ภาคผนวก

ตารางที่ 1 หน่วยของการวัด (Unit of Measurements)

ก. ค่าทางตัวเลขของคำนำหน้าที่ใช้กับหน่วย (Numerical Value of Prefices Used with Units)

Prefix	Number	Power of 10
Mega	1,000,000	1×10^{6}
Kilo	1,000	1×10^{3}
Hecto	100	1×10^{2}
Deca	10	1×10^{1}
Deci	0.1	1×10^{-1}
Centi	0.01	1×10^{-2}
Milli	0.001	1×10^{-3}
Micro	0.000001	1×10^{-6}

ข. การเปลี่ยนหน่วย และสัญญลักษณ์ (Conversion of Units and Symbols)

1 metre	= 1000 mm	Metre	m
1 cm	= 10 mm	Centimetre	cm
2.54 cm	= 1 in.	Millimetre	mm
453.6 gram	= 1 lb	Litre	l
1 gram	= 1000 mg	Millilitre	ml
1 litre	= 1000 ml	Kilogram	kg
1 ml.	= 1 cm^3	Gram	g
0.946 litre	= 1 qt	Milligram	mg

ค. สูตรการเปลี่ยนอุณหภูมิ (Temperature Conversion Formula)

$$^{o}C = \frac{(^{o}F - 32)}{1.8}$$

$$^{o}F = 1.8\ ^{o}C + 32$$

ตารางที่ 2 แฟคเตอร์ของการเปลี่ยนหน่วยทางเมตริก (Metric Conversion Factors)

Weight

1	pound	= 454 grams
2.2	pounds	= 1 kilogram
1	ounce	= 28.35 grams

Length

1	inch	= 2.54 centimeters
1	yard	= 0.914 meters
39.4	inches	= 1 meter
0.62	miles	= 1 kilometer

Volume

1	quart	= 946 milliliters
1	pint	= 473 milliliters
1	cup	= 236 milliliters
1.06	quarts	= 1 liter
1	cubic foot	= 28.3 liters

ตารางที่ 3 แอกติวิตีของโลหะบางชนิด (Activity Series of Some Metals)

Metals

Most active metals ; prepared by electrolysis	K, Ba, Ca, Na	Liberate H_2 from water
	Mg, Al	
Oxides reduced by aluminum or carbon	Mn, Zn, Cr, Fe	Liberate H_2 from acids

Metals

Oxides reduced by H_2 or CO	Cd, Ni, Sn, Pb	React slowly with acids
	H, Cu	
Oxides decomposed by heat alone; least active metals	Hg, Ag, Au, Pt	React only with strong oxidizing acids; no H_2 produced

ตารางที่ 4 หลักของการละลายทั่ว ๆ ไปของเกลือและเบส

1. NO_3^-	All nitrates are soluble.
2. $C_2H_3O_2^-$	All acetates are soluble. ($AgC_2H_3O_2$ only moderately).
3. Cl^-	All chlorides are soluble except AgCl, Hg_2Cl_2, and $PbCl_2$. ($PbCl_2$ is slightly soluble in cold water, moderately soluble in hot water).
4. SO_4^{2-}	All sulfates are soluble, except $BaSO_4$ and $PbSO_4$. ($CaSO_4$, Hg_2SO_4, and Ag_2SO_4 are slightly soluble ; the corresponding bisulfates are more soluble).
5. CO_3^{2-}, and PO_4^{3-}	All carbonates and phosphates are insoluble, except those of Na^+, K^+, and NH_4^+. (Many acid phosphates are soluble, as $Mg(H_2PO_4)_2$, and $Ca(H_2PO_4)_2$).
6. OH^-	All hydroxides are insoluble, except NaOH, KOH, and $Ba(OH)_2$. ($Ca(OH)_2$ is slightly soluble).
7. S^{2-}	All sulfides are insoluble, except those of Na^+, K^+, and NH_4^+, and those of the alkaline earths : Mg^{2+}, Ca^{2+}, Sr^{2+}, and Ba^{2+}. (Sulfides of Al^{3+} and Cr^{3+} hydrolyze and precipitate the corresponding hydroxides).
8. Na^+, K^+, NH_4^+	All salts of sodium, potassium, and ammonium are soluble, except several uncommon ones, as $Na_4Sb_2O_7$, $K_2NaCo(NO_2)_6$, $(NH_4)_2NaCo(NO_2)_6$, K_2PtCl_6, $(NH_4)_2PtCl_6$.
9. Ag^+	All silver salts are insoluble, except $AgNO_3$ and $AgClO_4$. ($AgC_2H_3O_2$ and Ag_2SO_4 are only moderately soluble).

ตารางที่ 5 น้ำหนักอะตอม (เทียบกับ ^{12}C)(Atomic Masses (relative to ^{12}c = 12.0000))

TABLE OF ATOMIC MASSES (relative to ^{12}C = 12.0000)

	Symbol	Atomic Number	Atomic Mass
Actinium	AC	89	227.0278*
Aluminum	Al	13	26.98154
Americium	Am	95	(243)
Antimony	Sb	51	121.75
Argon	Ar	18	39.948
Arscnic	As	33	74.9216
Astatine	At	85	(210)
Barium	Ba	56	137.33
Berkelium	Bk	97	(247)
Beryllium	Be	4	9.01218
Bismuth	Bi	83	208.9804
Boron	B	5	10.81
Bromine	Br	35	79.904
Cadmium	Cd	48	112.41
Calcium	Ca	20	40.08
Californium	Cf	98	(251)
Carbon	C	6	12.011
Cerium	Ce	58	140.12
Cesium	cs	55	132.9054
Chlorine	Cl	17	35.453
Chromium	Cr	24	51.996
Cobalt	co	27	58.9332
Copper	co	29	63.546
Curium	Cm	96	(247)
Dysprosium	Dy	66	162.50
Einsteinium	Es	99	(252)
Erbium	Er	68	167.26
Europium	Eu	63	151.96
Fermium	Fm	100	(257)
Fluorine	F	9	18.998403
Francium	Fr	87	(223)
Gadolimum	Gd	64	157.25
Gallium	Ga	31	69.72

Numbers in parentheses are mass numbers of the most stable isotope.
* Most commonly available long-lived Isotope.

	Symbol	Atomic Number	Atomic Mass
Praseodymium	Pr	59	140.9077
Promethium	Fm	61	(145)
Protactinium	Pa	91	231.0359
Radium	Ra	88	226.0254*
Radon	Rn	86	(222)
Rhenium	Re	75	186.207
Phodium	Rh	45	102.9055
Rubidium	Rb	37	85.4678
Ruthenium	Ru	44	101.07
Samarium	Sm	62	150.36
Scandium	SC	21	44.9559
Selenium	Se	34	78.96
Silicon	Si	14	28.0855
Silver	Ag	47	107.868
Sodium	Na	11	2%.98977
Strontium	Sr	38	87.62
Sulfur	S	16	32.06
Tantalum	Ta	73	180.9479
Technetium	TC	43	(98)
Tellurium	Te	52	127.60
Terbium	Tb	65	158.9254
Thallium	Tl	81	704.383
Thorium	Th	90	232.0381*
Thulium	Tm	69	168.9342
Tin	Sn	50	118.69
Titanium	Ti	22	47.88
Tungsten	W	74	183.85
Uranium	U	92	238.0289
Vanadium	V	23	50.9415
Xenon	Xe	54	131.29
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.9059
Zinc	Zn	30	65.38
Zirconium	Ze	40	91.22

Numbers in parentheses are mass numbers of the most stable isot
* Most commonly available long-lived isotope.

	Symbol	Atomic Number	Atomic Mass
Germanium	Ge	32	72.59
Gold	AU	79	196.9665
Hafnium	Hf	72	178.49
Helium	He	2	4.00260
Holmium	HO	67	164.9304
Hydrogen	H	1	1.0079
Indium	IN	49	114.82
Lodine	I	53	126.9045
Iridium	Ir	77	192.22
Iron	Fe	26	55.847
Krypton	Kr	36	83.80
Lanthanum	La	57	138.9055
Lawrencium	Lr	103	(260)
Lead	Pb	82	207.2
Lithium	Li	3	6.941
Lutetium	Lu	71	174.967
Magnesium	Mg	12	24.305
Manganese	Mn	25	54.9380
Mendelevium	Md	101	(258)
Mercury	Hg	80	200.59
Molybdenum	Ho	42	95.94
Neodymium	Nd	60	144.24
Neon	Ne	10	20.179
Neptunium	Np	93	237.0482*
Nickel	Ni	28	58.69
Niobium	Nb	41	92.9064
Nitrogen	N	7	14.0067
Nobelium	No	102	(259)
Osmium	OS	76	190.2
Oxygen	0	8	15.9994
Palladium	Pd	46	106.42
Phosphorus	P	15	30.97376
Platinum	Pt	78	195.08
Plutonium	Pu	94	(244)
Polonium	PO	a4	(209)
Potassium	K	19	39.0983

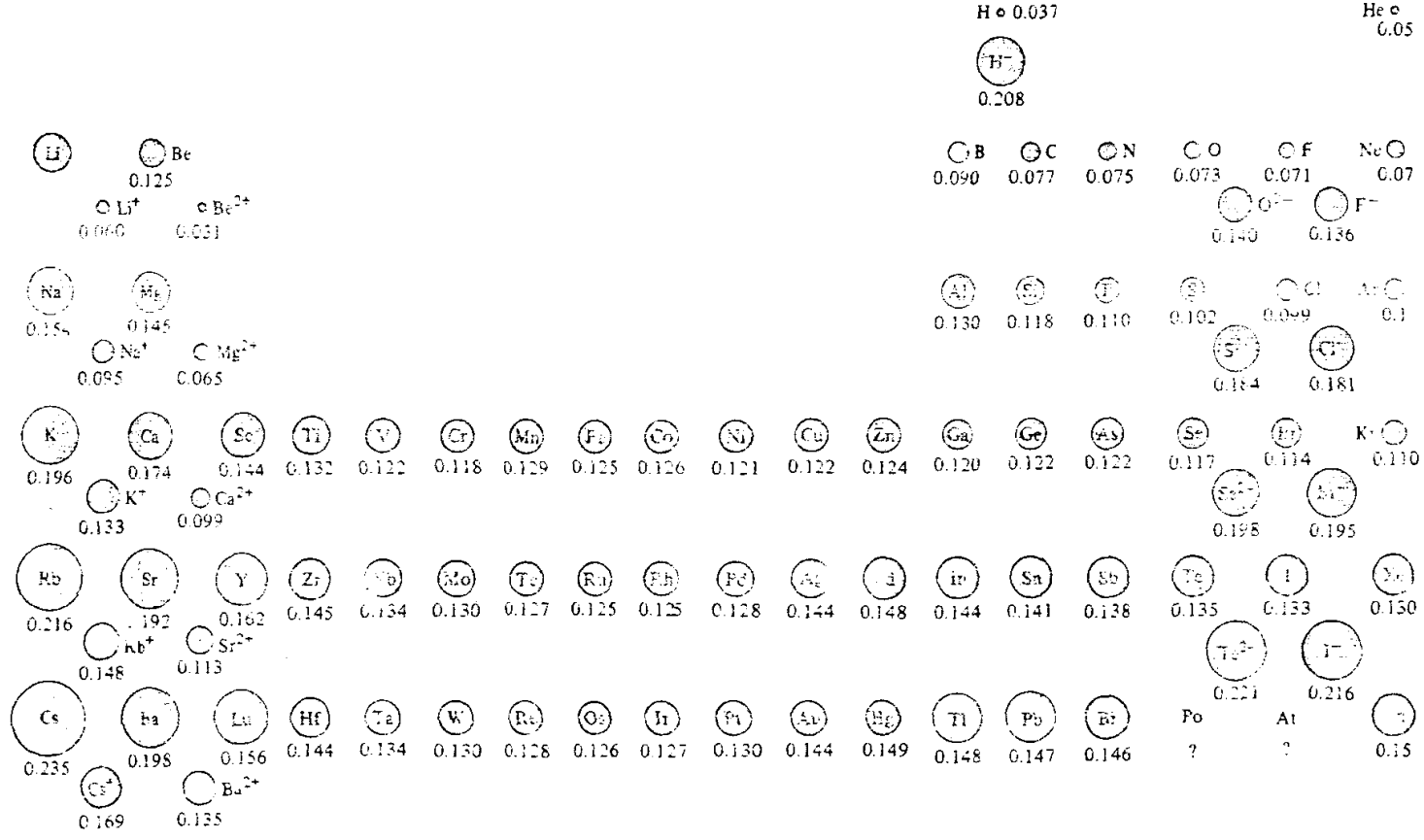
Numbers in parentheses are mass numbers of the most stable isotope.
* Most commonly available long-lived isotope.

ตารางที่ 6 การจัดเรียงตัวของอิเลคตรอนในอะตอมของธาตุ

(Electron Configuration of the Elements)

ATOMIC NUMBER			ATOMIC NUMBER			ATOMIC NUMBER		
1	H	$1s^1$	36	Kr	[Ar] $4s^23d^{10}4p^6$	71	Lu	[Xe] $6s^24f^{14}5d^1$
2	He	$1s^2$	37	Rb	[Kr] $5s^1$	72	Hf	[Xe] $6s^24f^{14}5d^2$
3	Li	[He] $2s^1$	38	Sr	[Kr] $5s^2$	73	Ta	[Xe] $6s^24f^{14}5d^3$
4	Be	[He] $2s^2$	39	Y	[Kr] $5s^24d^1$	74	W	[Xe] $6s^24f^{14}5d^4$
5	B	[He] $2s^22p^1$	40	Zr	[Kr] $5s^24d^2$	75	Re	[Xe] $6s^24f^{14}5d^5$
6	C	[He] $2s^22p^2$	41	Nb	[Kr] $5s^14d^4$	76	Os	[Xe] $6s^24f^{14}5d^6$
7	N	[He] $2s^22p^3$	42	Mo	[Kr] $5s^14d^5$	77	Ir	[Xe] $6s^24f^{14}5d^7$
8	O	[He] $2s^22p^4$	43	Tc	[Kr] $5s^24d^5$	78	Pt	[Xe] $6s^14f^{14}5d^9$
9	F	[He] $2s^22p^5$	44	Ru	[Kr] $5s^14d^7$	79	Au	[Xe] $6s^14f^{14}5d^{10}$
10	Ne	[He $2s^22p^6$	45	Rh	[Kr] $5s^14d^8$	80	Hg	[Xe] $6s^24f^{14}5d^{10}$
11	Na	[Ne] $3s^1$	46	Pd	[Kr] $4d^{10}$	81	Tl	[Xe] $6s^24f^{14}5d^{10}6p^1$
12	Mg	[Ne] $3s^2$	47	Ag	[Kr] $5s^14d^{10}$	82	Pb	[Xe] $6s^24f^{14}5d^{10}6p^2$
13	Al	[Ne] $3s^23p^1$	48	Cd	[Kr] $5s^24d^{10}$	83	Bi	[Xe] $6s^24f^{14}5d^{10}6p^3$
14	Si	[Ne] $3s^23p^2$	49	In	[Kr] $5s^24d^{10}5p^1$	84	Po	[Xe] $6s^24f^{14}5d^{10}6p^4$
15	P	[Ne] $3s^23p^3$	50	Sn	[Kr] $5s^24d^{10}5p^2$	85	At	[Xe] $6s^24f^{14}5d^{10}6p^5$
16	S	[Ne] $3s^23p^4$	51	Sb	[Kr] $5s^24d^{10}5p^3$	86	Rn	[Xe] $6s^24f^{14}5d^{10}6p^6$
17	Cl	[Ne] $3s^23p^5$	52	Te	[Kr] $5s^24d^{10}5p^4$	87	Fr	[Rn] $7s^1$
18	Ar	[Ne] $3s^23p^6$	53	I	[Kr] $5s^24d^{10}5p^5$	88	Ra	[Rn] $7s^2$
19	K	[Ar] $4s^1$	54	Xe	[Kr] $5s^24d^{10}5p^6$	89	Ac	[Rn] $7s^25f^1$
20	Ca	[Ar] $4s^2$	55	Cs	[Xe] $6s^1$	90	Th	[Rn] $7s^26d^2$
21	Sc	[Ar] $4s^23d^1$	56	Ba	[Xe] $6s^2$	91	Pa	[Rn] $7s^25f^26d^1$
22	Ti	[Ar] $4s^23d^2$	57	La	[Xe] $6s^24f^1$	92	U	[Rn] $7s^25f^36d^1$
23	V	[Ar] $4s^23d^3$	58	Ce	[Xe] $6s^24f^2$	93	Np	[Rn] $7s^25f^46d^1$
24	Cr	[Ar] $4s^13d^5$	59	Pr	[Xe] $6s^24f^3$	94	Pu	[Rn] $7s^25f^6$
25	Mn	[Ar] $4s^23d^5$	60	Nd	[Xe] $6s^24f^4$	95	Am	[Rn] $7s^25f^7$
26	Fe	[Ar] $4s^23d^6$	61	Pm	[Xe] $6s^24f^5$	96	Cm	[Rn] $7s^25f^76d^1$
27	Co	[Ar] $4s^23d^7$	62	Sm	[Xe] $6s^24f^6$	97	Bk	[Rn] $7s^25f^9$
28	Ni	[Ar] $4s^23d^8$	63	Eu	[Xe] $6s^24f^7$	98	Cf	[Rn] $7s^25f^{10}$
29	Cu	[Ar] $4s^13d^{10}$	64	Gd	[Xe] $6s^24f^75d^1$	99	Es	[Rn] $7s^25f^{11}$
30	Zn	[Ar] $4s^23d^{10}$	65	Tb	[Xe] $6s^24f^9$	100	Fm	[Rn] $7s^25f^{12}$
31	Ga	[Ar] $4s^23d^{10}4p^1$	66	Dy	[Xe] $6s^24f^{10}$	101	Md	[Rn] $7s^25f^{13}$
32	Ge	[Ar] $4s^23d^{10}4p^2$	67	Ho	[Xe] $6s^24f^{11}$	102	No	[Rn] $7s^25f^{14}$
33	As	[Ar] $4s^23d^{10}4p^3$	68	Er	[Xe] $6s^24f^{12}$	103	Lr	[Rn] $7s^25f^{14}6d^1$
34	Se	[Ar] $4s^23d^{10}4p^4$	69	Tm	[Xe] $6s^24f^{13}$			
35	Br	[Ar] $4s^23d^{10}4p^5$	70	Yb	[Xe] $6s^24f^{14}$			

ตารางที่ 7 ขนาดและรัศมีของอะตอมและไอออนในตารางธาตุ Size and Radii of atoms and ions in Periodic Table)



ตารางที่ 8 คาอิเลกโตรเนกาติวีตีของธาต (โดย L. Pauling)

(Electronegativity of the Elements)

H 2.1																
Li 10	Be 15											B 20	C 2.5	N 30	0 35	F 40
Na 0.9	Mg 12											Al 15	Si 1.8	P 2.1	S 25	Cl 30
K 0.8	Ca 1.0	SC 13	Ti 1.5	V 16	Cr 16	Mn 1.5	Fe 1.8	Co 1.8	Ni 1.8	Cu 1.9	Zn 1.6	Ga 16	Ge 1.8	As 2.0	Se 24	Br 28
Rb 0.8	Sr 10	Y 12	Zr 1.4	Nb 1.6	Mo 1.8	Tc 19	Ru 22	Rh 22	Pd 22	Ag 19	Cd 17	In 1.7	Sn 1.8	Sb 19	Te 21	I 25
Cs 0.7	Ba 09	La-Lu 1 l-l 2	Hf 13	Ta 1.5	W 1.7	Re 19	Os 22	Ir 22	Pt 22	Au 24	Hg 19	Tl 1.8	Pb 1.8	Bi 19	PO 20	At 22
Fr 07	Ra 09	AC 11	Th 13	Pa 15	U 17	Np-Lw 13										

ตารางที่ 9 ธาตุที่สำคัญและสมบัติบางประการ

(Important Elements and Some of their Properties)

Element	*Symbol*	*Atomic Weight*	*Atomic Number*	*Oxidation Number*	*Specific Gravity*	*Melting Point °C*	*Boiling Point °C*
Aluminum	Al	26.98	13	3	2.70	660	2467
Antimony	Sb	121.75	51	3-5	4.15	631	1380
Argon	Ar	39948	18	0	—	− 189	-186
Arsenic	As	74.92	33	3-5	5.73	817	613
Barium	Ba	137.34	56	?	3.51	725	1140
Bismuth	Bi	208.98	83	3	9.80	271	1560
Boron	B	10.81	5	3	2.34	2300	2550
Bromine	Br	79.90	35	1-5	2.93	− 7.2	59
Cadmium	Cd	112.4	48	2	8.64	321	765
Calcium	Ca	40.08	20	2	1.54	842	1487
Carbon	C	12.01 I	6	4-2	3.51	> 3550	4827
Chlorine	Cl	35.45	17	I-3-5-7	3.21	101	− 34.6
Chromium	Cr	52.0	24	2-3-6-7	7 20	1890	2482
Cobalt	C 0	58.93	27	2-3	8 9	1195	2900
Copper	c u	6355	29	I-2	8.92	1083	2595
Fluorine	F	18.998	9		—	-220	− 188
Gold	Au	196.97	79	1-3	19.3	1063	2966
Helium	He	4 0026	2	0	—	-272	-269
Hydrogen	H	1 008	1	I	—	− 259	-253
Iodine	I	1269	53	1-5-7	4.93	114	184
Iron	Fe	5585	26	2-3	786	1535	3000
Lead	Pb	207 2	82	2-4	11.34	328	1744
Magnesium	Mg	24.31	I2	?	1.74	651	1107
Manganese	Mn	54.938	25	2-3-4-6-7	7 2 0	1244	2097
Mercury	Hg	'0059	80	I-2	13 59	− 38.9	357
Molybdenum	Mo	9594	42	2-4-6	10 2	2610	5560
Nickel	Ni	5871	78	2-3	8 90	1453	2732
Nitrogen	N	14.0	7	3-s	—	− 210	− 196
Oxygen	0	159994	8	2	—	− 218	− 183
Phosphorus	P	30.974	15	3-s	—	44.1	280
Platinum	Pt	19509	is	2-4	21.45	1769	3827
Potassium	K	39 102	19	1	0.86	63.7	774
Radium	Ra	226 0	38	2	—	700	< 1737
Silicon	Si	28.086	14	4	2.33	1410	2355
Silver	Ag	10757	47	1	10.5	961	2212
Sodium	Na	22.99	I I	1	0.97	97.8	892
Strontium	Sr	37.62	38	2	2.6	769	1384
Sulfur	S	32.06	16	2-4-6	2.07	119	445
Tin	Sn	118 69	'0	2-4	728	232	2210
Tungsten	W	18385	74	2-4-6	19.35	3410	5927
Zinc	Zn	65.37	30	2	7.14	419	907

ตารางที่ 10 ความเข้มข้นของสารละลายกรดและเบส

(Concentrations of Common Acid and Base Solutions)

Reagent	Formula	Molarity (M)	Density (g/ml)	Percent Solute (%)
Acetic acid (glacial)	$HC_2H_3O_2$	17	1.05	99.5
Acetic acid (dilute)		6	1.04	34
Hydrochloric acid (concentrated)	HCl	12	1.18	36
Hydrochloric acid (dilute)		6	1.10	20
Nitric acid (concentrated)	HNO_3	16	1.42	72
Nitric acid (dilute)		6	1.19	32
Sulfuric acid (concentrated)	H_2SO_4	18	1.84	96
Sulfuric acid (dilute)		3	1.18	25
Ammonium hydroxide (concentrated)	NH_4OH	15	0.90	58
Ammonium hydroxide (dilute)		6	0.96	23
Sodium hydroxide (dilute)		6	1.22	20

ตารางที่ 11 จุดเดือดของน้ำที่ความดันต่าง ๆ

(Boiling Point of Water versus Pressure)

Pressure (mm)	Boiling point (^{o}C)
700	97.714
705	97.910
710	98.106
715	98.300
720	98.493
725	98.686
730	98.877
735	99.067
740	99.255
745	99.443
750	99.630
755	99.815
760	100.000
765	100.184
770	100.366
775	100.548
780	100.728
785	100.908
790	101.087
795	101.264
800	101.441

ตารางที่ 12 ความหนาแน่นของน้ำที่อุณหภูมิต่าง ๆ (Temperature versus Density of water)

Temperature (°C)	Density (g/mL)	Temperature (°C)	Density (g/mL)	Temperature (°C)	Density (g/mL)
-20	0.99349	27	0.996544	69	0.976361
-18	0.99474	28	0.996264	73	0.977793
-16	0.99561	29	0.995976	71	0.977219
-14	0.99672	30	0.995678	72	0.976640
-12	0.99749	31	0.995372	73	0.976056
-10	0.998137	32	0.995057	74	0.975466
-9	0.998417	33	0.994734	75	0.974871
-8	0.998671	34	0.994403	76	0.974271
-7	0.998899	35	0.994063	77	0.973665
-6	0.999102	36	0.993716	78	0.973055
-5	0.999283	37	0.993360	79	0.972439
-4	0.999441	38	0.992997	80	0.971819
-3	0.999578	39	0.992626	81	0.971193
-2	0.999694	40	0.992247	82	0.970562
-1	9.999790	41	0.991861	83	0.969926
0	0.999868	42	0.991467	84	0.969286
1	0.999927	43	0.991067	85	0.968640
2	0.999968	44	0.990659	86	0.967990
3	0.999992	45	0.990244	87	0.967335
4	1.000000	46	0.989822	88	0.966674
5	0.999992	47	0.989393	89	0.966009
6	0.999968	48	0.988957	90	0.965340
7	0.999930	49	0.988515	91	0.964665
8	0.999877	50	0.988066	92	0.963986
9	0.999809	51	0.987610	93	0.963302
10	0.999728	52	0.987148	94	0.962613
11	0.999634	53	0.986680	95	0.961920
12	0.999526	54	0.986205	96	0.961222
13	0.999406	55	0.985723	97	0.960519
14	0.999273	56	0.985236	98	0.959812
15	0.999129	57	0.984743	99	0.959100
16	0.998972	58	0.984243	100	0.958384
17	0.998804	59	0.983737	101	0.957662
18	0.998625	60	0.983226	102	0.956937
19	0.998435	61	0.982708	103	0.956207
20	0.998234	62	0.982185	104	0.955472
21	0.998022	63	0.981655	105	0.954733
22	0.997801	64	0.981120	106	0.953989
23	0.997569	65	0.980580	107	0.953240
24	0.997327	66	0.980034	108	0.952488
25	0.997075	67	0.979482	109	0.951730
26	0.996814	68	0.978924	110	0.950968

ตารางที่ 13 จุดเดือดของของเหลว (Boiling Points of Liquids)

Liquid	Boiling Point ^{o}C
Acetone	56.5
Carbon disulfide	46.3
Carbon tetrachloride	76.8
Chloroform	61.3
Ethanol	78.5
Ether	34.6
Methanol	64.6
Water	100.0

ตารางที่ 14 ค่าความดันไอของน้ำที่อุณหภูมิต่าง ๆ (Vapour Pressure of Water)

TEMPERATURE (^{o}C)	PRESSURE[a]			TEMPERATURE (^{o}C)	PRESSURE[a]		
	torr	atm	Pa		torr	atm	pa
0	4.6	0.0061	610	32	35.7	0.0469	4755
5	6.5	0.0086	872	33	37.7	0.0496	5030
10	9.2	0.0121	1227	34	39.9	0.0525	5319
15	12.13	0.0168	1705	35	42.2	0.0555	5622
16	13.6	0.0179	1818	36	44.6	0.0586	5941
17	14.5	0.0191	1937	37	47.1	0.0619	6275
18	15.5	0.0204	2063	38	49.7	0.0654	6625
19	16.5	0.0217	2197	39	52.4	0.0690	6992
20	17.5	0.0231	2338	40	55.3	0.0728	7376
21	18.6	0.0245	2486	45	71.9	0.0946	9583
22	19.8	0.0261	2643	50	92.5	0.1217	12,33.3
23	21.1	0.0277	2809	55	118.0	0.1553	15,737
24	22.4	0.0294	2983	60	149.4	0.1965	19,915
25	23.8	0.0313	3167	65	187.5	0.2468	25,002
26	25.2	0.0332	3360	70	233.7	0.3075	31,157
27	26.7	0.0352	3564	75	289.1	0.3804	38,543
28	28.3	0.0373	3779	80	355.1	0.4672	47,342
29	30.0	0.0395	4005	85	433.6	0.5705	57,808
30	31.8	0.0419	4242	90	525.8	0.6918	70,094
31	33.7	0.0443	4492	95	633.9	0.8341	'4.512
				100	760.0	1.0000	100,325

[a]Units in torr to nearest tenth ; atmospheres to nearest ten-thousandth ; pascals to nearest unit.

ตารางที่ 15 ค่าคงที่สมดุลของการแตกตัวของไอออนเชิงซ้อนและเกลือ

(Equilibium Constants for the dissociation of Complex ions and Salts)

Compound	Dissociation reaction	*K*	*pK*
AMMINE (AMMONIA) COMPLEX IONS			
Tetraamminecadmium(II)	$Cd(NH_3)_4^{2+} = Cd^{2+} + 4NH_3$	2×10^{-7}	6.7
Tetraamminecopper(II)	$Cu(NH_3)_4^{2+} = Cu^{2+} + 4NH_3$	8×10^{-13}	12.1
Diamminesilver(I)	$Ag(NH_3)_2^{+} = Ag^{+} + 2NH_3$	6×10^{-8}	7.2
Tetraamminezinc(II)	$Zn(NH_3)_4^{2+} = Zn^{2+} + 4NH_3$	1×10^{-9}	9.0
HYDROXIDE COMPLEX IONS-AMPHOTERIC HYDROXIDES			
Tetrahydroxoaluminate	$Al(OH)_4^- = Al(OH)_3(s) + OH^-$	3×10^{-2}	1.5
Tetrahydroxochromate(III)	$Cr(OH)_4^- = Cr(OH)_3(s) + OH^-$	2.5	-040
Trihydroxoplumbate(II) ion	$Pb(OH)_3^- = Pb(OH)_2(s) + OH^-$	2x 10'	-13
Trihydroxostannate(II)	$Sn(OH)_3^- = Sn(OH)_2(s) + OH^-$	2.6	-0.41
Tetrahydroxozincate	$Zn(OH)_4^{2-} = Zn(OH)_2(s) + 2OH^-$	4x 10'	−1.6
CHLORIDE COMPLEX IONS AND WEAK SALTS			
Dichlorocadmium	$CdCl_2(aq) = Cd^{2+} + 2Cl^-$	2.5×10^{-3}	2.60
Tetrachloroaurate(III) ion	$AuCl_4^- \rightleftharpoons Au^{3+} + 4Cl^-$	5×10^{-22}	21.3
Trichloroiron(III)	$FeCl_3(aq) = Fe^{3+} + 3Cl^-$	8×10^{-2}	1.9
Dichloroiron(III) ion	$FeCl_2^+(aq) \rightleftharpoons Fe^{3+} + 2Cl^-$	8 x 10'	2.9
Chloroiron(III) ion	$FeCl^{2+} \rightleftharpoons Fe^{3+} + Cl^-$	3.5×10^{-2}	1.46
Mercury(II) chloride	$HgCl_2(aq) \rightleftharpoons HgCl^+ + Cl^-$	K_1: 3.3x 10-'	6.46
Chloromercury(II) ion	$HgCl^+ \rightleftharpoons Hg^{2+} + Cl^-$	K_2: 1.6 x 10-'	6.74
Tetrachloromercurate(II)	$HgCl_4^{2-} \rightleftharpoons Hg^{2+} + 4Cl^-$		1507
Tin(II) chloride	$SnCl_2(aq) \rightleftharpoons Sn^{2+} + 2Cl^-$	5.7×10^{-3}	2.24
Tetrachlorostannate(II) ion	$SnCl_4^{2-} = Sn^{2+} + 4Cl^-$	3.3×10^{-2}	1.48
Hexachlorostannate(IV) ion	$SnCl_6^{2-} = Sn^{4+} + 6Cl^-$	$? 10^{-4}$	4
Dichloroargentate(I) ion	$AgCl_2^- = Ag^+ + 2Cl^-$	5×10^{-8}	5.3
OTHER COMPLEX IONS AND WEAK SALTS			
Tetracyanocadmate(II) ion	$Cd(CN)_4^{2-} = Cd^{2+} + 4CN^-$	8×10^{-18}	17.1
Thiocyanatoiron(III) ion	$FeSCN^{2+} = Fe^{3+} + SCN^-$	1×10^{-3}	3.0
Lead(II) acetate	$Pb(C_2H_3O_2)_2(aq) = Pb^{2+} + 2C_2H_3O_2^-$	1×10^{-4}	4.0
Triacetatoplumbate(II) ion	$Pb(C_2H_3O_2)_3^- = Pb^{2+} + 3C_2H_3O_2^-$	2.5×10^{-7}	6.60
Dicyanoargentate(I) ion	$Ag(CN)_2^- = Ag^+ + 2CN^-$	1×10^{-20}	20 0
Dithiosulfatoargentate(I) ion	$Ag(S_2O_3)_2^{3-} = Ag^+ + 2S_2O_3^{2-}$	4×10^{-14}	13.4

ตารางที่ 16 ค่าคงที่ของการแตกตัว (Ionization Constants)

Acid	Formula	K_a (25°C)
Acetic	$HC_2H_3O_2$	1.75×10^{-5}
ARsenic	H_3AsO_4	5.0×10^{-3}
	$H_2AsO_4^-$	9.3×10^{-8}
	$HAsO_4^{2-}$	3.0×10^{-12}
Aluminum ion	$Al(H_2O)_6^{3+}$	1.2×10^{-5}
Carbonic	H_2CO_3	4.2×10^{-7}
	HCO_3^-	4.8×10^{-11}
Ferric ion	$Fe(H_2O)_6^{3+}$	4.0×10^{-3}
Fopmic	$HCHO_2$	1.8×10^{-4}
Hydrocyanic	HCN	4.0×10^{-10}
Hydrofluoric	HF	7.0×10^{-4}
Hydrogen peroxide	H_2O_2	2.4×10^{-12}
Hydrosulfuric	H_2S	1.0×10^{-7}
	HS^-	1.0×10^{-15}
Hypochlorous	HClo	3.2×10^{-8}
Nitrous	HNO_2	4.5×10^{-4}
Oxalic	$H_2C_2O_4$	4.5×10^{-2}
	$HC_2O_4^-$	5.5×10^{-5}
Phosphoric	H_3PO_4	7.5×10^{-3}
	$H_2PO_4^-$	6.2×10^{-8}
	HPO_4^{2-}	1.7×10^{-12}
Sulfuric	H_2SO_4	very large
	HSO_4^-	$1.2 \quad 10^{-2}$
Zinc ion	$Zn(H_2O)_4^{2+}$	$2.5 \quad 10^{-10}$

Base	Formula	K_b (25°C)
Ammonia	NH_3	1.80×10^{-5}

ตารางที่ 17 ค่าคงที่ของผลคูณการละลาย (Solubility Product Constants)

Substance	K_{sp}	Substance	K_{sp}
$BaCO_3$	2.0×10^{-9}	$PbCl_2$	1.7×10^{-5}
$BaSO_4$	9.7×10^{-11}	Ag_2SO_4	1.2×10^{-5}
BaF_2	1.7×10^{-6}	$Ag_2O(Ag^+ + OH^-)$	2.0×10^{-8}
$Ca(OH)_2$	7.9×10^{-6}	$AgBrO_3$	5.2×10^{-5}
$CaCO_3$	4.8×10^{-9}	AgCl	1.6×10^{-10}
CaC_2O_4	2.3×10^{-9}	AgBr	5.2×10^{-13}
CaF_2	1.7×10^{-10}	AgI	9.5×10^{-17}
$CaSO_4$	2.6×10^{-5}	Ag_2S	9.5×10^{-50}
$Cu(OH)_2$	1.6×10^{-19}	Ag_2CO_3	8.2×10^{-12}
CuS	1.0×10^{-36}	Ag_2CrO_4	1.9×10^{-12}
$Fe(OH)_3$	5.3×10^{-38}	$La(IO_3)_3$	6.2×10^{-12}
$Mg(OH)_2$	9.6×10^{-12}	FeS	1.4×10^{-18}
PbS	1.3×10^{-28}	$Zn(OH)_2$	4.8×10^{-17}
$PbSO_4$	1.4×10^{-8}	ZnS	1.2×10^{-23}
$Pb(IO_3)_2$	2.6×10^{-13}	CoS	1.0×10^{-21}

ตารางที่ 18 อินดิเกเตอร์ ช่วงพีเอช และการเปลี่ยนสี

Name of indicator	pH interval	Color change	Solvent
Methyl violet	0.2– 3.0	Yellow, blue. violet	Water
Thymol blue	1.2– 2.8	Red to yellow	Water (+ NaOH)
Orange IV (tropeolin 00;	1.3– 3 0	Red to yellow	Water
Benzopurpurin 4B	1.2– 4 0	Violet tc, red	20% alcohol
Methyl orange	3.1– 4 4	Red to orange to yellow	Water
Bromphenol blue	3.0– 4.6	Yellow to blue violet	Water (+ NaOH)
Congo red	3.0– 5 0	Blue to red	70% alcohol
Bromcresol green	3.8– 5 4	Yellow to blue	Water (+ NaOH)
Methyl red	4.4– 6 2	Red to yellow	Water (+ NaOH)
Chlorphenol red	4.8– 6 a	Yellow to red	Water (+ NaOH)
Bromcresol purple	5.2– 6.8	Yellow to purple	Water (+ NaOH)
Litmus	4.5– 83	Red to blue	water
Bromthymol blue	6.0– 7 6	Yellow to blue	water (– NaOH)
Phenol red	6.8– a 2	Yellow to red	Water (+ NaOH)
Thymol blue	a o - 9 6	Yellow to blue	Water (+ NaOH)
Phenolphthalein	8.3–10.0	Colorless to red	70% alcohol
Thymolphthalein	9 3-10 5	Yellow to blue	70% alcohol
Alizarin yellow A	10.0–12.0	Yellow to red	20% alcohol
Indigo carmine	11 4-13.0	Blue to yellow	50% alcohol
Trinitrobenzene	12.0-140	Colorless to orange	70% alcohol

ตารางที่ 19 ค่าคงที่ทางฟิสิกส์เบื้องต้น (Fundamental Physical Constants)

Constant	Symbol	Value	SI Units	cgs Units
Avogadro constant	N_A	6.022 169	10^{23} mol^{-1}	10^{23} mol^{-1}
Boltzmann constant	k	1.380 622	10^{-23} J K^{-1}	10^{-16} erg K^{-1}
Electron charge	e	1.602 191 7 4.803 250	10^{-19} C -	[a] 10^{-20} cm$^{1/2}$ g$^{1/2}$ s^{-1} [b] 10^{-10} cm$^{3/2}$ g$^{1/2}$ s^{-1}
Electron rest mass	m_e	9.109 558	10^{-31} kg	10^{-28} g
Faraday constant	J	9.648 670	10^{4} C mol^{-1}	[a] 10^{3} cm$^{1/2}$ g$^{1/2}$ mol^{-1}
Gas constant	R	8.314 34 8.314 34 8.314 34 8.21	J mol^{-1} K^{-1} kPa·dm^3 mol^{-1} K^{-1} m^2·kg mol^{-1} K^{-1} s^{-2} -	10^{7} erg mol^{-1} K^{-1} - - 10^{-2} L atm mol^{-1} K^{-1}
Molar volume, ideal gas, standard conditions	V_0	2.241 36	10^{-3} m^3 mol^{-1}	10^{3} cm^3 mol^{-1}
Neutron rest mass	m_n	1.674 920	10^{-27} kg	10^{-24} g
Planck constant	h	6.626 196	10^{-34} J s	10^{-27} erg s
Proton rest mass	M_p	1.672 614	10^{-27} kg	10^{-24} g
Rydberg constant	R_∞	1.097 373 12	10^{7} m^{-1}	10^{5} cm^{-1}
Speed of light in a vacuum	c	2.997 925 0	10^{8} m·s^{-1}	10^{10} cm·s^{-1}
e	e	2.718 281 828		
π	π	3.141 592 653		

[a] Electromagnetic system.
[b] Electrostatic system.

ตารางที่ 20 ตารางลอการิทึม (Table of Logarithm)

	0	1	2		4	5			8	9
1.0	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374
1.1	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755
1.2	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106
1.3	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430
1.4	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732
1.5	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014
1.6	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279
1.7	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529
1.8	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765
1.9	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989
2.0	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201
2.1	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404
2.2	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598
2.3	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784
2.4	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962
2.5	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133
2.6	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298
2.7	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456
2.8	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609
2.9	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757
3.0	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900
3.1	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038
3.2	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172
3.3	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302
3.4	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428
3.5	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551
3.6	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670
3.7	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786
3.8	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899
3.9	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010
4.0	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117
4.1	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222
4.2	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325
4.3	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425
4.4	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522
4.5	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618
4.6	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712
4.7	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803
4.8	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893
4.9	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981
5.0	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067
5.1	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152
5.2	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235
5.3	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316
5.4	7324	7332	7340	7346	7356	7364	7372	7380	7388	7396
5.5	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474
5.6	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551
5.7	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627
5.8	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701
5.9	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774
6.0	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846

Logarithms of Numbers (*cont*)

N	0	1	2	3	4	5	6	7	8	9
6.1	.7853	.7860	7868	.7875	.7882	.7889	7896	.7903	.7910	.791?
6.2	.7924	.7931	.7938	.7945	.7952	.7959	7966	7973	7980	.79x?
63	.7993	.8000	.8007	.8014	,802 I	.8028	.8035	.8041	.8048	805?
6.5	.8062	.8069	.8075	.8082	.8089	.8096	8102	.8109	.8116	.8122
6.5	.8129	.8136	.8142	.8149	.8156	.8162	.8169	.8176	.8182	8189
6.6	.8195	.8202	.8209	.8215	.8222	.8228	.8235	.8241	.8248	.8254
67	.8261	8267	.8274	.8280	.8287	.X293	.x299	.8306	.8312	.8319
6.8	.8325	.8331	.8338	.8344	.835i	8357	.8363	8370	.8376	8382
6.9	.8388	.8395	.8401	.8407	.8414	8420	.8426	8432	8439	8445
70	8451	.8457	.8463	.8470	.8476	.8483	.8488	.8494	.8500	.8506
7.1	8513	.8519	.8525	.8531	.8537	.8543	8549	.8555	.8561	.8567
7.2	.8573	.8579	.8585	.8591	.8597	.8603	.8609	8615	.8621	8627
7.3	.8633	.8639	.8645	.8651	.8657	8663	8669	8675	.8681	8686
7.4	.8692	.8698	.8704	.8710	.8716	.8722	.8727	.8733	.8739	.8745
7.5	.8751	.8756	.8762	.8768	.8774	.8779	.8785	.8791	.8797	.8802
7.6	.8808	.8814	.8820	8825	.8831	.X837	.8842	.8848	.8854	.8859
7.7	.8865	.8871	.8876	.8882	.8887	.8893	8899	.8904	.8910	.8915
7.8	.8921	.8927	.8932	.8938	.8943	.8949	.8954	.8960	8965	8971
7.9	.8976	.8982	.8987	.8993	.8998	.9004	.9009	9015	9020	.9025
8.0	9031	.9036	.9042	.9047	.9053	.9058	.9063	.9069	9074	.9079
8. I	9085	.9090	.9096	.9101	.9106	.9112	9117	.9122	.9128	9133
8.2	9138	.9143	.9149	.9154	.9159	9165	.9170	.9175	.9180	.9186
83	.9191	.9196	.9201	.9206	.9212	9217	9222	9227	9232	9238
8.4	.9243	.9248	.9253	.9258	.9263	.9269	9274	.9279	.9284	.9289
85	.9294	.9299	.9304	.9309	.9315	9320	9325	.9330	.9335	9340
8.6	.9345	.9350	.9355	.9360	.9365	.9370	.9375	.9380	.9385	9390
8.7	.9395	.9400	.9405	.9410	.9415	.9420	.9425	.9430	9435	.9440
8.8	.9445	.9450	.9455	.9460	.9465	.9469	9471	9479	9484	9489
8.9	9494	.9499	.9504	.9509	.9513	9518	.9523	.9528	.9533	.9538
90	.9542	.9547	.9552	.9557	.9562	.9566	.9571	.9576	.9581	9586
9.1	.9590	.9595	.9600	.9605	.9609	.9614	.9619	9624	9628	9633
Y.2	.9638	.9643	.9647	9652	9657	9661	9666	.9671	.9675	9680
9.3	9685	.9689	.9694	9699	.9703	.9708	.9713	9717	V722	9727
9.4	.9731	.9736	.9741	.9745	9750	.9754	9759	.9763	976X	9773
9.5	.9777	.9782	.9786	.9791	.9795	9800	9805	.9809	.9814	9818
9.6	.9823	.9827	.9832	.9836	.9841	9845	.9850	.9854	.9859	9863
9.7	9868	.9872	.9877	.9881	.9886	.9890	.9894	.9899	.9903	.9908
9.8	.9912	.9917	.9921	.9926	.9930	9934	9939	.9943	.9948	9952
9.9	.9956	.9961	.9965	.9969	.9974	9978	9983	9987	9991	9996

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