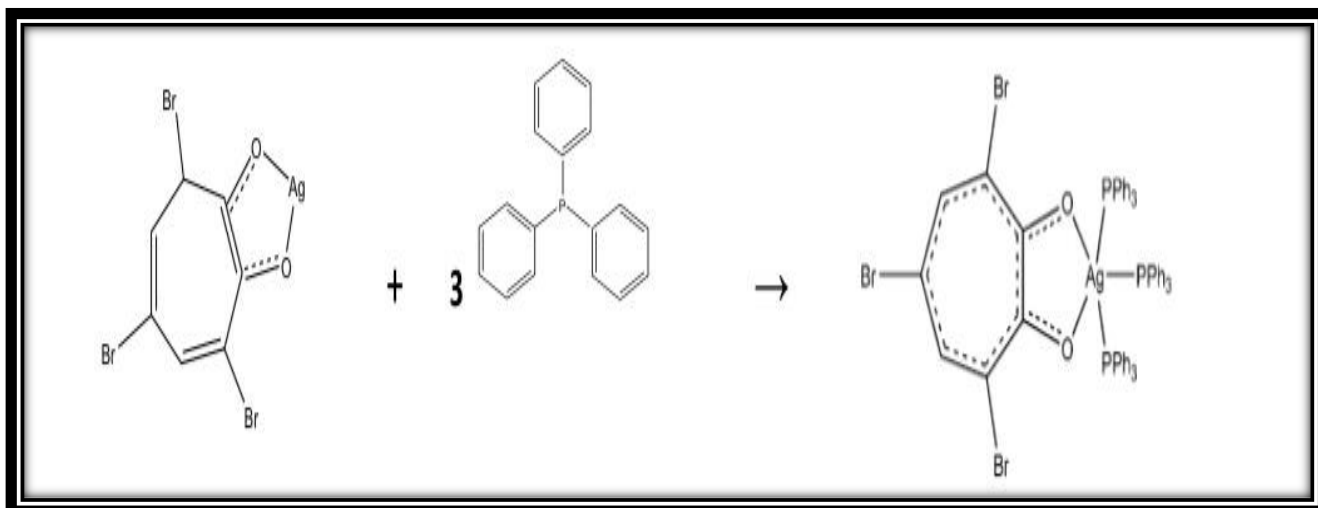
Symbol: Re; atomic number 75; atomic weight 186.21; a Group VIIB (Group 7) transition metal of manganese triad; electron configuration $[\text{Xe}]4f^{14} 5d^5 6s^2$; valence states -1, +1, +2, +3, +4, +5, +6, +7; most common valence state, +7.(Pradyot, 2002)

1.2.11 Osmium chemistry

Symbol: Os; atomic number 76; atomic weight 190.23; a Group VIII B (Group 8) transition metal element; a noble metal of platinum group; electron configuration $[\text{Xe}]4f^{14} 5d^6 6s^2$; valence states +1, +2, +3, +4, +5, +6, +7, +8; most common states +3, +4, +6.(Pradyot, 2002)

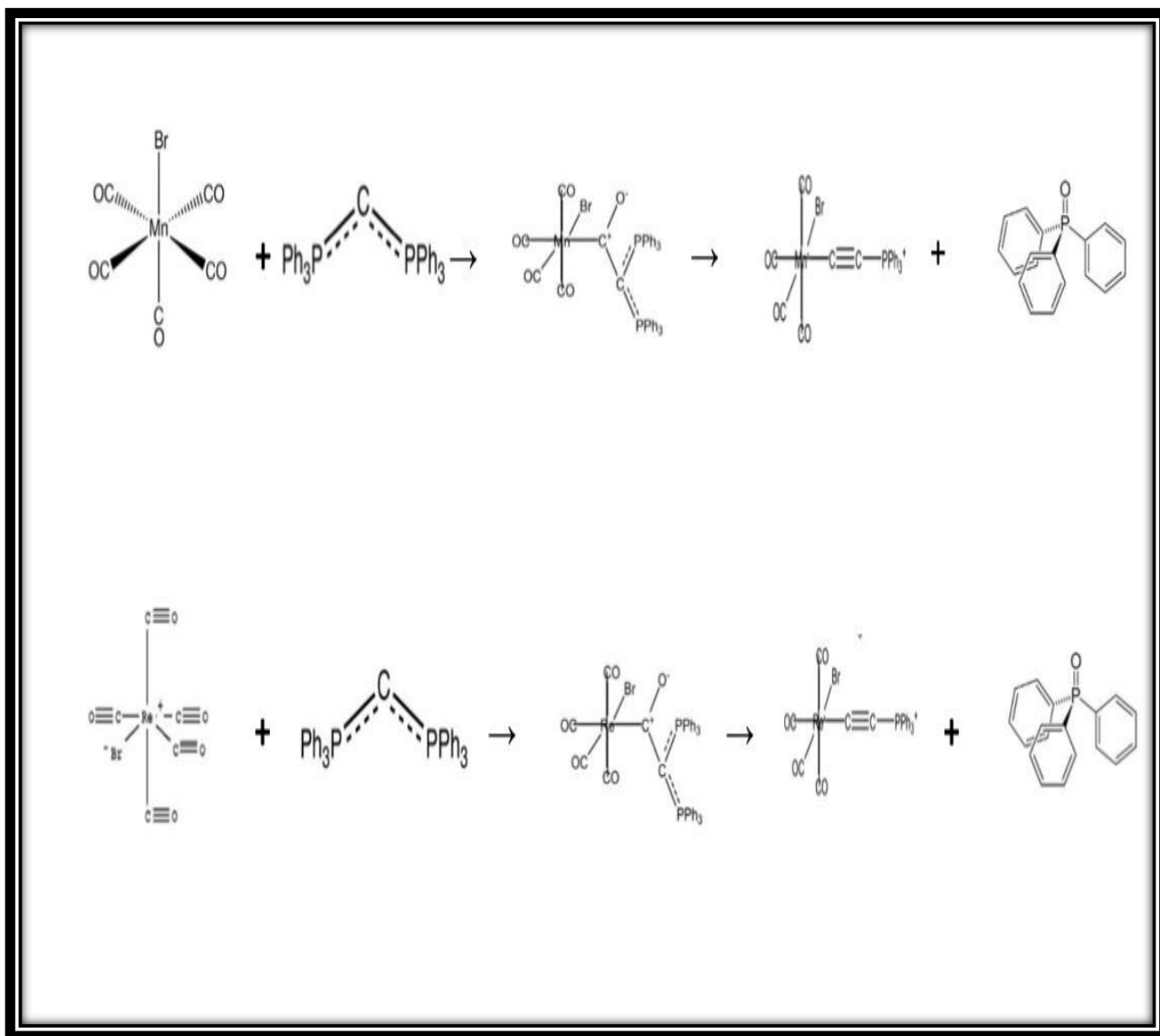
1.3 Metal Complexes of Di phenyl phosphine and Tri phenyl phosphine:-

The title compound, $[\text{Ag}(\text{C}_7\text{H}_2\text{Br}_3\text{O}_2)(\text{C}_{18}\text{H}_{15}\text{P})_3]$, a silver(I) derivative of 3,5,7-tribromotropolone, has three triphenyl- phosphine ligands coordinated to the silver center, whereas the 3,5,7-tribromotropolonate anion coordinates as a bidentate ligand. The compound is an example of a five-coordinate silver complex containing a bidentate ligand. (Harrison et al., 2010)



Scheme(1): - synthesis of the complex $[\text{Ag}(\text{C}_7\text{H}_2\text{Br}_3\text{O}_2)(\text{C}_{18}\text{H}_{15}\text{P})_3]$

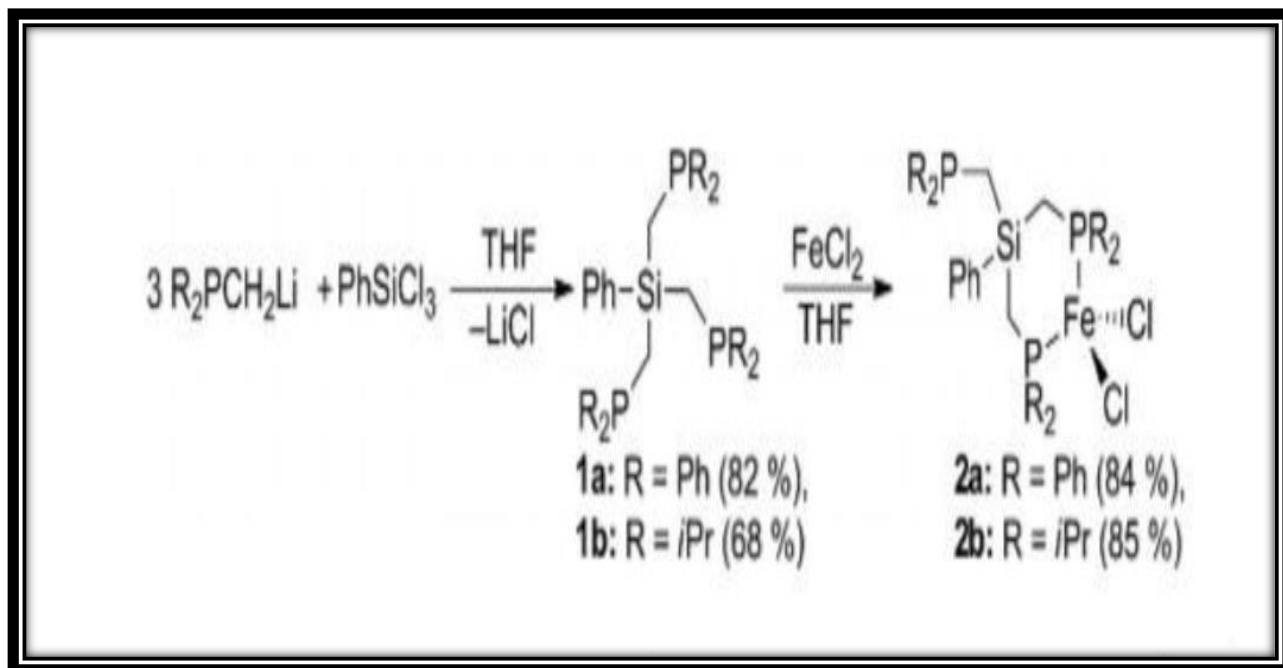
Hexa phenyl carbo di phosphorene when treated with manganese pentacarbonyl bromide or rhenium pentacarbonyl bromide gives $[M(\text{Br})(\text{CO})_4(\text{C}\equiv\text{CPPh}_3)]$, $M = \text{Mn}$ or Re , and triphenylphosphine oxide. (Kaska et al., 1974)



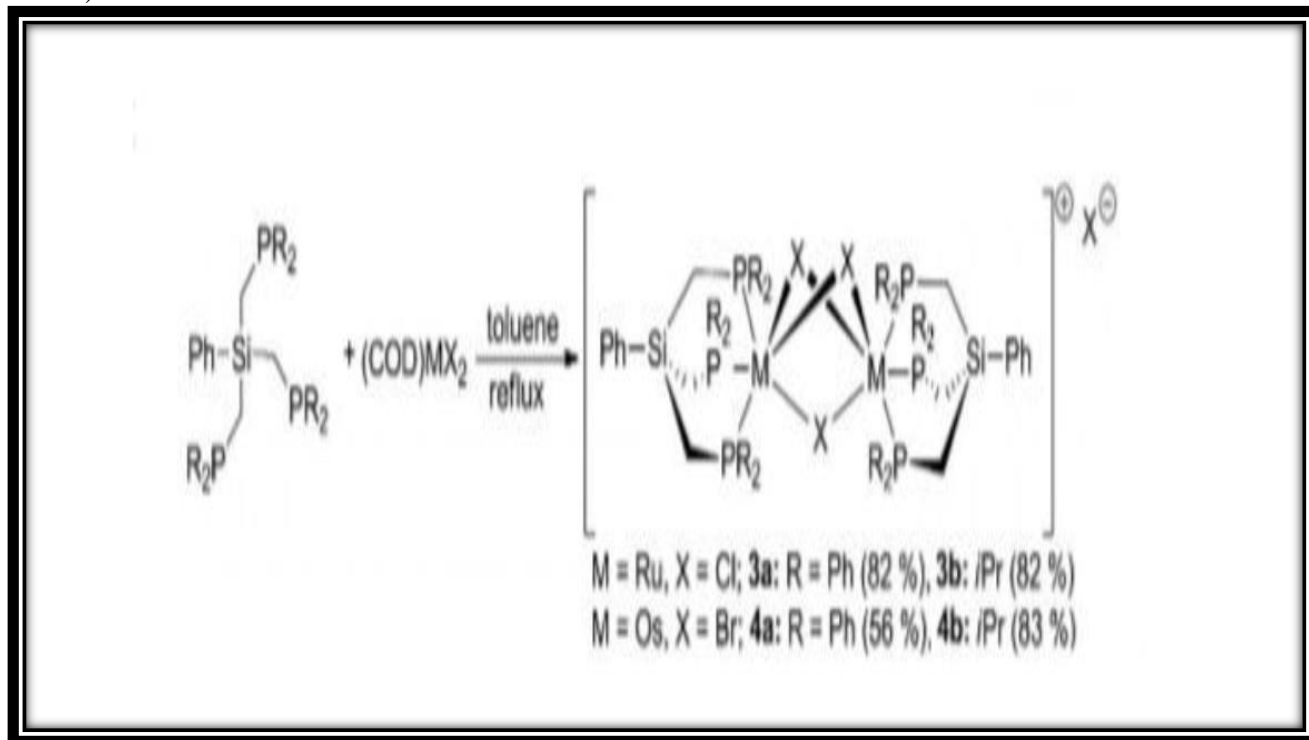
Scheme (2): - synthesis of the complex $[M(\text{Br})(\text{CO})_4(\text{C}\equiv\text{CPPh}_3)]$

A series of group 8 transition metal complexes of new tridentate phosphine ligands with Fe, Ru, and Os were prepared.

The new complexes were characterized by multinuclear NMR spectroscopy and X-ray crystallography. (Neumeier et al., 2013)

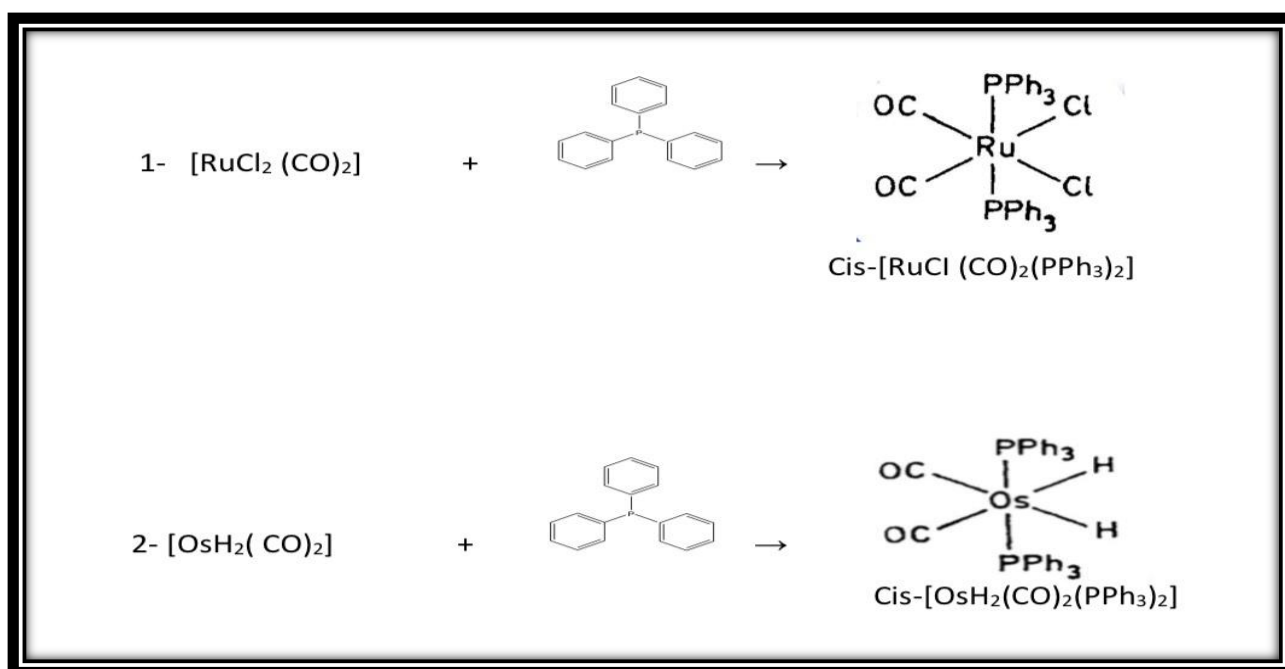


Scheme(3):- Synthesis of complex Si (1a and 1b), and reactions with iron di-chloride to give complex Fe(2a and 2b).



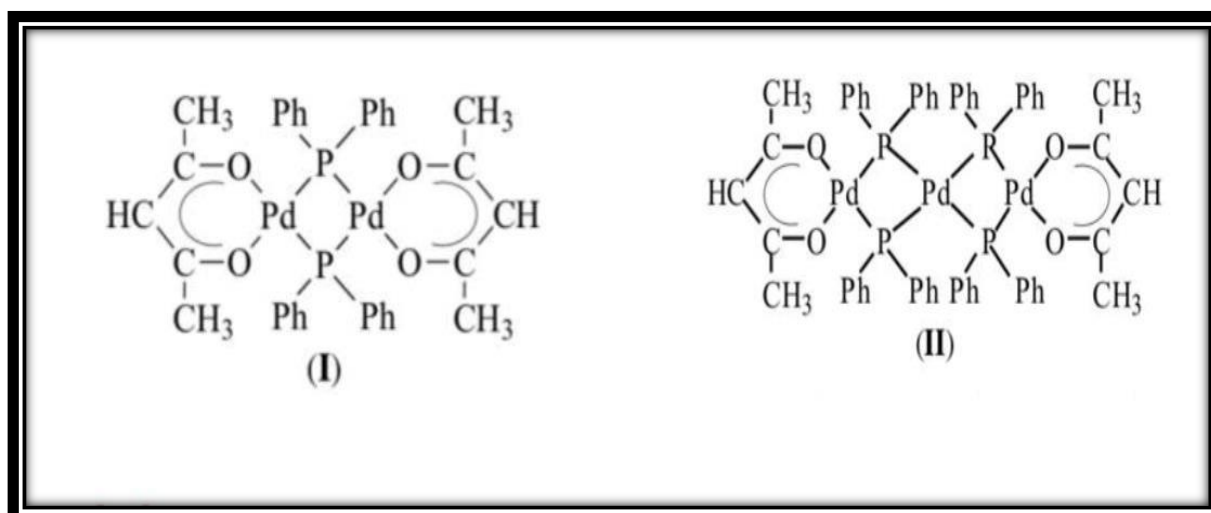
Scheme(4):- Synthesis of ruthenium and osmium complexes by using (1a and 1b).

The cis-isomer of $[\text{RuCl}(\text{CO})_2(\text{PPh}_3)_2]$ and $[\text{OsH}_2(\text{CO})_2(\text{PPh}_3)_2]$, synthesized by reaction of various ruthenium carbonyl halide species including $[\text{RuCl}_2(\text{CO})_2]$ and $[\text{OsH}_2(\text{CO})_2]$ with triphenylphosphine. (Ahmad et al., 1972)



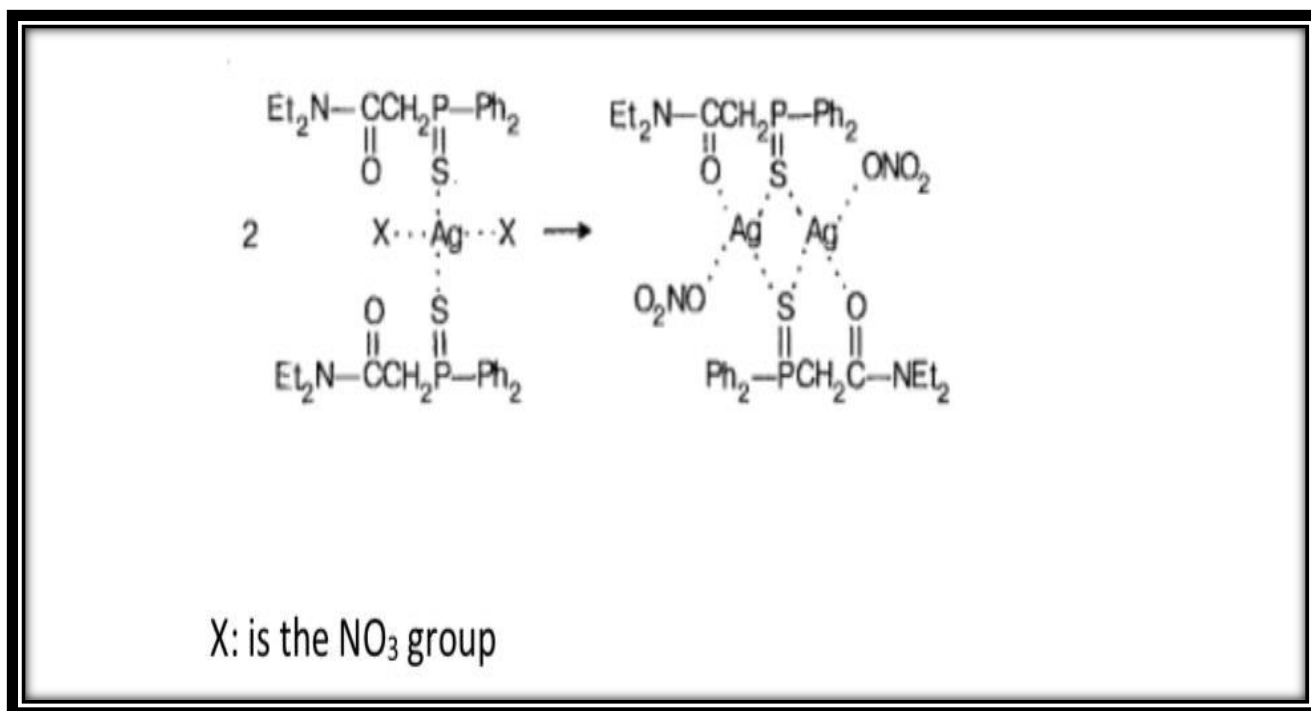
Scheme(5):- synthesis of the complexes $[\text{RuCl}(\text{CO})_2(\text{PPh}_3)_2]$ and $[\text{OsH}_2(\text{CO})_2(\text{PPh}_3)_2]$

Interaction of palladium bis (acetyl acetonate) with di phenyl phosphine is studied by NMR, IR, and UV methods. Reaction between reagents taken in equimolar amounts gives binuclear and trinuclear palladium complexes with bridging di phenyl phosphide and the chelate acetyl acetonate $[\text{Pd}(\text{acac})\text{PPh}_2]_2$ and $[\text{Pd}_3(\text{acac})_2(\text{PPh}_2)_4]$ ligands. (Belykh et al., 2002)



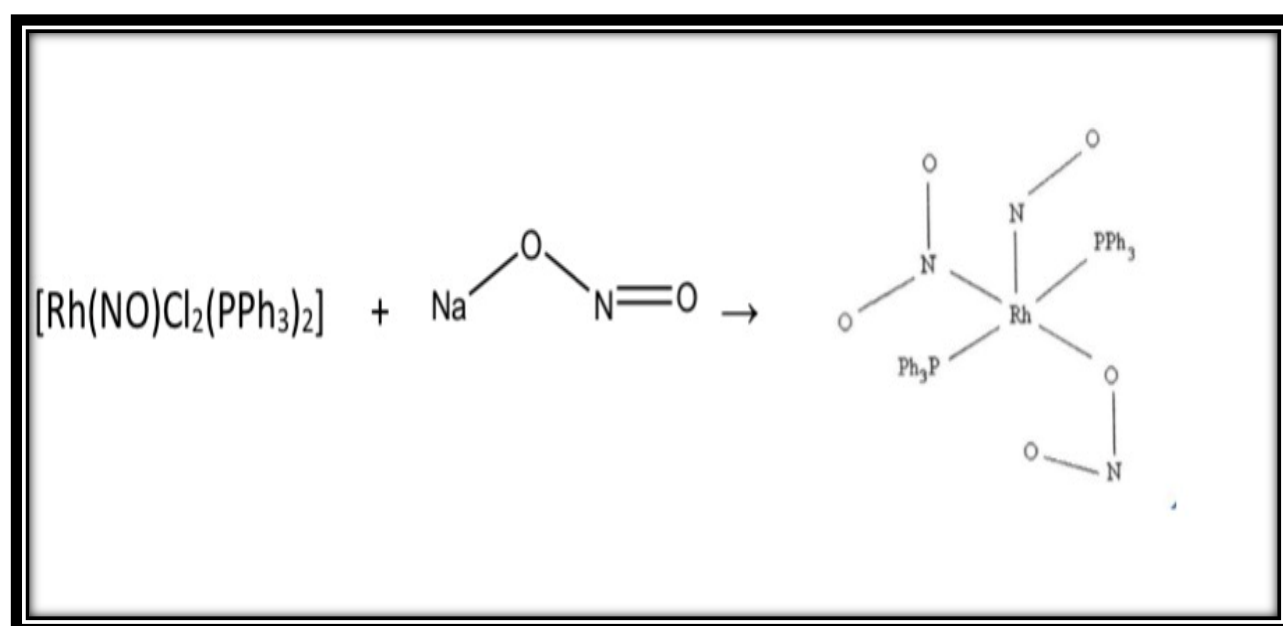
Scheme(6):- synthesis of the complexes $[\text{Pd}(\text{acac})\text{PPh}_2]_2$ and $[\text{Pd}_3(\text{acac})_2(\text{PPh}_2)_4]$

The crystalline complex $[\text{Ag}(\text{L}_1)\text{NO}_3]_2$ was isolated by the interaction of (N,N-di ethyl carbamoyl methyl)di phenyl phosphine sulfide $\text{Ph}_2\text{P}(\text{S})\text{CH}_2\text{C}(\text{O})\text{NEt}_2$ (L_1) with AgNO_3 in different solvents at the ratios of metal :ligand = 1:1 and 1:2. According to the X-ray data, complex that formed is a center-symmetric dimer with bridge sulfur atoms. The cations of the metal are in a tetrahedral environment formed by two S atoms and the O atoms of CO and NO_3 groups. (Pasechnik et al., 1994)



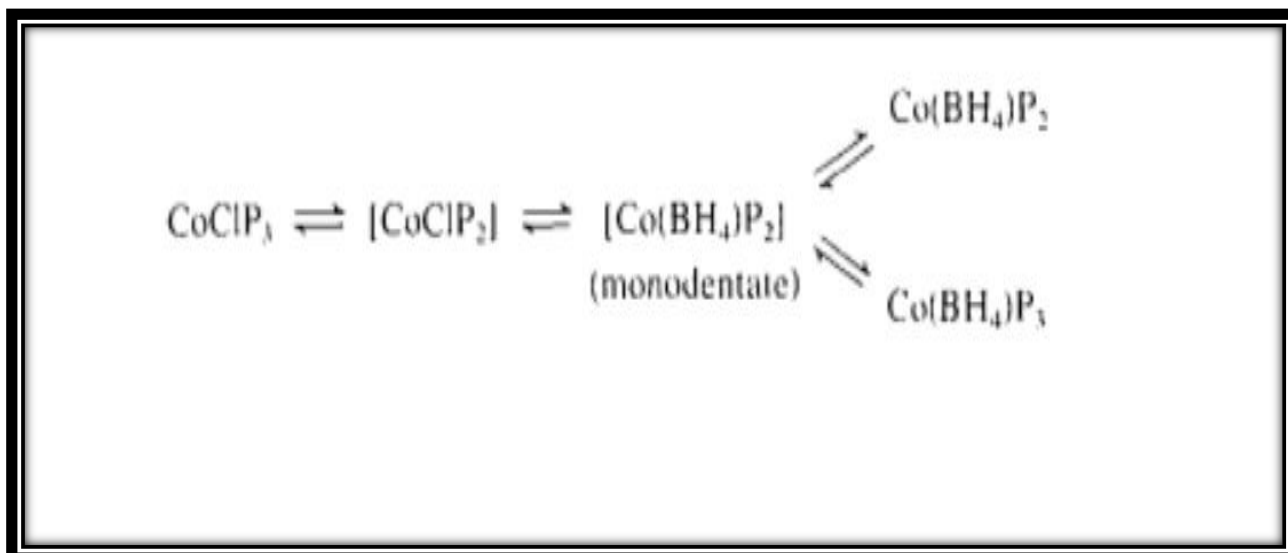
Scheme(7):- synthesis of the complex $[\text{Ag}(\text{L}_1)\text{NO}_3]_2$

Compound $[\text{Rh}(\text{NO})(\text{NO}_2)_2(\text{PPh}_3)_2]$ was prepared from the reaction of $[\text{Rh}(\text{NO})\text{Cl}_2(\text{PPh}_3)_2]$ with sodium nitrit, the molecular geometry is that of a distorted square pyramir. (Rajaseelan et al., 1999)



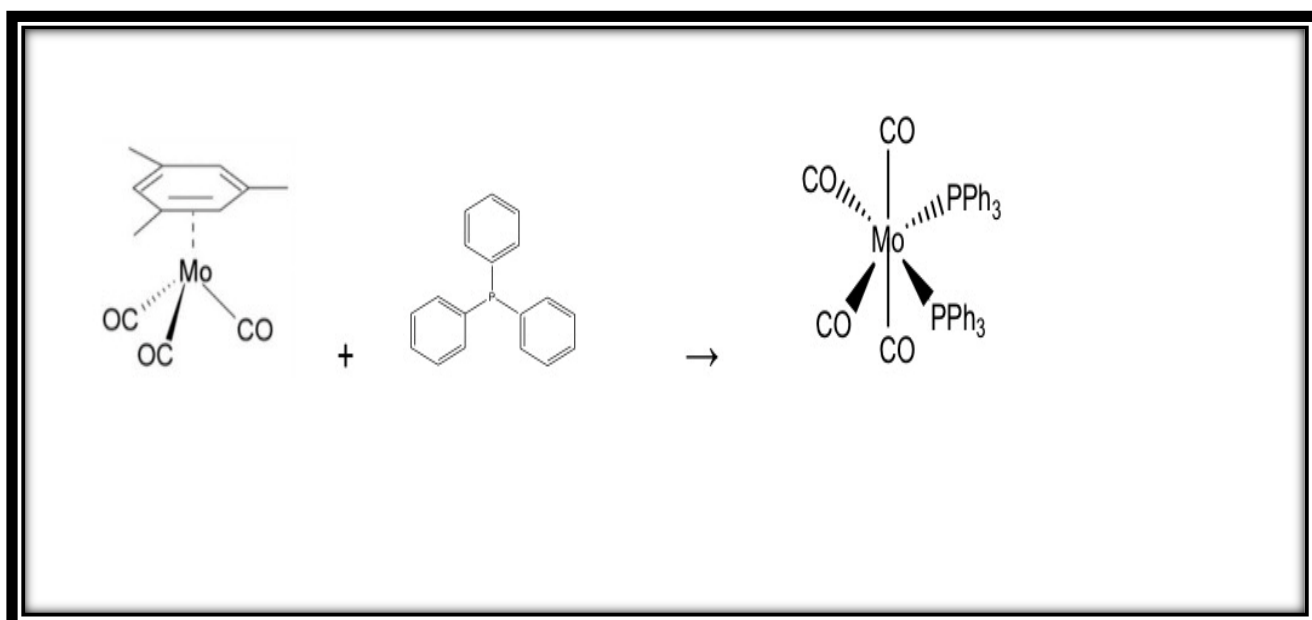
Scheme(8):- synthesis of the complex $[\text{Rh}(\text{NO})(\text{NO}_2)_2(\text{PPh}_3)_2]$

The reactions of NaBH₄ with Co(II) compounds in the presence of triphenylphosphine (P) have been studied in ethanol and benzene solutions. The conditions for the isolation of the Co(I) complexes, [Co(BH₄)P_n] (n = 2, 3), have been established. (Holah et al., 1978)



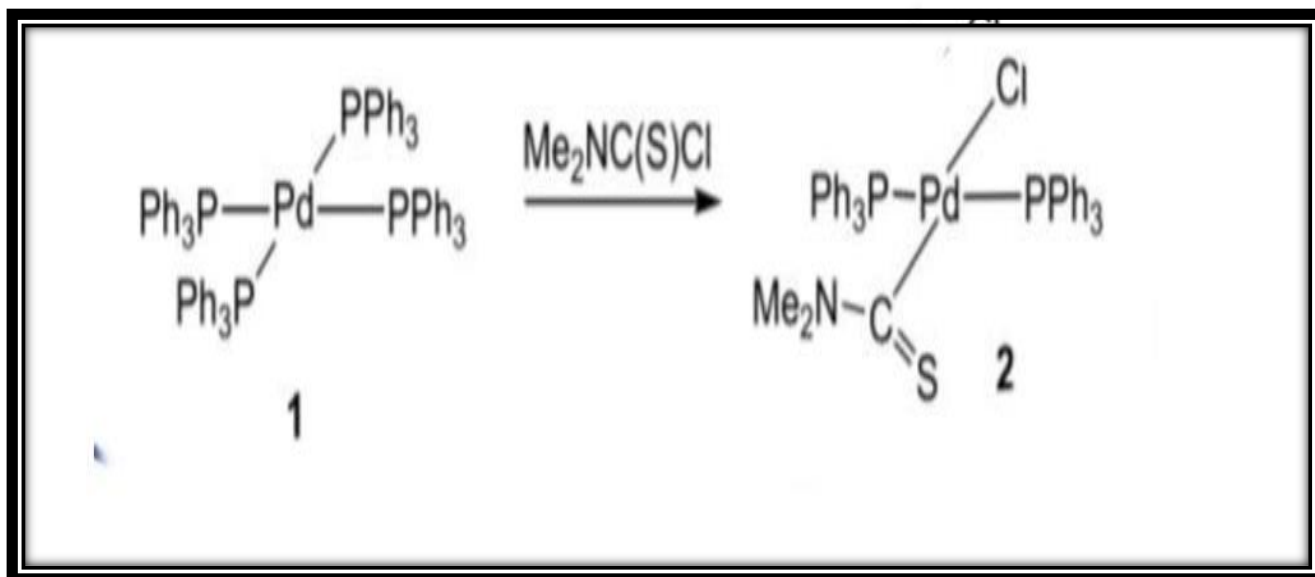
Scheme(9):- synthesis of the complex [Co(BH₄)P_n]

Synthesis of cis-[Mo(CO)₄(PPh₃)₂] by reaction of [Mo(CO)₃(1,3,5-trimethylbenzene)] and PPh₃ and under a nitrogen atmosphere. THF was then added, under reflux for 1 hour. The product was obtained as light-yellow crystals. (Tshabang et al., 2018)



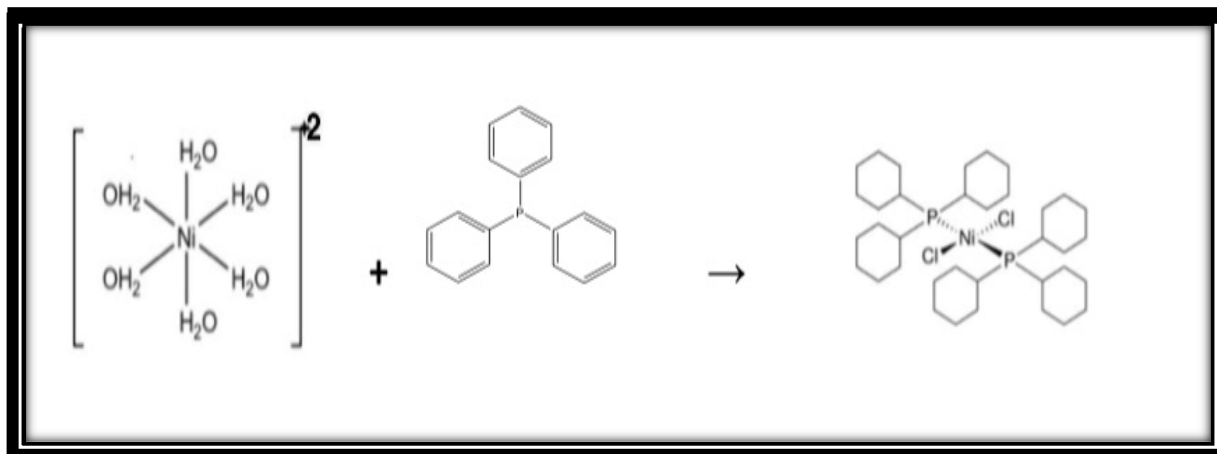
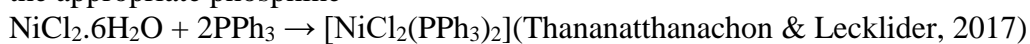
Scheme(10):- synthesis of the complex cis-[Mo(CO)₄(PPh₃)₂]

Treatment of $[\text{Pd}(\text{PPh}_3)_4]$ with $\text{Me}_2\text{NC}(=\text{S})\text{Cl}$ in dichloromethane at $-20\text{ }^\circ\text{C}$ produces the complex $[\text{Pd}(\text{PPh}_3)_2\text{-SCNMe}_2\text{Cl}]$. (Yih et al., 2003)



Scheme(11):- synthesis of the complex $[\text{Pd}(\text{PPh}_3)_2\text{-SCNMe}_2\text{Cl}]$

Bis(triphenylphosphine)nickel(II) chloride $[\text{NiCl}_2(\text{PPh}_3)_2]$, was synthesis by using $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ and the appropriate phosphine



Scheme(12):- synthesis of the complex $[\text{NiCl}_2(\text{PPh}_3)_2]$

1.4 Application

1.4.1 Uses of Triphenylphosphine

Triphenylphosphine (Ph_3P) is a very versatile reagent extensively used by organic chemists. Ph_3P exists as relatively air-stable, colorless crystals at room temperature. It dissolves in non-polar organic solvents such as benzene and diethyl ether. Ph_3P undergoes slow oxidation by air to give triphenylphosphine oxide, Ph_3PO . This impurity can be removed by recrystallization of Ph_3P from either hot ethanol or hot isopropanol. (Pedrosa, 2008)

Triphenylphosphine is one of the most widely used phosphorus-containing reagents in organic synthesis for many types of transformations such as the Mitsunobu,¹ the Wittig,² and the Staudinger³ reaction. (Charette et al., 2000)

Triphenylphosphine is known to catalyze the isomerization of α,β acetylenic esters to produce $\Delta^2,4$ -dienoates.⁶ The latter are common flavor constituents and important. (Årstad et al., 2002)

1.4.2 Uses of Di phenyl phosphine

Di phenyl phosphine is commonly used in laboratory as organic phosphorus compound, it is unpleasant odor colorless liquid, and it is pungent, it is easily oxidized in air and can cause spontaneous combustion, it is sensitive to air and light, it need the protection of nitrogen. It can be used as precursor to synthesize some organic phosphine ligand.

Di phenyl phosphine acts as an intermediate in the preparation of di phenyl phosphide derivatives, (Balakrishna et al., 2012)

Also it acts as an intermediate in the preparation of di phenyl phosphide derivatives, phosphonium salts, phosphine ligands and Wittig-Horner reagents. The presence of hydrogen atom bonded to phosphorus undergoes Michael-like addition to activated alkenes. It is involved in the preparation of 1,2-bis(di phenyl phosphino)ethane and (phenyl-(phenyl methyl)phosphoryl)benzene. (Longmire & Zhang, 1997)

1.5 References

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