LABORATORY NOTEBOOK ISSUANCE PAGE

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Laboratory Notebook Guidelines

Purpose of a Laboratory Notebook

A laboratory notebook provides a permanent record of research, ideas, concepts, data, analysis, and/or observations. It is a legal record of your work and may be used as evidence for patent filing, patent protection, or other legal purposes. Documentation and maintenance of your records is a fundamental part of GLP (Good Laboratory Practice) and is essential for the management and protection of intellectual property rights. The proper use of a laboratory notebook will ensure that the progress from conception to reduction to practice can be retraced in a chronological and logical manner, thus providing a solid basis for patent purposes. Moreover, the contents of the laboratory notebook must be able to withstand any challenges to their validity or accuracy.

General Guidance

A laboratory notebook should be permanently bound and tamper evident with sequentially numbered pages. Pages must never be removed or tampered with.

A laboratory notebook is a legal document and must be handled accordingly. Entries should start at the top of each documentation page. Spaces, which are free of entries, must be crossed out. Do not start a new page until the previous page is full or has been marked so that no additional entries can be made on it. Do not write outside the documentation area. If an entry will be continued on the next page, this should be noted in the spaces provided.

Entries must be made in ink, preferably archival ink. Never use pencils or any non-permanent writing instrument.

It is permitted to affix entries, such as raw data tables, folded graphs, or computer printouts to the documentation pages in an appropriate, chronological location. This must be done so that the entry is permanent. Initial both the affixed entry and the notebook page. The purpose of these supplemental entries should be clearly described nearby.

Never attempt to remove, obliterate, blot out or erase entries. Before a page is signed and dated, you may correct an entry by marking with a single line through the specific error and add your initials next to it. It is important that the error is still legible.

Every laboratory notebook page must be signed by the author and countersigned by at least one corroborating witness. This witness should not be directly involved in the documented activities. The witness confirms with their signature and the date that she/he understood the entries and that the activities performed took place on a certain date.

After a page is signed and dated, no further changes, interlineations, deletions, or additions are permitted. If an entry must be corrected subsequently, use a new page and refer to it in your new entry.

The person assigned the laboratory book is responsible for its content and safe keeping. Entries by a third party are not permitted, with the exception of the witness when signing and dating a page.

Immediately enter your work in a clear, concise, structured and legible manner. Entries should be recorded with the intent of an independent person, who is skilled in the art, being able to comprehend and reproduce your results.

Record all experimental work, calculations, sketches, diagrams, and any other related information directly into the notebook.

Retain a consistent language, numbering system, and indication nomenclature throughout the laboratory notebook in order to avoid confusion. Abbreviations must be defined and remain constant throughout the entire book.

Provide figures and equations with numbers or letters and refer to them within the description.

Filter Paper Properties, Qualitative

Whatman Grade	Particle Retention (µm)	Speed (Herzberg (s/100 mL)	Thickness (mm)	Weight (g/m²)	Wet Burst (psi)
1	11	150	0.18	87	0.25
2	8	240	0.19	97	0.29
3	6	325	0.39	185	0.40
4	20–25	37	0.21	92	0.22
5	2.5	1,420	0.20	100	0.40
6	3	715	0.18	100	0.25
113	30	28	0.42	125	9

Filter Paper Properties, Quantitative

Whatman Grade	Particle Retention (µm)	Speed (Herzberg (s/100 mL)	Ash %	Thickness (mm)	Weight (g/m²)	Wet Burst (psi)
40	8	340	0.007	0.21	95	0.29
41	20–25	54	0.007	0.22	85	0.22
42	2.5	1,870	0.007	0.20	100	0.40
44	16	995	0.007	0.18	80	0.29
50	2.7	2,685	0.015	0.12	97	6
52	7	235	0.015	0.18	96	7
54	20–25	39	0.015	0.19	90	7
540	8	200	0.006	0.16	85	7
541	20–25	34	0.006	0.16	78	7
542	2.7	2,510	0.006	0.15	96	6

Filter Properties, Glass Fiber

Whatman Grade	Particle Retention (Liquid) (µm)	Speed (Herzberg (s/100 mL)	Thickness (mm)
GF/A	1.6	62	0.26
GF/B	1.0	195	0.68
GF/C	1.2	100	0.26
GF/D	2.7	410	0.67
GF/F	0.7	325	0.42

Fritted Glassware Porosity Chart

Porosity (µm)	Applications	Ace Desig.	Corning® Desig.
145–174	Coarse filtration, gas dispersion	A	EC(170–220)
70–100	Coarse filtration, gas dispersion	B	—
25–50	Filtration, gas dispersion	C	C(40–60)
10–20	Filtration and extraction	D	M(10–15)
4–8	Filtration and extraction	E	F(4–5.5)
—	General bacterial filtrations	VF	VF(2–2.5)
—	General bacterial filtrations	UF	UF(0.9–1.4)

Filter Membrane Chart, Syringe

Solvent	Membrane Type Nylon	PTFE
Acids, dilute or weak	M	S
Acids, strong or concentrated	U	S
Alcohols, aliphatic	S	S
Aldehydes	M	S
Bases	S	S
Esters	S	S
Hydrocarbons, aliphatic	S	S
Hydrocarbons, aromatic	M	M
Hydrocarbons, halogenated	M	M
Ketones	S	S
Oxidizing agents, strong	U	M

S = Satisfactory
U = Unsatisfactory
M = Marginal, may be Satisfactory for short-term (trial advised)

Syringe Needle Conversion Chart, PTFE

Needle Gauge	Nominal O.D. in.	mm	Nominal I.D. in.	mm	Wall Thickness in.	tol. (in.)
7	0.178	4.52	0.148	3.76	0.015	±0.0040
8	0.163	4.14	0.133	3.38		
9	0.148	3.76	0.118	3.00		
10	0.130	3.30	0.106	2.69	0.012	±0.0030
11	0.119	3.02	0.095	2.41		
12	0.109	2.77	0.085	2.16		
13	0.100	2.54	0.076	1.93		
14	0.090	2.29	0.066	1.68		
15	0.083	2.11	0.059	1.50		
16	0.077	1.96	0.053	1.35		
17	0.071	1.80	0.047	1.19		
18	0.066	1.68	0.042	1.07		
19	0.062	1.57	0.038	0.97		
20	0.058	1.47	0.034	0.86		
22	0.046	1.17	0.028	0.71	0.009	±0.0020
24	0.040	1.02	0.022	0.56		
26	0.036	0.91	0.018	0.46		
28	0.033	0.84	0.015	0.38		
30	0.030	0.76	0.012	0.30		

Glove Applications Guide

Disposable gloves offer touch sensitivity, dexterity, and protection for one-time use and intermittent contact or splash applications.

- **Latex**—form-fitting protection available in powder-free, powdered, and sterile surgical grade
- **Nitrile, accelerator-free**—All advantages of nitrile and free from accelerators which have been linked to dermatitis
- **Nitrile**—greater chemical and puncture resistance than latex or vinyl disposables
- **Polyethylene**—economical short-term protection
- **Vinyl**—offers a unique balance of softness, flexibility, and strength
- **Glove liners**—for inspection or for protection from allergic reactions, rashes, and moisture

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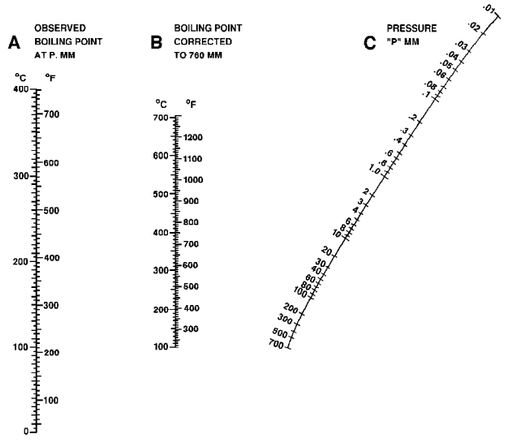
Physical Properties of Solvents

Solvent Name	Density	Boiling Point (°C)	Melting Point (°C)	Flash Point (°C)	Viscosity (cp, 20 °C)	Dielectric Constant (20°C)	UV Cutoff (nm)	Refractive Index (20 °C)
Acetic acid	1.049	118	17	40	1.31(15)	6.15	—	1.372
Acetic anhydride	1.082	138–140	–73	54	—	—	—	1.39
Acetone	0.791	56	–94	–17	0.32	20.7(25)	330	1.359
Acetonitrile	0.786	82	–48	5	0.37	37.5	190	1.344
Benzene	0.874	80	6	–11	0.65	2.28	280	1.501
Benzonitrile	1.01	191	–13	71	1.24(25)	—	300	1.528
1–Butanol	0.81	117.7	–90	35	2.95	17.8	215	1.399
2–Butanone (or methyl ethyl ketone)	0.805	80	–87	–3	0.42(15)	18.5	329	1.379
Butyl acetate	0.882	124–126	–78	22	0.73	—	254	1.394
tert–Butyl methyl ether	0.74	53–56	—	–32	0.27	—	210	1.369
Carbon disulfide	1.266	46	–112	–30	0.37	—	380	1.627
Carbon tetrachloride	1.594	77	–23	—	0.97	2.24	263	1.46
Chlorobenzene	1.106	132	–45	23	0.8	2.71	287	1.524
1–Chlorobutane (or butyl chloride)	0.886	77–78	–123	–6	0.35	—	225	1.402
Chloroform	1.492	61	–64	—	0.58	4.81	245	1.446
Cyclohexane	0.779	80	7	–18	0.98	2.02	200	1.426
Cyclopentane	0.751	50	–94	–37	0.44	1.97	200	1.4
1,2–Dichlorobenzene	1.306	180	–17	65	1.32(25)	9.93(25)	295	1.551
1,2–Dichloroethane	1.256	83	–35	15	0.79	—	225	1.445
Dichloromethane	1.325	40	–97	—	0.45(15)	9.08	233	1.424
Di(ethylene glycol) diethyl ether (or 2–ethoxyethyl ether)	0.909	180–190	—	71	—	—	260	1.412
N,N–Dimethylacetamide	0.937	165	–20	70	2.14	37.8	268	1.438
N,N–Dimethylformamide	0.944	153	–61	57	0.92	36.7	268	1.43
1,4–Dioxane	1.034	100–102	12	12	1.44(15)	2.209(25)	215	1.422
Ether	0.706	34.6	–116	–40	0.24	4.34	218	1.353
Ethyl acetate	0.902	77	–84	–3	0.46	6.02(25)	256	1.372
Ethyl alcohol	0.816	78	–114	16	1.10(25)	24.55(25)	205	1.363
Ethylene glycol dimethyl ether (or monoglyme)	0.867	85	–58	0	0.46(25)	7.20(25)	220	1.379
Heptane	0.684	98	–91	–1	0.42	1.92	220	1.387
Hexane	0.659	69	–95	–23	0.31	1.89	200	1.375
Hexanes	0.672	68–70	—	–22	—	—	210	1.379
2–Methoxyethanol	0.965	124–125	–85	46	1.72	16.9	210	1.402
2–Methoxyethyl acetate	1.009	145	–65	43	—	—	254	1.402
Methyl alcohol	0.791	64.7	–98	11	0.55	32.6(25)	205	1.329
2–Methylbutane	0.62	30	—	–56	—	—	192	1.354
3–Methyl–1–butanol (or isoamyl alcohol)	0.809	130	–117	45	—	—	215	1.406
4–Methyl–2–pentanone (or methyl isobutyl ketone)	0.801	117–118	–80	13	0.58	—	334	1.396
2–Methyl–1–propanol (or isobutyl alcohol)	0.803	108	–108	27	4.70(15)	15.8(25)	200	1.396
2–Methyl–2–propanol	0.775	83	25–26	11	—	—	215	1.387
1–Methyl–2–pyrrolidinone	1.028	81–82 (10 mm)	–24	86	1.67(25)	32	285	1.47
Methyl sulfoxide	1.101	189	18.4	85	2.24	—	268	1.479
Nitromethane	1.127	101.2	–29	35	0.67	—	380	1.382
1–Octanol	0.827	196	–15	81	10.6(15)	—	215	1.429
Pentane	0.626	35–36	–130	–49	0.24	1.84	200	1.358
3–Pentanone	0.813	102	–40	–49	—	—	330	1.392
1–Propanol	0.804	97	–127	15	2.26	20.1(25)	210	1.384
2–Propanol	0.785	82.4	–89.5	22	2.86(15)	18.3(25)	210	1.377
Propylene carbonate	1.189	240	–55	132	—	—	235	1.421
Pyridine	0.978	115	–42	20	0.95	12.3(25)	330	1.51
Tetrachloroethylene	1.623	121	–22	—	—	—	290	1.506
Tetrahydrofuran	0.889	65–67	–108	–17	0.55	7.6	212	1.407
Toluene	0.865	110.6	–93	4	0.59	2.4(25)	284	1.496
1,1,2–Trichlorotrifluoroethane	1.57	47–48	–35	—	0.69	—	231	1.358
2,2,4–Trimethylpentane	0.692	98–99	–107	–7	0.5	1.94	215	1.391
Water	1	100	0	—	1	78.54	<190	1.333
m–Xylene	0.868	138–139	—	25	—	—	—	1.497
o–Xylene	0.87	143–145	–23	32	0.81	2.57	288	1.505
p–Xylene	0.866	138	12	27	0.65	2.27	290	1.495

Also, find a pdf file on the Solvents Table at **Aldrich.com/solvents** *(Click on Solvent Selector under the Tool Box menu.)*

Pressure–Temperature Nomograph



To get a theoretical bp @ 760 mm:

1. Mark the observed boiling point on chart **A**.
2. Mark the pressure on chart **C**.
3. The line drawn from point **A** to **C** intersects chart **B** to give the theoretical bp at 760 mm.

To get an alternative bp/pressure:

4. Line up point **B** figured in step 3 with another pressure (chart **C**).
5. Extend the line **BC** through chart **A** to approximate the corresponding bp.

Table of Atomic Weights

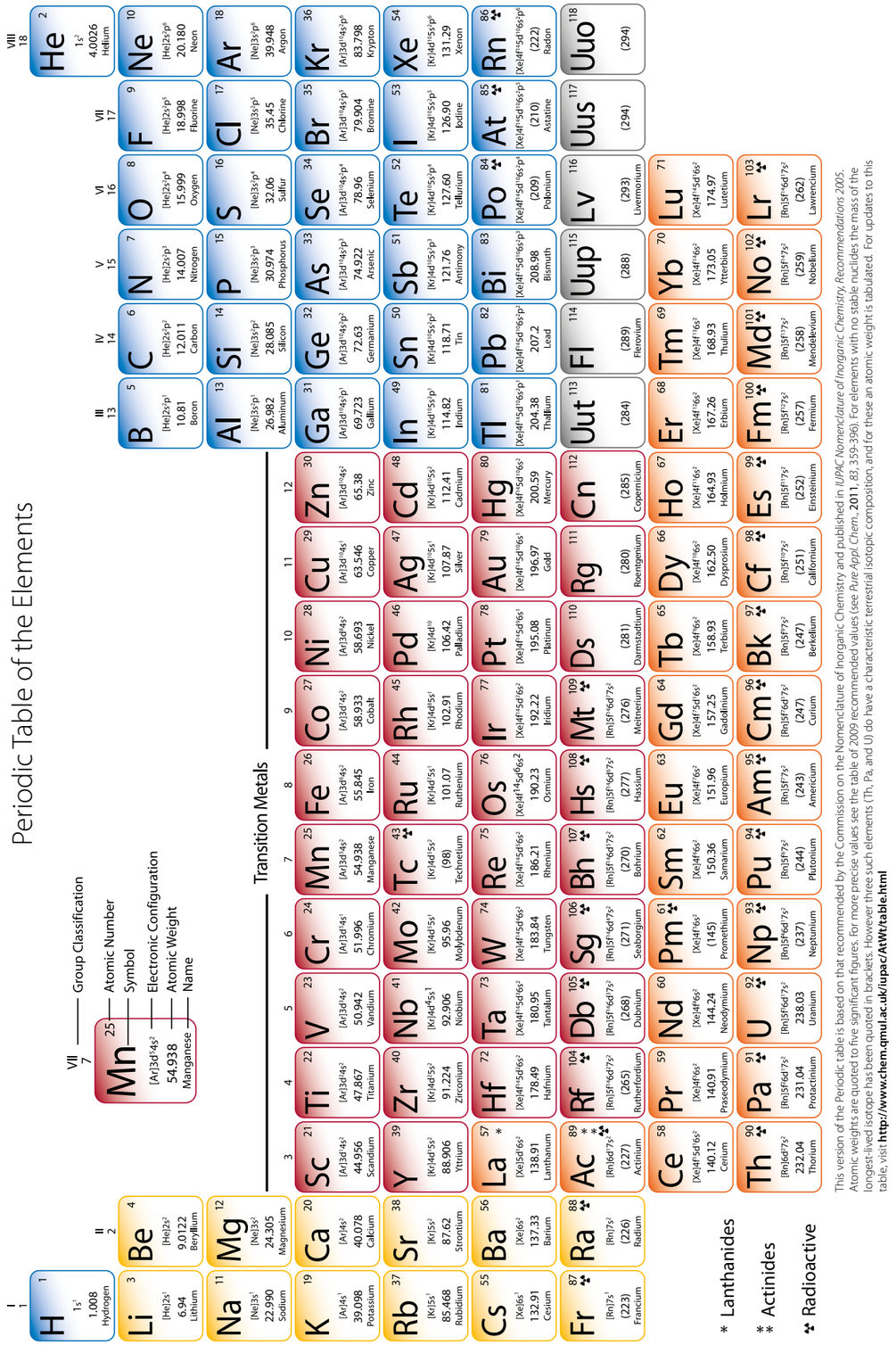
Name	Symbol	Atomic No.	Atomic Weight
Actinium	Ac	89	[227]
Aluminum	Al	13	26.981 5386(8)
Americium	Am	95	[243]
Antimony	Sb	51	121.760(1)
Argon	Ar	18	39.948(1)
Arsenic	As	33	74.921 60(2)
Astatine	At	85	[210]
Barium	Ba	56	137.327(7)
Berkelium	Bk	97	[247]
Beryllium	Be	4	9.012 182(3)
Bismuth	Bi	83	208.980 40(1)
Bohrium	Bh	107	[264]
Boron	B	5	[10.806; 10.821]
Bromine	Br	35	79.904(1)
Cadmium	Cd	48	112.411(8)
Calcium	Ca	20	40.078(4)
Californium	Cf	98	[251]
Carbon	C	6	[12.0096; 12.0116]
Cerium	Ce	58	140.116(1)
Cesium	Cs	55	132.905 4519(2)
Chlorine	Cl	17	[35.446; 35.457]
Chromium	Cr	24	51.9961(6)
Cobalt	Co	27	58.933 195(5)
Copernicium	Cn	112	[285]
Copper	Cu	29	63.546(3)
Curium	Cm	96	[247]
Darmstadtium	Ds	110	[281]
Dubnium	Db	105	[262]
Dysprosium	Dy	66	162.500(1)
Einsteinium	Es	99	[252]
Erbium	Er	68	167.259(3)
Europium	Eu	63	151.964(1)
Fermium	Fm	100	[257]
Fluorine	F	9	18.998 4032(5)
Francium	Fr	87	[223]
Gadolinium	Gd	64	157.25(3)
Gallium	Ga	31	69.723(1)
Germanium	Ge	32	72.63(1)
Gold	Au	79	196.966 569(4)
Hafnium	Hf	72	178.49(2)
Hassium	Hs	108	[277]
Helium	He	2	4.002 602(2)
Holmium	Ho	67	164.930 32(2)
Hydrogen	H	1	[1.007 84; 1.008 11]
Indium	In	49	114.818(3)
Iodine	I	53	126.904 47(3)
Iridium	Ir	77	192.217(3)
Iron	Fe	26	55.845(2)
Krypton	Kr	36	83.798(2)
Lanthanum	La	57	138.905 47(7)
Lawrencium	Lr	103	[262]
Lead	Pb	82	207.2(1)
Lithium	Li	3	[6.938; 6.997]
Lutetium	Lu	71	174.9668(1)
Magnesium	Mg	12	24.3050(6)
Manganese	Mn	25	54.938 045(5)
Meitnerium	Mt	109	[268]
Mendelevium	Md	101	[258]
Mercury	Hg	80	200.59(2)

Name	Symbol	Atomic No.	Atomic Weight
Molybdenum	Mo	42	95.96(2)
Neodymium	Nd	60	144.242(3)
Neon	Ne	10	20.1797(6)
Neptunium	Np	93	[237]
Nickel	Ni	28	58.6934(4)
Niobium	Nb	41	92.906 38(2)
Nitrogen	N	7	[14.006 43; 14.007 28]
Nobelium	No	102	[259]
Osmium	Os	76	190.23(3)
Oxygen	O	8	[15.999 03; 15.999 77]
Palladium	Pd	46	106.42(1)
Phosphorus	P	15	30.973 762(2)
Platinum	Pt	78	195.084(9)
Plutonium	Pu	94	[244]
Polonium	Po	84	[209]
Potassium	K	19	39.0983(1)
Praseodymium	Pr	59	140.907 65(2)
Promethium	Pm	61	[145]
Protactinium	Pa	91	231.035 88(2)
Radium	Ra	88	[226]
Radon	Rn	86	[222]
Rhenium	Re	75	186.207(1)
Rhodium	Rh	45	102.905 50(2)
Roentgenium	Rg	111	[272]
Rubidium	Rb	37	85.4678(3)
Ruthenium	Ru	44	101.07(2)
Rutherfordium	Rf	104	[261]
Samarium	Sm	62	150.36(2)
Scandium	Sc	21	44.955 912(6)
Seaborgium	Sg	106	[266]
Selenium	Se	34	78.96(3)
Silicon	Si	14	[28.084; 28.086]
Silver	Ag	47	107.8682(2)
Sodium	Na	11	22.989 769 28(2)
Strontium	Sr	38	87.62(1)
Sulfur	S	16	[32.059; 32.076]
Tantalum	Ta	73	180.947 88(2)
Technetium	Tc	43	[98]
Tellurium	Te	52	127.60(3)
Terbium	Tb	65	158.925 35(2)
Thallium	Tl	81	[204.382; 204.385]
Thorium	Th	90	232.038 06(2)
Thulium	Tm	69	168.934 21(2)
Tin	Sn	50	118.710(7)
Titanium	Ti	22	47.867(1)
Tungsten	W	74	183.84(1)
Ununhexium	Uuh	116	[291]
Ununoctium	Uuo	118	[294]
Ununpentium	Uup	115	[288]
Ununquadium	Uuq	114	[289]
Ununtrium	Uut	113	[284]
Uranium	U	92	238.028 91(3)
Vanadium	V	23	50.9415(1)
Xenon	Xe	54	131.293(6)
Ytterbium	Yb	70	173.054(5)
Yttrium	Y	39	88.905 85(2)
Zinc	Zn	30	65.38(2)
Zirconium	Zr	40	91.224(2)

Numbers in ( ) indicate the uncertainty in the last digit.

Numbers in [ ] indicate the isotope with the longest half-life.

Adapted from the IUPAC Commission on Atomic Weights and Isotopic Abundances. *Atomic Weights Of The Elements 2009* (**http://www.chem.qmul.ac.uk/iupac/AtWt/**)



This version of the Periodic table is based on that recommended by the Commission on the Nomenclature of Inorganic Chemistry and published in *IUPAC Nomenclature of Inorganic Chemistry, Recommendations 2005*. Atomic weights are quoted to five significant figures. For more precise values see the table of 2009 recommended values (see *Pure Appl. Chem.*, **2011**, *83*, 359-396). For elements with no stable nuclides the mass of the longest-lived isotope has been quoted in brackets. However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated. For updates to this table, visit **http://www.chem.qmul.ac.uk/iupac/AtWt/table.html**