CHAPTER FOUR

TERNARY METAL, HISTIDINE, IMINODIACETIC ACID OR NITRILOTRIACETIC ACID AND DIAMINE SYSTEMS

In the present chapter, the study of the ternary systems MAL, where M = Cu(II), Ni(II); A = Histidine (Hist), Iminodiacetic acid (IMDA) or Nitrilotriacetic acid (NTA) and L = ethylenediamine (en), propylenediamine (pn), 1,3-diamino-propane or N-substituted ethylenediamine, has been carried out.

The 1:1 complexes of these multidentate ligands are formed at low pH and remains stable upto higher pH[1]. In the 1:1 complex of these ligands with metal ion, the remaining coordination positions of the metal ion are occupied by water molecules. On the addition of a secondary ligand, water molecules are displaced resulting in the formation of the mixed ligand complex MAL where A = Histidine, IMDA or NTA and L = diamines. The reaction can be represented as follows :

$$MA + L \rightleftharpoons MAL$$

$$K_{MAL}^{MA} = \frac{[MAL]}{[MA]\ [L]}$$

Histidine exhibits bi or tridentate[2] character, coordination taking place from COO^- and from nitrogen of the imidazole group or two nitrogens from both imidazole and amino groups. IMDA behaves as a tridentate[3] ligand coordination taking place from the nitrogen atom and two carboxylate groups. NTA behaves as a tri[4] or tetradentate[5] ligand, coordination taking place from nitrogen atom and two or three COO^- groups, respectively.

The formation constants K_{MAL}^{MA} have been determined using two methods as in case of dipyridyl in chapter III. In case of (M.NTA.L) systems, second method could not be applied because solubility of NTA in water is less and so it is not possible to prepare solution having concentration 0.02M as required in method II. With dilute solution of NTA, separation of curve 1 and curve 2 as in fig. IV 3 is very small and so there are chances of errors. Method II was also not used where L = 1,3-diaminopropane and N-substituted en because a concentrated solution containing large quantity of the diamine is required. As said earlier, the diamines are costly.

Experimental :

The reagents and instruments used were same as detailed in previous chapters. Histidine, IMDA and NTA used were of A.R. quality.

For studying the ternary systems following solutions were prepared :

Method I : For Histidine :

1. Perchloric acid (0.2M, 5.0 ml.) + perchloric acid (0.02M, 5.0 ml.)+ secondary ligand (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.8 ml.) + conductivity water (26.2 ml.),
2. Perchloric acid (0.2M, 5.0 ml.) + secondary ligand (0.02M, 5.0 ml.) + metal perchlorate (0.02M, 5.0 ml.) + histidine (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.7 ml.) + conductivity water (21.3 ml.).
3. Perchloric acid (0.2M, 5.0 ml.) + Histidine (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.9 ml.) + conductivity water (31.1 ml.).
4. Perchloric acid (0.2M, 5.0 ml.) + Histidine (0.02M, 5.0 ml.) + metal perchlorate (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.8 ml.) + conductivity water (26.2 ml.).
5. Perchloric acid (0.2M, 5.0 ml.) + perchloric acid (0.02M, 5.0 ml.)+

sodium perchlorate (1M, 8.9 ml.) + conductivity water (31.1 ml.).

For IMDA :

1. Perchloric acid (0.2M, 5.0 ml.) + perchloric acid (0.02M, 10.0 ml.) + secondary ligand (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.7 ml.) + conductivity water (21.3 ml.).
2. Perchloric acid (o.2M, 5.0 ml.) + secondary ligand (0.02M, 5.0 ml.) + metal perchlorate (0.02M, 5.0 ml.) + IMDA (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.7 ml.)+ conductivity water (21.3 ml.).
3. Perchloric acid (0.2M, 5.0 ml.) + IMDA (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.9 ml.) + conductivity water (31.1 ml.).
4. Perchloric acid (0.2M, 5.0 ml.) + IMDA (0.02M, 5.0 ml.) + metal perchlorate (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.8 ml.)+ conductivity water(26.2 ml.).
5. Perchloric acid (0.2M, 5.0 ml.) + perchloric acid (0.02M, 10.0 ml.)+ sodium perchlorate (1M, 8.8 ml.) + conductivity water (26.2 ml.).

For NTA :

1. Perchloric acid (0.2M, 5.0 ml.) + perchloric acid (0.02M, 15.0 ml.) + secondary ligand (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.6 ml.) + conductivity water (16.4 ml.).
2. Perchloric acid (0.2M, 5.0 ml.) + secondary ligand (0.02M, 5.0 ml.) +metal perchlorate (o.02M, 5.0Ml.) + NTA (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.7 ml.) + conductivity water (21.3 ml.).
3. Perchloric acid (0.2M, 5.0 ml.) + NTA (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.9 ml.) + conductivity water (31.1 ml.).
4. Perchloric acid (0.2M, 5.0 ml.) + metal perchlorate (o.02M, 5.0 ml.) + NTA (0.02M, 5.0 ml.) + sodium perchlorate (1M, 8.8 ml.)+

conductivity water (25.2 ml.).

5. Perchloric acid (0.2M, 5.0 ml.) + perchloric acid (0.02M, 15.0 ml.) + sodium perchlorate (1M, 8.7 ml.) + conductivity water (21.3 ml.).

Method II For Histidine :

1. Perchloric acid (0.5M, 10.0 ml.) + perchloric acid (0.02M, 10.0 ml.) + sodium perchlorate (1M, 4.8 ml.) + conductivity water (25.2 ml.).
2. Perchloric acid (0.5M, 10.0 ml.) + Histidine (0.02M, 10.0 ml.) + metal perchlorate (0.02M, 10.0 ml.) + sodium perchlorate (1M, 4.6 ml.) + conductivity water (15.4 ml.).

For IMDA

1. Perchloric acid (0.5M, 10.0 ml.) + perchloric acid (0.02M, 20.0 ml.) + sodium perchlorate (1M, 4.6 ml.) + conductivity water (15.4 ml.).
2. Perchloric acid (0.5M, 10.0 ml.) + IMDA (0.02M, 10.0 ml.) + metal perchlorate (0.02M, 10.0 ml.) + sodium perchlorate (1M, 4.6 ml.) + conductivity water (15.4 ml.).

Total volume was made 50.0 ml. and ionic strength was raised to 0.2M in both the methods. In the method I, the solution(1 to 6) were titrated against 0.2M sodium hydroxide. In method II, the solutions (1,2) were titrated against 1.0M secondary ligand (amine).

The plot of pH against volume of alkali by method I have been presented in figs. IV 1, IV 2, IV 5 to IV 12 and IV 15 to IV 42. The plots of pH against volume of secondary ligand in method II are shown in figs. IV 3, IV 4, IV 13 and IV 14.

In the method I, in the curve(1) and curve(5), one, two and three equivalents of extra acid have been added in case of histidine, IMDA and NTA, respectively, in order to account for the extra hydrogen ions liberated due to the combination of the primary ligands, histidine, IMDA or NTA with the metal ions. Similarly in the method II, in the curve(1), one and two equivalents of extra acid have been added in case of histidine and IMDA, respectively.

In the method I, it is observed from curve(4) and curve(5) that MA is formed at low pH. It undergoes hydroxo-complex formation at higher pH. The curve(2) remains merged with curve(1) at low pH showing that complexation of the aliphatic amine does not take place at low pH. Curve(2) diverges from curve(1) at higher pH showing that MAL formation takes place where MA 1:1 complex formation is complete. In this range hydroxo complex formation also does not starts. The horizontal distance between curve(1) and curve(2) corresponds to the amount of secondary ligand which gets bound with MA. The $\bar{n}$ and pL values were calculated at different pH in the same manner as done in Chapter III and have been presented in Tables IV 2.1Ab to IV 2.6Ab, IV 2.1Ba to IV 2.8 Ba, IV 2.1Bb to IV 2.8Bb, IV 2.1Ca to IV 2.8Ca and IV 2.1Cb to IV 2.8Cb..

In method II, curve(2) is slightly above curve(1) at low pH, because coordination of A m is not complete and the uncoordinated NH_2 group absorbs protons from solution forming NH_3^+. At pH ~ 3-4 both the curves overlap showing that (MA) 1:1 complex formation is complete and after that curve(2) diverges from curve(1) showing that combination of the secondary ligand (L) starts with MA at that pH. From the horizontal distance between these two curves $\bar{n}$ and pL values can be calculated in the same manner as done in Chapter III and have been represented in tables IV 2.1'Ab, IV 2.2'Ab, IV 2.1'Ba, IV 2.2'Ba, IV 2.1'Bb, IV 2.2'Bb. The values of pL, at $\bar{n}$ = 0.5 give the values of $\log K^{MA}_{MAL}$. More precise values were obtained by plotting pL at each point against the corresponding value of $\log(1-\bar{n})/\bar{n}$ and getting a straight line (Figs IV 43 to IV 86). The value of $pL-\log(1-\bar{n})/\bar{n}$ at each point on the straight line is equal to $\log K^{MA}_{MAL}$. The average values of $\log K^{MA}_{MAL}$, thus obtained by both the methods have been presented with mean deviation in table IV 3.0.

It is observed that the values of K^{MA}_{MAL} obtained by both the methods give almost identical values. The values are also in close agreement with the values reported in some cases by other workers using different methods.[6-7]

The mixed ligand formation constants, K^{MA}_{MAL} where L = ethylenediamine, are less than those where L = propylenediamine. This is in accordance with the basicity of the ligands. It is observed that 1,3-diaminopropane forms less stable complexes than en or pn. This is because it forms a six membered ring.

In the study of mixed ligand complexes containing charged primary ions A^{n-} and secondary ligand ions with negative charge,[8-10] it has been observed earlier that K^{MA}_{MAL} values are very much lower than K^{M}_{ML}. This is because of the repulsion between the incoming charged ligand ion and the already existing charged ion. However, it is observed that in the present study of these systems with histidine, IMDA and NTA as primary ligands and L = en, pn or 1,3-diaminopropane, the values of K^{MA}_{MAL} are not very much lower than K^{M}_{ML}, values. This is because the incoming secondary ligands are neutral bases and face no repulsion from the charged polybasic amino acid ions. The difference $K^{MA}_{MAL} - K^{M}_{ML}$, is, however, more in cases where L = N-alkyl substituted ethylenediamine due to steric hinderance produced by alkyl groups on the nitrogen atom. The lowering in the values is in the order N-N-diethyl en > N-N-dimethyl en > N-N'-dimethyl en > N-ethyl en N-methylen>en.

Anomaly is observed only in case of $\boxed{M.NTA.L}$. In this case $K^{M.NTA}_{M.NTA.L'} > K^{M.NTA}_{M.NTA.L''}$, L' being N-N-dimethyl en and L" being N-N'-dimethyl en.

In cases[9,10] of charged secondary ligand ions K^{MA}_{MAL} values go on decreasing as A^{n-} has one, two or three negative charges as in ions of Histidine, IMDA and NTA. In the present cases where secondary ligands are neutral diamines, there is no electrostatic repulsion and hence the difference in K^{MA}_{MAL} values with different A^{n-} is not very marked.

In case of $\boxed{Cu.NTA.L}$ complexes K^{MA}_{MAL} is much lower than K^{M}_{ML},. This can be explained in terms of Jahn-Teller distortion. NTA occupies three positions in the equatorial plane. The diamine has, therefore, to occupy one position in the equatorial plane and other in the axial direction. Due to distortion along the Z direction, the diamine has to span more and is put to strain. This lowers down the values of $K^{Cu.NTA}_{Cu.NTA.L}$.

It is also observed that $\log K^{Cu}_{Cu.L} - \log K^{Cu.NTA}_{Cu.NTA.L}$, where L = 1,3-diaminopropane is less than in cases where L = ethylene-diamine or propylenediamine. This is because 1,3-diaminopropane is a longer chain compound and hence feels less strain in occupying one equatorial and one axial position in the distorted $(Cu.NTA)^{-1}$ complex. The difference in the Δ values of Cu(II) and Ni(II) complexes is, therefore, less in this case than in analogous en or pn complexes.

In case of (Cu.IMDA.L), the values of K^{Cu}_{CuAL} are not very much lowered. This is because in Cu.IMDA.L the primary ligand occupies only two equatorial positions and hence leaves the other two equatorial positions to be occupied by the secondary ligands. Thus the secondary ligand has not to occupy positions along the distorted axial direction.

Table IV 1.1A

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.022M T°_{Hist} = 0.002M T°_{M} = 0.002M

*Perchloric acid		Histidine		Ni.Histidine	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.60	0.00	1.65	0.00	1.65
1.00	1.70	1.00	1.75	1.00	1.75
2.00	1.80	2.00	1.90	2.00	1.90
3.00	2.00	3.00	2.10	3.00	2.10
4.00	2.20	4.00	2.75	4.00	2.60
4.60	2.50	4.10	2.90	4.20	3.10
4.90	2.75	4.20	3.10	4.40	3.70
5.00	2.85	4.30	3.50	4.50	4.00
5.20	3.15	4.34	3.90	4.60	4.15
5.30	3.70	4.36	4.25	4.70	4.30
5.34	4.25	4.38	4.50	4.80	4.45
5.36	4.90	4.42	5.00	5.00	4.70
5.38	5.40	4.50	5.40	5.10	4.90
5.40	5.70	4.60	5.75	5.20	5.10
5.42	6.00	4.70	6.10	5.30	5.30
5.46	6.80	4.80	6.50	5.40	5.60
5.50	8.30	4.90	7.10	5.42	6.00
5.54	9.30	4.94	7.55	5.46	6.90
5.58	9.60	4.96	7.80	5.52	8.50
5.62	9.90	4.98	8.00	5.60	8.80
5.72	10.30	5.04	8.40	5.70	9.20
5.80	10.50	5.10	8.65	5.80	9.50
5.90	10.70	5.20	8.95	5.90	9.75
6.00	10.80	5.40	9.50	6.00	10.00
		5.60	10.00		

Table IV 1.2A

$N = 0.2M$ $V° = 50$ ml. $\mu = 0.2M$ $t = 30°C.$
$E° = 0.02M$ $^{*}E° = 0.022M$ $T^{o}_{Hist} = 0.002M$ $T^{o}_{M} = 0.002M$
$T^{o}_{L} = 0.002M$

*Ethylenediamine		Ni.Hist en		*Propylenediamine		Ni.Hist pn	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.65	0.00	1.75	0.00	1.65	0.00	1.70
1.00	1.80	1.00	2.00	1.00	1.80	1.00	1.95
2.00	1.95	2.00	2.20	2.00	1.90	2.00	2.20
3.00	2.20	3.00	2.80	3.00	2.15	3.00	2.80
4.00	2.75	3.30	3.40	4.00	2.75	3.30	3.50
4.20	3.20	3.40	4.00	4.20	3.15	3.38	4.00
4.30	3.60	3.50	4.30	4.30	3.90	3.50	4.30
4.32	4.00	3.70	4.50	4.32	4.70	3.80	4.70
4.34	4.70	4.00	4.90	4.34	5.10	4.00	4.95
4.36	5.10	4.20	5.30	4.36	5.30	4.20	5.30
4.38	5.45	4.30	5.60	4.40	5.70	4.30	5.55
4.42	5.90	4.40	5.90	4.45	6.00	4.40	5.85
4.50	6.40	4.50	6.15	4.50	6.25	4.50	6.05
4.55	6.60	4.60	6.35	4.60	6.60	4.60	6.20
4.60	6.90	4.80	6.60	4.70	6.95	4.80	6.45
4.70	7.20	5.00	6.95	4.80	7.25	4.90	6.65
4.80	7.55	5.10	7.10	4.85	7.50	5.00	6.85
4.90	8.00	5.20	7.35	4.90	7.80	5.20	7.30
4.95	8.35	5.25	7.60	4.95	8.25	5.30	7.60
5.00	8.75	5.34	8.00	5.00	8.70	5.34	7.80
5.10	9.30	5.42	8.60	5.05	9.00	5.38	8.10
5.20	9.60	5.50	9.25	5.10	9.25	5.40	8.35
5.40	10.00	5.55	9.55	5.20	9.50	5.50	9.20
5.60	10.35	5.70	10.10	5.40	9.95	5.55	9.60

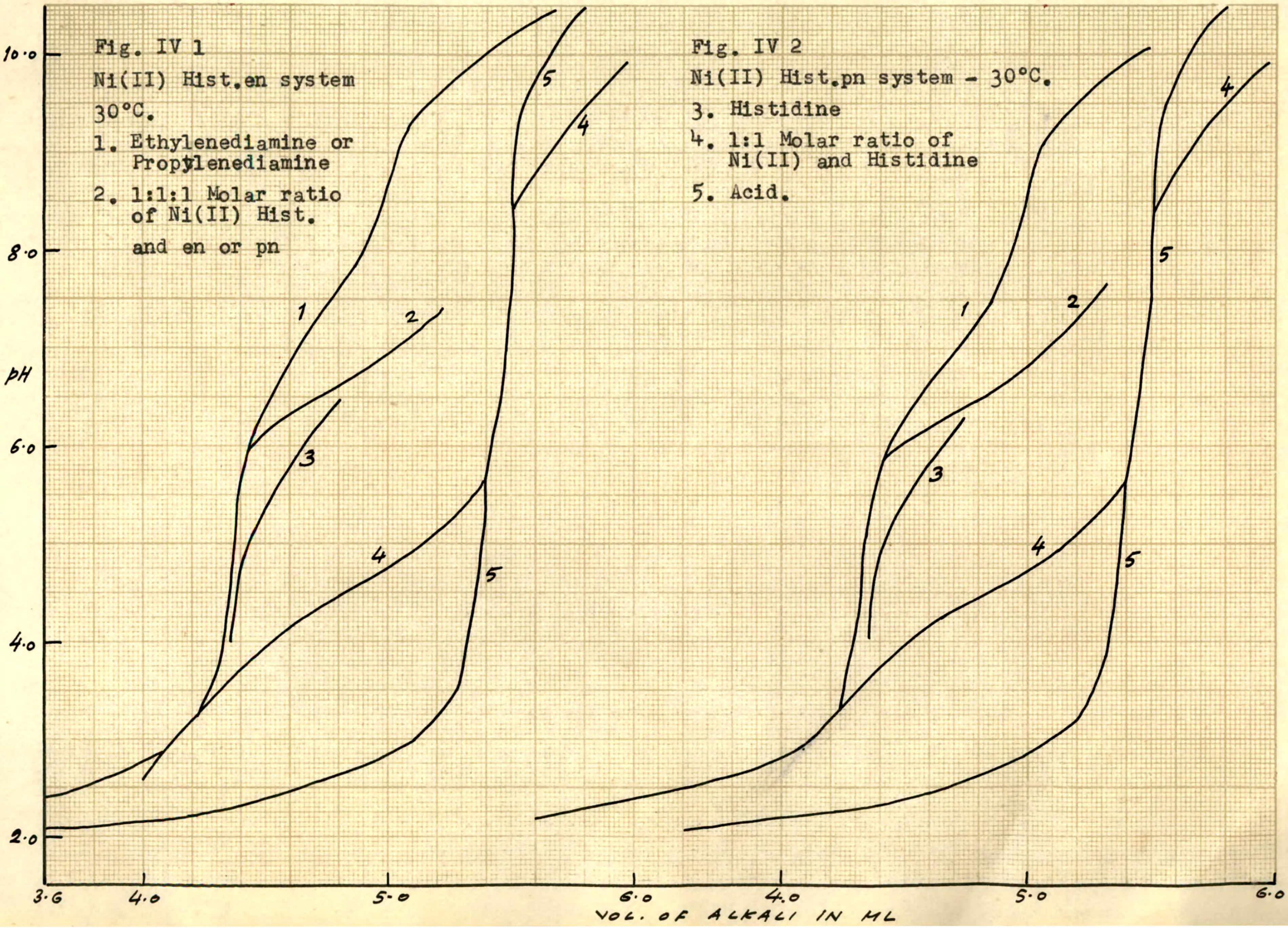

Fig. IV 1

Ni(II) Hist.en system

30°C.

1. Ethylenediamine or
   Propylenediamine
2. 1:1:1 Molar ratio
   of Ni(II) Hist.
   and en or pn

Fig. IV 2

Ni(II) Hist.pn system - 30°C.

3. Histidine
4. 1:1 Molar ratio of
   Ni(II) and Histidine
5. Acid.

Table IV 1.2'A

N = 1.0M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.1M *E° = 0.104M T°_{Hist} = 0.004M T°_{M} = 0.004M

*Perchloric acid		Ni.Hist en		*Perchloric acid		Ni.Hist pn	
Vol.of en (in ml.)	B	Vol.of en (in ml.)	B	Vol.of pn (in ml.)	B	Vol.of pn (in ml.)	B
0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
1.00	1.10	1.00	1.20	1.00	1.10	1.00	1.20
2.00	1.50	2.00	1.70	2.00	1.50	2.00	1.70
2.30	1.80	2.20	2.05	2.30	1.80	2.20	2.05
2.40	2.00	2.30	2.40	2.40	2.00	2.30	2.40
2.50	2.30	2.35	3.60	2.50	2.25	2.40	3.60
2.55	3.60	2.40	3.90	2.54	2.50	2.42	3.95
2.56	3.90	2.45	4.25	2.58	3.00	2.45	4.20
2.58	4.30	2.50	4.60	2.60	4.40	2.50	4.50
2.60	5.20	2.55	4.90	2.62	5.20	2.55	4.75
2.62	5.60	2.60	5.20	2.66	5.50	2.60	5.00
2.64	5.70	2.65	5.60	2.70	5.70	2.65	5.30
2.68	5.90	2.70	5.70	2.75	5.90	2.70	5.50
2.72	6.05	2.80	5.95	2.80	6.05	2.80	5.80
2.76	6.15	2.90	6.15	2.90	6.25	2.90	6.00
2.80	6.30	3.00	6.35	3.00	6.40	3.00	6.20
2.90	6.45	3.10	6.55	3.10	6.55	3.20	6.45
3.00	6.65	3.20	6.70	3.20	6.65	3.40	6.65
3.10	6.75	3.40	6.90	3.40	6.85	3.60	6.80
3.20	6.90	3.60	7.05	3.60	7.00	3.80	7.00
3.40	7.10	3.80	7.20	3.80	7.15	4.00	7.15
3.60	7.25	4.00	7.35	4.00	7.35	4.20	7.25
3.80	7.35	4.20	7.45	4.20	7.45	4.40	7.35
4.00	7.50	4.40	7.60	4.40	7.60	4.60	7.50
4.20	7.65	4.80	7.85	4.60	7.70	4.80	7.65
4.40	7.80	5.20	8.15	4.80	7.95	5.00	7.80
4.60	7.95	5.50	8.45	5.00	8.20	5.20	8.00
4.80	8.15		(ppts.)			5.60	8.50
							(ppts.)

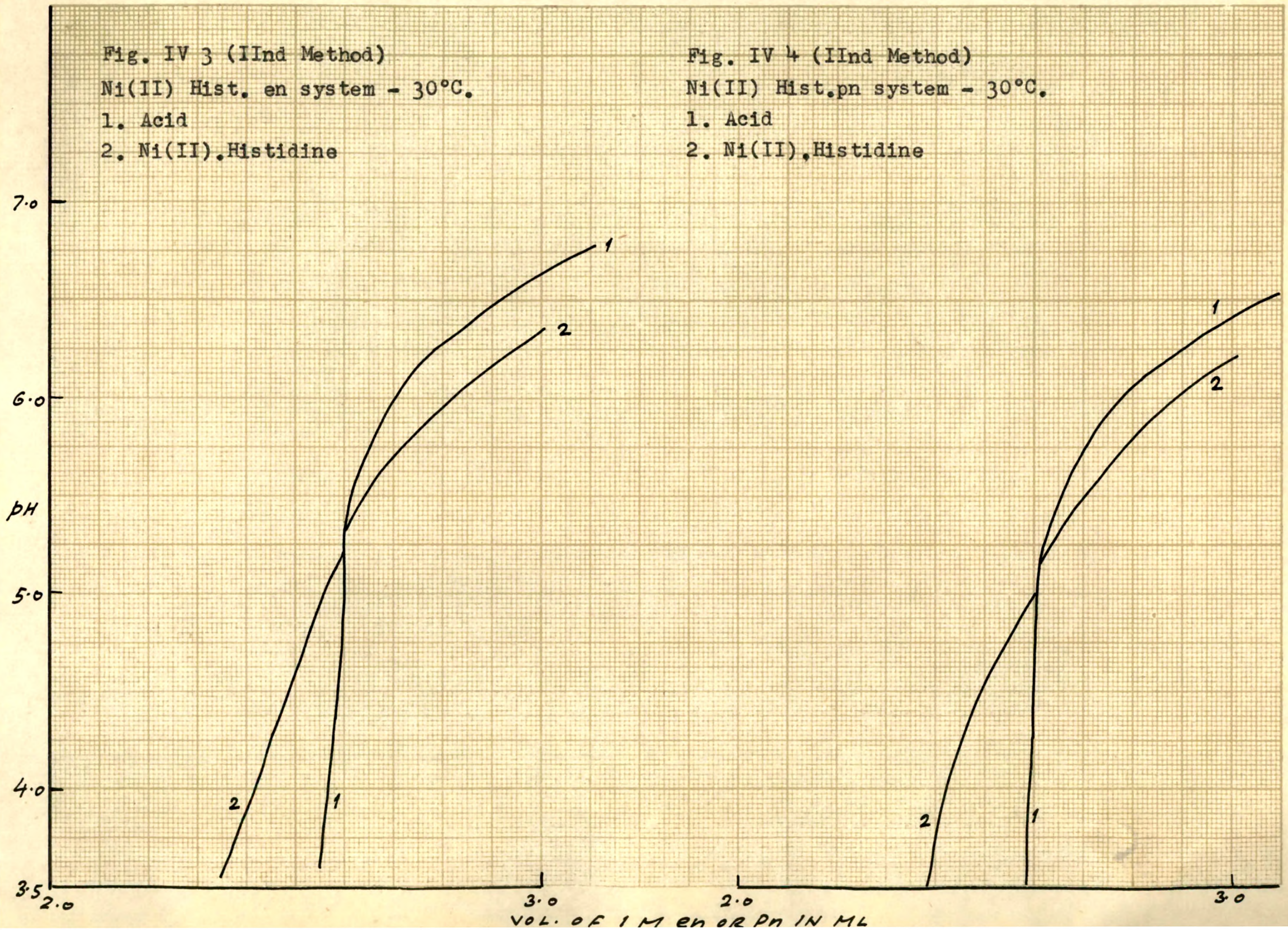

Fig. IV 3 (IInd Method)
Ni(II) Hist. en system - 30°C.
1. Acid
2. Ni(II).Histidine

Fig. IV 4 (IInd Method)
Ni(II) Hist.pn system - 30°C.
1. Acid
2. Ni(II).Histidine

Table IV 1.3A

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.022M T°_{Hist} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*1,3-Diamine propane		Ni.Hist 1,3 pn		*N-Methyl en		Ni.Hist N-Methyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.60	0.00	1.70	0.00	1.60	0.00	1.70
1.00	1.70	1.00	1.85	1.00	1.70	1.00	1.90
2.00	1.90	2.00	2.20	2.00	1.80	2.00	2.10
3.00	2.10	3.00	2.80	3.00	2.10	3.00	2.70
3.80	2.45	3.20	3.10	4.00	2.65	3.20	3.00
4.00	2.70	3.30	3.40	4.20	2.95	3.30	3.30
4.20	3.10	3.40	3.85	4.30	3.20	3.38	3.70
4.30	3.55	3.50	4.10	4.35	3.60	3.42	3.85
4.34	4.10	3.60	4.25	4.38	4.10	3.46	4.00
4.36	4.70	3.80	4.45	4.40	4.80	3.52	4.10
4.38	5.50	4.00	4.80	4.44	5.30	3.70	4.40
4.40	6.35	4.20	5.20	4.48	5.90	3.80	4.50
4.42	7.25	4.30	5.60	4.52	6.25	4.00	4.75
4.44	7.50	4.35	6.15	4.60	6.55	4.20	5.05
4.48	7.90	4.40	7.00	4.70	6.95	4.40	5.65
4.56	8.30	4.44	7.55	4.80	7.30	4.50	6.00
4.60	8.40	4.48	7.70	4.90	7.75	4.60	6.25
4.70	8.75	4.52	7.80	5.00	8.30	4.80	6.65
4.80	9.00	4.60	7.95	5.05	8.55	4.90	6.85
4.90	9.20	4.70	8.15	5.10	8.75	5.00	7.00
5.00	9.45	4.80	8.30	5.20	9.10	5.10	7.25
5.10	9.65	5.00	8.60	5.30	9.30	5.20	7.50
5.20	9.85	5.20	8.95	5.40	9.50	5.30	7.85
5.30	10.05	5.40	9.35	5.80	10.00	5.35	8.05
5.40	10.20						(ppts.)
5.60	10.40						

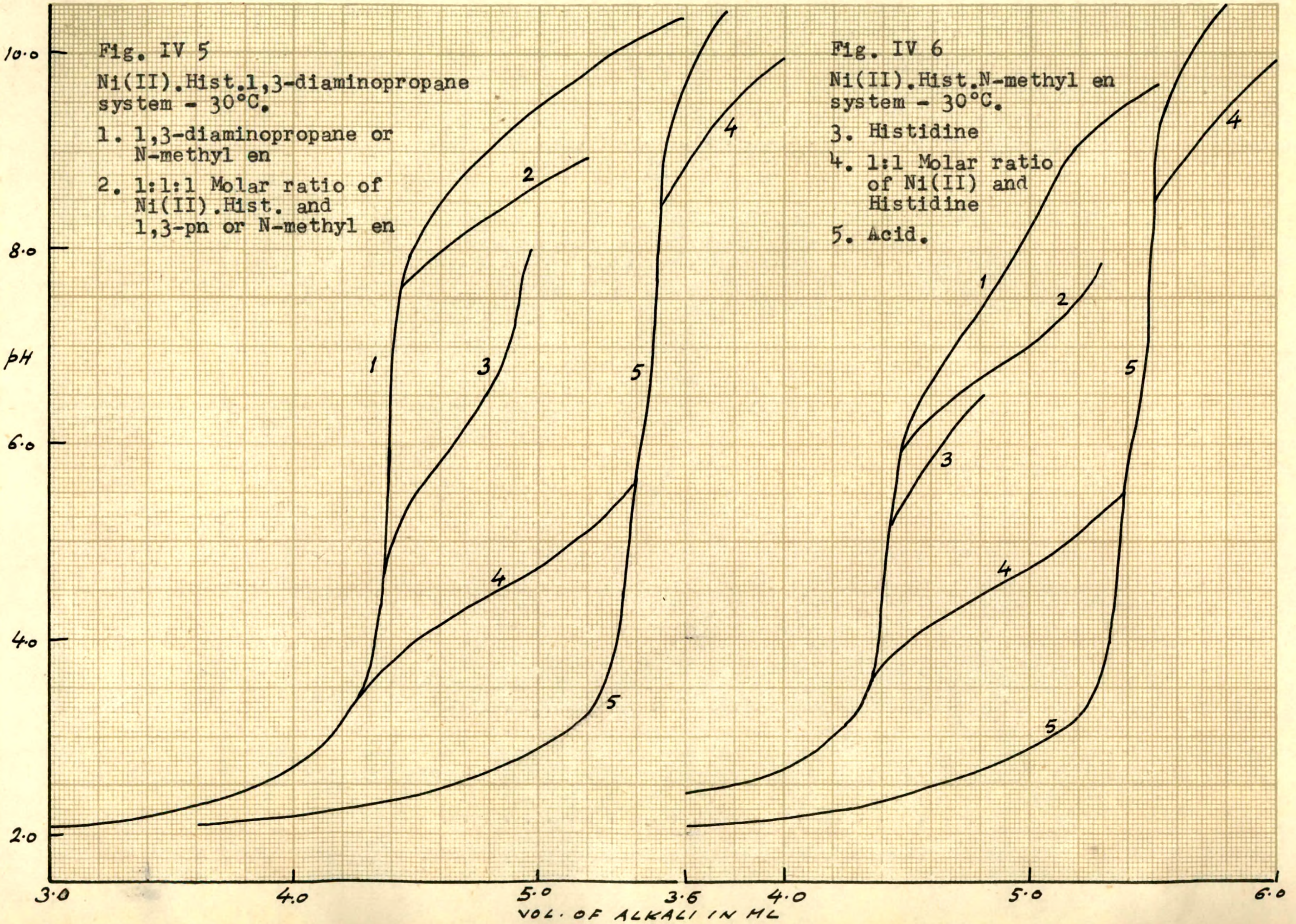

Fig. IV 5

Ni(II).Hist.1,3-diaminopropane system - 30°C.

1. 1,3-diaminopropane or N-methyl en
2. 1:1:1 Molar ratio of Ni(II).Hist. and 1,3-pn or N-methyl en

Fig. IV 6

Ni(II).Hist.N-methyl en system - 30°C.

3. Histidine
4. 1:1 Molar ratio of Ni(II) and Histidine
5. Acid.

Table IV 1.4A

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.022M T°_{Hist} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*N-Ethyl en		Ni.Hist N-Ethyl en		*N-N'-Dimethyl en		Ni.Hist N-N'-Dimethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.60	0.00	1.70	0.00	1.65	0.00	1.75
1.00	1.75	1.00	1.90	1.00	1.80	1.00	1.90
2.00	1.90	2.00	2.20	2.00	1.90	2.00	2.15
3.00	2.15	3.00	2.75	3.00	2.10	3.00	2.70
4.00	2.80	3.30	3.30	3.80	2.50	3.20	3.00
4.20	3.20	3.40	3.70	4.20	3.00	3.30	3.20
4.30	3.45	3.50	4.05	4.26	3.50	3.40	3.50
4.36	3.90	3.60	4.25	4.40	3.80	3.45	3.80
4.38	4.25	3.80	4.50	4.45	4.30	3.50	4.00
4.40	4.70	4.00	4.75	4.48	5.00	3.60	4.20
4.42	5.20	4.10	4.95	4.50	5.60	3.80	4.50
4.44	5.60	4.20	5.05	4.52	5.80	4.00	4.70
4.48	6.10	4.30	5.30	4.54	6.10	4.20	5.00
4.56	6.60	4.40	5.65	4.60	6.50	4.40	5.50
4.60	6.80	4.50	6.10	4.70	7.00	4.50	5.90
4.70	7.20	4.55	6.30	4.80	7.40	4.60	6.30
4.80	7.60	4.60	6.50	4.90	7.90	4.70	6.60
4.85	7.85	4.70	6.80	5.00	8.55	4.80	6.85
4.90	8.15	4.80	7.05	5.05	8.90	4.90	7.10
4.95	8.50	4.90	7.25	5.10	9.10	5.00	7.35
5.00	8.85	5.00	7.50	5.20	9.50	5.10	7.60
5.10	9.30	5.10	7.75	5.30	9.75	5.20	7.95
5.20	9.60	5.20	8.00	5.40	9.95	5.25	8.15
5.40	10.00	5.30	8.20 (ppts.)	5.50	10.15	5.30	8.50 (ppts.)

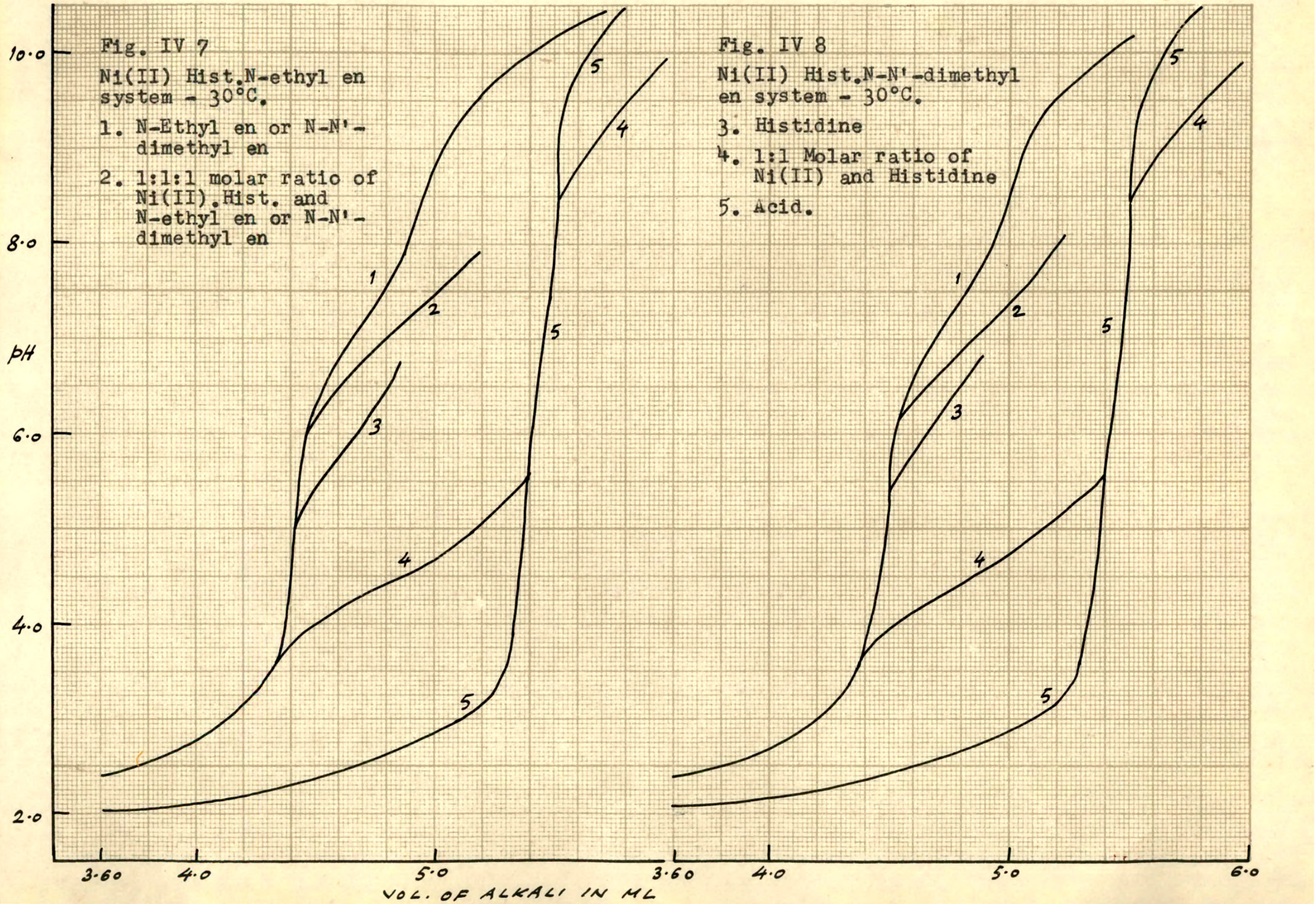
Fig. IV 7
Ni(II) Hist. N-ethyl en system - 30°C.
1. N-Ethyl en or N-N'-dimethyl en
2. 1:1:1 molar ratio of Ni(II). Hist. and N-ethyl en or N-N'-dimethyl en
Fig. IV 8
Ni(II) Hist. N-N'-dimethyl en system - 30°C.
3. Histidine
4. 1:1 Molar ratio of Ni(II) and Histidine
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
3.60
4.0
5.0
6.0
VOL. OF ALKALI IN ML
1
2
3
4
5

Table IV 1.1B

N = 0.2M $V° = 50$ ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.024M T°_{IMDA} = 0.002M T°_{M} = 0.002M

*Perchloric acid		IMDA		Cu.IMDA		Ni.IMDA	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.60	0.00	1.60	0.00	1.60
1.00	1.60	1.00	1.70	1.00	1.70	1.00	1.70
2.00	1.70	2.00	1.80	2.00	1.80	2.00	1.80
3.00	1.90	3.00	2.00	3.00	2.00	3.00	2.00
4.00	2.10	4.00	2.30	4.00	2.15	4.00	2.25
5.00	2.40	4.60	2.55	5.00	2.50	5.00	2.80
5.60	2.90	5.00	3.00	5.20	2.70	5.20	3.05
5.70	3.15	5.20	3.40	5.40	3.00	5.40	3.50
5.80	3.50	5.30	3.80	5.60	3.35	5.50	3.90
5.84	4.20	5.34	4.40	5.70	3.60	5.60	4.30
5.86	4.60	5.36	4.90	5.80	4.00	5.70	4.90
5.88	5.20	5.38	5.40	5.84	4.20	5.75	5.20
5.90	5.70	5.40	5.90	5.86	4.70	5.80	5.45
5.92	6.00	5.42	6.30	5.88	5.30	5.90	5.95
5.94	6.40	5.44	6.70	5.92	6.30	5.92	6.20
5.96	6.80	5.46	7.40	5.96	6.80	5.94	6.60
5.98	7.20	5.48	7.90	6.00	7.50	5.96	7.00
6.00	8.30	5.50	8.15	6.02	7.80	6.00	9.00
6.02	9.10	5.52	8.40	6.06	8.10	6.05	9.25
6.06	9.50	5.60	8.80	6.10	8.30	6.10	9.45
6.10	9.80	5.70	9.15	6.20	8.65	6.20	9.70
6.20	10.20	5.80	9.45	6.30	8.95	6.30	10.00
6.30	10.50	5.90	9.70	6.40	9.20	6.40	10.25
6.60	10.85	6.00	9.90	6.50	9.50	6.50	10.45

Table IV 1.2B

N = 0.2M V° = 50 ml. μ = 0.2M   t = 30°C.

E° = 0.02M $^*E^\circ$ = 0.024M T°_{IMDA} = 0.002M T°_M = 0.002M

T°_L = 0.002M

*Ethylenediamine		Cu.IMDA en		Ni.IMDA en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.55	0.00	1.60	0.00	1.70
1.00	1.70	1.00	1.70	1.00	1.80
2.00	1.80	2.00	1.80	2.00	2.06
3.00	2.00	3.00	2.05	3.00	2.30
4.00	2.35	4.00	2.40	4.00	2.85
4.40	2.70	4.50	2.80	4.30	3.25
4.60	2.95	4.70	3.20	4.40	3.60
4.75	3.50	4.80	3.65	4.50	4.15
4.80	3.90	4.85	4.00	4.65	4.65
4.82	4.60	4.90	4.50	4.70	5.00
4.84	5.20	5.00	4.80	4.76	5.40
4.86	5.50	5.10	5.05	4.80	5.50
4.90	5.80	5.20	5.25	4.90	5.90
4.95	6.20	5.40	5.55	5.00	6.15
5.00	6.45	5.60	5.85	5.10	6.30
5.10	6.85	5.70	6.10	5.20	6.45
5.20	7.20	5.80	6.35	5.40	6.75
5.30	7.50	5.85	6.60	5.50	6.95
5.40	8.00	5.90	7.00	5.70	7.35
5.50	8.70	5.94	7.55	5.75	7.65
5.60	9.20	6.00	7.80	5.80	8.00
5.70	9.55	6.10	9.00	5.90	8.90
5.80	9.80	6.20	9.50	6.00	9.60
6.00	10.20	6.30	9.90	6.20	10.40

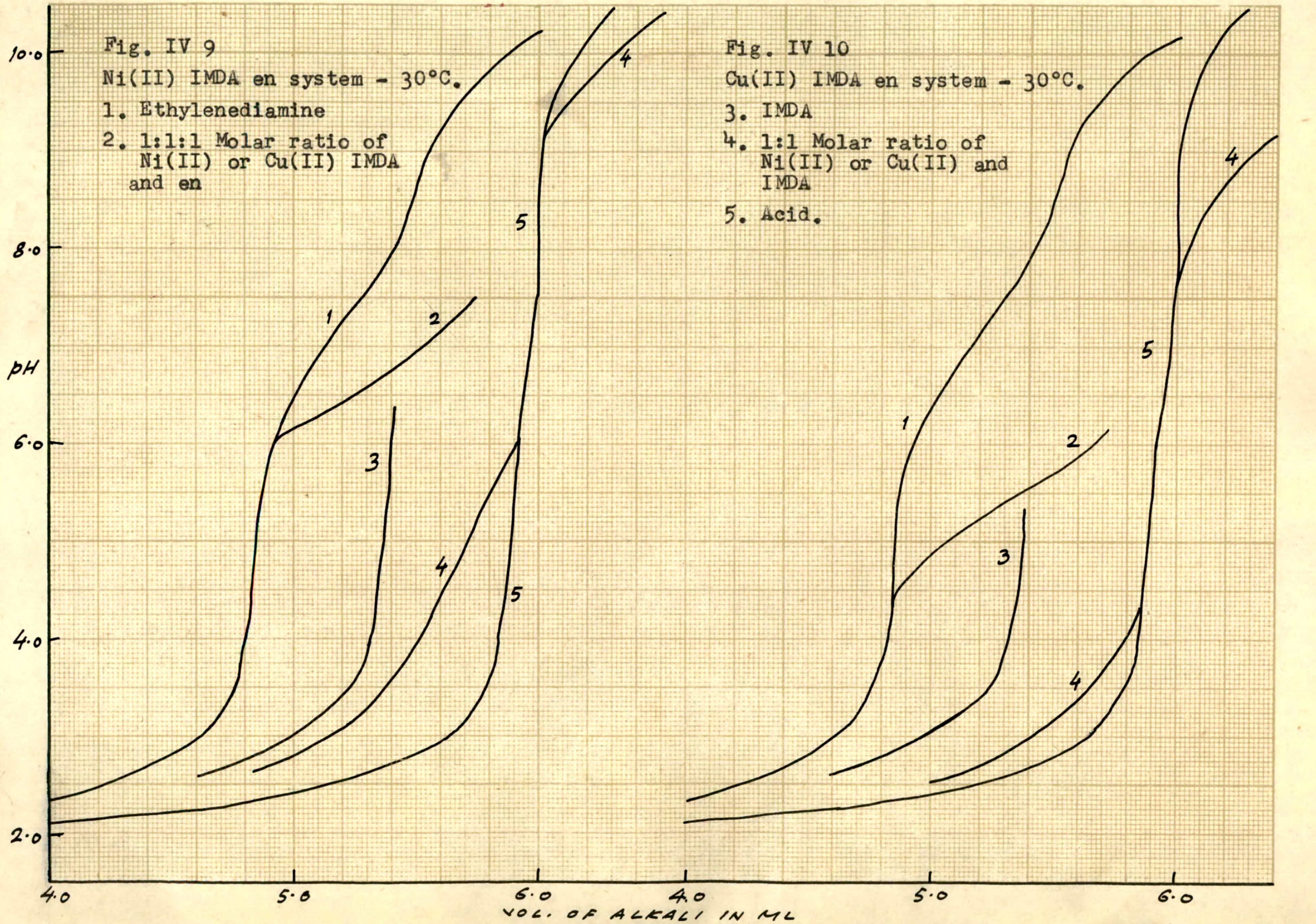
Fig. IV 9
Ni(II) IMDA en system - 30°C.
1. Ethylenediamine
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) IMDA and en
Fig. IV 10
Cu(II) IMDA en system - 30°C.
3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and IMDA
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
4.0
5.0
6.0
VOL. OF ALKALI IN ML
1
2
3
4
5

Table IV 1.3B

N = 0.2M V° = 50 ml. μ = 0.2M   t = 30°C.

E° = 0.02M   *E° = 0.024M T°_{IMDA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*Propylenediamine		Cu.IMDA pn		Ni.IMDA pn	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.55	0.00	1.65	0.00	1.65
1.00	1.65	1.00	1.75	1.00	1.75
2.00	1.80	2.00	1.90	2.00	1.95
3.00	2.00	3.00	2.10	3.00	2.25
4.00	2.40	4.00	2.40	4.00	2.80
4.60	2.90	4.50	2.95	4.30	3.20
4.76	3.40	4.70	3.50	4.40	3.55
4.80	3.80	4.74	3.80	4.50	4.10
4.82	4.30	4.82	4.25	4.65	4.60
4.84	4.80	4.90	4.65	4.75	5.00
4.86	5.20	5.00	4.95	4.80	5.40
4.90	5.70	5.20	5.30	4.90	5.70
5.00	6.20	5.40	5.55	5.00	5.90
5.10	6.60	5.60	5.90	5.20	6.20
5.20	6.90	5.70	6.20	5.40	6.50
5.30	7.30	5.75	6.45	5.60	6.85
5.40	7.85	5.80	6.70	5.70	7.10
5.45	8.30	5.84	7.20	5.80	7.20
5.50	8.70	5.88	8.00	5.85	8.10
5.55	9.00	5.90	8.40	5.90	8.70
5.66	9.50	5.94	8.90	5.95	9.20
5.80	9.80	6.00	9.30	6.00	9.55
6.00	10.15	6.10	9.85	6.10	10.00
6.30	10.50	6.20	10.20		

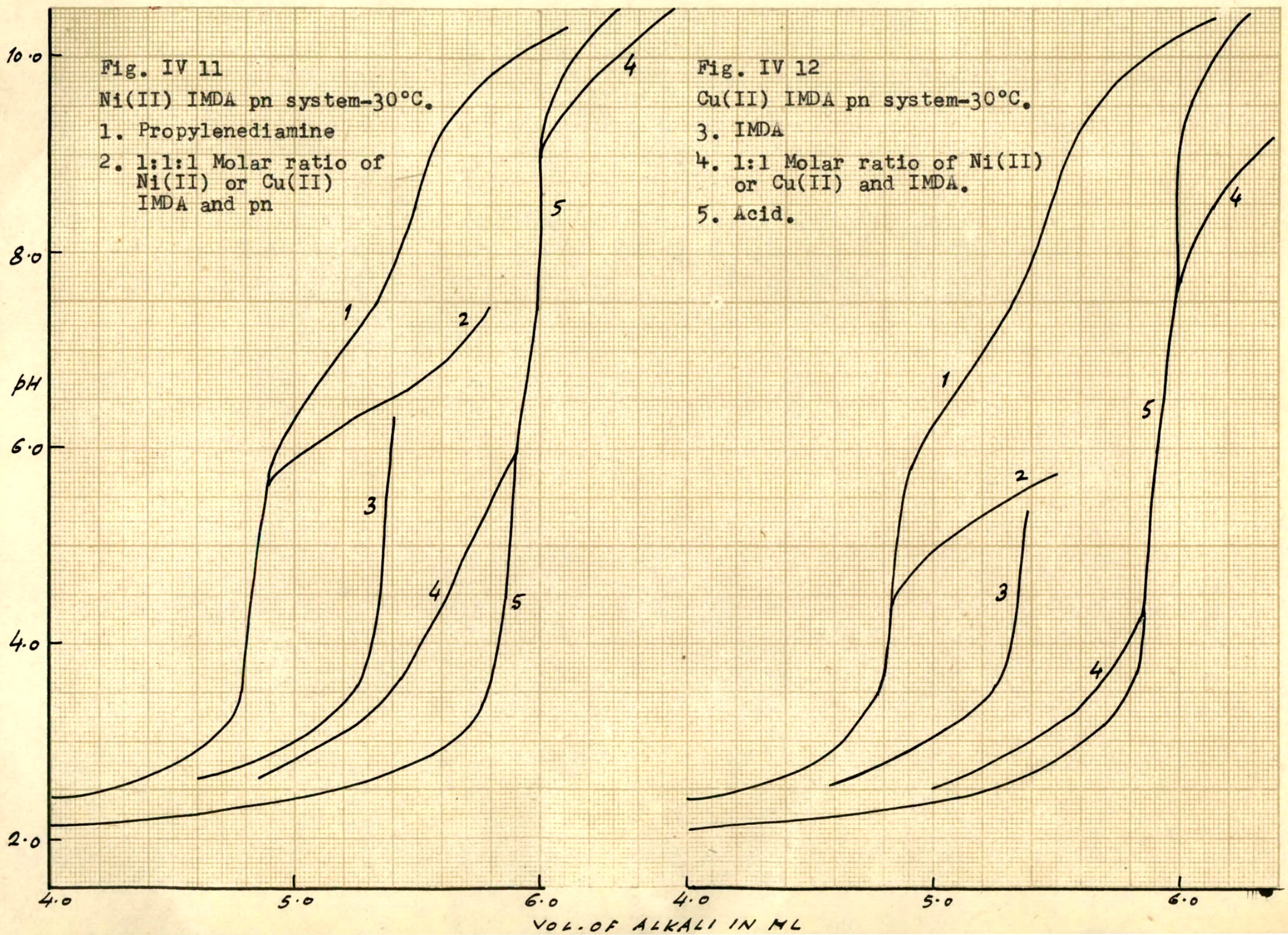

Fig. IV 11

Ni(II) IMDA pn system-30°C.

1. Propylenediamine
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) IMDA and pn

Fig. IV 12

Cu(II) IMDA pn system-30°C.

3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and IMDA.
5. Acid.

Table IV 1.2'B

N = 1.0M V° = 50 ml. T°_{IMDA} = 0.004M   t = 30°C.

E° = 0.1M   *E° = 0.108M μ = 0.2M T°_{M} = 0.004M

*Perchloric acid		Cu.IMDA en		Ni.IMDA en	
Vol.of en (in ml.)	B	Vol.of en (in ml.)	B	Vol.of en (in ml.)	B
0.00	0.85	0.00	0.90	0.00	0.90
1.00	1.00	1.00	1.05	1.00	1.10
2.00	1.35	2.00	1.50	2.00	1.60
2.40	1.75	2.30	1.80	2.40	2.15
2.60	2.25	2.50	2.15	2.50	2.50
2.64	2.65	2.58	2.45	2.54	2.75
2.66	2.90	2.62	2.70	2.56	2.90
2.68	3.40	2.66	3.40	2.58	3.15
2.70	4.95	2.70	4.10	2.62	3.70
2.72	5.35	2.72	4.35	2.64	4.00
2.74	5.60	2.75	4.50	2.66	4.30
2.76	5.75	2.80	4.70	2.68	4.60
2.80	5.95	2.85	4.90	2.70	5.10
2.85	6.15	2.90	5.10	2.74	5.50
2.90	6.30	2.94	5.40	2.80	5.70
3.00	6.55	3.00	5.60	2.90	6.00
3.20	6.80	3.10	6.00	3.00	6.15
3.40	7.00	3.20	6.25	3.10	6.40
3.60	7.15	3.40	6.55	3.30	6.60
4.00	7.45	3.60	6.80	3.50	6.80
4.20	7.60	3.80	7.00	3.80	7.10
4.60	7.85	4.00	7.15	4.20	7.30
4.80	8.00	4.40	7.40	4.40	7.40
5.00	8.20	4.80	7.70	4.80	7.70
5.20	8.40	5.00	7.85	5.20	8.00
5.60	8.80	5.20	8.05	5.40	8.20
5.80	9.00	5.60	8.45 (ppts.)	5.60	8.40 (ppts.)

Table IV 1.3'B

N = 1.0M V° = 50 ml. T°_{IMDA} = 0.004M t = 30°C.

E° = 0.1M *E° = 0.108M μ = 0.2M T°_{M} = 0.004M

*Perchloric acid		Cu.IMDA pn		Ni.IMDA pn	
Vol.of pn (in ml.)	B	Vol.of pn (in ml.)	B	Vol.of pn (in ml.)	B
0.00	0.85	0.00	0.95	0.00	0.95
1.00	1.00	1.00	1.10	1.00	1.10
2.00	1.35	2.00	1.50	2.00	1.50
2.40	1.75	2.30	1.80	2.50	2.60
2.50	2.00	2.50	2.20	2.58	3.25
2.60	2.40	2.58	2.55	2.60	3.50
2.64	2.75	2.62	2.95	2.62	3.80
2.66	3.20	2.66	3.30	2.64	4.10
2.68	4.00	2.68	3.80	2.66	4.40
2.70	5.00	2.70	4.10	2.70	5.00
2.72	5.25	2.75	4.40	2.75	5.25
2.76	5.50	2.80	4.60	2.80	5.45
2.80	5.70	2.90	4.90	2.90	5.70
2.90	5.95	2.95	5.15	3.00	5.90
3.00	6.15	3.00	5.45	3.10	6.10
3.20	6.45	3.10	5.80	3.30	6.35
3.30	6.55	3.20	6.05	3.50	6.55
3.60	6.80	3.40	6.40	3.70	6.75
3.80	7.00	3.60	6.60	4.00	6.95
4.00	7.15	3.80	6.80	4.20	7.10
4.20	7.35	4.00	6.95	4.40	7.20
4.60	7.55	4.20	7.10	4.80	7.45
4.80	7.75	4.60	7.35	5.00	7.60
5.00	7.95	5.00	7.70	5.20	7.80
5.20	8.20	5.20	7.95	5.60	8.15
5.60	8.65	5.60	8.40	5.80	8.40
6.00	9.00	5.80	8.60 (ppts.)	6.00	8.60 (ppts.)

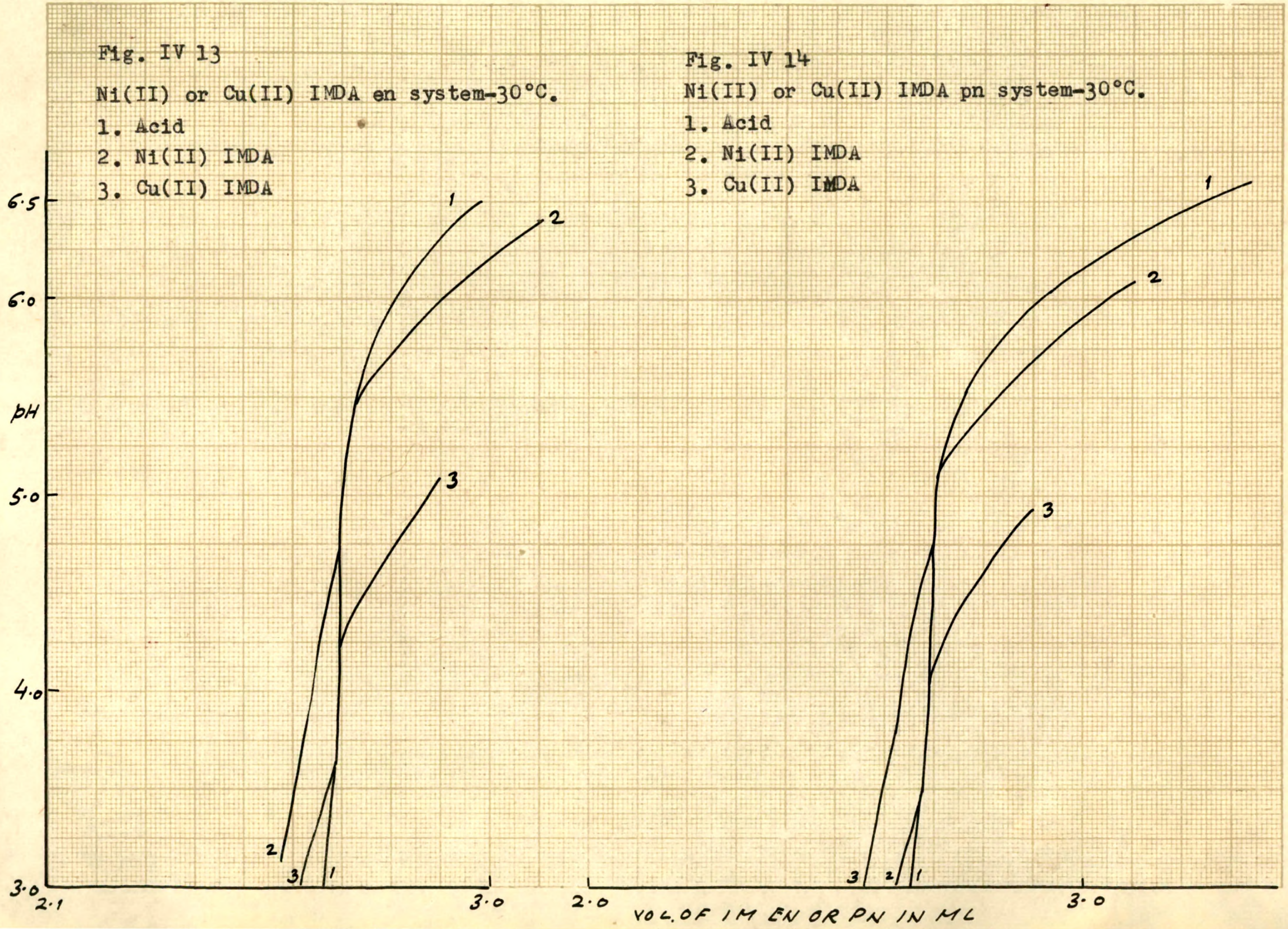

Fig. IV 13

Ni(II) or Cu(II) IMDA en system-30°C.

1. Acid
2. Ni(II) IMDA
3. Cu(II) IMDA

Fig. IV 14

Ni(II) or Cu(II) IMDA pn system-30°C.

1. Acid
2. Ni(II) IMDA
3. Cu(II) IMDA

Table IV 1.4B

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.2M *E° = 0.024M T°_{IMDA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*1,3-Diamine Propane		Cu.IMDA 1,3 pn		Ni.IMDA 1,3 pn	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.55	0.00	1.65	0.00	1.65
1.00	1.65	1.00	1.70	1.00	1.80
2.00	1.75	2.00	1.90	2.00	1.95
3.00	1.95	3.00	2.10	3.00	2.20
4.00	2.30	4.00	2.40	3.80	2.60
4.50	2.70	4.50	2.80	4.20	2.95
4.60	2.85	4.70	3.15	4.40	3.35
4.80	3.25	4.80	3.55	4.50	3.70
4.85	3.60	4.85	4.10	4.55	4.00
4.88	4.40	4.88	4.50	4.65	4.45
4.90	5.20	4.90	5.10	4.75	4.90
4.92	6.05	4.92	5.50	4.80	5.30
4.94	6.80	4.96	6.10	4.84	5.70
4.96	7.35	5.00	6.30	4.86	6.10
4.98	7.65	5.05	6.55	4.88	6.70
5.05	8.10	5.16	6.90	4.90	7.10
5.14	8.50	5.26	7.10	4.95	7.50
5.26	8.85	5.40	7.30	5.00	7.65
5.40	9.15	5.60	7.55	5.10	7.85
5.50	9.40	5.80	7.90	5.20	8.00
5.60	9.60	6.00	8.70	5.40	8.30
5.80	9.95	6.10	9.20	5.60	8.60
6.00	10.25	6.20	9.60	5.80	9.00
6.20	10.50	6.40	10.20	6.00	9.55

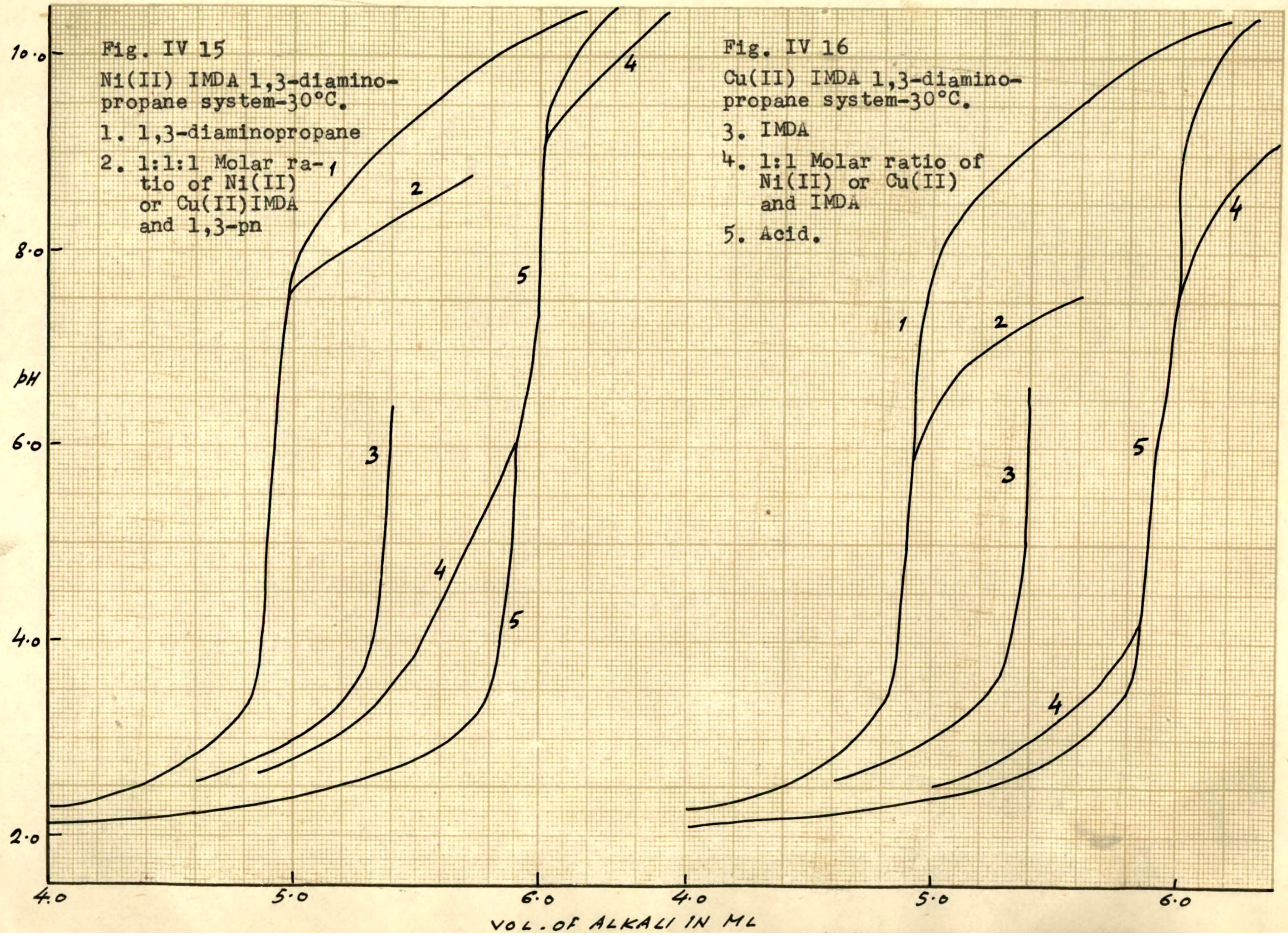

Fig. IV 15

Ni(II) IMDA 1,3-diamino-propane system-30°C.

1. 1,3-diaminopropane
2. 1:1:1 Molar ratio of Ni(II) or Cu(II)IMDA and 1,3-pn

Fig. IV 16

Cu(II) IMDA 1,3-diamino-propane system-30°C.

3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and IMDA
5. Acid.

Table IV 1.5B

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.024M T°_{IMDA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*N-Methyl en		Cu.IMDA N-Methyl en		Ni.IMDA N-Methyl en	
Vol.of alkali (in ml.)	B 1	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.60	0.00	1.60
1.00	1.60	1.00	1.70	1.00	1.70
2.00	1.75	2.00	1.80	2.00	2.00
3.00	1.95	3.00	2.00	3.00	2.20
4.00	2.25	4.00	2.40	4.00	2.70
4.50	2.55	4.30	2.60	4.20	3.00
4.80	3.20	4.60	2.90	4.40	3.45
4.85	3.50	4.70	3.10	4.60	4.20
4.88	3.90	4.76	3.40	4.70	4.60
4.90	4.40	4.82	3.75	4.74	4.80
4.92	4.70	4.86	4.05	4.78	5.10
4.96	5.45	4.90	4.40	4.82	5.40
5.00	5.90	4.95	4.75	4.90	5.70
5.05	6.30	5.00	4.95	5.00	6.05
5.12	6.60	5.10	5.25	5.10	6.25
5.20	6.90	5.20	5.45	5.20	6.45
5.30	7.25	5.40	5.70	5.30	6.65
5.40	7.60	5.60	6.00	5.40	6.85
5.50	8.15	5.70	6.20	5.60	7.20
5.60	8.65	5.80	6.55	5.70	7.40
5.70	9.00	5.85	6.90	5.75	7.60
5.90	9.45	5.88	7.50	5.80	7.85
6.20	9.85	5.90	7.80	5.85	8.10
6.60	10.30	5.92	8.00	5.90	8.40 (ppts.)

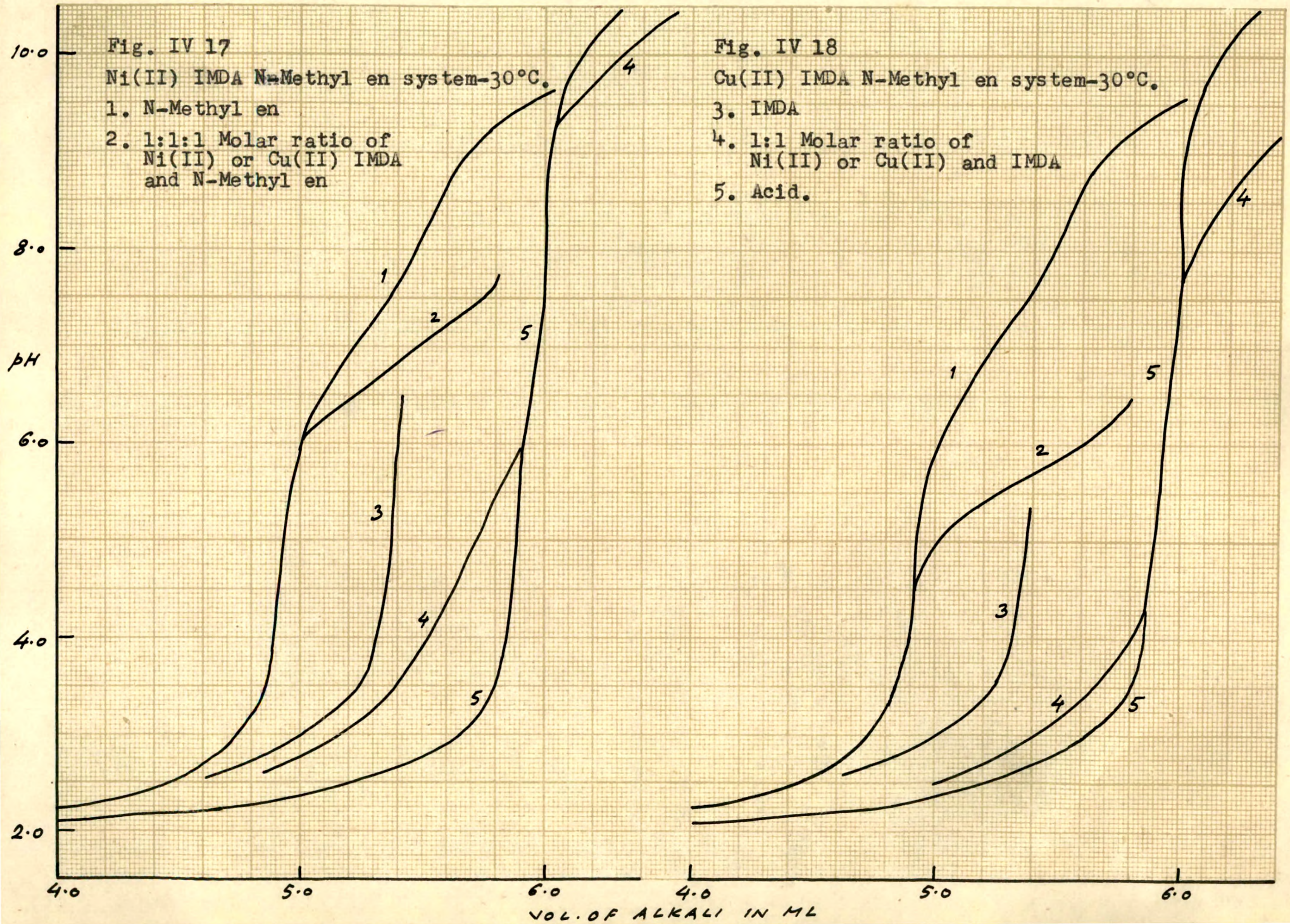
Fig. IV 17
Ni(II) IMDA N-Methyl en system-30°C.
1. N-Methyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) IMDA and N-Methyl en
Fig. IV 18
Cu(II) IMDA N-Methyl en system-30°C.
3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and IMDA
5. Acid.
pH
10·0
8·0
6·0
4·0
2·0
4·0
5·0
6·0
VOL. OF ALKALI IN ML

Table IV 1.6B

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.2M *E° = 0.24M T°_{IMDA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*N-Ethyl en		Cu.IMDA N-Ethyl en		Ni.IMDA N-Ethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.55	0.00	1.60	0.00	1.65
1.00	1.65	1.00	1.75	1.00	1.75
2.00	1.80	2.00	1.90	2.00	1.95
3.00	2.00	3.00	2.05	3.00	2.15
4.00	2.30	4.00	2.40	3.60	2.40
4.60	2.75	4.40	2.60	4.00	2.70
4.80	3.20	4.60	2.90	4.20	2.90
4.85	3.55	4.70	3.25	4.40	3.20
4.88	3.95	4.75	3.60	4.50	3.50
4.90	4.50	4.80	4.10	4.60	3.90
4.92	5.00	4.82	4.35	4.70	4.10
4.94	5.50	4.84	4.60	4.73	4.50
4.98	6.10	4.86	4.80	4.78	4.80
5.05	6.45	4.92	5.10	4.86	5.10
5.15	6.85	5.00	5.30	4.90	5.40
5.20	7.15	5.20	5.75	4.94	5.75
5.30	7.50	5.30	5.95	5.00	6.15
5.40	8.00	5.40	6.10	5.10	6.50
5.45	8.35	5.50	6.25	5.20	6.70
5.50	8.80	5.60	6.40	5.30	6.95
5.60	9.40	5.72	6.80	5.40	7.15
5.70	9.65	5.76	7.00	5.60	7.65
5.80	9.90	5.80	7.20	5.80	8.05
6.00	10.30	5.85	7.50 (ppts.)	5.90	8.50 (ppts.)

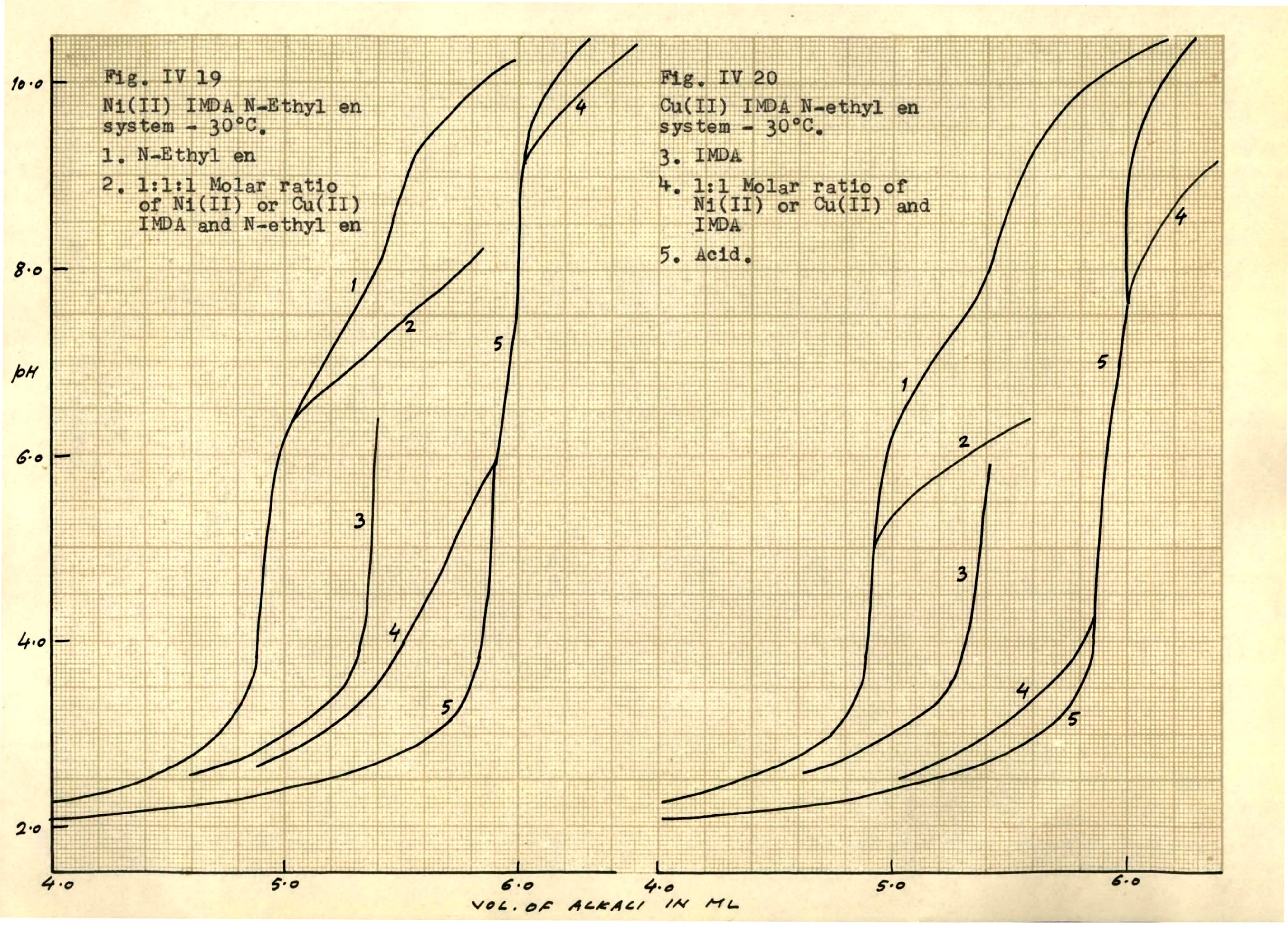

Fig. IV 19
Ni(II) IMDA N-Ethyl en system - 30°C.
1. N-Ethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) IMDA and N-ethyl en
Fig. IV 20
Cu(II) IMDA N-ethyl en system - 30°C.
3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and IMDA
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
4.0
5.0
6.0
VOL. OF ALKALI IN ML
1
2
3
4
5

Table IV 1.7B

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.024M T°_{IMDA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

N-N'-Dimethyl en		Cu.IMDA N-N'-Dimethyl en		Ni.IMDA N-N'-Dimethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.55	0.00	1.60	0.00	1.65
1.00	1.65	1.00	1.75	1.00	1.75
2.00	1.75	2.00	1.90	2.00	1.90
3.00	1.95	3.00	2.10	3.00	2.15
4.00	2.30	4.00	2.45	4.00	2.60
4.50	2.60	4.40	2.70	4.40	3.00
4.80	3.00	4.80	3.25	4.60	3.65
4.90	3.45	4.90	3.60	4.70	4.10
4.95	3.90	4.95	3.95	4.75	4.40
4.98	4.50	5.00	4.40	4.80	4.70
5.00	4.90	5.05	4.80	4.90	4.90
5.05	5.55	5.10	5.10	5.00	5.50
5.10	6.05	5.20	5.55	5.10	5.95
5.15	6.45	5.30	5.80	5.20	6.25
5.25	6.85	5.40	6.05	5.30	6.45
5.40	7.50	5.60	6.40	5.40	6.70
5.46	7.90	5.70	6.60	5.60	7.20
5.52	8.40	5.80	7.00	5.70	7.50
5.60	8.75	5.85	7.40	5.80	7.95
5.70	9.20	5.90	7.80	5.90	8.50
5.80	9.55	5.95	8.25	6.00	9.10
6.00	10.00	6.00	8.60	6.10	9.60
6.30	10.40	6.10	9.10	6.20	9.90
6.70	10.70	6.20	9.55	6.40	10.30

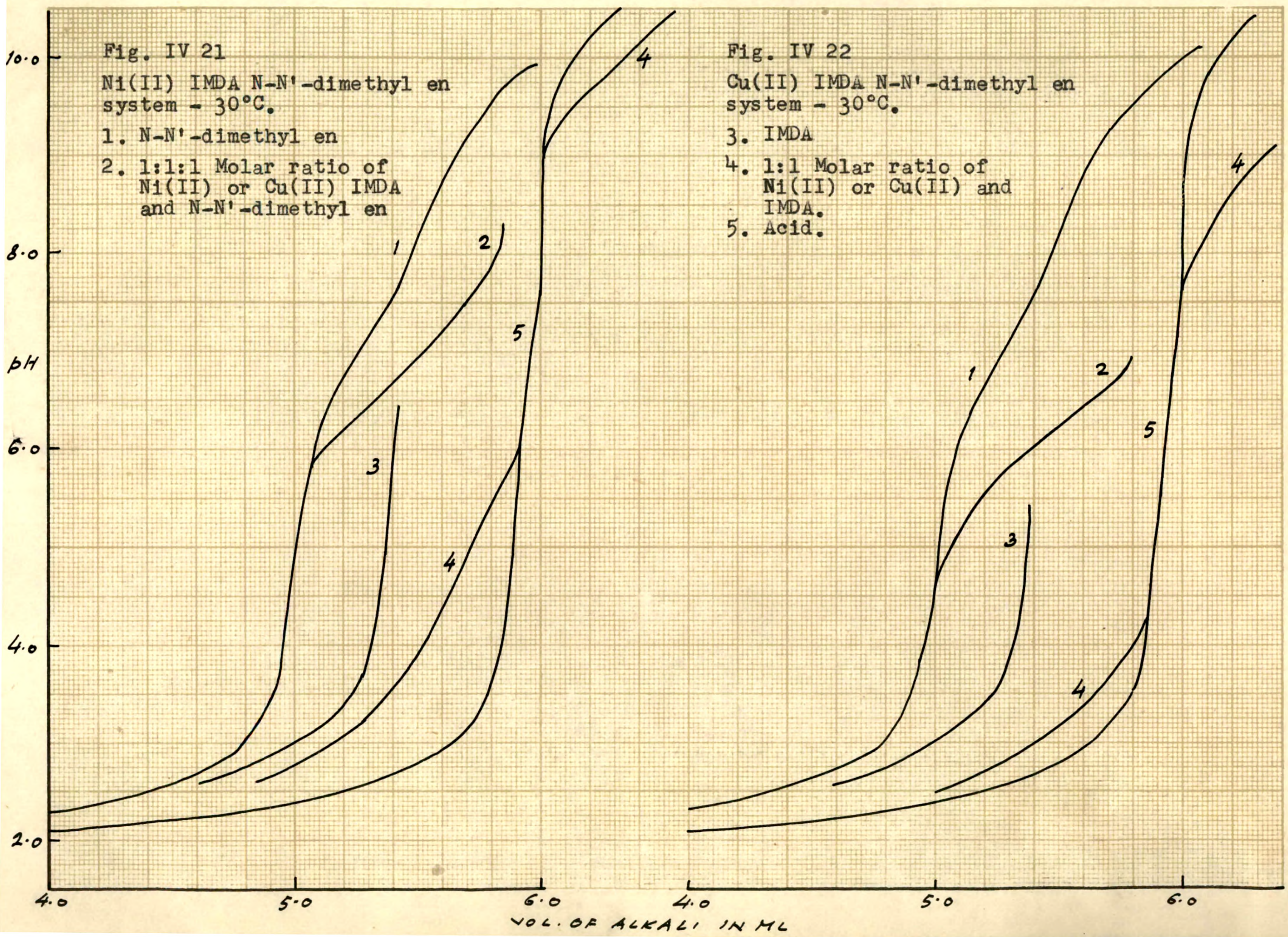
Fig. IV 21
Ni(II) IMDA N-N'-dimethyl en system - 30°C.
1. N-N'-dimethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) IMDA and N-N'-dimethyl en
Fig. IV 22
Cu(II) IMDA N-N'-dimethyl en system - 30°C.
3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and IMDA.
5. Acid.
1
2
3
4
5
10·0
8·0
pH
6·0
4·0
2·0
4·0
5·0
6·0
VOL. OF ALKALI IN ML

Table IV 1.8B

$N = 0.2M \quad V^{\circ} = 50$ ml. $\quad \mu = 0.2M \quad t = 30^{\circ}C.$

$E^{\circ} = 0.02M \quad {}^{*}E^{\circ} = 0.024M \quad T^{\circ}_{IMDA} = 0.002M \quad T^{\circ}_{M} = 0.002M$

$T^{\circ}_{L} = 0.002M$

N-N-Dimethyl en		Cu.IMDA N-N-Dimethyl en		Ni.IMDA N-N-Dimethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.60	0.00	1.70	0.00	1.65
1.00	1.70	1.00	1.80	1.00	1.80
2.00	1.80	2.00	1.95	2.00	1.95
3.00	2.00	3.00	2.20	3.00	2.20
4.00	2.30	4.00	2.55	4.00	2.70
4.40	2.60	4.40	2.90	4.30	3.10
4.60	2.80	4.60	3.30	4.50	3.60
4.76	3.15	4.70	3.65	4.60	4.10
4.86	3.60	4.75	4.10	4.70	4.45
4.90	4.10	4.80	4.55	4.75	4.80
4.92	4.60	4.85	4.80	4.80	5.00
4.94	5.00	4.90	5.00	4.90	5.40
4.98	5.50	5.00	5.30	5.00	5.80
5.02	5.80	5.10	5.45	5.10	6.10
5.10	6.10	5.30	5.75	5.20	6.30
5.20	6.50	5.55	6.10	5.30	6.45
5.30	6.90	5.60	6.30	5.40	6.65
5.40	7.40	5.70	6.60	5.50	6.90
5.45	7.90	5.75	6.80	5.60	7.15
5.50	8.40	5.80	7.50	5.70	7.50
5.60	8.95	5.82	8.05	5.75	7.75
5.80	9.60	5.86	8.60	5.80	8.10
6.00	10.00	5.92	9.15	5.85	8.50
6.40	10.55	5.96	9.50 (ppts.)	5.90	8.80 (ppts.)

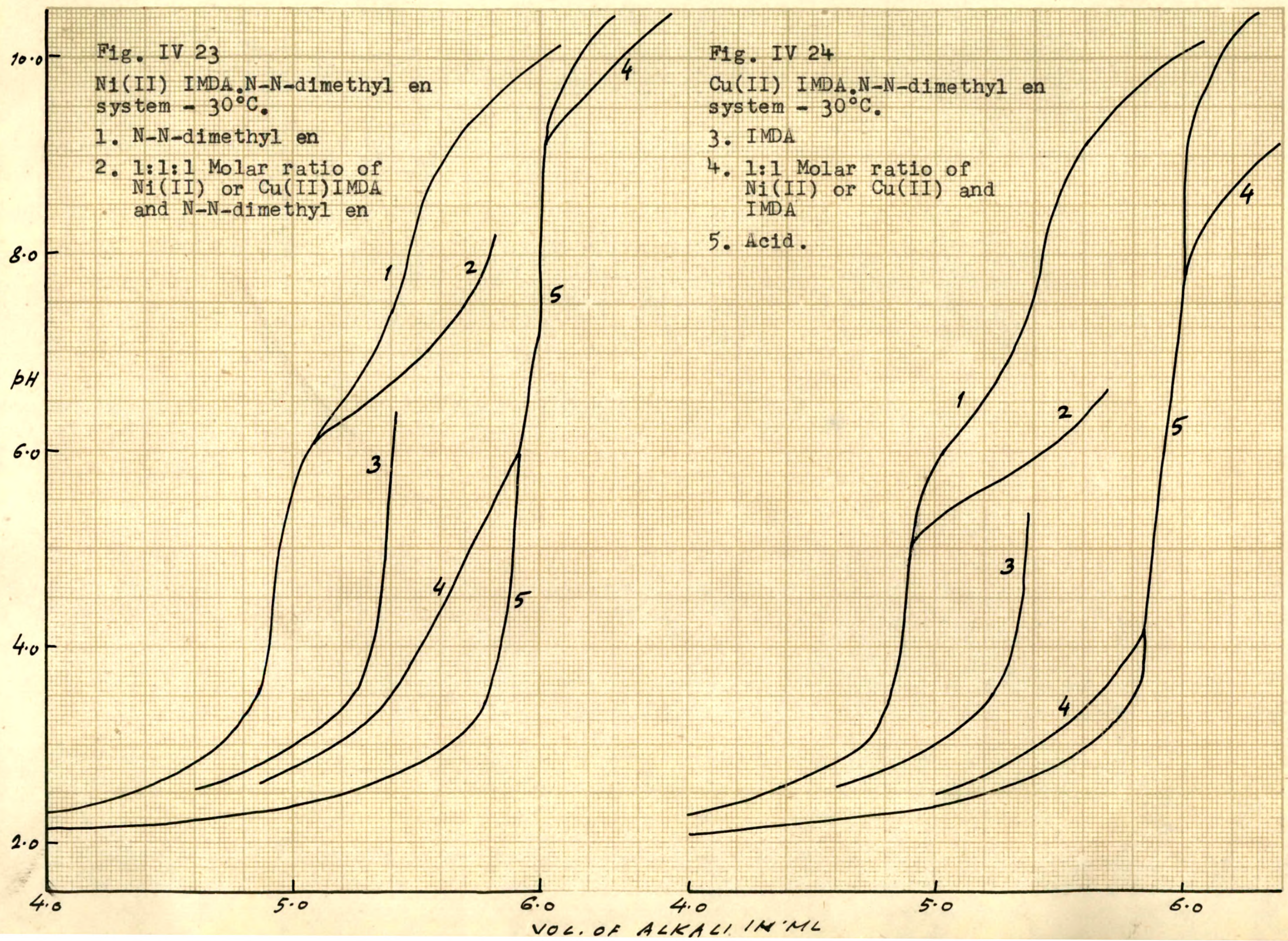

Fig. IV 23

Ni(II) IMDA.N-N-dimethyl en system - 30°C.

1. N-N-dimethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II)IMDA and N-N-dimethyl en

Fig. IV 24

Cu(II) IMDA.N-N-dimethyl en system - 30°C.

3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and IMDA
5. Acid.

Table IV 1.9B

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M $^{*}E^{\circ}$ = 0.024M T°_{IMDA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

N-N-Diethyl en		Cu.IMDA N-N-Diethyl en		Ni.IMDA N-N-Diethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.55	0.00	1.70	0.00	1.70
1.00	1.65	1.00	1.80	1.00	1.80
2.00	1.80	2.00	1.90	2.00	2.00
3.00	2.00	3.00	2.10	3.00	2.25
4.00	2.30	4.00	2.40	4.00	2.70
4.50	2.60	4.60	2.85	4.40	3.20
4.70	3.00	4.70	3.10	4.50	3.50
4.85	3.50	4.84	3.50	4.58	3.90
4.88	3.80	4.92	4.10	4.62	4.20
4.90	4.30	4.96	5.25	4.70	4.60
4.92	4.80	5.00	5.45	4.80	4.90
4.94	5.30	5.10	5.85	4.85	5.20
4.96	5.60	5.20	6.25	4.90	5.60
5.00	6.15	5.30	6.45	5.00	6.40
5.05	6.55	5.40	6.60	5.05	6.70
5.10	6.85	5.60	6.90	5.20	7.15
5.20	7.30	5.70	7.05	5.40	7.50
5.30	7.70	5.80	7.30	5.50	7.80
5.40	8.05	5.90	7.65	5.60	8.00
5.50	8.70	5.95	8.00	5.70	8.30
5.55	9.05	6.00	8.30	5.76	8.55
5.60	9.30	6.05	8.65	5.82	8.80
5.70	9.65	6.10	9.05	5.90	9.15
5.80	9.90	6.20	9.60	6.00	9.55
6.00	10.25	6.30	10.00		(ppts.)
6.50	10.70				

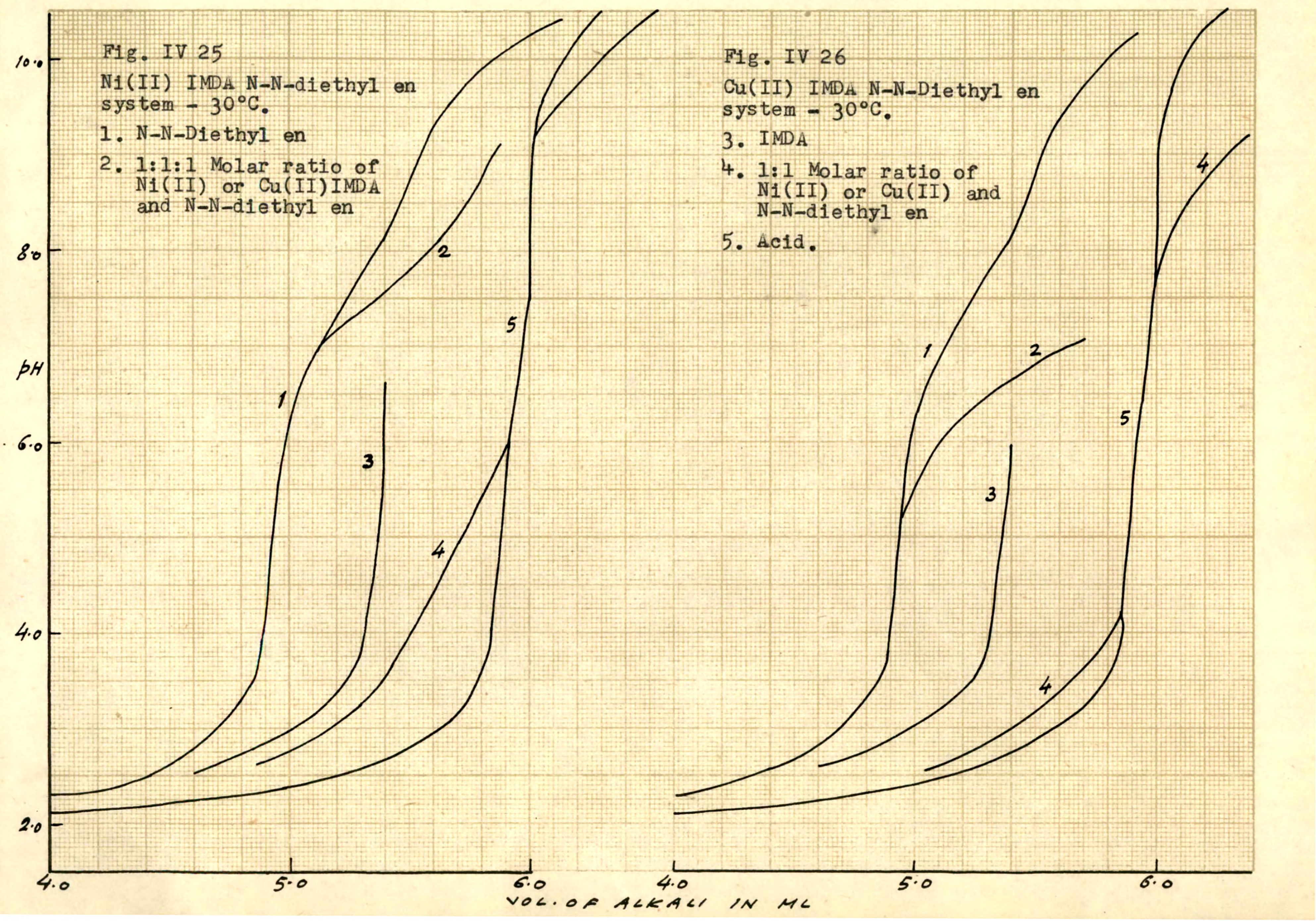
Fig. IV 25
Ni(II) IMDA N-N-diethyl en system - 30°C.
1. N-N-Diethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II)IMDA and N-N-diethyl en
Fig. IV 26
Cu(II) IMDA N-N-Diethyl en system - 30°C.
3. IMDA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and N-N-diethyl en
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
4.0
5.0
6.0
VOL. OF ALKALI IN ML

Table IV 1.1C

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M $^*E^\circ$ = 0.026M T°_{NTA} = 0.002M T°_M = 0.002M

*Perchloric acid		NTA		Cu.NTA		Ni.NTA	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.55	0.00	1.50	0.00	1.55
1.00	1.55	1.00	1.60	1.00	1.55	1.00	1.60
2.00	1.65	2.00	1.70	2.00	1.65	2.00	1.70
3.00	1.80	3.00	1.80	3.00	1.75	3.00	1.80
4.00	1.95	4.00	2.00	4.00	1.90	4.00	1.95
5.00	2.20	5.00	2.35	5.00	2.15	5.00	2.15
5.80	2.50	5.50	2.70	5.80	2.50	5.80	2.50
6.00	2.75	5.70	3.00	6.00	2.75	6.10	3.00
6.20	3.10	5.80	3.20	6.10	3.05	6.20	3.40
6.30	3.40	5.90	3.60	6.20	3.35	6.30	3.80
6.35	3.70	5.94	4.10	6.30	3.70	6.40	4.20
6.38	4.00	5.96	4.80	6.40	4.20	6.42	5.20
6.40	4.50	5.98	5.50	6.42	5.40	6.46	6.30
6.42	5.00	6.00	6.00	6.44	5.80	6.48	6.80
6.44	5.60	6.02	6.90	6.46	6.30	6.50	7.25
6.46	6.20	6.04	7.40	6.48	6.80	6.52	8.55
6.48	6.80	6.06	7.90	6.50	7.30	6.56	9.00
6.50	7.50	6.10	8.30	6.52	8.20	6.64	9.30
6.52	8.50	6.15	8.50	6.60	8.50	6.68	9.40
6.56	9.10	6.20	8.80	6.70	8.90	6.80	9.85
6.60	9.50	6.30	9.10	6.80	9.20	6.90	10.20
6.70	10.05	6.40	9.30	6.90	9.50	7.00	10.40
6.80	10.40	6.50	9.55	7.00	9.70	7.05	10.70
7.00	10.70	6.70	10.00	7.10	10.00	7.10	10.90
		7.00	10.60				

Table IV 1.2C

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.026M T°_{NTA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*Ethylenediamine		Cu.NTA.en		Ni.NTA en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.60	0.00	1.60	0.00	1.60
1.00	1.70	1.00	1.70	1.00	1.70
2.00	1.80	2.00	1.80	2.00	1.85
3.00	2.00	3.00	2.00	3.00	2.00
4.00	2.20	4.00	2.20	4.00	2.30
5.00	2.80	5.00	3.00	5.00	2.80
5.20	3.20	5.10	3.50	5.20	3.20
5.25	3.45	5.20	3.85	5.30	3.50
5.30	3.80	5.22	4.10	5.34	3.80
5.32	3.45	5.26	4.50	5.38	4.30
5.36	5.20	5.32	4.90	5.40	4.80
5.40	5.60	5.38	5.20	5.42	5.70
5.45	6.10	5.45	5.40	5.46	6.00
5.50	6.40	5.60	5.65	5.52	6.15
5.60	6.80	5.70	5.85	5.60	6.30
5.70	7.15	5.80	6.00	5.70	6.50
5.80	7.50	5.90	6.20	5.80	6.65
5.90	7.90	6.00	6.35	6.00	6.90
6.00	8.60	6.20	6.70	6.20	7.20
6.10	9.10	6.30	7.15	6.40	7.50
6.20	9.50	6.35	7.55	6.45	8.20
6.30	9.75	6.40	8.35	6.50	8.65
6.40	9.90	6.45	9.00	6.55	9.15
6.60	10.20	6.60	9.70	6.60	9.50
6.80	10.50			6.70	9.90

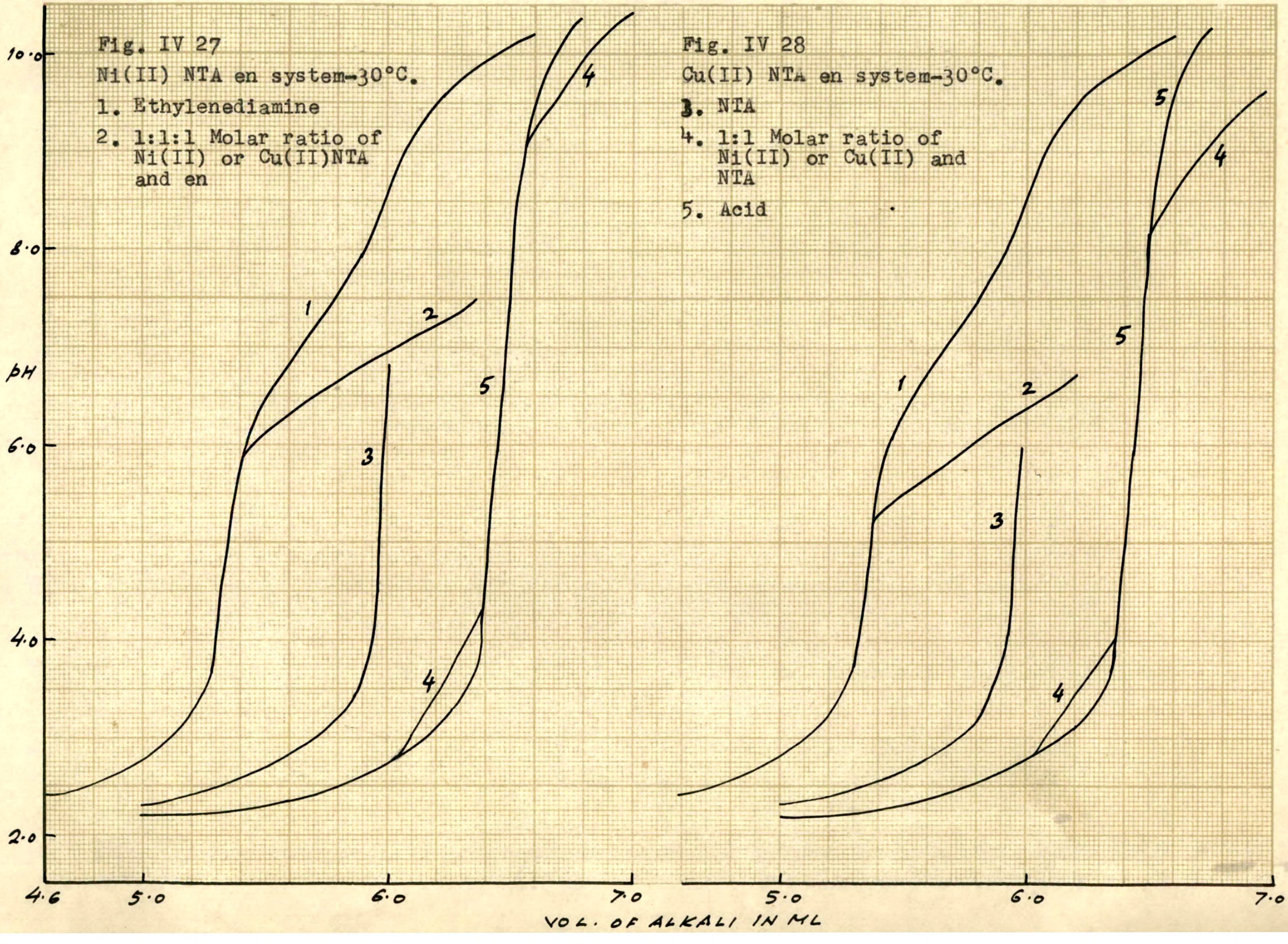

Fig. IV 27
Ni(II) NTA en system-30°C.
1. Ethylenediamine
2. 1:1:1 Molar ratio of Ni(II) or Cu(II)NTA and en
Fig. IV 28
Cu(II) NTA en system-30°C.
3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA
5. Acid
pH
10.0
8.0
6.0
4.0
2.0
4.6
5.0
6.0
7.0
VOL. OF ALKALI IN ML
1
2
3
4
5

Table IV 1.30

$N = 0.2M$ $V^{\circ} = 50$ ml. $\mu = 0.2M$ $t = 30°C.$

$E^{\circ} = 0.02M$ $^{*}E^{\circ} = 0.026M$ $T^{\circ}_{NTA} = 0.002M$ $T^{\circ}_{M} = 0.002M$

$T^{\circ}_{L} = 0.002M$

*Propylenediamine		Cu.NTA pn		Ni.NTA pn	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.60	0.00	1.60	0.00	1.60
1.00	1.70	1.00	1.70	1.00	1.70
2.00	1.80	2.00	1.80	2.00	1.80
3.00	2.00	3.00	2.00	3.00	2.00
4.00	2.20	4.00	2.20	4.00	2.20
5.00	2.80	5.00	3.00	5.00	2.80
5.20	3.15	5.10	3.20	5.20	3.35
5.28	3.50	5.20	3.80	5.30	4.00
5.32	3.90	5.25	4.20	5.34	4.80
5.34	4.30	5.34	4.75	5.38	5.35
5.36	4.80	5.40	5.00	5.42	5.60
5.40	5.50	5.50	5.25	5.60	6.10
5.45	5.95	5.60	5.45	5.70	6.30
5.50	6.30	5.80	5.75	5.80	6.45
5.60	6.70	5.90	5.90	6.00	6.75
5.70	7.00	6.00	6.10	6.20	7.05
5.80	7.35	6.10	6.25	6.30	7.25
5.90	7.80	6.20	6.45	6.36	7.50
5.95	8.10	6.30	6.90	6.40	7.70
6.00	8.60	6.35	7.35	6.44	7.95
6.05	8.95	6.38	7.90	6.50	8.50
6.20	9.50	6.40	8.35	6.60	9.30
6.40	9.90	6.44	8.80	6.65	9.60
6.60	10.25	6.50	9.15	6.70	9.90
		6.60	9.65		

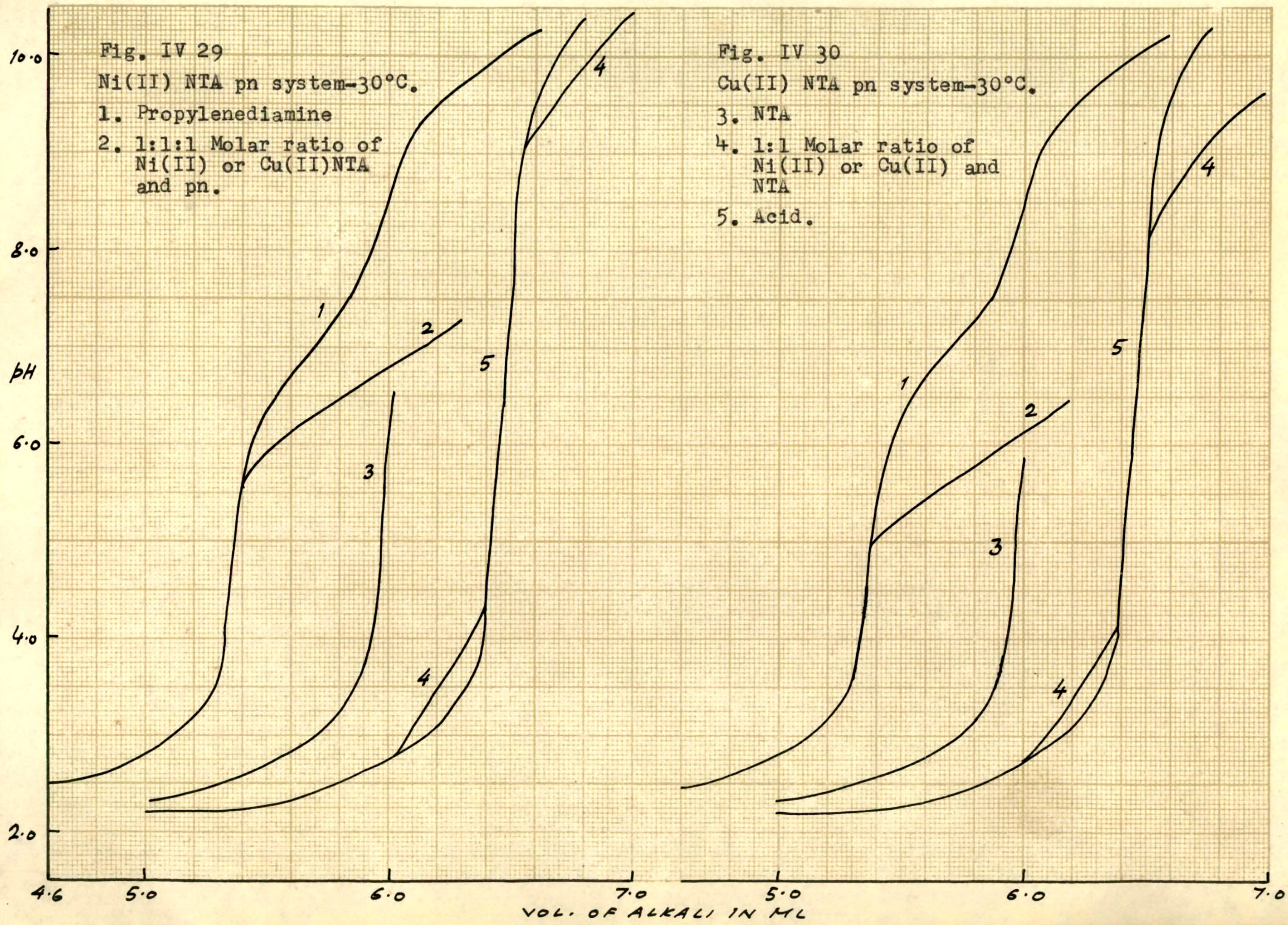

Fig. IV 29

Ni(II) NTA pn system-30°C.

1. Propylenediamine
2. 1:1:1 Molar ratio of Ni(II) or Cu(II)NTA and pn.

Fig. IV 30

Cu(II) NTA pn system-30°C.

3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA
5. Acid.

Table IV 1.4C

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.

E° = 0.02M *E° = 0.026M T°_{NTA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*1,3-Diamino pn		Cu.NTA 1,3 pn		Ni.NTA 1,3 pn	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.55	0.00	1.60
1.00	1.60	1.00	1.65	1.00	1.70
2.00	1.70	2.00	1.75	2.00	1.80
3.00	1.80	3.00	1.90	3.00	1.95
4.00	2.00	4.00	2.10	4.00	2.15
5.00	2.65	5.00	2.70	5.00	2.80
5.20	3.05	5.20	3.00	5.20	3.20
5.30	3.55	5.30	3.60	5.30	3.70
5.32	3.80	5.36	4.75	5.34	4.35
5.35	4.50	5.38	5.40	5.36	5.10
5.38	5.50	5.40	5.50	5.38	5.70
5.40	6.50	5.44	5.80	5.40	6.30
5.42	7.20	5.48	6.10	5.42	7.20
5.46	7.70	5.50	6.30	5.46	7.40
5.50	7.90	5.55	6.60	5.50	7.55
5.52	8.05	5.60	6.85	5.60	7.90
5.60	8.35	5.70	7.20	5.70	8.10
5.70	8.65	5.80	7.45	5.80	8.30
5.80	8.90	5.90	7.60	6.00	8.60
6.00	9.30	6.00	7.75	6.20	8.85
6.20	9.70	6.10	7.90	6.40	9.20
6.40	10.05	6.20	8.10	6.60	9.65
6.60	10.25	6.40	8.50	6.70	9.90
7.00	10.60	6.60	9.10	6.80	10.10
		6.80	9.80		

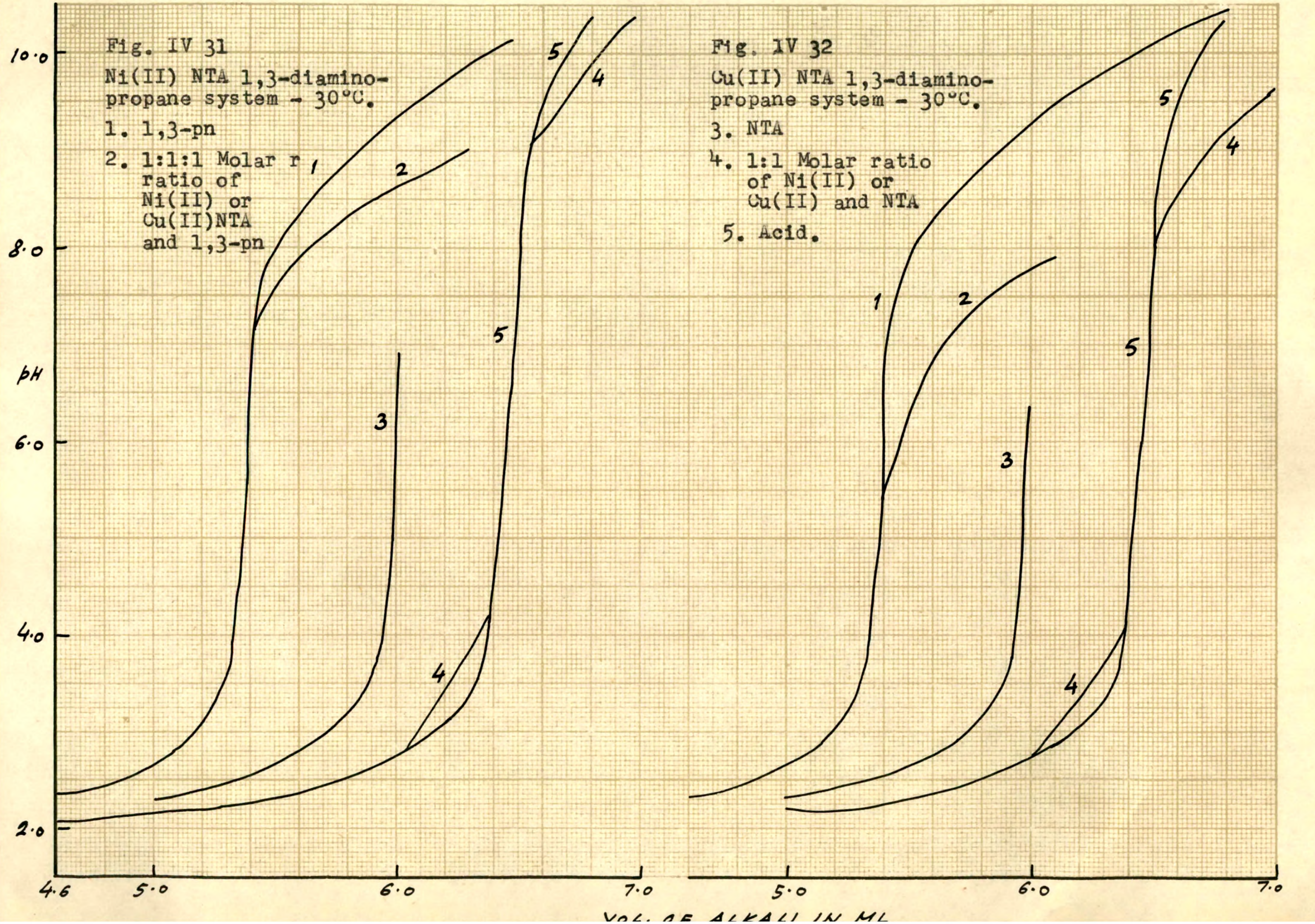
Fig. IV 31
Ni(II) NTA 1,3-diamino-propane system - 30°C.
1. 1,3-pn
2. 1:1:1 Molar r ratio of Ni(II) or Cu(II)NTA and 1,3-pn
Fig. IV 32
Cu(II) NTA 1,3-diamino-propane system - 30°C.
3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
4.6
5.0
6.0
7.0
VOL. OF ALKALI IN ML
1
2
3
4
5

Table IV 1.5C

$N = 0.2M \quad V° = 50$ ml. $\quad \mu = 0.2M \quad t = 30°C.$

$E° = 0.02M \quad {}^{*}E° = 0.026M \quad T^{\circ}_{NTA} = 0.002M \quad T^{\circ}_{M} = 0.002M$

$T^{\circ}_{L} = 0.002M$

*N-Methyl en		Cu.NTA N-Methyl en		Ni.NTA N-Methyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.55	0.00	1.60
1.00	1.60	1.00	1.65	1.00	1.70
2.00	1.70	2.00	1.80	2.00	1.80
3.00	1.80	3.00	1.95	3.00	2.00
4.00	2.10	4.00	2.15	4.00	2.15
5.00	2.70	5.00	2.70	5.00	2.80
5.20	3.05	5.20	3.10	5.30	3.40
5.30	3.45	5.30	3.45	5.35	3.80
5.36	3.90	5.34	3.90	5.38	4.15
5.38	4.60	5.38	4.60	5.40	4.70
5.40	4.90	5.40	5.00	5.42	5.10
5.42	5.30	5.45	5.25	5.46	5.55
5.44	5.70	5.50	5.50	5.50	6.00
5.48	6.20	5.55	5.75	5.60	6.35
5.60	6.70	5.60	5.90	5.70	6.55
5.70	7.05	5.70	6.10	5.80	6.75
5.80	7.40	5.80	6.20	5.90	6.90
5.90	7.90	6.00	6.45	6.00	7.05
6.00	8.40	6.20	6.75	6.20	7.45
6.10	8.85	6.30	7.00	6.30	7.70
6.20	9.10	6.40	7.40	6.35	7.90
6.40	9.50	6.50	8.20	6.40	8.10
6.60	9.75	6.54	8.50	6.50	8.55
7.40	10.60		(ppts.)	6.60	8.90

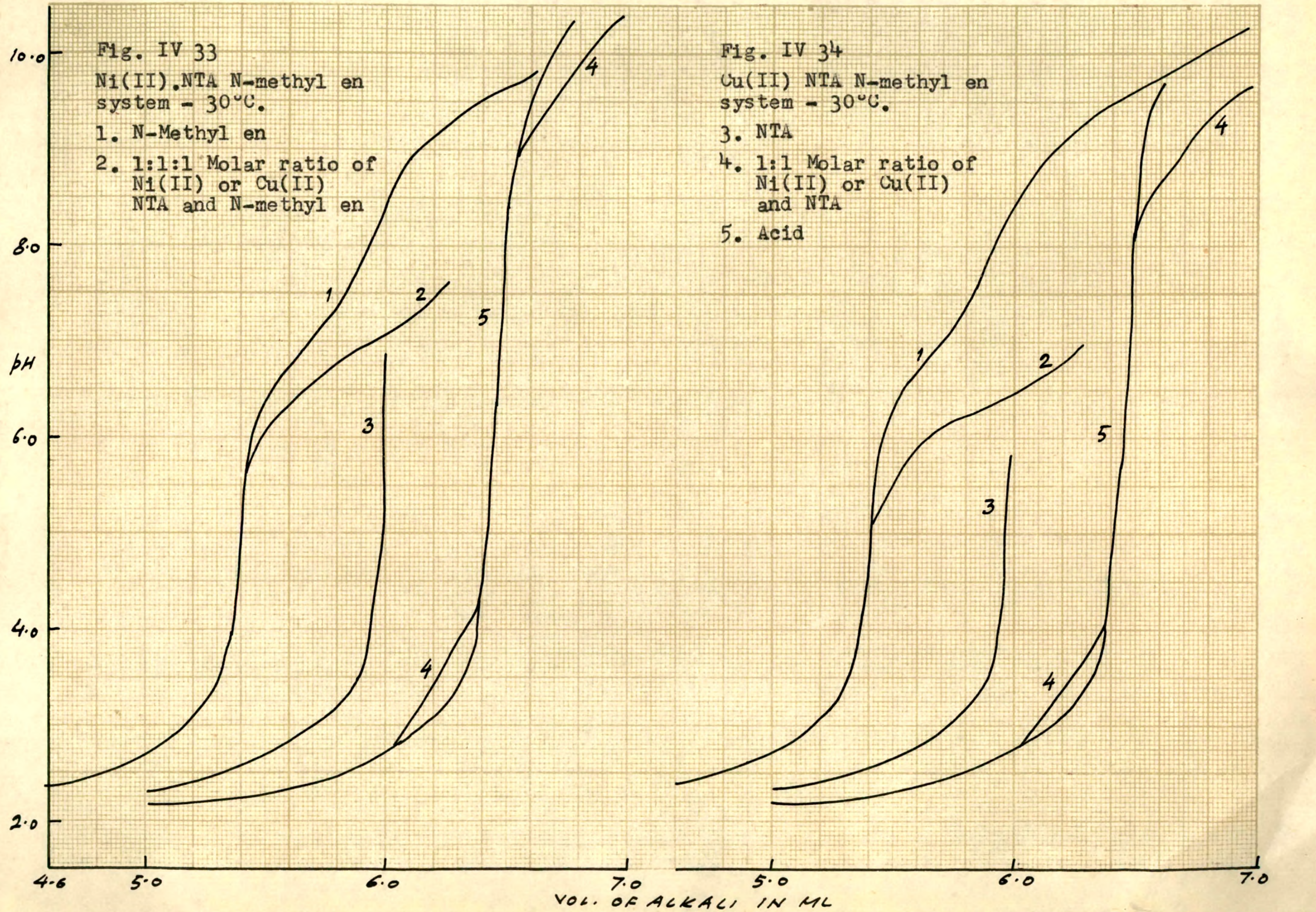

Fig. IV 33
Ni(II).NTA N-methyl en system - 30°C.
1. N-Methyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) NTA and N-methyl en

Fig. IV 34
Cu(II) NTA N-methyl en system - 30°C.
3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA
5. Acid

Table IV 1.6C

$N = 0.2M$ $V° = 50$ ml. $\mu = 0.2M$ $t = 30°C.$

$E° = 0.02M$ $^{*}E° = 0.026M$ $T^{\circ}_{NTA} = 0.002M$ $T^{\circ}_{M} = 0.002M$

$T^{\circ}_{L} = 0.002M$

% *N-Ethyl en		Cu.NTA N-Ethyl en		Ni.NTA N-Ethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.65	0.00	1.65
1.00	1.60	1.00	1.75	1.00	1.75
2.00	1.70	2.00	1.80	2.00	1.85
3.00	1.85	3.00	2.00	3.00	2.00
4.00	2.10	4.00	2.25	4.00	2.20
5.00	2.65	5.00	2.90	5.00	2.80
5.20	2.90	5.20	3.30	5.20	3.10
5.30	3.25	5.30	3.70	5.30	3.40
5.40	3.75	5.32	3.90	5.38	4.00
5.42	4.30	5.34	4.20	5.40	4.40
5.44	4.60	5.36	4.50	5.42	4.90
5.46	5.10	5.38	4.80	5.44	5.40
5.48	5.50	5.40	5.00	5.48	5.85
5.50	5.80	5.44	5.30	5.52	6.15
5.55	6.20	5.48	5.55	5.60	6.50
5.60	6.55	5.52	5.75	5.70	6.80
5.70	6.95	5.56	5.90	5.80	7.05
5.80	7.30	5.60	6.05	5.90	7.25
5.90	7.75	5.65	6.20	6.00	7.50
5.95	8.05	5.70	6.25	6.10	7.70
6.00	8.35	5.80	6.45	6.20	7.95
6.10	8.95	5.85	6.55	6.30	8.30
6.20	9.35	5.90	6.60	6.40	8.70
6.40	9.80	6.00	6.85	6.50	9.10
6.60	10.20	6.20	7.40		(ppts.)
7.00	10.60		(ppts.)		

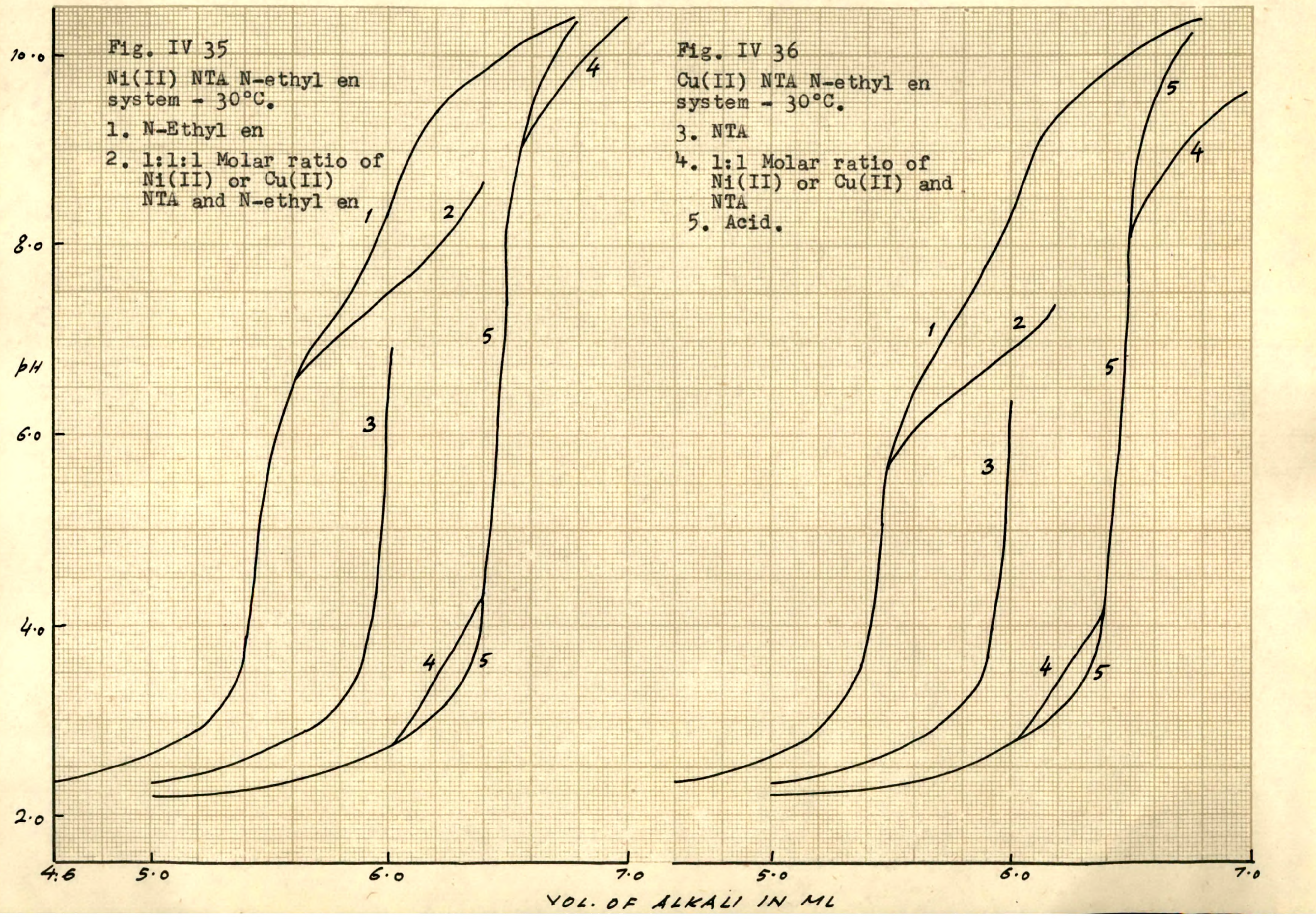
Fig. IV 35
Ni(II) NTA N-ethyl en system - 30°C.
1. N-Ethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) NTA and N-ethyl en
Fig. IV 36
Cu(II) NTA N-ethyl en system - 30°C.
3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
4.6
5.0
6.0
7.0
VOL. OF ALKALI IN ML

Table IV 1.7C

$N = 0.2M$ $V^\circ = 50$ ml. $\mu = 0.2M$ $t = 30°C$.

$E^\circ = 0.02M$ $^*E^\circ = 0.026M$ $T^\circ_{NTA} = 0.002M$ $T^\circ_M = 0.002M$

$T^\circ_L = 0.002M$

*N-N'-Dimethyl en		Cu.NTA N-N'-Dimethyl en		Ni.NTA N-N'-Dimethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.55	0.00	1.60
1.00	1.60	1.00	1.65	1.00	1.70
2.00	1.70	2.00	1.80	2.00	1.80
3.00	1.90	3.00	1.90	3.00	1.90
4.00	2.10	4.00	2.20	4.00	2.10
5.00	2.60	5.00	2.70	5.00	2.70
5.30	3.05	5.30	3.20	5.20	3.00
5.40	3.40	5.40	3.60	5.35	3.60
5.45	3.80	5.45	4.15	5.40	4.20
5.48	4.20	5.50	4.65	5.44	4.70
5.50	4.50	5.55	5.25	5.48	5.35
5.52	4.90	5.60	5.55	5.52	5.80
5.54	5.20	5.70	5.95	5.56	6.05
5.56	5.60	5.80	6.25	5.60	6.25
5.60	6.00	5.90	6.50	5.70	6.70
5.65	6.50	6.00	6.70	5.80	6.90
5.70	6.75	6.10	6.90	5.90	7.15
5.80	7.15	6.20	7.10	6.00	7.40
5.90	7.60	6.30	7.60	6.10	7.60
6.00	8.10	6.35	7.80	6.20	7.90
6.10	8.70	6.40	8.10	6.30	8.25
6.20	9.20	6.50	8.65	6.40	8.65
6.30	9.50	6.70	9.50	6.50	9.20
6.40	9.80	6.80	9.80	6.70	10.00
6.60	10.20				
7.00	10.70				

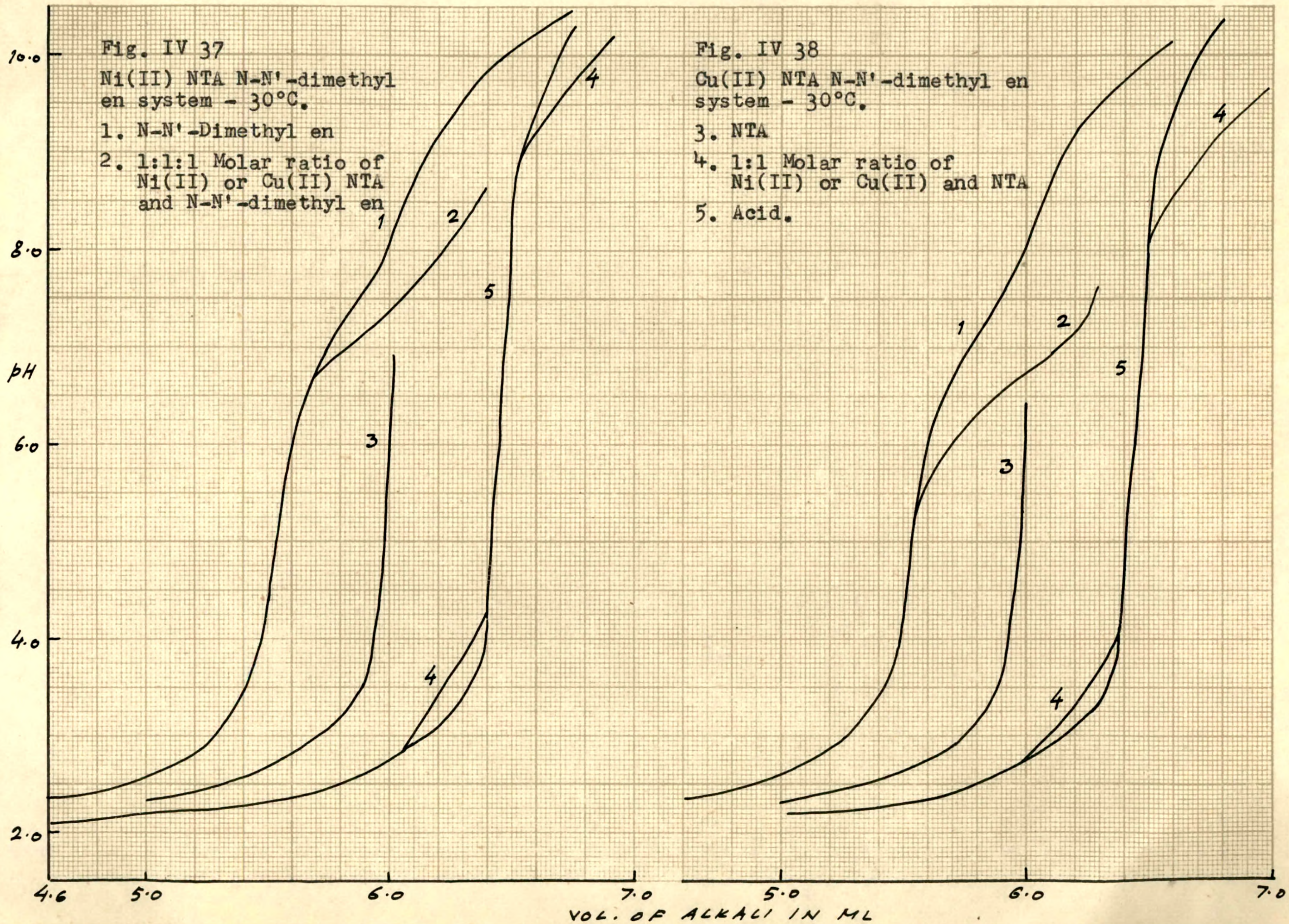

Fig. IV 37

Ni(II) NTA N-N'-dimethyl en system - 30°C.

1. N-N'-Dimethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) NTA and N-N'-dimethyl en

Fig. IV 38

Cu(II) NTA N-N'-dimethyl en system - 30°C.

3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA
5. Acid.

Table IV 1.8C

N = 0.2M V° = 50 ml. μ = 0.2M t = 30°C.
E° = 0.02M *E° = 0.026M T^{o}_{NTA} = 0.002M T^{o}_{M} = 0.002M
T^{o}_{L} = 0.002M

*N-N-Dimethyl en		Cu.NTA N-N-Dimethyl en		Ni.NTA N-N-Dimethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.55	0.00	1.60
1.00	1.60	1.00	1.65	1.00	1.70
2.00	1.70	2.00	1.75	2.00	1.80
3.00	1.80	3.00	1.90	3.00	2.00
4.00	2.00	4.00	2.10	4.00	2.20
5.00	2.65	5.00	2.80	5.00	2.80
5.20	3.00	5.20	3.15	5.20	3.10
5.36	3.50	5.30	3.70	5.30	3.50
5.40	3.90	5.32	3.90	5.35	3.90
5.42	4.40	5.36	4.40	5.40	4.65
5.44	4.90	5.40	4.75	5.42	5.00
5.46	5.20	5.45	4.90	5.50	5.60
5.48	5.40	5.50	5.10	5.60	6.00
5.52	5.70	5.60	5.40	5.70	6.20
5.60	6.10	5.80	5.85	5.80	6.40
5.70	6.50	6.00	6.15	5.92	6.70
5.80	6.90	6.20	6.55	6.00	6.85
5.86	7.20	6.30	7.10	6.10	7.10
5.90	7.50	6.35	7.45	6.20	7.35
5.95	8.05	6.40	8.10	6.30	7.70
6.00	8.60	6.45	8.90	6.36	8.00
6.10	9.00	6.52	9.40	6.42	8.50
6.20	9.35	6.60	9.85	6.50	9.10
6.40	9.80	6.70	10.20	6.60	9.70
6.60	10.20			6.80	10.35
7.00	10.70				

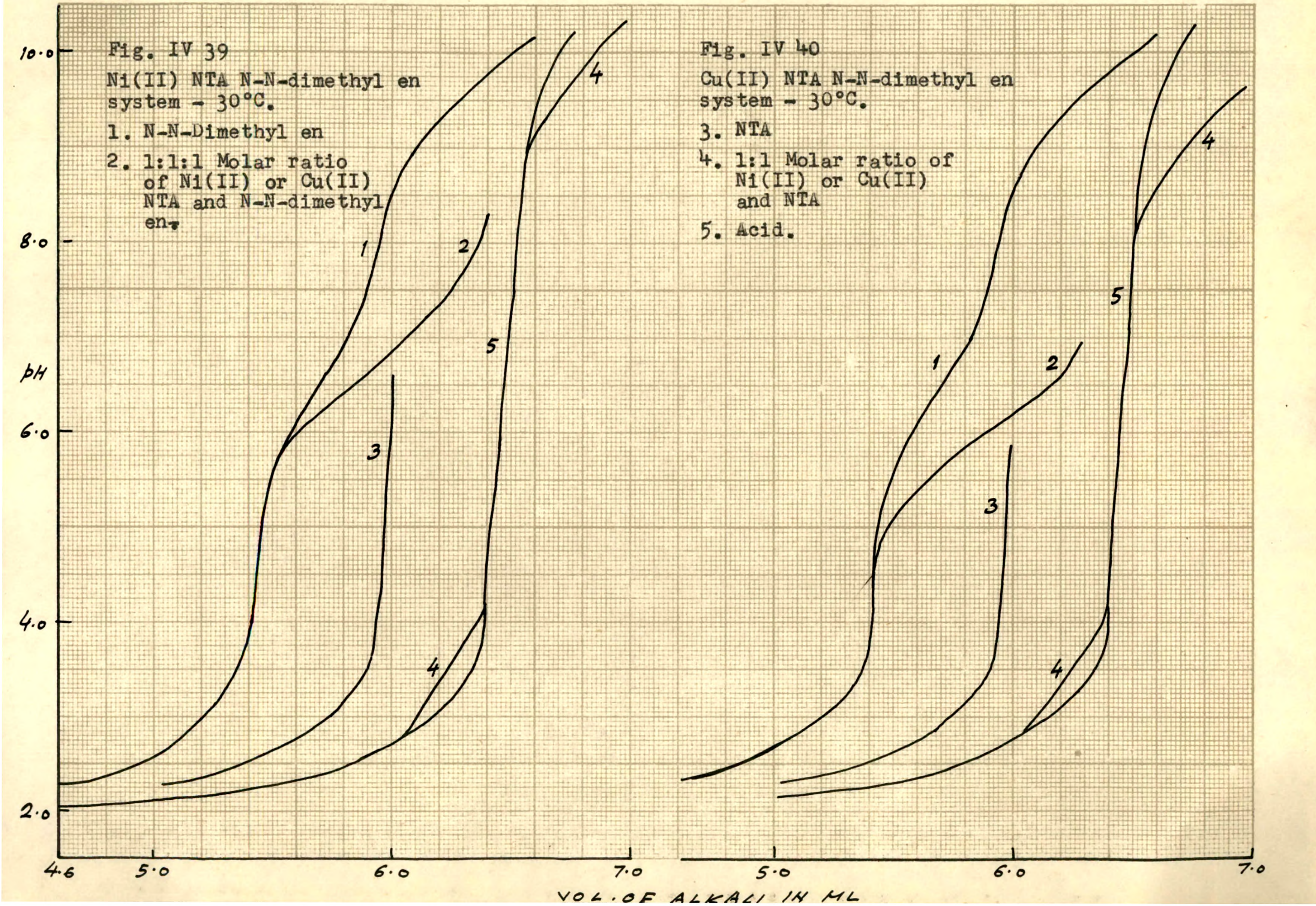
Fig. IV 39
Ni(II) NTA N-N-dimethyl en system - 30°C.
1. N-N-Dimethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) NTA and N-N-dimethyl en.
Fig. IV 40
Cu(II) NTA N-N-dimethyl en system - 30°C.
3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
4.6
5.0
6.0
7.0
5.0
6.0
7.0
VOL. OF ALKALI IN ML
1
2
3
4
5
1
2
3
4
5
4
4

Table IV 1.9C

N = 0.2M   V° = 50 ml. μ = 0.2M   t = 30°C.

E° = 0.02M   *E° = 0.026M T°_{NTA} = 0.002M T°_{M} = 0.002M

T°_{L} = 0.002M

*N-N-Diethyl en		Cu.NTA N-N-Diethyl en		Ni.NTA N-N-Diethyl en	
Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B	Vol.of alkali (in ml.)	B
0.00	1.50	0.00	1.55	0.00	1.55
1.00	1.60	1.00	1.60	1.00	1.65
2.00	1.70	2.00	1.70	2.00	1.75
3.00	1.80	3.00	1.90	3.00	1.90
4.00	2.10	4.00	2.10	4.00	2.10
5.00	2.65	5.00	2.60	5.00	2.65
5.30	3.10	5.30	3.00	5.20	2.90
5.40	3.55	5.40	3.45	5.34	3.30
5.45	4.10	5.45	3.90	5.40	3.60
5.48	4.80	5.48	4.30	5.44	3.95
5.50	5.20	5.52	5.35	5.48	4.65
5.54	5.80	5.56	5.60	5.52	5.40
5.58	6.25	5.60	5.80	5.56	5.90
5.62	6.50	5.65	6.10	5.60	6.25
5.70	7.00	5.70	6.35	5.64	6.55
5.80	7.40	5.75	6.55	5.70	6.85
5.90	7.80	5.80	6.75	5.80	7.15
5.95	8.05	5.90	7.05	5.90	7.50
6.00	8.40	6.00	7.30	6.00	7.80
6.10	8.90	6.10	7.50	6.10	8.20
6.20	9.30	6.20	7.70	6.20	8.55
6.30	9.60	6.30	7.95	6.30	8.85
6.60	10.10	6.40	8.20	6.40	9.15
7.00	10.60	6.50	8.50	6.60	9.70
				6.80	10.10

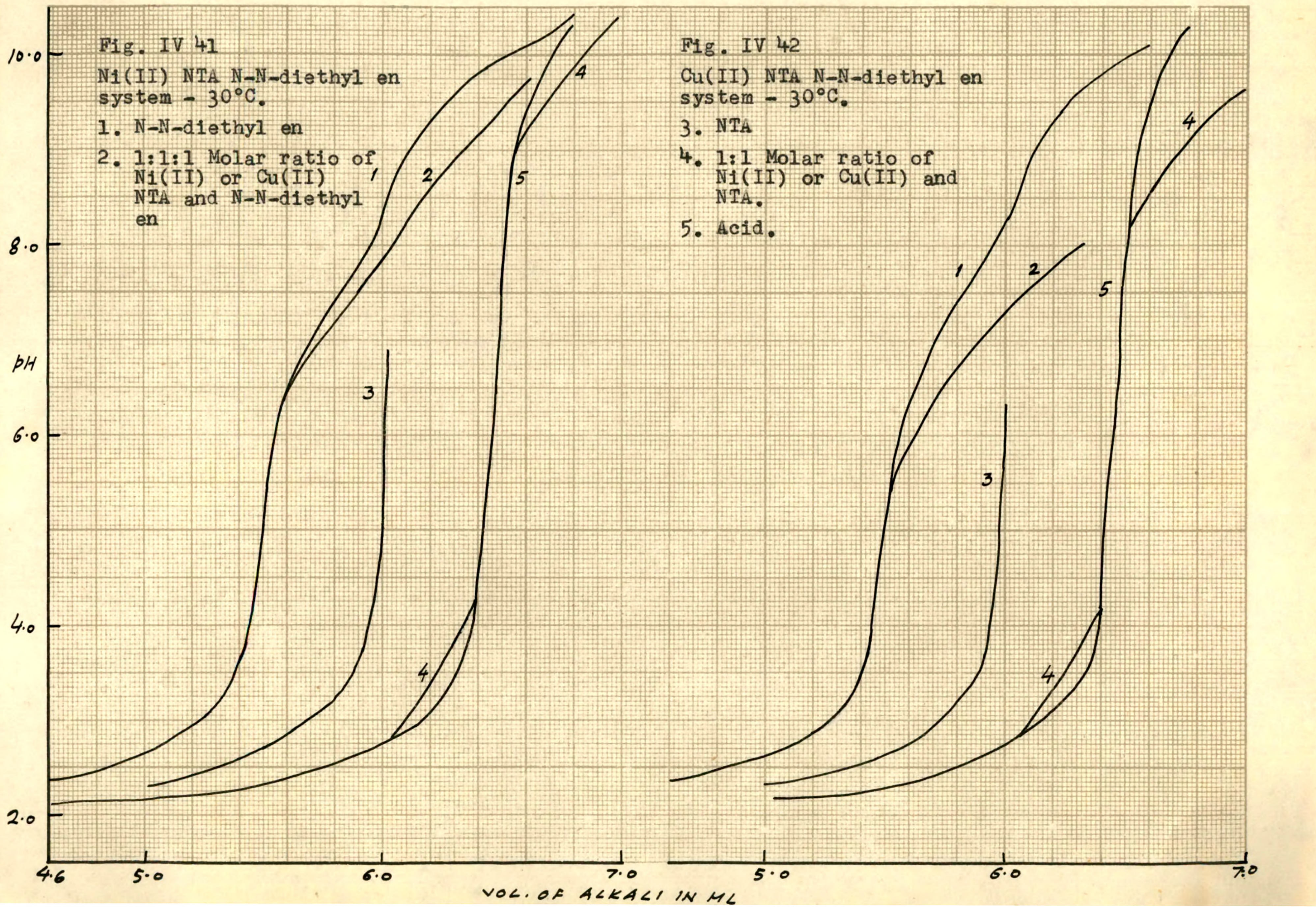
Fig. IV 41
Ni(II) NTA N-N-diethyl en system - 30°C.
1. N-N-diethyl en
2. 1:1:1 Molar ratio of Ni(II) or Cu(II) NTA and N-N-diethyl en
Fig. IV 42
Cu(II) NTA N-N-diethyl en system - 30°C.
3. NTA
4. 1:1 Molar ratio of Ni(II) or Cu(II) and NTA.
5. Acid.
pH
10.0
8.0
6.0
4.0
2.0
4.6
5.0
6.0
7.0
VOL. OF ALKALI IN ML

Table IVI2.1Ab

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Ni.Histidine ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.60	1.82_1	4.54	4.78	0.24	0.26_4	0.45_8	6.91_4	6.45_6
6.70	1.80_1	4.56	4.86	0.30	0.33_3	0.34_5	6.77_7	6.43_2
6.80	1.76_1	4.58	4.92	0.34	0.38_6	0.20_2	6.66_4	6.46_2
6.90	1.74_1	4.61	4.98	0.37	0.42_5	0.13_1	6.53_5	6.40_4
7.00	1.70_1	4.63	5.03	0.40	0.47_0	0.05_1	6.41_7	6.36_6
7.10	1.64_0	4.66	5.09	0.43	0.52_4	$\bar{1}.95_7$	6.31_8	6.36_1
7.20	1.58_0	4.69	5.13	0.44	0.55_7	$\bar{1}.90_0$	6.20_7	6.30_7

$\log K_{MAL} = 6.40 \pm 0.05$

Table IV 2.1'Ab

B, T_L^o, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Ni.Histidine ethylenediamine system - 30°C.

B	T_L^o	V'	V"	V"-V'	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
5.90	0.05_2	2.68_0	2.77_0	0.09_0	0.45_0	0.08_7	6.65_3	6.56_3
5.95	0.05_2	2.69_0	2.79_0	0.10_0	0.50_0	0.00_0	6.55_5	6.55_5
6.00	0.05_3	2.70_5	2.81_5	0.11_0	0.55_0	$\bar{1}.91_3$	6.46_0	6.54_7
6.05	0.05_3	2.72_0	2.83_5	0.11_5	0.57_5	$\bar{1}.86_8$	6.36_1	6.49_3
6.10	0.05_4	2.74_0	2.86_0	0.12_0	0.60_0	$\bar{1}.82_4$	6.26_3	6.43_9
6.15	0.05_4	2.75_5	2.89_0	0.13_5	0.67_5	$\bar{1}.68_2$	6.16_7	6.48_5
6.20	0.05_5	2.77_0	2.91_0	0.14_0	0.70_0	$\bar{1}.63_2$	6.07_2	6.44_0
6.25	0.05_5	2.79_0	2.94_0	0.15_0	0.75_0	$\bar{1}.52_3$	5.97_7	6.45_4
6.30	0.05_5	2.82_0	2.97_5	0.15_5	0.77_5	$\bar{1}.46_3$	5.88_2	6.41_9

$\log K_{MAL} = 6.48 \pm 0.04$

Table IV 2.2Ab

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.Histidine propylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
6.85	1.56_1	4.66	5.00	0.34	0.43_6	0.11_2	6.81_6	6.70_4
6.90	1.52_1	4.68	5.03	0.35	0.46_0	0.06_9	6.76_2	6.69_3
6.95	1.50_1	4.70	5.05	0.35	0.46_6	0.05_9	6.69_6	6.63_7
7.00	1.46_0	4.72	5.08	0.36	0.49_3	0.01_1	6.64_9	6.63_8
7.05	1.44_0	4.74	5.10	0.36	0.50_0	0.00_0	6.59_6	6.59_6
7.10	1.42_0	4.75	5.13	0.38	0.53_5	$\bar{1}.93_8$	6.55_1	6.61_3
7.15	1.40_0	4.77	5.16	0.39	0.55_7	$\bar{1}.90_0$	6.50_6	6.60_6

$\log K_{MAL} = 6.64 \pm 0.03$

Table IV 2.2'Ab

B, T_L^o, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.Histidine propylenediamine system - 30°C.

B	T_L^o	V'	V"	V"-V'	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
5.80	0.05_3	2.71_5	2.80_0	0.08_5	0.42_5	0.17_6	6.91_6	6.74_0
5.85	0.05_3	2.73_0	2.82_0	0.09_0	0.45_0	0.08_7	6.85_7	6.77_0
5.90	0.05_3	2.74_5	2.84_0	0.09_5	0.47_5	0.04_3	6.76_0	6.71_7
5.95	0.05_4	2.76_5	2.86_5	0.10_0	0.50_0	0.00_0	6.66_4	6.66_4
6.00	0.05_4	2.79_0	2.90_0	0.11_0	0.55_0	$\bar{1}.91_3$	6.56_8	6.65_5
6.05	0.05_5	2.79_0	2.91_0	0.12_0	0.60_0	$\bar{1}.82_4$	6.47_5	6.65_1

$\log K_{MAL} = 6.70 \pm 0.04$

Fig. IV 43 Ni(II) Histidine en system - 30°C.

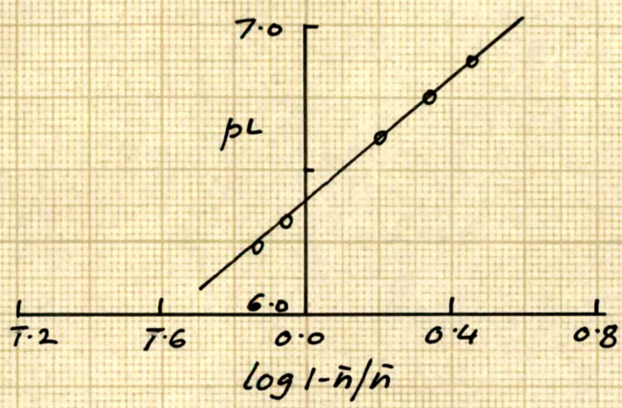

Fig. IV 44 (IInd Method)
Ni(II) Hist.en system - 30°C.

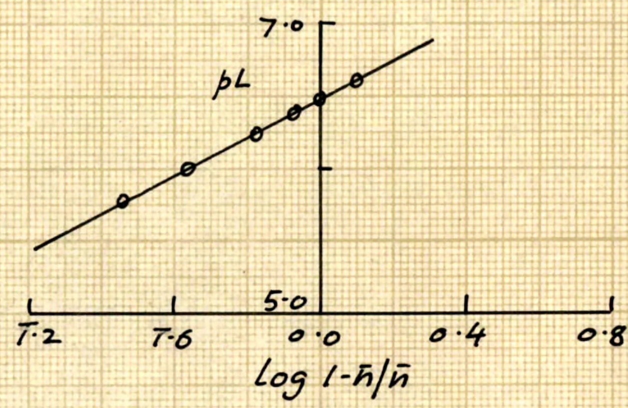

Fig. IV 45 Ni(II) Hist.pn system - 30°C.

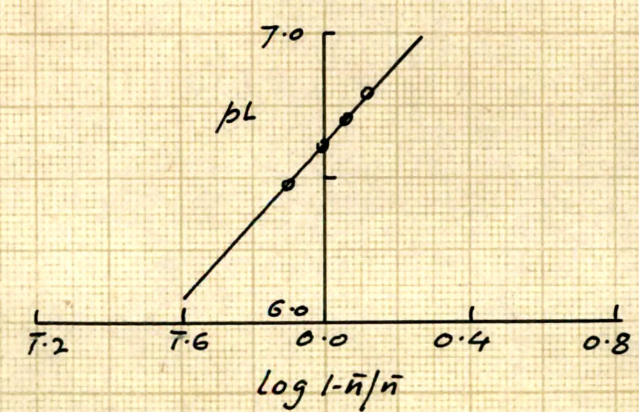

Fig. IV 46 (IInd Method)
Ni(II) Hist.pn system - 30°C.

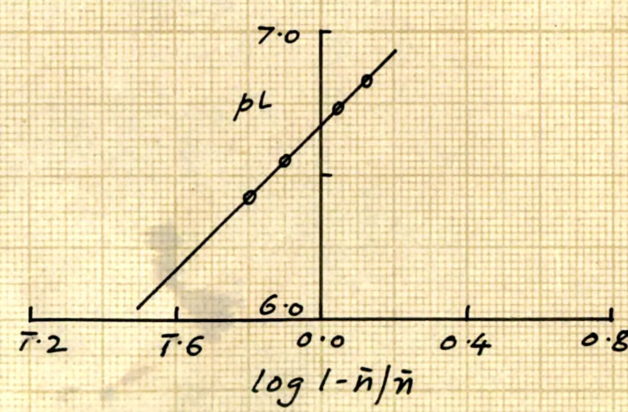

Table IV 2.3Ab

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.Histidine 1,3-diaminopropane system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
8.20	1.85_0	4.54	4.72	0.18	0.19_5	0.61_6	5.92_9	5.31_3
8.30	1.80_5	4.57	4.80	0.23	0.25_5	0.46_6	5.78_6	5.32_0
8.35	1.78_0	4.58	4.83	0.25	0.28_1	0.40_8	5.71_4	5.30_6
8.40	1.75_0	4.59	4.86	0.27	0.30_8	0.34_9	5.64_5	5.29_6
8.45	1.72_0	4.61	4.89	0.28	0.32_5	0.31_7	5.57_0	5.25_3
8.50	1.70_0	4.62	4.92	0.30	0.35_3	0.26_3	5.50_5	5.24_2
8.55	1.68_0	4.64	4.95	0.31	0.36_9	0.23_3	5.43_4	5.20_1
8.60	1.64_0	4.65	4.98	0.33	0.40_2	0.17_0	5.37_5	5.20_5

$\log K_{MAL} = 5.26 \pm 0.04$

Table IV 2.4Ab

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.Histidine N-methyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.10	1.50_0	4.76	5.05	0.29	0.38_6	0.20_1	6.45_3	6.25_2
7.20	1.43_5	4.78	5.09	0.31	0.43_2	0.11_9	6.34_0	6.22_1
7.25	1.40_0	4.78	5.11	0.33	0.47_1	0.05_0	6.30_0	6.25_0
7.30	1.38_5	4.80	5.13	0.33	0.47_6	0.04_2	6.23_4	6.19_2
7.35	1.36_5	4.81	5.15	0.34	0.49_8	0.00_3	6.18_4	6.18_4
7.40	1.34_5	4.82	5.17	0.35	0.52_0	$\bar{1}.96_5$	6.13_6	6.17_1
7.45	1.32_0	4.83	5.19	0.36	0.54_5	$\bar{1}.92_1$	6.09_4	6.17_3
7.50	1.30_5	4.84	5.21	0.37	0.56_7	$\bar{1}.88_3$	6.05_1	6.16_8

$\log K_{MAL} = 6.20 \pm 0.03$

Table IV 2.5Ab

B. $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.Histidine N-ethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.30	1.46_5	4.73	4.91	0.18	0.24_6	0.48_6	6.58_9	6.10_2
7.40	1.40_5	4.75	4.96	0.21	0.29_9	0.37_0	6.47_7	6.10_7
7.50	1.36_0	4.78	5.00	0.22	0.32_2	0.32_3	6.35_3	6.03_0
7.60	1.32_5	4.80	5.05	0.25	0.37_7	0.21_8	6.25_6	6.03_8
7.70	1.29_0	4.82	5.09	0.27	0.41_9	0.14_2	6.15_8	6.01_6
7.80	1.25_5	4.84	5.13	0.29	0.46_2	0.06_6	6.06_8	6.00_2
7.90	1.22_0	4.85	5.16	0.31	0.50_8	$\bar{1}.98_6$	5.98_7	6.00_1
8.00	1.18_5	4.87	5.20	0.33	0.55_7	$\bar{1}.90_0$	5.91_6	6.01_6

$\log K_{MAL} = 6.04 \pm 0.04$

Table IV 2.6Ab

B. $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.Histidine N-N'-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.60	1.23_5	4.86	5.10	0.24	0.38_9	0.19_6	5.51_3	5.31_7
7.70	1.20_0	4.87	5.13	0.26	0.43_3	0.11_7	5.42_5	5.30_8
7.75	1.18_0	4.88	5.15	0.27	0.45_8	0.07_3	5.38_6	5.31_3
7.80	1.17_0	4.89	5.16	0.27	0.46_2	0.06_6	5.33_2	5.26_6
7.90	1.14_0	4.91	5.19	0.28	0.49_1	0.01_5	5.24_2	5.22_7
7.95	1.12_5	4.91	5.20	0.29	0.51_6	$\bar{1}.97_2$	5.20_8	5.23_6
8.00	1.11_0	4.92	5.22	0.30	0.54_1	$\bar{1}.92_8$	5.17_6	5.24_8
8.10	1.08_5	4.93	5.24	0.31	0.57_2	$\bar{1}.87_4$	5.09_7	5.22_3

$\log K_{MAL} = 5.26 \pm 0.03$

Fig. IV 47 Ni(II) Hist.1,3-diamino-propane system - 30°C.

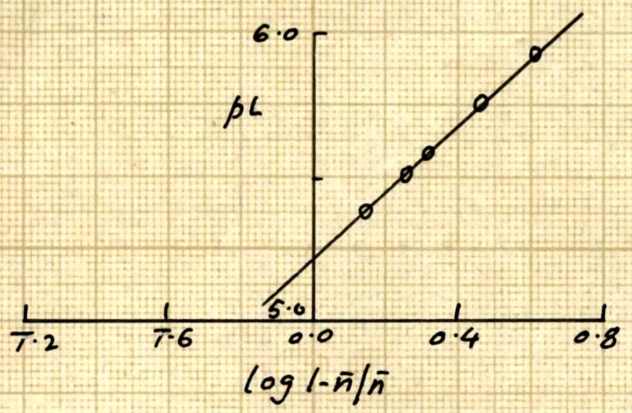

Fig. IV 48 Ni(II) Hist.N-methyl en system - 30°C.

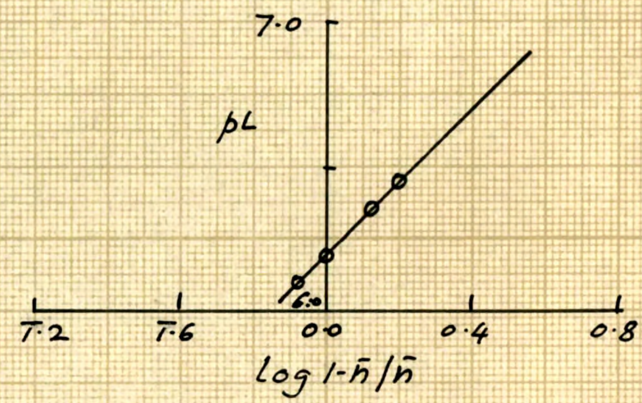

Fig. IV 49 Ni(II) Hist.N-ethyl en system - 30°C.

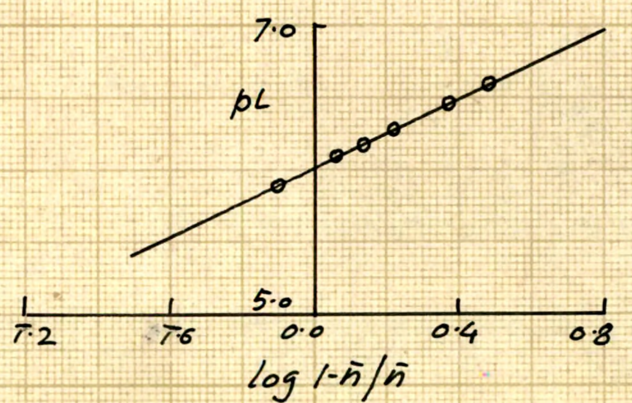

Fig. IV 50 Ni(II) Hist.N-N'-dimethyl en system - 30°C.

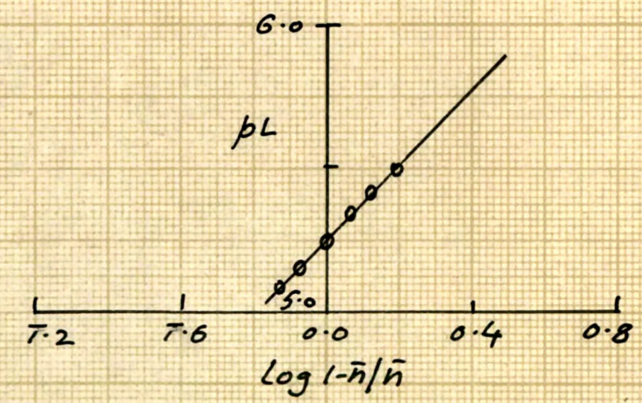

Table IV 2.1Ba

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.IMDA ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
5.30	2.00_0	4.88	5.21	0.33	0.33_1	0.30_6	9.42_5	9.11_9
5.35	2.00_0	4.88	5.24	0.36	0.36_1	0.24_8	9.34_6	9.09_8
5.40	2.00_0	4.88	5.28	0.40	0.40_1	0.17_4	9.27_6	9.10_2
5.45	2.00_0	4.88	5.31	0.43	0.43_1	0.12_0	9.19_9	9.07_9
5.50	2.00_0	4.88	5.34	0.46	0.46_1	0.06_8	9.13_7	9.06_9
5.55	2.00_0	4.88	5.38	0.50	0.50_1	$\bar{1}.99_0$	9.06_0	9.07_0
5.60	2.00_0	4.89	5.41	0.52	0.52_1	$\bar{1}.96_3$	8.97_6	9.01_3
5.65	2.00_0	4.89	5.45	0.56	0.56_1	$\bar{1}.89_3$	8.92_0	9.02_7
5.70	2.00_0	4.89	5.49	0.60	0.60_1	$\bar{1}.82_2$	8.86_4	9.04_2
5.75	2.00_0	4.90	5.52	0.62	0.62_1	$\bar{1}.78_5$	8.78_9	9.00_4

$\log K_{MAL} = 9.06 \pm 0.04$

Table IV 2.1'Ba

B, T_L°, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.IMDA ethylenediamine system - 30°C.

B	T_L°	V'	V"	V"-V'	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
4.50	0.05_2	2.69_0	2.75_5	0.06_5	0.32_5	0.31_7	9.41_6	9.09_9
4.60	0.05_2	2.69_5	2.77_5	0.08_0	0.40_0	0.17_6	9.21_7	9.04_1
4.70	0.05_3	2.69_5	2.80_0	0.10_5	0.52_5	$\bar{1}.95_6$	9.01_8	9.06_2
4.75	0.05_3	2.69_5	2.81_5	0.12_0	0.60_0	$\bar{1}.82_4$	8.91_9	9.09_5
4.80	0.05_3	2.69_5	2.82_5	0.13_0	0.65_0	$\bar{1}.73_1$	8.82_0	9.08_9
4.85	0.05_3	2.70_0	2.83_5	0.13_5	0.67_5	$\bar{1}.68_2$	8.71_9	9.03_7

$\log K_{MAL} = 9.07 \pm 0.03$

Table IV 2.2Ba

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.IMDA propylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
5.10	2.00_0	4.87	5.07	0.20	0.20_1	0.60_2	9.84_6	9.24_4
5.20	2.00_0	4.87	5.13	0.26	0.26_1	0.45_2	9.68_3	9.23_1
5.30	2.00_0	4.87	5.20	0.33	0.33_1	0.33_1	9.53_0	9.19_9
5.40	2.00_0	4.88	5.27	0.39	0.39_1	0.19_2	9.37_4	9.18_2
5.50	2.00_0	4.89	5.35	0.46	0.46_1	0.06_8	9.23_2	9.16_4
5.60	2.00_0	4.90	5.44	0.54	0.54_1	$\bar{1}.92_8$	9.10_8	9.18_0
5.70	2.00_0	4.90	5.50	0.60	0.60_1	$\bar{1}.82_2$	8.97_6	9.15_4

$\log K_{MAL} = 9.19 \pm 0.03$

Table IV 2.2' Ba

B, T_L^o, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.IMDA propylenediamine system - 30°.

B	T_L^o	V'	V"	V"-V'	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
4.40	0.05_2	2.70_0	2.75_5	0.05_5	0.27_5	0.42_1	9.71_7	9.29_6
4.45	0.05_2	2.70_0	2.76_0	0.06_0	0.30_0	0.36_8	9.63_4	9.26_6
4.50	0.05_2	2.70_0	2.77_5	0.07_5	0.37_5	0.22_2	9.51_7	9.29_5
4.55	0.05_3	2.70_0	2.78_5	0.08_5	0.42_5	0.13_1	9.41_7	9.28_6
4.60	0.05_3	2.70_0	2.80_0	0.10_0	0.50_0	0.00_0	9.31_8	9.31_8
4.65	0.05_3	2.70_0	2.81_5	0.11_5	0.57_5	$\bar{1}.86_9$	9.21_9	9.35_0

$\log K_{MAL} = 9.28 \pm 0.02$

Fig. IV 51 Cu(II) IMDA en system - 30°C.

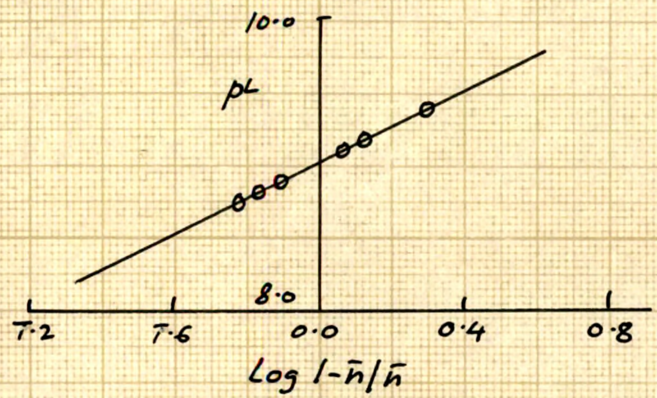

Fig. IV 52 (IInd Method)
Cu(II) IMDA en system - 30°C.

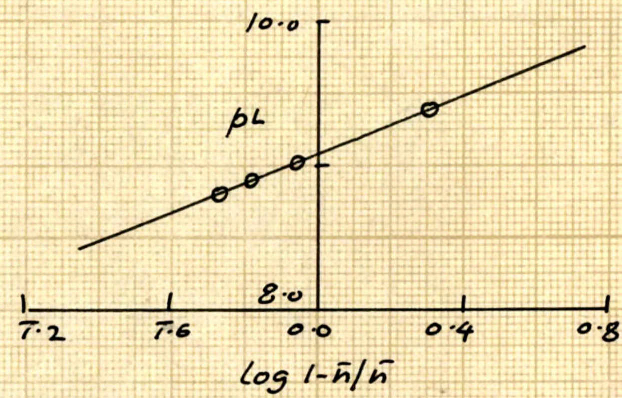

Fig. IV 53 Cu(II) IMDA pn system - 30°C.

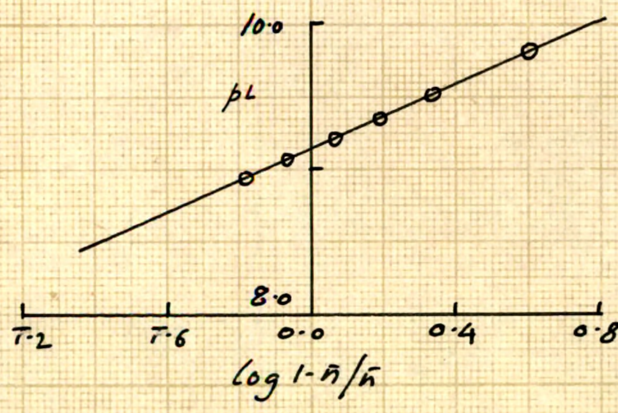

Fig. IV 54 (IInd Method)
Cu(II) IMDA pn system - 30°C.

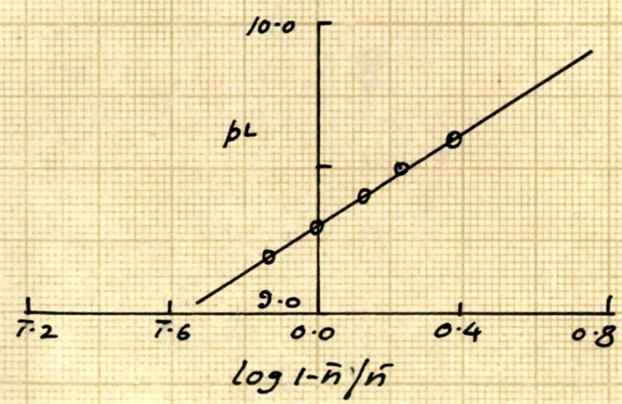

Table IV 2.3Ba

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.IMDA 1,3-diaminopropane system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.05	2.00_0	4.95	5.22	0.27	0.27_0	0.43_2	8.18_6	7.75_4
7.10	2.00_0	4.95	5.26	0.31	0.31_0	0.34_7	8.11_2	7.76_5
7.15	2.00_0	4.95	5.29	0.34	0.34_0	0.28_8	8.03_2	7.74_4
7.20	2.00_0	4.95	5.32	0.37	0.37_0	0.23_1	7.95_4	7.72_3
7.25	2.00_0	4.95	5.35	0.40	0.40_0	0.17_6	7.87_7	7.70_1
7.30	2.00_0	4.95	5.40	0.45	0.45_0	0.08_7	7.81_6	7.72_9
7.35	2.00_0	4.96	5.43	0.47	0.47_0	0.05_2	7.73_4	7.68_2
7.40	2.00_0	4.96	5.48	0.52	0.52_0	$\bar{1}.96_5$	7.67_7	7.71_2
7.45	2.00_0	4.96	5.53	0.57	0.57_0	$\bar{1}.87_7$	7.62_3	7.74_6
7.50	2.00_0	4.97	5.55	0.58	0.58_0	$\bar{1}.86_0$	7.54_2	7.68_2

$\log K_{MAL} = 7.72 \pm 0.02$

Table IV 2.4Ba

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.IMDA N-methylethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
5.50	2.00_0	4.97	5.23	0.23	0.26_0	0.45_4	9.28_3	8.82_9
5.60	2.00_0	4.98	5.30	0.32	0.32_0	0.32_7	9.12_3	8.79_6
5.70	2.00_0	4.98	5.37	0.39	0.39_0	0.19_4	8.97_4	8.78_0
5.80	1.99_5	5.00	5.45	0.45	0.45_1	0.08_5	8.82_5	8.74_0
5.90	1.98_0	5.00	5.52	0.52	0.52_5	$\bar{1}.95_6$	8.69_4	8.73_8
6.00	1.96_0	5.02	5.60	0.58	0.59_2	$\bar{1}.83_8$	8.56_7	8.72_9

$\log K_{MAL} = 8.77 \pm 0.03$

Table IV 2.5Ba

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.IMDA N.ethylethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.00	1.98_5	4.98	5.32	0.34	0.34_2	0.28_4	8.94_8	8.66_4
6.05	1.97_5	4.99	5.36	0.37	0.37_5	0.22_2	8.87_4	8.65_2
6.10	1.96_5	4.99	5.39	0.40	0.40_7	0.16_3	8.80_0	8.63_7
6.15	1.95_2	5.00	5.43	0.43	0.44_0	0.10_4	8.72_9	8.62_5
6.20	1.94_0	5.00	5.45	0.45	0.46_4	0.06_2	8.65_2	8.59_0
6.25	1.92_7	5.01	5.49	0.48	0.49_8	0.00_3	8.58_5	8.58_2
6.30	1.91_5	5.02	5.52	0.50	0.52_2	$\bar{1}.96_1$	8.51_1	8.55_0
6.35	1.89_7	5.02	5.56	0.54	0.56_9	$\bar{1}.87_9$	8.46_2	8.58_3
6.40	1.88_0	5.03	5.59	0.56	0.59_6	$\bar{1}.83_1$	8.39_6	8.56_5

$\log K_{MAL} = 8.60 \pm 0.03$

Table IV 2.6Ba

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.IMDA N-N'-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.10	1.89_6	5.11	5.44	0.33	0.34_7	0.27_4	7.87_5	7.60_1
6.15	1.88_5	5.11	5.46	0.35	0.37_1	0.22_9	7.79_7	7.56_8
6.20	1.87_5	5.12	5.49	0.37	0.39_4	0.18_7	7.71_9	7.53_2
6.25	1.86_0	5.12	5.52	0.40	0.42_9	0.12_4	7.65_1	7.52_7
6.30	1.84_5	5.13	5.55	0.42	0.45_5	0.07_8	7.57_9	7.50_1
6.35	1.82_7	5.14	5.58	0.44	0.48_1	0.03_3	7.50_9	7.47_6
6.40	1.81_0	5.15	5.61	0.46	0.50_7	$\bar{1}.98_8$	7.44_0	7.45_2

$\log K_{MAL} = 7.52 \pm 0.04$

Fig. IV 55 Cu(II) IMDA 1,3-diamino-propane systeme - 30°C.

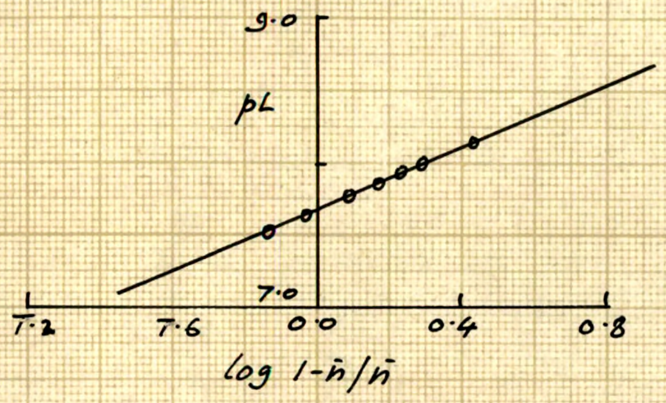

Fig. IV 56 Cu(II) IMDA N-methyl en system - 30°C.

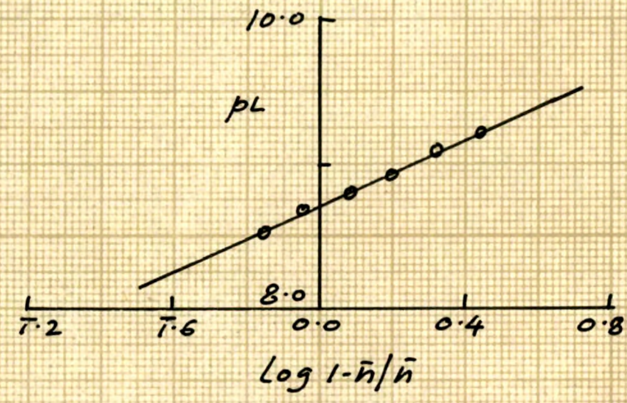

Fig. IV 57 Cu(II) IMDA N-ethyl en system - 30°C.

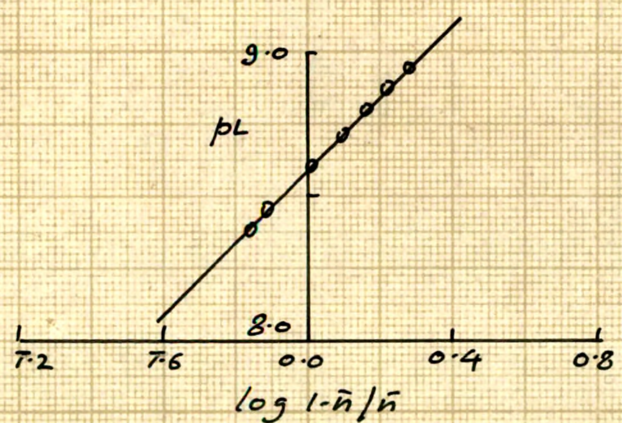

Fig. IV 58 Cu(II) IMDA N-N'-dimethyl en system - 30°C.

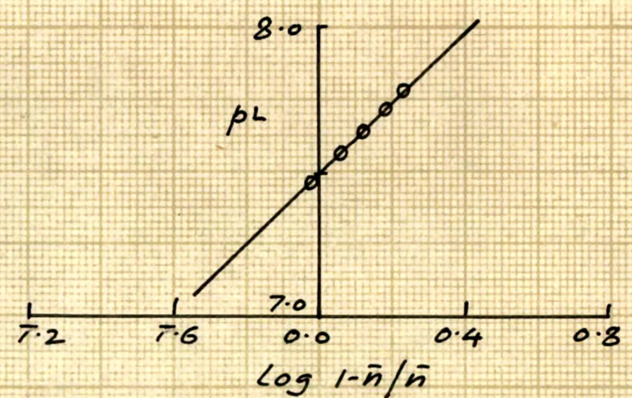

Table IV 2.7Ba

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.IMDA N-N-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
5.60	1.91_2	4.96	5.18	0.22	0.23_0	0.52_5	8.02_7	7.50_2
5.70	1.87_2	4.98	5.25	0.27	0.28_9	0.49_1	7.97_4	7.48_3
5.80	1.83_7	5.00	5.33	0.33	0.36_0	0.25_0	7.83_5	7.58_5
5.90	1.80_1	5.02	5.39	0.37	0.41_1	0.15_6	7.69_0	7.53_4
6.00	1.75_1	5.04	5.45	0.41	0.46_9	0.05_4	7.55_8	7.50_4
6.10	1.70_1	5.07	5.51	0.44	0.51_4	$\bar{1}.97_5$	7.42_3	7.44_8
6.20	1.65_1	5.09	5.56	0.47	0.57_0	$\bar{1}.87_7$	7.30_7	7.43_0

$\log K_{MAL} = 7.48 \pm 0.06$

Table IV 2.8Ba

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.IMDA N-N-diethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$,	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.40	1.86_0	5.03	5.27	0.24	0.25_8	0.45_9	7.72_9	7.27_0
6.50	1.84_0	5.05	5.33	0.28	0.30_4	0.35_9	7.56_9	7.21_0
6.60	1.80_1	5.07	5.40	0.33	0.36_6	0.23_8	7.42_9	7.19_1
6.70	1.80_0	5.07	5.47	0.40	0.44_4	0.09_7	7.30_6	7.20_9
6.80	1.76_0	5.09	5.54	0.45	0.51_1	$\bar{1}.98_1$	7.18_7	7.20_6
6.90	1.72_0	5.11	5.60	0.49	0.57_0	$\bar{1}.87_7$	7.07_2	7.19_5
7.00	1.68_0	5.13	5.66	0.53	0.63_1	$\bar{1}.76_7$	6.97_2	7.20_5

$\log K_{MAL} = 7.21 \pm 0.02$

Fig. IV 59 Cu(II) IMDA N-N-dimethyl
en system - 30°C.

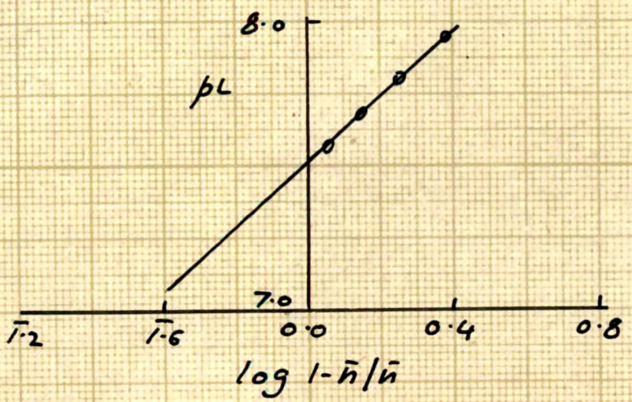

Fig. IV 60 Cu(II) IMDA N-N-diethyl
en system - 30°C.

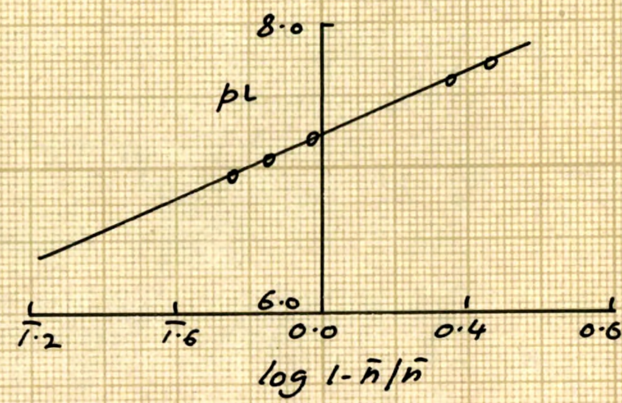

Table IV 2.1Bb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
6.70	1.78_1	5.06	5.34	0.28	0.31_5	0.33_7	6.78_4	6.44_7
6.80	1.74_1	5.09	5.41	0.32	0.37_1	0.22_9	6.65_6	6.42_7
6.90	1.68_1	5.12	5.47	0.35	0.41_7	0.14_6	6.53_2	6.38_6
7.00	1.62_1	5.15	5.53	0.38	0.46_9	0.05_3	6.42_0	6.36_7
7.10	1.56_1	5.17	5.57	0.40	0.51_3	$\bar{1}.97_8$	6.31_1	6.33_3
7.20	1.52_1	5.21	5.63	0.42	0.55_3	$\bar{1}.90_8$	6.20_7	6.29_9
7.30	1.46_1	5.24	5.68	0.44	0.60_8	$\bar{1}.80_9$	6.12_9	6.32_0

$\log K_{MAL} = 6.37 \pm 0.04$

Table IV 2.1' Bb

B, T_L^o, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA ethylenediamine system - 30°C.

B	T_L^o	V'	V"	V"-V'	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL.$\log(1-\bar{n})/\bar{n}$
5.90	0.05_4	2.79_0	2.86_0	0.07_0	0.35_0	0.26_9	6.63_5	6.36_8
5.95	0.05_4	2.80_0	2.88_0	0.08_0	0.40_0	0.17_6	6.53_8	6.36_2
6.00	0.05_5	2.81_5	2.90_5	0.09_0	0.45_0	0.08_7	6.44_1	6.35_4
6.05	0.05_5	2.82_5	2.92_5	0.10_0	0.50_0	0.00_0	6.34_4	6.34_4
6.10	0.05_5	2.84_0	2.95_0	0.11_0	0.55_0	$\bar{1}.91_3$	6.24_8	6.33_5
6.15	0.05_6	2.85_5	2.97_5	0.12_0	0.60_0	$\bar{1}.82_4$	6.15_3	6.32_9
6.20	0.05_6	2.87_0	3.00_0	0.13_0	0.65_0	$\bar{1}.73_1$	6.05_7	6.32_6

$\log K_{MAL} = 6.34 \pm 0.02$

Table IV 2.2Bb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA propylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
6.30	1.82_2	5.02	5.23	0.21	0.23_1	0.52_2	7.57_5	7.05_3
6.40	1.80_1	5.05	5.31	0.26	0.28_9	0.39_1	7.43_6	7.04_5
6.50	1.74_1	5.07	5.37	0.30	0.34_5	0.27_8	7.30_3	7.02_5
6.60	1.70_1	5.09	5.45	0.36	0.41_2	0.15_4	7.18_7	7.03_3
6.70	1.64_1	5.13	5.51	0.38	0.46_3	0.06_5	7.06_8	7.00_3
6.80	1.60_1	5.16	5.57	0.41	0.51_2	$\bar{1}.97_8$	6.95_8	6.98_0
6.90	1.54_1	5.20	5.62	0.42	0.54_5	$\bar{1}.92_2$	6.84_1	6.91_9
7.00	1.50_1	5.22	5.66	0.44	0.58_6	$\bar{1}.82_9$	6.74_1	6.91_2

$\log K_{MAL} = 6.99 \pm 0.04$

Table IV 2.2'Bb

B, T_L^o, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA propylenediamine system - 30°C.

B	T_L^o	V'	V"	V"-V'	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
5.60	0.05_3	2.78_5	2.85_5	0.07_0	0.35_0	0.26_9	7.33_9	7.06_1
5.65	0.05_4	2.80_0	2.88_0	0.08_0	0.40_0	0.17_6	7.23_2	7.05_6
5.70	0.05_4	2.81_0	2.90_0	0.09_0	0.45_0	0.08_7	7.13_4	7.04_7
5.75	0.05_5	2.82_5	2.92_0	0.09_5	0.47_5	0.04_3	7.03_6	6.99_3
5.80	0.05_5	2.83_5	2.94_5	0.11_0	0.55_0	$\bar{1}.91_3$	6.93_9	7.02_6
5.85	0.05_6	2.85_0	2.97_0	0.12_0	0.60_0	$\bar{1}.82_4$	6.84_2	7.01_8
5.90	0.05_6	2.86_5	2.99_5	0.13_0	0.65_0	$\bar{1}.73_1$	6.74_6	7.01_5

$\log K_{MAL} = 7.03 \pm 0.02$

Fig. IV 61 Ni(II) IMDA en system - 30°C.

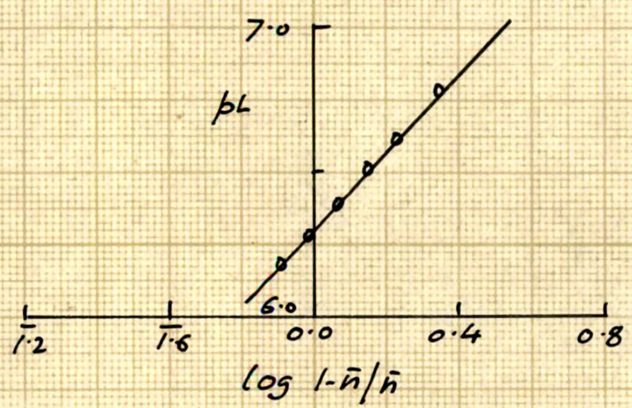

Fig. IV 62 (IInd Method)
Ni(II) IMDA en system-30°C.

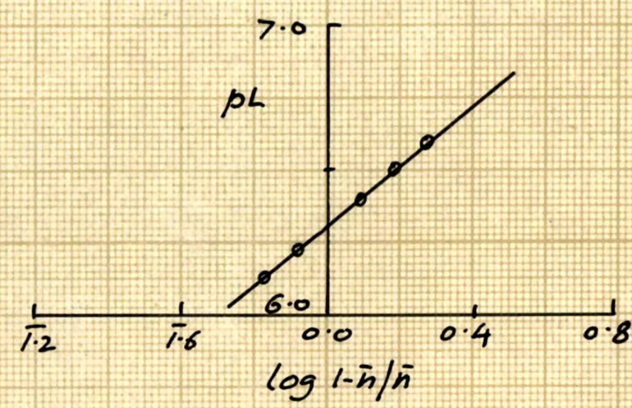

Fig. IV 63 Ni(II) IMDA pn system - 30°C.

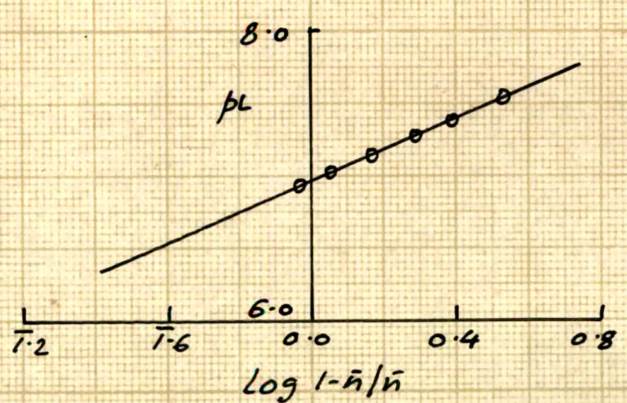

Fig. IV 64 (IInd Method)
Ni(II) IMDA pn system - 30°C.

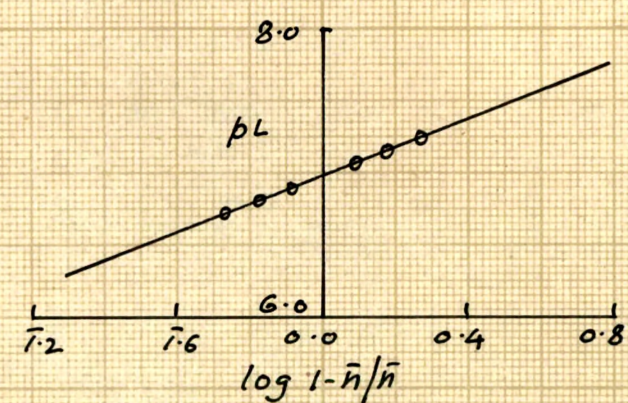

Table IV 2.3Bb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA 1,3-diaminopropane system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
8.20	1.85_0	5.07	5.33	0.26	0.28_1	0.40_8	5.98_3	5.57_5
8.30	1.80_5	5.09	5.40	0.31	0.34_3	0.28_2	5.84_5	5.56_3
8.40	1.75_0	5.11	5.47	0.36	0.41_1	0.15_6	5.71_9	5.56_3
8.50	1.70_0	5.14	5.54	0.40	0.47_0	0.05_2	5.59_6	5.54_4
8.60	1.64_0	5.18	5.60	0.42	0.51_2	$\bar{1}.97_9$	5.46_9	5.49_0
8.70	1.60_0	5.20	5.66	0.46	0.57_5	$\bar{1}.86_8$	5.37_1	5.50_3
8.80	1.50_9	5.24	5.72	0.48	0.63_6	$\bar{1}.75_7$	5.28_6	5.52_9

$\log K_{MAL} = 5.53 \pm 0.03$

Table IV 2.4Bb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA N-methyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
6.80	1.67_0	5.18	5.37	0.19	0.22_7	0.53_2	6.83_1	6.29_9
6.90	1.60_0	5.21	5.43	0.23	0.27_5	0.42_1	6.69_6	6.27_5
7.00	1.55_0	5.24	5.48	0.24	0.30_9	0.34_9	6.55_8	6.20_9
7.10	1.50_0	5.26	5.55	0.29	0.38_6	0.20_1	6.45_7	6.25_6
7.20	1.43_5	5.29	5.59	0.30	0.41_8	0.14_3	6.33_4	6.19_1
7.30	1.38_5	5.32	5.65	0.33	0.47_6	0.04_1	6.23_9	6.19_8
7.40	1.34_5	5.35	5.71	0.36	0.53_5	$\bar{1}.93_9$	6.15_5	6.21_6
7.50	1.30_5	5.38	5.75	0.37	0.56_6	$\bar{1}.88_4$	6.05_4	6.17_0

$\log K_{MAL} = 6.22 \pm 0.03$

Table IV 2.5Bb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL-$\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA N-ethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL-$\log(1-\bar{n})/\bar{n}$
7.40	1.40_5	5.27	5.50	0.23	0.32_7	0.31_3	6.49_8	6.18_5
7.50	1.36_0	5.29	5.54	0.25	0.36_8	0.23_5	6.38_7	6.15_2
7.60	1.32_5	5.32	5.58	0.26	0.39_2	0.19_0	6.27_1	6.08_0
7.70	1.29_0	5.35	5.64	0.29	0.44_9	0.08_9	6.18_6	6.09_7
7.80	1.25_5	5.37	5.68	0.31	0.49_4	0.01_0	6.09_9	6.08_9
7.90	1.22_0	5.39	5.72	0.33	0.54_1	$\bar{1}.92_8$	6.02_2	6.09_3
8.00	1.18_5	5.40	5.76	0.36	0.60_7	$\bar{1}.81_1$	5.97_3	6.16_2

$\log K_{MAL} = 6.12 \pm 0.04$

Table IV 2.6Bb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL-$\log(1-\bar{n})/\bar{n}$ data for Ni.IMDA N-N'-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL-$\log(1-\bar{n})/\bar{n}$
7.20	1.42_5	5.32	5.60	0.28	0.39_2	0.19_0	5.84_1	5.65_1
7.30	1.37_5	5.35	5.64	0.29	0.42_1	0.13_8	5.75_6	5.61_8
7.40	1.32_5	5.38	5.67	0.29	0.43_7	0.11_0	5.81_0	5.70_0
7.50	1.27_5	5.39	5.69	0.30	0.47_0	0.05_2	5.70_3	5.65_3
7.60	1.23_5	5.41	5.72	0.31	0.50_2	$\bar{1}.99_6$	5.60_6	5.71_0
7.70	1.20_0	5.43	5.75	0.32	0.53_3	$\bar{1}.94_2$	5.51_4	5.57_2
7.80	1.17_0	5.44	5.77	0.33	0.56_4	$\bar{1}.88_8$	5.42_8	5.57_0

$\log K_{MAL} = 5.63 \pm 0.05$

Fig. IV 65 Ni(II) IMDA 1,3-diamino-propane system - 30°C.

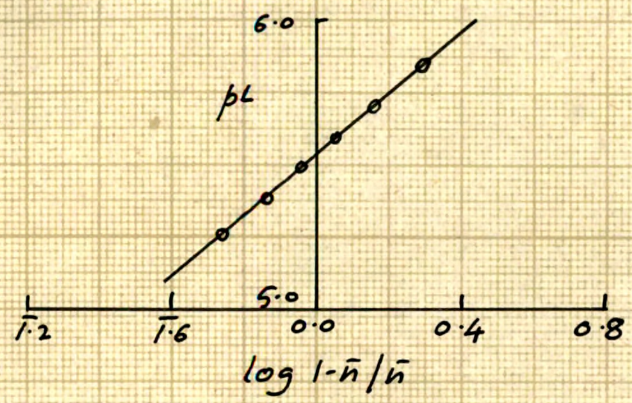

Fig. IV 66 Ni(II) IMDA N-methyl en system - 30°C.

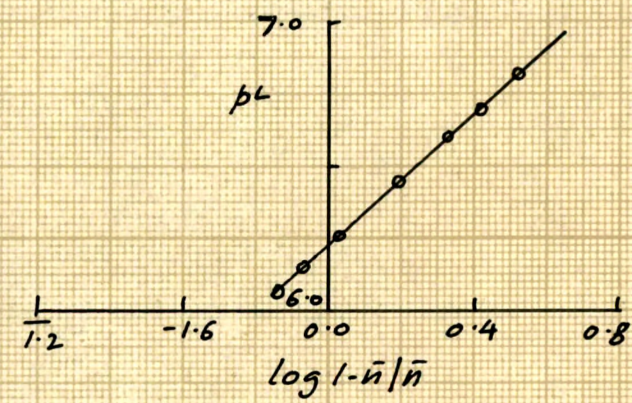

Fig. IV 67 Ni(II) IMDA N-ethyl en system - 30°C.

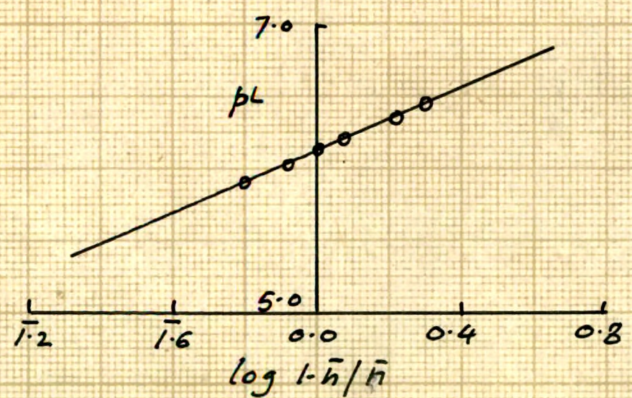

Fig. IV 68 Ni(II) IMDA N-N'-dimethyl en system - 30°C.

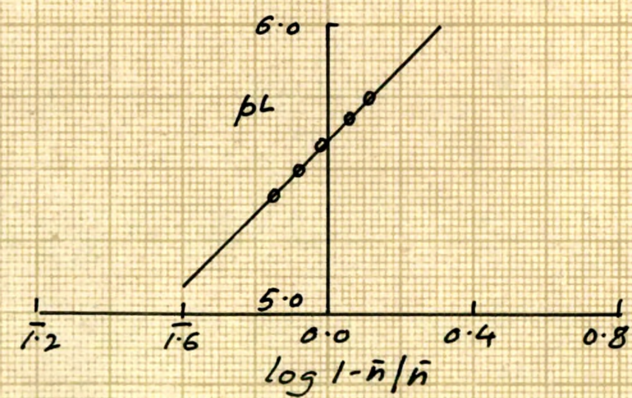

Table IV 2.7Bb

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Ni.IMDA N-N-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.90	1.32_5	5.31	5.49	0.18	0.27_2	0.42_7	6.04_6	5.61_9
7.00	1.28_5	5.34	5.54	0.20	0.31_1	0.34_5	5.94_5	5.60_0
7.10	1.25_0	5.36	5.58	0.22	0.35_2	0.26_5	5.85_0	5.58_5
7.20	1.21_5	5.37	5.61	0.24	0.39_5	0.18_5	5.76_2	5.57_7
7.30	1.19_5	5.39	5.64	0.25	0.41_8	0.14_3	5.66_4	5.52_1
7.40	1.17_0	5.41	5.68	0.27	0.46_1	0.06_8	5.58_5	5.51_7
7.50	1.14_5	5.41	5.70	0.29	0.50_6	$\bar{1}.98_9$	5.51_3	5.52_4
7.60	1.12_5	5.42	5.73	0.31	0.55_1	$\bar{1}.91_1$	5.44_4	5.53_3

$\log K_{MAL} = 5.56 \pm 0.04$

Table IV 2.8Bb

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Ni.IMDA N-N-diethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
7.90	1.26_0	5.35	5.54	0.19	0.30_1	0.36_6	5.44_0	5.07_4
8.00	1.22_0	5.38	5.59	0.21	0.34_4	0.28_0	5.34_9	5.06_9
8.10	1.18_0	5.40	5.63	0.23	0.39_0	0.19_4	5.26_0	5.07_6
8.20	1.14_0	5.42	5.66	0.24	0.42_1	0.13_8	5.18_0	5.04_2
8.30	1.12_0	5.44	5.69	0.25	0.45_4	0.08_0	5.09_6	5.01_6
8.40	1.10_0	5.45	5.71	0.26	0.47_3	0.04_7	5.01_6	4.96_9
8.50	1.08_0	5.46	5.74	0.28	0.51_8	$\bar{1}.96_8$	4.93_7	4.96_9

$\log K_{MAL} = 5.03 \pm 0.04$

Fig. IV 69 Ni(II) IMDA N-N-dimethyl en system - 30°C.

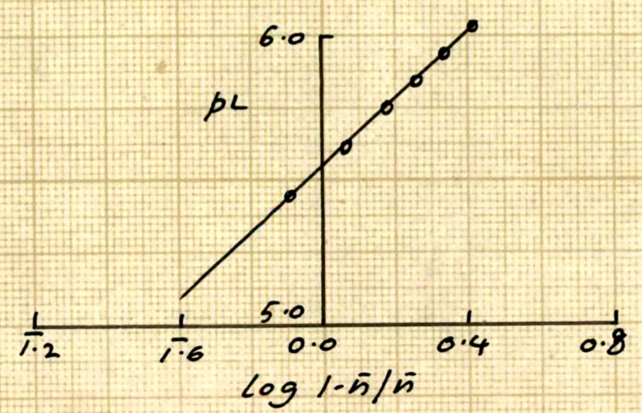

Fig. IV 70 Ni(II) IMDA N-N-diethyl en system - 30°C.

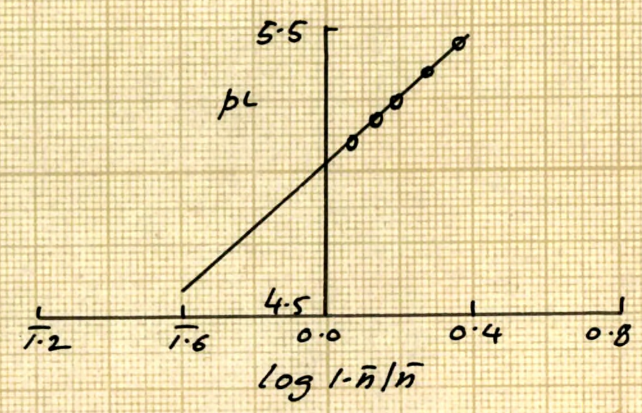

Table IV 2.1Ca

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.NTA ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.20	1.88_2	5.48	5.90	0.42	0.44_7	0.09_2	7.76_8	7.67_6
6.25	1.86_2	5.49	5.94	0.45	0.48_4	0.02_8	7.70_6	7.67_8
6.30	1.84_2	5.50	5.97	0.47	0.51_1	$\bar{1}.98_1$	7.63_7	7.65_6
6.35	1.82_2	5.51	6.00	0.49	0.53_8	$\bar{1}.93_3$	7.57_2	7.63_9
6.40	1.80_2	5.52	6.04	0.52	0.57_8	$\bar{1}.88_3$	7.52_0	7.63_7
6.45	1.80_2	5.53	6.06	0.53	0.58_9	$\bar{1}.84_3$	7.44_3	7.60_0
6.50	1.78_2	5.54	6.09	0.55	0.61_8	$\bar{1}.80_6$	7.40_7	7.60_1

$\log K_{MAL} = 7.64 \pm 0.03$

Table IV 2.2Ca

B. $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Cu.NTA propylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
5.95	1.88_3	5.46	5.89	0.43	0.45_7	0.07_4	8.37_0	8.29_6
6.00	1.90_3	5.47	5.94	0.47	0.49_4	0.00_9	8.30_8	8.29_9
6.05	1.88_2	5.47	5.95	0.48	0.51_1	$\bar{1}.98_1$	8.22_9	8.25_8
6.10	1.88_2	5.48	6.00	0.52	0.55_3	$\bar{1}.90_7$	8.17_7	8.27_0
6.15	1.86_2	5.48	6.01	0.53	0.57_0	$\bar{1}.87_7$	8.10_2	8.22_5
6.20	1.84_2	5.50	6.06	0.56	0.60_9	$\bar{1}.80_7$	8.05_3	8.24_6
6.25	1.84_2	5.50	6.08	0.58	0.63_0	$\bar{1}.76_8$	7.98_9	8.22_1

$\log K_{MAL} = 8.25 \pm 0.03$

Table IV 2.3Ca

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.NTA 1,3-diaminopropane system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.50	2.00_0	5.46	5.83	0.37	0.37_0	0.27_1	7.36_8	7.09_7
7.55	2.00_0	5.46	5.85	0.39	0.39_0	0.19_4	7.28_5	7.09_1
7.60	2.00_0	5.46	5.89	0.43	0.43_0	0.12_2	7.21_8	7.09_6
7.65	2.00_0	5.47	5.92	0.45	0.45_9	0.08_7	7.13_6	7.04_9
7.70	1.99_0	5.47	5.96	0.49	0.49_3	0.01_2	7.07_6	7.06_4
7.75	1.98_0	5.47	5.99	0.52	0.52_5	$\bar{1}.95_6$	7.00_8	7.05_2
7.80	1.97_0	5.48	6.04	0.56	0.56_9	$\bar{1}.87_9$	6.94_9	7.07_0
7.85	1.96_0	5.49	6.07	0.58	0.59_2	$\bar{1}.83_8$	6.88_4	7.04_6
7.90	1.95_0	5.50	6.10	0.60	0.61_5	$\bar{1}.79_6$	6.81_5	7.01_9

$\log K_{MAL} = 7.06 \pm 0.02$

Table IV 2.4Ca

B, $\bar{n}_H$, $\bar{n}$, $\log(1.\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.NTA N-methyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
6.20	1.91_0	5.49	5.77	0.28	0.29_3	0.38_2	7.94_8	7.56_6
6.30	1.88_5	5.51	5.85	0.34	0.36_1	0.24_8	7.80_5	7.55_7
6.40	1.84_5	5.53	5.93	0.40	0.43_4	0.11_5	7.67_3	7.55_8
6.50	1.81_0	5.56	6.00	0.44	0.48_6	0.02_4	7.53_4	7.51_0
6.60	1.76_5	5.59	6.09	0.50	0.56_6	$\bar{1}.88_4$	7.43_0	7.54_6
6.70	1.72_0	5.61	6.14	0.53	0.61_6	$\bar{1}.79_4$	7.31_0	7.51_6
6.80	1.67_0	5.65	6.20	0.55	0.65_9	$\bar{1}.71_4$	7.19_3	7.47_9

$\log K_{MAL} = 7.53 \pm 0.03$

Fig. IV 71 Cu(II) NTA en system-30°C.

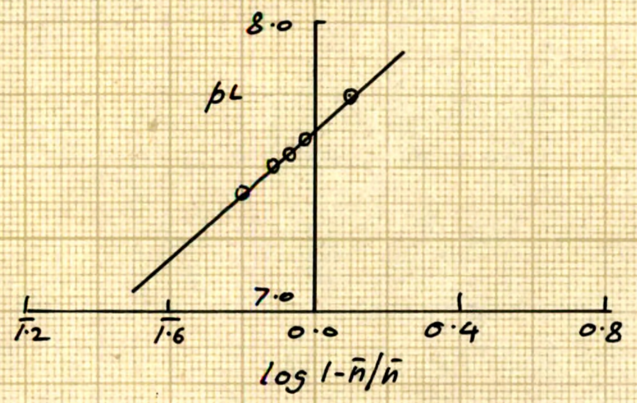

Fig. IV 72 Cu(II) NTA pn system-30°C.

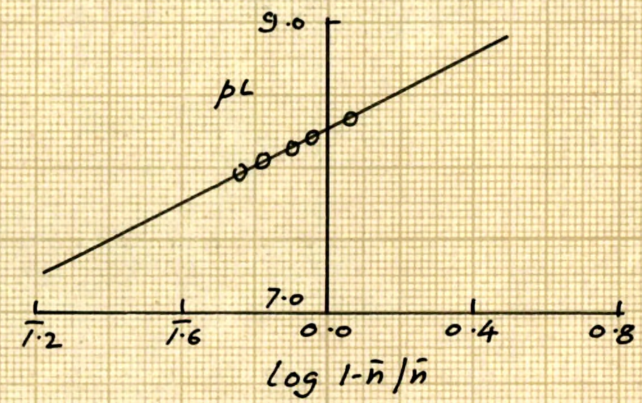

Fig. IV 73 Cu(II) NTA 1,3-diamino-propane system - 30°C.

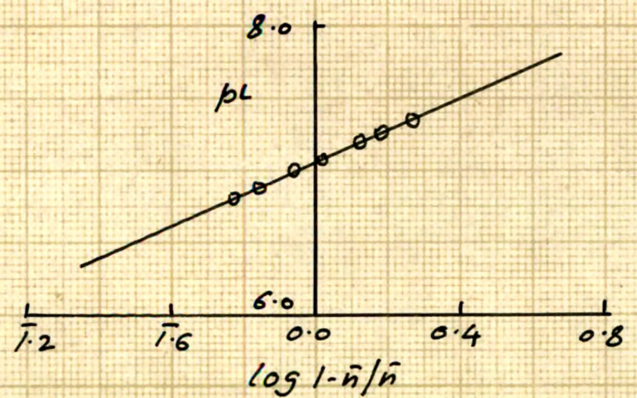

Fig. IV 74 Cu(II) NTA N-methyl en system - 30°C.

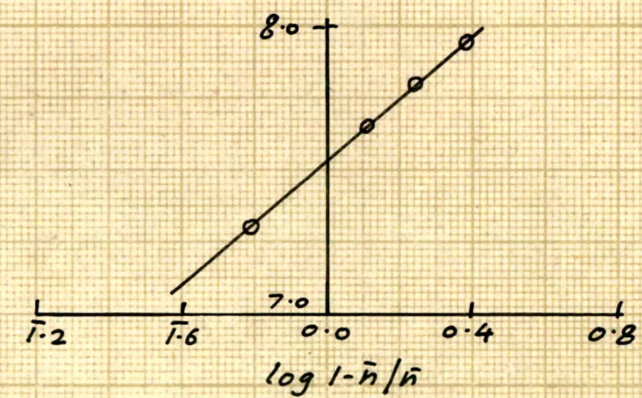

Table IV 2.5Ca

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.NTA N-ethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.00	1.64_5	5.73	6.07	0.34	0.41_3	0.18_2	7.17_4	6.99_2
7.05	1.62_0	5.74	6.09	0.35	0.43_2	0.11_9	7.10_7	6.98_8
7.10	1.60_0	5.75	6.11	0.36	0.44_9	0.08_9	7.04_0	6.95_1
7.15	1.56_0	5.76	6.13	0.37	0.47_4	0.04_5	6.98_2	6.93_7
7.20	1.54_0	5.77	6.15	0.38	0.49_3	0.01_2	6.92_1	6.90_9
7.25	1.50_0	5.78	6.16	0.38	0.50_6	$\bar{1}.98_9$	6.85_6	6.86_7
7.30	1.46_5	5.79	6.19	0.40	0.54_6	$\bar{1}.92_0$	6.81_9	6.89_9

$\log K_{MAL} = 6.93 \pm 0.03$

Table IV 2.6Ca

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.NTA N-N'-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
6.60	1.73_0	5.69	5.94	0.25	0.28_8	0.39_3	6.92_7	6.53_4
6.70	1.68_5	5.70	5.99	0.29	0.34_4	0.28_0	6.79_1	6.51_1
6.80	1.63_0	5.73	6.05	0.32	0.39_2	0.19_0	6.65_9	6.46_9
6.90	1.59_5	5.75	6.10	0.35	0.43_8	0.10_8	6.53_2	6.42_4
7.00	1.53_5	5.77	6.15	0.38	0.49_4	0.00_8	6.42_3	6.41_5
7.10	1.47_5	5.79	6.19	0.40	0.54_2	$\bar{1}.92_7$	6.31_5	6.38_8
7.20	1.42_5	5.81	6.23	0.42	0.58_9	$\bar{1}.84_3$	6.21_8	6.37_5

$\log K_{MAL} = 6.44 \pm 0.05$

Table IV 2.7Ca

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.NTA N-N-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
5.80	1.83_7	5.54	5.77	0.23	0.25_0	0.47_7	7.77_0	7.29_3
5.90	1.80_1	5.56	5.83	0.27	0.30_0	0.36_8	7.61_9	7.25_1
6.00	1.75_1	5.58	5.90	0.32	0.36_5	0.24_0	7.48_4	7.24_4
6.10	1.70_1	5.60	5.95	0.35	0.41_1	0.15_6	7.34_3	7.18_7
6.20	1.65_1	5.62	6.01	0.39	0.47_3	0.04_7	7.22_3	7.17_6
6.30	1.59_6	5.65	6.08	0.43	0.53_9	$\bar{1}.93_2$	7.11_7	7.18_5
6.40	1.54_6	5.67	6.13	0.46	0.59_5	$\bar{1}.83_3$	7.01_5	7.18_2
6.50	1.50_0	5.70	6.18	0.48	0.64_0	$\bar{1}.75_0$	6.91_4	7.16_4

$\log K_{MAL} = 7.21 \pm 0.04$

Table IV 2.8Ca

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Cu.NTA N-N-diethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})\bar{n}$
7.40	1.40_0	5.80	6.04	0.24	0.34_3	0.28_2	6.11_3	5.83_1
7.50	1.36_0	5.83	6.09	0.26	0.38_2	0.20_9	6.00_0	5.79_1
7.60	1.32_0	5.86	6.14	0.28	0.42_4	0.13_3	5.89_9	5.76_6
7.70	1.26_0	5.89	6.19	0.30	0.47_6	0.04_1	5.81_2	5.77_1
7.80	1.22_0	5.91	6.24	0.33	0.54_0	$\bar{1}.95_8$	5.73_0	5.77_2
7.90	1.18_0	5.93	6.27	0.34	0.57_6	$\bar{1}.86_7$	5.66_0	5.79_3
8.00	1.14_0	5.96	6.32	0.36	0.63_1	$\bar{1}.76_7$	5.60_0	5.83_3

$\log K_{MAL} = 5.79 \pm 0.02$

Fig. IV 75 Cu(II) NTA N-ethyl en system - 30°C.

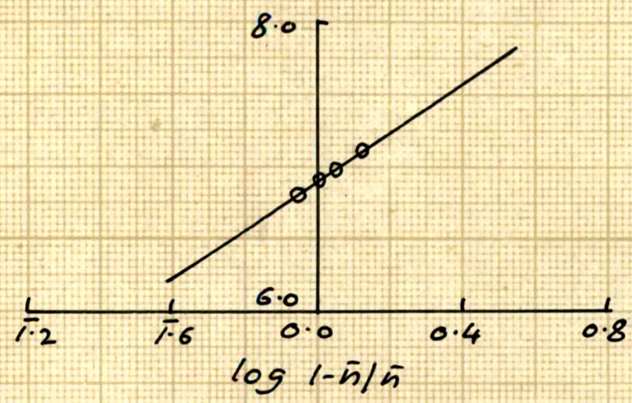

Fig. IV 76 Cu(II) NTA N-N'-dimethyl en system - 30°C.

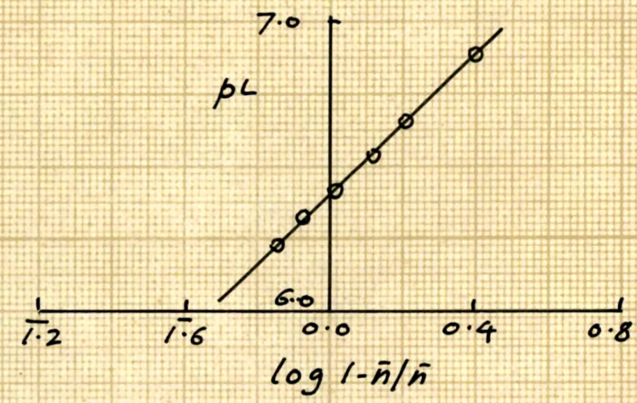

Fig. IV 77 Cu(II) NTA N-N-dimethyl en system - 30°C.

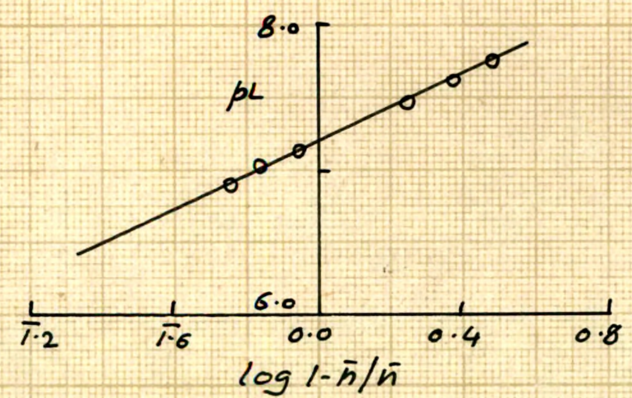

Fig. IV 78 Cu(II) NTA N-N-diethyl en system - 30°C.

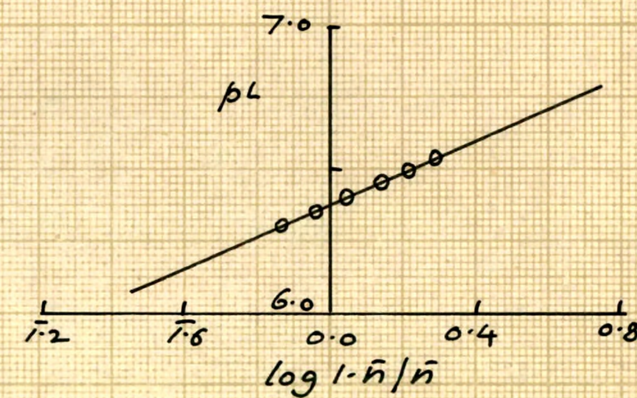

Table IV 2.1Cb

B, $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Ni.NTA ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.60	1.76_1	5.56	5.76	0.20	0.22_7	0.53_1	6.90_4	6.37_3
6.70	1.74_1	5.58	5.82	0.24	0.27_6	0.41_9	6.76_3	6.34_4
6.80	1.70_1	5.61	5.90	0.29	0.34_1	0.28_5	6.64_1	6.35_6
6.90	1.64_1	5.64	5.97	0.33	0.40_2	0.17_2	6.52_5	6.35_3
7.00	1.60_0	5.67	6.04	0.37	0.46_2	0.06_6	6.41_8	6.35_2
7.10	1.54_0	5.70	6.10	0.40	0.51_9	$\bar{1}.96_6$	6.32_1	6.35_5
7.20	1.50_0	5.73	6.17	0.44	0.58_2	$\bar{1}.85_6$	6.24_1	6.38_5

$\log K_{MAL} = 6.36 \pm 0.01$

Table IV 2.2Cb

B. $\bar{n}_H$, $\bar{n}$, log(1-$\bar{n}$)/$\bar{n}$, pL and pL-log(1-$\bar{n}$)/$\bar{n}$ data for Ni.NTA propylenediamine system -system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	log(1-$\bar{n}$)/$\bar{n}$	pL	pL-log(1-$\bar{n}$)/$\bar{n}$
6.40	1.78_2	5.53	5.76	0.23	0.25_8	0.45_3	7.42_2	6.96_4
6.50	1.76_1	5.55	5.83	0.28	0.31_8	0.33_0	7.28_9	6.95_9
6.60	1.68_1	5.57	5.89	0.32	0.38_1	0.21_0	7.16_8	6.95_8
6.70	1.66_1	5.61	5.98	0.37	0.44_6	0.09_4	7.05_8	6.96_4
6.80	1.62_1	5.65	6.05	0.40	0.49_4	0.01_1	6.94_5	6.93_4
6.90	1.56_1	5.68	6.12	0.44	0.56_4	$\bar{1}.88_8$	6.86_3	6.97_5
7.00	1.50_0	5.71	6.17	0.46	0.61_3	$\bar{1}.79_9$	6.77_5	6.97_6

$\log K_{MAL} = 6.96 \pm 0.01$

Table IV 2.3Cb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.NTA 1,3-diaminopropane system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
8.30	1.80_5	5.59	5.79	0.20	0.22_1	0.54_7	5.77_4	5.22_7
8.40	1.75_0	5.62	5.86	0.24	0.27_4	0.42_3	5.63_1	5.20_8
8.50	1.70_0	5.65	5.93	0.28	0.32_9	0.30_9	5.49_7	5.18_8
8.60	1.64_0	5.68	6.00	0.32	0.39_0	0.19_4	5.37_5	5.18_1
8.70	1.60_0	5.72	6.08	0.36	0.44_9	0.08_9	5.25_8	5.16_9
8.80	1.50_9	5.76	6.16	0.40	0.52_9	$\bar{1}.94_9$	5.17_7	5.22_8
8.90	1.44_9	5.81	6.24	0.43	0.59_3	$\bar{1}.83_6$	5.09_4	5.25_8

$\log K_{MAL} = 5.21 \pm 0.03$

Table IV 2.4Cb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.NTA N-methyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.00	1.55_0	5.69	5.94	0.25	0.32_2	0.32_3	6.56_8	6.24_5
7.10	1.50_0	5.72	6.02	0.30	0.40_0	0.17_6	6.47_1	6.29_5
7.20	1.43_5	5.75	6.08	0.33	0.46_0	0.06_9	6.37_0	6.30_1
7.30	1.38_5	5.78	6.13	0.35	0.50_5	$\bar{1}.99_1$	6.26_7	6.27_6
7.40	1.34_5	5.80	6.17	0.37	0.55_0	$\bar{1}.91_3$	6.17_3	6.26_0
7.50	1.30_5	5.83	6.21	0.38	0.58_2	$\bar{1}.85_6$	6.07_4	6.21_8
7.60	1.27_5	5.85	6.25	0.40	0.62_7	$\bar{1}.77_4$	5.99_7	6.22_3

$\log K_{MAL} = 6.28 \pm 0.02$

Fig. IV 79 Ni(II) NTA en system - 30°C.

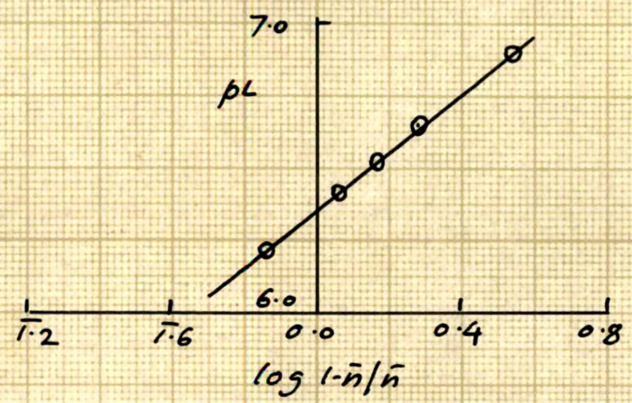

Fig. IV 80 Ni(II) NTA pn system - 30°C.

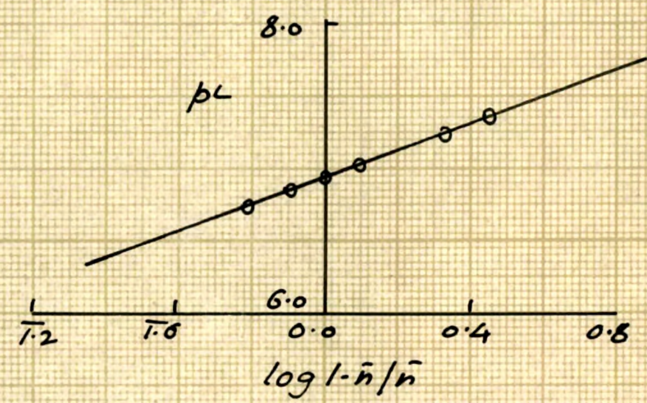

Fig. IV 81 Ni(II) NTA 1,3-diamino-propane system - 30°C.

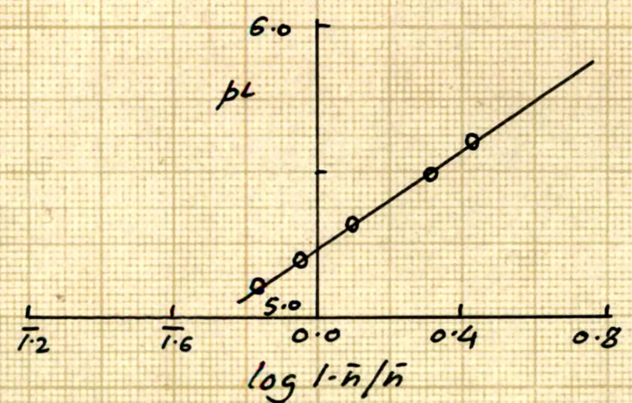

Fig. IV 82 Ni(II) NTA N-methyl en system - 30°C.

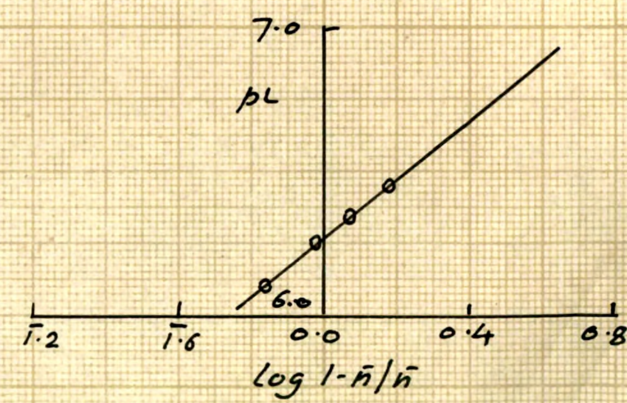

Table IV 2.5Cb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.NTA N-ethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.60	1.32_5	5.87	6.06	0.19	0.28_6	0.39_7	6.20_5	5.80_8
7.70	1.29_0	5.90	6.11	0.21	0.32_5	0.31_7	6.10_2	5.78_5
7.80	1.25_5	5.91	6.15	0.24	0.38_2	0.20_9	6.01_6	5.80_7
7.90	1.22_0	5.93	6.19	0.26	0.42_6	0.12_9	5.92_8	5.79_9
8.00	1.18_5	5.94	6.22	0.28	0.47_2	0.04_8	5.84_8	5.80_0
8.10	1.15_5	5.96	6.25	0.29	0.50_2	$\bar{1}.99_6$	5.76_0	5.76_4
8.20	1.13_0	5.98	6.29	0.31	0.54_8	$\bar{1}.91_6$	5.69_1	5.77_5
8.30	1.11_0	5.99	6.31	0.32	0.57_6	$\bar{1}.86_7$	5.61_0	5.74_3
8.40	1.09_5	6.00	6.34	0.34	0.62_0	$\bar{1}.78_7$	5.55_0	5.76_3

$\log K_{MAL} = 5.78 \pm 0.02$

Table IV 2.6Cb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.NTA N-N'-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
7.70	1.20_0	5.93	6.12	0.19	0.31_6	0.34_5	5.35_1	5.00_6
7.80	1.17_0	5.94	6.16	0.22	0.37_6	0.22_0	5.27_5	5.05_5
7.90	1.14_0	5.96	6.20	0.24	0.42_0	0.14_0	5.19_3	5.05_3
8.00	1.11_0	5.98	6.23	0.25	0.45_0	0.08_7	5.10_5	5.01_8
8.10	1.08_5	6.00	6.26	0.26	0.47_6	0.04_1	5.01_5	4.97_4
8.20	1.06_5	6.02	6.29	0.27	0.50_6	$\bar{1}.98_9$	4.93_6	4.94_7
8.30	1.04_5	6.03	6.32	0.29	0.55_4	$\bar{1}.90_6$	4.87_5	4.96_9
8.40	1.02_5	6.04	6.34	0.30	0.58_5	$\bar{1}.85_1$	4.80_2	4.95_1

$\log K_{MAL} = 4.99 \pm 0.04$

Table IV 2.7Cb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.NTA N-N-dimethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
6.80	1.36_0	5.78	5.98	0.20	0.29_4	0.38_0	6.19_5	5.81_5
6.90	1.32_5	5.80	6.02	0.22	0.32_3	0.32_1	6.08_3	5.76_2
7.00	1.28_5	5.83	6.07	0.24	0.37_3	0.22_5	5.99_0	5.76_5
7.10	1.25_0	5.85	6.11	0.26	0.40_5	0.16_7	5.89_2	5.72_5
7.20	1.21_5	5.86	6.14	0.28	0.44_8	0.09_0	5.80_6	5.71_6
7.30	1.19_5	5.87	6.18	0.31	0.51_9	$\bar{1}.96_7$	5.75_1	5.78_4
7.40	1.17_0	5.88	6.21	0.33	0.56_4	$\bar{1}.88_8$	5.68_2	5.79_4
7.50	1.14_5	5.90	6.25	0.35	0.61_1	$\bar{1}.80_4$	5.62_1	5.81_7

$\log K_{MAL} = 5.77 \pm 0.03$

Table IV 2.8Cb

B, $\bar{n}_H$, $\bar{n}$, $\log(1-\bar{n})/\bar{n}$, pL and pL$-\log(1-\bar{n})/\bar{n}$ data for Ni.NTA N-N-diethyl ethylenediamine system - 30°C.

B	$\bar{n}_H$	V"	V"'	V"'-V"	$\bar{n}$	$\log(1-\bar{n})/\bar{n}$	pL	pL$-\log(1-\bar{n})/\bar{n}$
8.50	1.01_9	6.02	6.17	0.15	0.29_4	0.38_0	4.77_4	4.39_4
8.60	1.01_9	6.04	6.21	0.17	0.33_3	0.30_1	4.69_4	4.39_3
8.70	0.97_9	6.06	6.25	0.19	0.38_8	0.19_8	4.62_8	4.43_0
8.80	0.95_9	6.08	6.28	0.20	0.41_6	0.14_7	4.54_6	4.39_9
8.90	0.95_9	6.09	6.31	0.22	0.45_8	0.07_3	4.47_6	4.40_3
9.00	0.93_8	6.12	6.35	0.23	0.48_9	0.01_9	4.40_0	4.38_1
9.10	0.93_8	6.14	6.39	0.25	0.53_2	$\bar{1}.94_4$	4.33_7	4.39_3

$\log K_{MAL} = 4.40 \pm 0.01$

Fig. IV 83 Ni(II) NTA N-ethyl en system - 30°C.

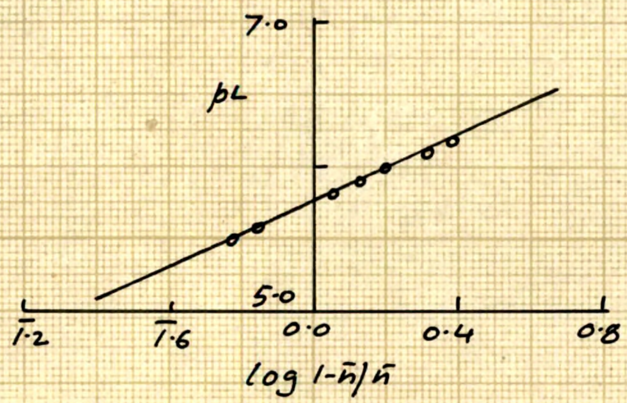

Fig. IV 84 Ni(II) NTA N-N'-dimethyl en system - 30°C.

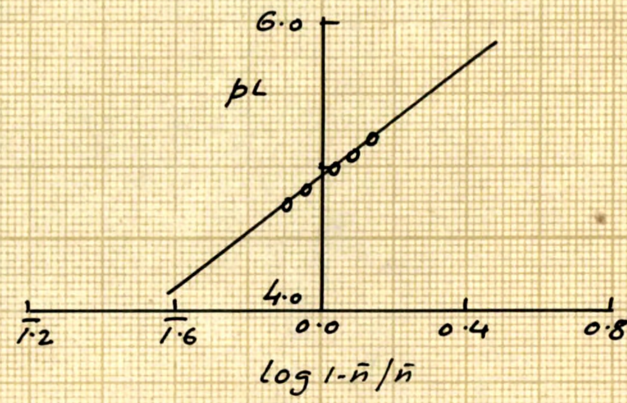

Fig. IV 85 Ni(II) NTA N-N-dimethyl en system - 30°C.

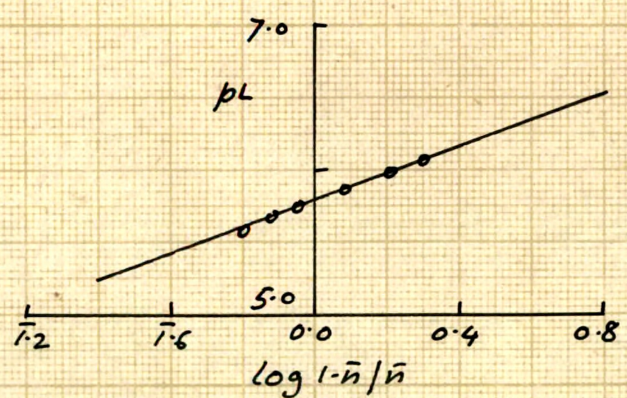

Fig. IV 86 Ni(II) NTA N-N-diethyl en system - 30°C.

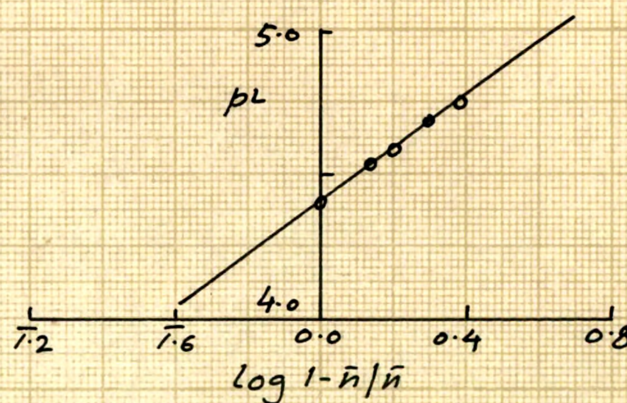

Table IV 3.0

Logarithms of stability constants of ternary Histidine-Ni^{2+}-ligand complexes, IMDA-M^{2+}-ligand complexes, NTA-M^{2+}-ligand complexes by method I

Ligand (L)	$\log K^{Ni.Hist.}_{Ni.Hist.L}$	$\log K^{Cu.IMDA}_{Cu.IMDA.L}$	$\log K^{Ni.IMDA}_{Ni.IMDA.L}$	$\log K^{Cu.NTA}_{Cu.NTA.L}$	$\log K^{Ni.NTA}_{Ni.NTA.L}$
Ethylenediamine(en)	6.40 ± 0.05	9.06 ± 0.04	6.37 ± 0.04	7.64 ± 0.03	6.36 ± 0.01
Propylenediamine(pn)	6.64 ± 0.03	9.19 ± 0.03	6.99 ± 0.04	8.25 ± 0.03	6.96 ± 0.01
1,3-Diaminopropane	5.26 ± 0.04	7.72 ± 0.02	5.53 ± 0.03	7.06 ± 0.02	5.21 ± 0.03
N-Methyl en	6.20 ± 0.03	8.77 ± 0.03	6.22 ± 0.03	7.53 ± 0.03	6.28 ± 0.02
N-Ethyl en	6.04 ± 0.04	8.60 ± 0.03	6.12 ± 0.04	6.93 ± 0.03	5.78 ± 0.02
N-N'-Dimethyl en	5.26 ± 0.03	7.52 ± 0.04	5.63 ± 0.05	6.44 ± 0.05	4.99 ± 0.05
N-N-Dimethyl en	-	7.48 ± 0.06	5.56 ± 0.04	7.21 ± 0.04	5.77 ± 0.03
N-N-Diethyl en	-	7.21 ± 0.02	5.03 ± 0.04	5.79 ± 0.02	4.40 ± 0.01

Method II

Ligand (L)	$\log K^{Ni.Hist.}_{Ni.Hist.L}$	$\log K^{Cu.IMDA.}_{Cu.IMDA.L}$	$\log K^{Ni.IMDA.}_{Ni.IMDA.L}$
Ethylenediamine(en)	6.48 ± 0.04	9.07 ± 0.03	6.34 ± 0.02
Propylenediamine(pn)	6.70 ± 0.04	9.28 ± 0.02	7.03 ± 0.02

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