

pH INDICATORS (SOLIDS)

Sr.	CODE	ITEM	pH	COLOUR CHANGE
1	80001	Alizarin AR	5.8 - 7.2	Yellow - Red violet
2	26048	Alizarin red S (pH Indicator)	4.3 - 6.3 9.4 - 12.0	Brilliant yellow - Pink Brown orange - Violet
3	80002	Alizarin red S AR	4.3 - 6.3 9.4 - 12.0	Brilliant yellow - Pink Brown orange - Violet
4	44092	Alkali blue pH indicator	11.5 - 13.0	Blue - Pink violet
5	30011	Brilliant yellow indicator powder	6.4 - 9.4	Yellow - Red orange
6	80013	Bromocresol green AR pH Indicator	3.8 - 5.4	Yellowish green - Blue
7	30013	Bromocresol green sodium salt	3.8 - 5.4	Greenish yellow - Blue
8	80014	Bromocresol purple AR pH Indicator	5.2 - 6.8	Greenish yellow - Blue violet
9	30016	Bromocresol purple sodium salt	5.2 - 6.8	Greenish yellow - Blue violet
10	80015	Bromophenol blue AR pH Indicator	3.0 - 4.6	Greenish yellow - Blue violet
11	80020	Bromothymol blue AR pH Indicator	5.8 - 7.6	Yellow - Blue
12	30021	Bromothymol blue sod. salt WS pH Ind.	5.8 - 7.6	Yellow - Blue
13	30025	Congo red pH Indicator	3.0 - 5.2	Violet - Red orange
14	30026	o-Cresol phthalein	8.2 - 9.8	Colourless - Violet red
15	30028	m-Cresol purple pH Indicator	1.2 - 2.8 7.4 - 9.0	Pink - Yellow Brownish yellow - Violet
16	80029	Cresol red AR pH Indicator	0.5 - 2.5 6.5 - 8.5	Pink - Brownish yellow Yellow - Purple
17	36133	Crystals violet pH Indicator	0.0 - 1.8	Yellow - Blue violet
18	36133	Dimethyl yellow MS & pH Indicator	0.0 - 1.8	Yellow - Blue violet
19	30037	Dimethyl yellow pH Indicator	3.0 - 4.0	Pink - Brownish yellow
20	20909	2,4-Dinitrophenol pH Indicator	2.8 - 4.0	Colourless - Greenish yellow
21	30053	Lacmoid pH Indicator	4.0 - 6.0	Orange red - Violet
22	30059	Litmus EP pH Indicator	5.0 - 8.0	Red - Blue
23	30063	Metanil yellow pH Indicator	1.2 - 3.2	Red - Yellow
24	80063	Metanil yellow AR	1.2 - 3.2	Red - Yellow
25	30065	Methyl orange Indicator solution	3.1 - 4.4	Pink - Orange yellow
26	30067	Methyl red pH Indicator	4.5 - 6.2	Red violet - Brownish yellow
27	80070	Methyl red thymol blue AR	4.0 - 10.0	Red - Yellow - Blue
28	30076	α -naphtholphthalein pH Indicator	7.1 - 8.3	Pink brown - Blue
29	20075	1-Naphthol benzein	8.5 - 9.8	Yellow - Green
30	20897	3-Nitrophenol pH Indicator	6.6 - 8.6	Almost colourless - Yellow
31	80077	β -Naphthol violet	10.0 - 12.0	Yellow - Violet
32	80078	Neutral red AR (pH Indicator)	6.8 - 8.0	Violet red - Orange yellow
33	30082	4-Nitrophenol	5.4 - 7.5	Colourless - Yellow
34	30089	Phenolphthalein powder	8.2 - 9.8	Colourless - Red violet
35	30088	Phenolphthalein (powder) pH Indicator	8.2 - 9.8	Colourless - Red violet
36	80090	Phenol red powder AR	1.2 - 3.0 6.5 - 8.0	Brownish orange - Yellow Brownish yellow - Red violet
37	30091	Phenol red sod.salt (WS) pH Indicator	1.2 - 3.0 6.5 - 8.0	Brownish orange - Yellow Brownish orange - red violet
38	30093	Phenol violet	8.0 - 10.0	Yellow - Violet
39	80113	Thymol blue AR powder	1.2 - 2.8 7.8 - 9.5	Violet red - Brownish yellow Greenish yellow - Blue
40	30114	Thymol blue sod.salt pH Indicator	1.2 - 2.8 7.8 - 9.5	Violet red - Brownish yellow Greenish yellow - Blue
41	80116	Thymolphthalein AR pH Indicator	9.3 - 10.5	Colourless - Blue
42	30118	Thymol violet pH Indicator	9.0 - 13.0	Yellow - Green - Violet
43	80119	Titan yellow AR pH Indicator	12.0 - 13.0	Yellow - red
44	30120	Tropeolin O pH Indicator	11.1 - 12.7	Yellow - Orange
45	30122	Tropeolin OOO pH Indicator	11.0 - 13.0	Yellow - Red
46	80125	p-Xylenol blue AR	1.2 - 2.8 8.0 - 9.6	Red - Yellow Yellow - Blue

pH INDICATORS (SOLUTIONS)

Sr.	CODE	ITEM	pH / COLOUR CHANGE
1	31006	Bromophenol blue solution	3.0 - 4.6 Greenish yellow - Blue violet
2	31007	Bromothymol blue solution	5.8 - 7.6 Yellow - Blue
3	31004	Bromocresol green indicator soln.	3.8 - 5.4 Greenish yellow - Blue
4	31005	Bromocresol purple solution	5.2 - 6.8 Greenish yellow - Blue violet
5	31009	Congo red indicator solution	3.0 - 5.2 Violet - Orange red
6	31013	Cresol red indicator solution	6.5 - 8.5 Yellow - Purple
7	31020	Methyl orange indicator solution	3.1 - 4.4 Pink - Orange yellow
8	81083	Methyl purple solution AR	4.8 - 5.6 Purple - Green
9	31022	Methyl red pH indicator solution	4.5 - 6.2 Red violet - Brownish yellow
10	31027	Neutral red indicator solution	6.8 - 8.0 Violet red - Orange yellow
11	31030	Phenol red indicator solution	1.2 - 3.0 Brownish orange - Yellow 6.5 - 8.0 Brownish yellow - red violet
12	31028	Phenolphthalein indicator solution	8.3 - 10.0 Colourless - Red Violet
13	31031	Thymol blue solution (pH indicator)	1.2 - 2.8 Violet red - Brownish yellow 7.8 - 9.5 Greenish yellow - Blue
14	31032	Thymolphthalein solution	9.3 - 10.5 Colourless - Blue
15	31047	Universal indicator 1-10 soln.	pH 1 Red pH 6 Yellow pH 2 Rose pH 7 Yellow green pH 3 Orange red pH 8 Green pH 4 Orange pH 9 Blue violet pH 5 Yellow orange pH 10 Violet
16	31049	Universal indicator 4-11 soln.	pH 4 Red pH 7.5 Green pH 5.0 Orange red pH 8.5 Greenish blue pH 5.5 Orange yellow pH 9.0 Blue pH 6.0 Yellow pH 9.5 Bright blue pH 6.5 Greenish yellow pH 10.0 Violet pH 7.0 Light green pH 11.0 Deeper reddish violet

USEFUL SOLVENTS CHARACTERISTICS

Solvent	Boiling point (°C) (760 mmHg)	Melting point (°C)	Molecular weight (g)	Density at 20°C
Acetic acid	118	17	60	1.05
Acetic anhydride	140	-73	102	1.08
Acetone	56	-95	58	0.79
Acetonitrile	82	-44	41	0.78
Anisole	154	-38	108	0.99
Benzene	80	5.5	78	0.88
Butan-1-ol	118	-89	74	0.81
tert-Butanol	82	26	74	0.79
Carbon disulphide	46	-111	76	1.26
Carbon tetrachloride	77	-23	154	1.59
Chlorobenzene	132	-46	113	1.11
Chloroform	61	-64	119	1.49
Cyclohexane	81	6.5	84	0.78
Dibutyl ether	142	-95	130	0.77
Dibutyl phthalate	340	-35	278	1.05
Dichloromethane	40	-95	85	1.33
Diethyl ether	35	-116	74	0.71
Diethylene glycol	245	-7	106	1.11
Diethylene glycol monomethyl ether	194	-76	120	1.02
Dimethyl sulphoxide	189	18	78	1.10
Dimethylformamide	153	-60	73	0.95
1,4-Dioxane	101	12	88	1.03
Diphenyl ether	258	27	170	1.07
Ethanol	78	-114	46	0.79
Ethyl acetate	77	-84	88	0.90
Ethylene glycol (ethane-1,2-diol)	197	-26	62	1.11
Ethylene glycol dimethyl ether	83	-58	90	0.86
Ethylene glycol monomethyl ether	125	-85	76	0.96
Formamide	210 (dec.)	3	45	1.13
Formic acid	101	8	46	1.22
Glycerol	290	18	92	1.26
Hexane	69	-95	86	0.66
Mesitylene	165	-45	120	0.87
Methanol	65	-98	32	0.79
Methyl ethyl ketone	80	-87	72	0.80
Methylcyclohexane	101	-127	98	0.77
N-Methyl-2-pyrrolidone	202	-24	99	1.03
Morpholine	129	-3	87	1.00
Nitrobenzene	211	6	123	1.20
Nitromethane	101	-29	61	1.14
Pentane	36	-130	72	0.63
Propan-2-ol	82	-88	60	0.79
Propan-1-ol	97	-126	60	0.80
Pyridine	115	-42	79	0.98
Quinoline	237	-15	129	1.09
Tetrachloroethane	146	-44	168	1.59
Tetrahydrofuran	66	-109	72	0.89
Toluene	111	-95	92	0.87
Triethanolamine	335	22	149	1.13
Triethylamine	90	-115	101	0.73
Triethylene glycol	288	-4	150	1.12
Trifluoroacetic acid	72	-15	114	1.49
Water	100	0	18	1.00
Xylenes (mixed)	138-142	13°	106	0.86

Particle sizes

Approximate Millimeter	Mesh Size	Approximate Microne Size
0.010	850	10
0.020	635	20
0.038	400	38
0.045	325	45
0.053	270	53
0.063	230	63
0.075	200	75
0.090	170	90
0.106	140	106
0.125	120	125
0.150	100	150
0.180	80	180
0.212	70	212
0.250	60	250
0.300	50	300
0.355	45	355
0.425	40	425
0.500	35	500
0.600	30	600
0.710	25	710
0.850	20	850
1.000	18	1000
1.180	16	1180
1.400	14	1400
1.700	12	1700
2.000	10	2000
2.360	8	2360
2.800	7	2800
3.350	6	3350
4.000	5	4000
4.750	4	4750

Transmittance-Absorbance units

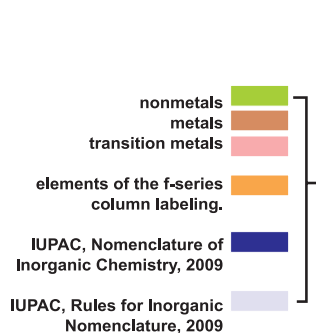
%T	A.U.	%T	A.U.
1	2.000	51	0.292
2	1.699	52	0.284
3	1.523	53	0.276
4	1.398	54	0.268
5	1.301	55	0.260
6	1.222	56	0.252
7	1.155	57	0.244
8	1.097	58	0.236
9	1.046	59	0.229
10	1.000	60	0.222
11	0.959	61	0.215
12	0.921	62	0.208
13	0.886	63	0.201
14	0.854	64	0.194
15	0.824	65	0.187
16	0.796	66	0.180
17	0.770	67	0.174
18	0.745	68	0.167
19	0.721	69	0.161
20	0.699	70	0.155
21	0.678	71	0.149
22	0.658	72	0.143
23	0.638	73	0.137
24	0.620	74	0.131
25	0.602	75	0.125
26	0.585	76	0.119
27	0.569	77	0.114
28	0.553	78	0.108
29	0.538	79	0.102
30	0.523	80	0.097
31	0.509	81	0.092
32	0.495	82	0.086
33	0.482	83	0.081
34	0.469	84	0.076
35	0.456	85	0.071
36	0.444	86	0.066
37	0.432	87	0.060
38	0.420	88	0.056
39	0.409	89	0.051
40	0.398	90	0.046
41	0.387	91	0.041
42	0.377	92	0.036
43	0.367	93	0.032
44	0.357	94	0.027
45	0.347	95	0.022
46	0.337	96	0.018
47	0.328	97	0.013
48	0.319	98	0.009
49	0.310	99	0.004
50	0.301	100	0.000

Preparation of standard solution

	Specific gravity (20°C)	Molarity (M)	Quantity required in ml to make 1 liter 1 Molar solution	Normality (N)	Quantity required in ml to make 1 liter 1 Normal solution
Glacial Acetic acid	1.05	17.4	57.5	17.4	57.5
Ammonia 30%	0.89	14.5	69.0	14.5	69.0
Ammonia 25%	0.91	13.4	74.6	13.4	74.6
Hydrochloric acid 36%	1.18	11.7	85.8	11.7	85.8
Hydrofluoric acid 40%	1.13	22.6	44.2	22.6	44.2
Hydrofluoric acid 48%	1.15	28.9	34.5	28.9	34.5
Nitric acid 70%	1.42	15.8	63.3	15.8	63.3
Perchloric acid 60%	1.54	9.2	108.7	9.2	108.7
Perchloric acid 70%	1.67	11.6	86.2	11.6	86.2
Sulphuric acid 98%	1.84	18.0	53.1	36.0	26.2
Phosphoric acid 85%	1.70	15.2	65.8	45.6	21.9

1	2
I a	II a
1 H 1.0079 -259,14 -252,87 2,2 0,084	
13,598 10 ⁻⁹	
-1,1	
1s ²	
HYDROGEN	
3 Li 6,941	4 Be 9,0122
180,54 1347 1,0 0,53 1,85	1278 2970 1,5 1,85
5,392 0,68	9,322 0,31
1 He 2s ²	2 He 2s ²
LITHIUM BERYLLIUM	
11 Na 22,990 97,81 882,9 0,97	12 Mg 24,305 648,8 1090 1,2 1,74
5,139 0,95	7,646 0,65
1 Ne 3s ²	2 Ne 3s ²
SODIUM MAGNESIUM	
19 K 39,098 77,64 0,9 0,86	20 Ca 40,078 839 1484 1,0 1,54
4,341 1,33	6,113 0,99
1 Ar 4s ²	2 Ar 4s ²
POTASSIUM CALCIUM	
37 Rb 85,468 36,89 688 0,9 1,53	38 Sr 87,62 769 1384 1,0 2,63
4,177 1,48	5,695 1,13
1 Kr 5s ²	2 Kr 5s ²
RUBIDIUM STRONTIUM	
55 Cs 132,91 28,40 678,4 0,9 1,90	56 Ba 137,33 725 1640 1,0 3,65
3,894 1,69	5,212 1,35
1 Xe 6s ²	2 Xe 6s ²
CESIUM BARIUM	
87 Fr [223,02] 27 677 0,9	88 Ra [226,03] 700 1140 1,0 5,00
1,76 5,279	1,40
1 Rn 7s ²	2 Rn 7s ²
FRANCIUM RADIUM	

- Elements 104-118 are relatively recent elements.
- Based on 2009 IUPAC Table of Standard Atomic Weights of the Elements.
- Elements for which the atomic weight is given within [brackets] have no stable nuclides and are represented by e elements' longest lived isotope reported in the IUPAC 2009 values.



Element Symbol

Atomic number

25

Mn

54,938
1244
1962
1.6
7.44

Relative atomic mass

Melting Point

Boiling Point

Electronegativity (Allred, Rochow)

Density, 20°C

Crystal Ionic Radius, A (Principal valence-state)

Ionisation Potential eV, (I-Spectra)

Oxidation states

Electron configuration

7,435
0,8

2,3,4,6,7

Ar 3d⁵4s²

MANGANESE

3	4	5	6	7	8	9	10	11	12								
III b	IV b	V b	VI b	VII b	VIII				lb	II b							
21 Sc 44,956 1541 2831 1,2 2,99	22 Ti 47,867 1660 3287 1,3 4,51	23 V 50,942 1890 3380 1,5 6,09	24 Cr 51,996 1857 2672 1,6 7,14	25 Mn 54,938 1535 1962 1,7 7,44	26 Fe 55,847 1495 2760 1,8 7,87	27 Co 58,933 1495 2870 1,8 8,89	28 Ni 58,69 1453 2732 1,9 8,91	29 Cu 63,546 1083 2567 2,0 8,92	30 Zn 65,39 418,6 907 1,7 7,14								
1 Ar 3d ⁴ 4s ²	2 Ar 3d ⁴ 4s ²	3 2,3,4,5 Ar 3d ⁴ 4s ²	4 2,3,6 Ar 3d ⁴ 4s ²	5 2,3,4,6,7 Ar 3d ⁴ 4s ²	6 2,3,6 Ar 3d ⁴ 4s ²	7 2,3 Ar 3d ⁴ 4s ²	8 2,3 Ar 3d ⁴ 4s ²	9 1,2 Ar 3d ⁴ 4s ²	10 2 Ar 3d ⁴ 4s ²								
SCANDIUM TITANIUM VANADIUM CHROMIUM MANGANESE IRON COBALT NICKEL COPPER ZINC		39 Y 88,906 1522 3338 1,1 4,47		40 Zr 91,224 1852 4377 1,2 6,51	41 Nb 92,906 2468 4742 1,2 6,51	42 Mo 95,94 2617 4877 1,3 10,28	43 Tc [98,906] 2172 3900 1,4 11,49	44 Ru 101,07 2310 3727 1,4 12,45	45 Rh 102,91 1966 3443 1,5 12,41	46 Pd 106,42 1582 3140 1,4 12,02	47 Ag 107,87 961,9 2212 1,5 10,49	48 Cd 112,41 320,9 765 1,5 8,64					
YTRITIUM ZIRCONIUM NIOBIUM MOLYBDENUM TECHNETIUM RUTHENIUM RHODIUM PALLADIUM SILVER CADMIUM		72 Hf 178,49 2227 4602 1,2 13,31		73 Ta 180,95 2996 5425 1,3 16,88	74 W 183,85 3410 5660 1,6 19,26	75 Re 186,2 3410 5827 1,6 21,03	76 Os 190,2 3045 5027 1,6 22,61	77 Ir 192,22 2410 5130 1,6 22,65	78 Pt 195,08 1064 4190 1,7 22,65	79 Au 196,97 1064 4190 1,8 19,32	80 Hg 200,59 2382 356,6 1,5 13,55						
LANTHANIDES		65 La 138,91 921 3457 1,1 6,16		66 Ce 140,12 931 3426 1,1 6,77	67 Pr 140,91 931 3512 1,1 6,77	68 Nd 144,24 1021 3068 1,1 7,00	69 Pm [146,92] 1168 2460 1,1 7,22	70 Sm 150,36 1077 1791 1,1 7,54	71 Eu 151,97 822 1597 1,1 5,25	72 Gd 157,25 1313 3266 1,1 7,89	73 Tb 158,93 1356 3123 1,1 8,25	74 Dy 162,50 1412 2562 1,1 8,56	75 Ho 164,93 1474 2695 1,1 8,78	76 Er 167,26 1497 2900 1,1 9,05	77 Tm 168,93 1545 1947 1,1 9,32	78 Yb 173,04 819 1194 1,1 6,97	79 Lu 174,97 1663 3395 1,1 9,84
ACTINIDES		89 Ac [227,03] 1050 3200 1,0 10,07		90 Th 232,04 1750 4790 1,1 11,72	91 Pa 231,04 1600 3818 1,1 15,37	92 U 238,03 1132 3902 1,2 18,97	93 Np [237,05] 640 3902 1,2 20,48	94 Pu [244,06] 641 3232 1,2 19,74	95 Am [243,06] 994 2607 1,2 13,51	96 Cm [247,07] 1340 2607 1,2 13,51	97 Bk [247,07] 1340 2607 1,2 13,51	98 Cf [251,08] 15,1 15,1	99 Es [252,08] 15,1 15,1	100 Fm [257,10] 15,1 15,1	101 Md [258,10] 15,1 15,1	102 No [259,10] 15,1 15,1	103 Lr [262,11] 15,1 15,1

LANTHANIDES
This group of elements are known as Lanthanides (Rare Earth elements). The elements are closely related as the 14 electrons are successively added to 4f orbitals. Though the leading element Lanthanum does not have 4f orbitals, its properties are characteristic of the elements of the group. The elements generally exhibit strong electropositive ionic state in M³⁺ form. The chemical properties of the Lanthanides are related to the decreasing ionic size which is popularly known as "Lanthanide contraction".

ACTINIDES
All the elements of this group are radioactive. Similar to Lanthanides, electrons are added, but with more complex order in 5f orbitals. For these elements the energy levels in the outer 5f orbitals are very close to each other. Though the Actinides have +3 as the principal valency, they also exhibit different ionic states from +3 to +6.

13	14	15	16	17	18												
III a	IV a	V a	VI a	VII a	0												
5 B 10,811 2079 2550 2,0 2,46	6 C 12,011 3367 4827 2,5 2,267	7 N 14,007 -209,86 -195,8	8 O 15,999 -218,4 -182,96	9 F 18,998 -188,14 4,1	10 Ne 20,179 -246,67 -246,05												
8,298 0,20	11,260 0,15	14,534 1,71	13,618 1,40	17,422 1,36	21,564 1,82												
3 He 2s ² 2p ¹	4 C -4,2,4 He 2s ² 2p ²	5 N -3,2,3,4,5 He 2s ² 2p ³	6 O -2,-1 He 2s ² 2p ⁴	7 F -1 He 2s ² 2p ⁵	8 Ne +1(gas) He 2s ² 2p ⁶												
BORON CARBON NITROGEN OXYGEN FLUORINE NEON		13 Al 26,982 660,37 1,5 2,70		14 Si 28,086 1410 2355 1,7 2,33	15 P 30,974 44,1 112,8 2,1 182	16 S 32,066 280 444,67 2,4 2,06	17 Cl 35,453 -100,98 -189,2	18 Ar 39,948 -185,7 -185,2									
5,986 0,50	8,151 0,41	10,486 0,34	10,360 0,29	10,967 1,81	15,759 1,54												
3 Ne 3s ² 3p ¹	4 Ne 3s ² 3p ²	5 Ne 3s ² 3p ³	6 Ne 3s ² 3p ⁴	7 Ne 3s ² 3p ⁵	8 Ne 3s ² 3p ⁶												
ALUMINIUM SILICON PHOSPHORUS SULPHUR CHLORINE ARGON		31 Ga 69,723 29,78 2403 1,8 5,91		32 Ge 72,61 937,4 2830 2,0 5,32	33 As 74,922 817 613 2,2 5,72	34 Se 78,96 217 684,9 2,5 4,82	35 Br 79,904 -7,2 58,78 2,7 3,14	36 Kr 83,80 -156,6 -152,3									
5,999 0,62	7,899 0,53	9,81 0,58	9,752 0,69	11,814 1,96	13,999 1,69												
3 Ar 3d ⁵ 4s ²	4 Ar 3d ⁵ 4s ²	5 -3,3,5 Ar 3d ⁵ 4s ²	6 -2,4,6 Ar 3d ⁵ 4s ²	7 -1,1,3,5,7 Ar 3d ⁵ 4s ²	8 +1(gas) Ar 3d ⁵ 4s ²												
GALLIUM GERMANIUM ARSENIC SELENIUM BROMINE KRYPTON		49 In 114,82 156,6 2080 1,5 7,31		50 Sn 118,71 2320 1,7 7,29	51 Sb 121,75 572 1,8 6,69	52 Te 127,60 449,5 2,0 6,25	53 I 126,90 184,4 2,0 6,25	54 Xe 131,29 -111,9 -107,1									
5,786 0,81	7,344 1,02	8,641 0,9	9,009 0,81	10,451 1,12	16,130 1,90												
3 Kr 4d ⁵ 5s ² 5p ¹	4 Kr 4d ⁵ 5s ² 5p ²	5 -3,3,5 Kr 4d ⁵ 5s ² 5p ³	6 -2,4,6 Kr 4d ⁵ 5s ² 5p ⁴	7 -1,1,3,5,7 Kr 4d ⁵ 5s ² 5p ⁵	8 +1(gas) Kr 4d ⁵ 5s ² 5p ⁶												
INDIUM TIN ANTIMONY TELLURIUM IODINE XENON		81 Tl 204,38 303,5 1457 1,4 11,85		82 Pb 207,2 327,5 1740 1,6 11,34	83 Bi 208,98 271,3 1560 1,7 9,80	84 Po [209,98] 254 962 1,8 9,20	85 At [209,98] 302 337 2,0	86 Rn [222,02] -71 -61,8 9,23									
6,108 1,44	7,416 1,20	7,289 0,96	8,42 0,65	2,27 10,748													
LANTHANIDES		65 La 138,91 921 3457 1,1 6,16		66 Ce 140,12 931 3426 1,1 6,77	67 Pr 140,91 931 3512 1,1 6,77	68 Nd 144,24 1021 3068 1,1 7,00	69 Pm [146,92] 1168 2460 1,1 7,22	70 Sm 150,36 1077 1791 1,1 7,54	71 Eu 151,97 822 1597 1,1 5,25	72 Gd 157,25 1313 3266 1,1 7,89	73 Tb 158,93 1356 3123 1,1 8,25	74 Dy 162,50 1412 2562 1,1 8,56	75 Ho 164,93 1474 2695 1,1 8,78	76 Er 167,26 1497 2900 1,1 9,05	77 Tm 168,93 1545 1947 1,1 9,32	78 Yb 173,04 819 1194 1,1 6,97	79 Lu 174,97 1663 3395 1,1 9,84
ACTINIDES		89 Ac [227,03] 1050 3200 1,0 10,07		90 Th 232,04 1750 4790 1,1 11,72	91 Pa 231,04 1600 3818 1,1 15,37	92 U 238,03 1132 3902 1,2 18,97	93 Np [237,05] 640 3902 1,2 20,48	94 Pu [244,06] 641 3232 1,2 19,74	95 Am [243,06] 994 2607 1,2 13,51	96 Cm [247,07] 1340 2607 1,2 13,51	97 Bk [247,07] 1340 2607 1,2 13,51	98 Cf [251,08] 15,1 15,1	99 Es [252,08] 15,1 15,1	100 Fm [257,10] 15,1 15,1	101 Md [258,10] 15,1 15,1	102 No [259,10] 15,1 15,1	103 Lr [262,11] 15,1 15,1

LANTHANIDES
This group of elements are known as Lanthanides (Rare Earth elements). The elements are closely related as the 14 electrons are successively added to 4f orbitals. Though the leading element Lanthanum does not have 4f orbitals, its properties are characteristic of the elements of the group. The elements generally exhibit strong electropositive ionic state in M³⁺ form. The chemical properties of the Lanthanides are related to the decreasing ionic size which is popularly known as "Lanthanide contraction".

ACTINIDES
All the elements of this group are radioactive. Similar to Lanthanides, electrons are added, but with more complex order in 5f orbitals. For these elements the energy levels in the outer 5f orbitals are very close to each other. Though the Actinides have +3 as the principal valency, they also exhibit different ionic states from +3 to +6.