

Sublimation Pressure Data for Organic Compounds.

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CONSIDERING THE valuable information which may be derived either directly or indirectly from sublimation data, it is rather surprising that there is so little quantitative information available in the literature on the sublimation process. Apparently, no compilation of such data has been attempted. This summary of most of the available data, although not exhaustive, is the first serious attempt at a tabulation for organic compounds.

The variation of sublimation pressure with temperature may be represented to a first approximation by

$$\log_{10} p = B - A/T$$

where p is the pressure of the saturated vapor in millimeters of mercury at the absolute temperature T ($T = t^{\circ} \text{C.} + 273.18$). The constants A and B are related to the heat of sublimation and the entropy of sublimation (assuming these to be constant) in the following way:

$$H = 2.303 R A$$

$$S = 2.303 R (B - 2.881)$$

R is the gas constant, 1.986 cal. per gram mole.

The values of A and B are quoted to an accuracy at least sufficient to reproduce sublimation pressures over the quoted temperature ranges to within the accuracy of the original observations. The ΔH and ΔS values derived from A and B are less certain if only because of the limitations in the relations used.

Table I contains all the compounds for which full details are available. In cases where the authors have given an equation but have not deduced values for the heat and entropy of sublimation such values have been calculated and appear in bold face. The constants A and B are valid for the temperature ranges quoted for each compound. It is obviously difficult to assess the quality of many of the results quoted, but an assessment has been attempted and the data considered most acceptable are footnoted. In arriving at these conclusions the following facts were taken into account:

In recent years there has been a considerable advance in the quality of the equipment available for the measurement of sublimation pressures.

The adverse effect of impurities on the accuracy of the measurements was not fully appreciated by a considerable number of authors.

In cases where doubts exist as to the validity of the results published, the data has been ignored.

Failure by certain authors to ensure complete saturation in the air-flow method would invalidate their results.

The effusion method is less sensitive to impurities than methods involving the use of a gauge.

The fact that comparatively few measurements which have been described survive a critical appraisal, results in the paucity of reliable data.

Table II contains a list of compounds for which limited sublimation pressure data are available. In the references given no heats or entropy values have been calculated for these compounds.

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Table I. Sublimation Data

Compound	Temp. Range, ° C.	ΔH , Kcal./ Mole	ΔS , Cal./ Mole Deg.	A	B	Method ^a	Ref.
Acetic acid	-35-+10	9.9	25.7	2177	8.502	...	(41)
<i>p</i> -Acetylanisole	10-60	22.4	51.9	4892	14.217	E	(82)
Acetylene	-140--82	5.2	27.7	1144	8.933	...	(41)
<i>p</i> -Aminophenol ^b	130-157	22.0	...	...	...	K	(33)
Anthanthrene	...	32.3	45.8	7060	12.889	E	(49)
Anthracene	...	22.3	...	...	...	...	(57)
Anthracene	100-160	17.2	27.6	3760.6	8.910	...	(41)
Anthracene	...	22.8	39.7	4980	11.549	E	(66)
Anthracene ^b	65-80	24.4	44.7	5320	12.638	E	(13)
Anthracene	...	21.9	39.1	4790	11.420	E	(49)
Anthracene	...	22.0	40.0	4820	11.611	E	(49)
Anthracene	123-148	23.3	...	...	...	J	(84)
Anthracene	105-125	23.4	41.7	5102	12.002	F	(76)
Anthracene	...	22.3	...	...	...	...	(93, 95)
Anthraquinone	...	26.3	43.1	5747	12.305	...	(41)
Anthraquinone	...	25.0	43.8	5470	12.437	E	(49)
<i>cis</i> -Azobenzene ^b	30-60	17.9	30.9	3914	9.652	E	(17)
<i>trans</i> -Azobenzene ^b	30-60	17.9	31.2	3911	9.721	E	(17)
Azulene	...	16.2	...	...	...	...	(43)
Benzanthrone	...	27.6	48.1	6030	13.416	E	(49)
Benzene	-30-5	10.6	31.9	2309	9.846	...	(41)
Benzene	-58--30	10.3	30.5	2241	9.556	...	(41)
Benzene	...	10.7	...	...	...	...	(9)
Benzil	...	19.8	...	...	...	...	(93, 95)
Benzoic acid	...	20.1	...	...	...	...	(93, 95)
Benzoic acid ^b	70-114	21.8	45.5	4776	12.8699	A	(28)
Benzoic acid	60-121	20.1	41.5	4409	11.956	B	(52)
Benzoic acid	104-116	19.5	39.9	4277	11.620	...	(46)
3,4-Benzophenanthrene	...	25.4	...	...	...	...	(57)
Benzophenone	...	21.3	43.7	4654	12.434	E	(65)
Benzophenone	...	18.7	...	...	...	...	(93, 95)
Benzophenone	...	18.8	...	...	...	...	(90, 95)
Benzophenone ^b	...	22.7	65.46	4966	17.46	E	(59)
Benzophenone ^b	...	22.0	40.6	4818	17.19	E	(59)
Benzoquinone	...	15.0	32.5	3280	10.00	C	(24)
Betaine of <i>p</i> -aminobenzoic acid	...	34	...	...	...	...	(95)
Betaine of sulfanilic acid	...	16	...	...	...	...	(95)
9,9'-Bianthryl	...	35.4	...	...	...	...	(57)
9,9'-Biphenanthryl	...	36.2	...	...	...	...	(57)
Butyramide	80-100	20.8	45.5	4539	12.816	...	(21)
Camphor	0-25	15.7	38.8	3439	11.352	E	(97)
Camphor	0-180	12.8	27.1	2797	8.799	...	(41)
Camphor	...	12.1	...	...	...	H	(94)
ϵ -Caprolactam	21-41	19.9	40.9	4339	11.839	...	(3)
Carbon tetrachloride	-64--48	9.2	28.5	2027	9.089	...	(62)
Chloroacetophenone ^b	5-50	21.7	49.9	4740	13.779	...	(7)
<i>o</i> -Chlorobenzoic acid	...	19.0	...	...	...	E	(95)
<i>m</i> -Chlorobenzoic acid	...	19.3	...	...	...	...	(95)
<i>p</i> -Chlorobenzoic acid	...	21.0	...	...	...	C	(95)
<i>p</i> -Chloroiodo benzene ^b	30-50	14.6	31.7	3200	9.819	...	(38)
<i>m</i> -Chloronitro benzene	...	17.9	...	...	...	...	(90, 95)
<i>m</i> -Chlorophenol	...	12.7	...	...	...	...	(95)
<i>p</i> -Chlorophenol	...	12.4	...	...	...	...	(95)
Chrysene	...	28.1	...	...	...	...	(57)
Cinnamic acid	10-55	26.2	62.6	5723	16.569	E	(81)
Citronellol	10-60	15.8	31.5	3447	9.757	E	(82)
Coronene	...	35.5	...	...	...	...	(49)
Coumarin	20-80	20.6	...	...	...	E	(80)
<i>m</i> -Cresyl acetate ^b	2-44	14.5	31.5	3170	9.759	E	(7)
Cyclamen aldehyde	10-60	17.3	35.1	3794	10.519	E	(82)
Cycloheptadecanone	...	18.1	...	...	...	...	(95)
Cyclohexadecanone	...	19.6	...	...	...	...	(95)
Cyclohexane	-5 +5	8.9	26.1	1953	8.594	...	(41)
Cyclohexanone	...	11.8	29.4	...	...	E	(64)
Cyclononadecanone	...	19.7	...	...	...	...	(95)
Cyclo-octadecanone	...	18.5	...	...	...	...	(95)
Cyclopentadecanone	...	18.5	...	...	...	...	(95)
Cyclotetradecanone	...	19.3	...	...	...	...	(95)
Cyclo-trimethylene trinitramine ^b	110-138	26.8	41.1	5850	11.870	E	(35)
<i>p</i> -Dibromobenzene	-25-30	14.3	27.3	3115	8.846	E	(98)
1,2-Dibromoethane	...	14.1	...	...	...	E	(64)
<i>p</i> -Dichlorobenzene	10-50	16.3	41.7	3570	11.985	A	(27)
<i>p</i> -Dichlorobenzene	-25-30	13.6	36.1	2972	10.760	E	(70)
<i>p</i> -Dichlorobenzene	30-50	17.3	43.9	3771	12.480	...	(41)
1,1, <i>p,p</i> -Dichloro-diphenyltrichloroethane	50-90	27.5	49.9	6010	13.778	A	(31)
1,1, <i>p,p</i> -Dichloro-diphenyltrichloroethane ^b	66-100	28.2	51.7	6160	14.191	E	(37)
1,1, <i>p,p</i> -Dichloro-diphenyltrichloroethane	40-90	20.0	30.7	4370	9.60	A	(54)
2,6-Dichlorohydroquinone	...	22	25.8	4800	8.54	C	(24)

Table I. Continued

Compound	Temp. Range, ° C.	ΔH , Kcal./		A	B	Method ^d	Ref.
		Mole	Mole Deg.				
2,6-Dichloroquinone	1-42	16.7	31.9	3670	9.85	C	(24)
Diformylhydrazine	97-130	24.1	39.6	5264	11.53	...	(87)
9,10-Dihydroanthracene	...	21.4	...	...	...	...	(57)
5,12-Dihydrotetracene	...	28.8	...	...	...	...	(57)
<i>o</i> -Dihydroxybenzene	...	19.3	...	...	...	...	(90, 95)
<i>m</i> -Dihydroxybenzene	...	22.8	...	...	...	...	(90, 95)
<i>p</i> -Dihydroxybenzene	...	23.7	...	...	...	...	(90, 95)
<i>trans</i> -Diiodoethylene ^b	-8-20	9.72	13.6	2130	5.86	E	(18)
2,6-Dimethyl-3,5-dinitro-4- <i>tert</i> -butylacetophenone	20-80	25.8	...	...	...	E	(80)
Dimethyl fumaric ester	...	20.2	...	...	...	...	(90, 95)
Dimethyl glyoxime	...	23.2	...	...	...	...	(79)
3,4-Dimethyl hexadiene	...	12.7	...	...	...	...	(79)
Dimethyl maleic ester	...	10.6	...	...	...	...	(90, 95)
Dimethyl racemic ester	...	22.7	...	...	...	...	(32, 95)
<i>d</i> -Dimethyl tartrate ^b	35-44	27.0	62.8	5903.2	16.610	E	(26)
<i>d</i> -Dimethyl tartrate	...	21.1	...	...	...	...	(32, 95)
<i>meso</i> -Dimethyl tartrate	...	23.5	...	...	...	...	(32, 95)
<i>dl</i> -Dimethyl tartrate ^b	42-85	27.2	60.6	5941.3	16.127	E	(26)
<i>o</i> -Dinitrobenzene	...	20.7	...	...	...	...	(90, 95)
<i>m</i> -Dinitrobenzene	...	19.4	...	...	...	...	(90, 95)
<i>p</i> -Dinitrobenzene	...	21.2	...	...	...	...	(90, 95)
4,4'-Dinitrobiphenyl	138-155	25.0	35.9	5458	10.744	E	(78)
3,5-Dinitro- <i>o</i> -cresol ^b	17-51	24.7	51.5	5400	14.140	E	(7)
Diphenyl	...	16.4	...	...	...	...	(93, 95)
Diphenyl	15-40	19.5	43.0	4262	12.282	E	(13)
Diphenyl	4-34	17.4	34.3	3799	10.38	E	(16)
Diphenyl	14.3-34	17.9	37.2	3918	11.002	E	(78)
Diphenylamine	25-51	23.1	43.7	4654	12.434	C	(2)
9,10'-Diphenylanthracene	...	32.0	...	...	...	...	(57)
9,10-Diphenylanthracene ^b	208-229	37.6	60.3	8213	16.058	J	(84)
Diphenylcyanoarsine ^b	23-53	20.2	35.8	4420	10.724	E	(7)
Diphenylethane	...	17.5	...	...	...	...	(93, 95)
Diphenylmethane	5-26	15.3	28.5	3341	9.12	E	(16)
Enanthamide	72-92	23.8	49.2	5182	13.617	A	(82)
<i>meso</i> -Erythritol	...	32.3	...	...	...	E	(67)
Ethylene dibromide	-21-8	11.9	32.0	2606	9.884	E	(62)
Fluorene ^b	33-49	19.8	39.1	4324	11.325	E	(13)
Formic acid	-5-8	14.5	43.9	3160	12.486	I	(23)
Fumaric acid	...	32.5	...	...	...	...	(90, 95)
2-Fuoric acid ^b	44-55	25.9	58.2	5667	14.62	E	(11)
<i>n</i> -Heptadecane	15-20	31.4	77.1	6866	19.738	E	(15)
α -Hexachlorobenzene ^b	51-71	22.2	41.5	4850	11.950	E	(7)
β -Hexachlorobenzene ^b	95-117	24.6	40.7	5375	11.790	E	(7)
γ -Hexachlorobenzene ^b	60-92	27.6	57.8	6020	15.515	E	(7)
δ -Hexachlorobenzene ^b	55-75	23.3	44.6	5100	12.635	E	(7)
Hexachlorobenzene	96-124	21.9	38.9	4793	11.397	F	(76)
Hexachloroethane ^b (cubic form)	13-174	12.2	26.8	2677	8.731	H	(50)
Hexachloroethane ^b (triclinc form)	13-174	14.1	32.1	3077	9.890	H	(50)
Hexachloroethane	62.1-239	12.06	26.35	2636	8.640	I	(55)
Hexachloroethane	31-60	14.0	...	...	...	A	(17)
<i>n</i> -Hexadecane	15-17	30.1	75.9	6579	19.466	E	(15)
Hexamethylbenzene	...	19.3	37.5	4215	11.070	E	(63)
Hexamethylcyclotrisiloxane ^b	24-62	13.2	34.1	2883	10.335	K	(71)
Hydroquinone	53-72	24.8	48.4	5420	13.46	C	(24)
<i>p</i> -Hydroxybenzoic acid	125-160	27.8	49.0	6063	13.623	A	(28)
Indole	10-55	17.9	38.1	3916	11.204	E	(81)
Iodobenzene	-30--18	10.3	21.1	2246	7.500	...	(41)
Iodoform	...	16.7	45.4	...	...	E	(61)
<i>m</i> -Iodonitrobenzene	...	19.8	...	...	...	...	(90, 95)
Maleic acid	...	26.3	...	...	...	...	(90, 95)
Methane	-194--184	2.4	21.8	5168.8	7.651	...	(41)
Methane	...	2.5	...	...	...	...	(37)
<i>o</i> -Methoxybenzoic acid ^b	80-95	21.72	41.0	4746	11.871	A	(28)
<i>N</i> -Methyl acetamide	15-30	12.9	26.8	2823	8.739	H	(1)
Methyl anthranilate	10-60	18.7	41.6	4094	11.988	E	(82)
Methyl methacrylate	...	14.5	...	...	...	...	(22)
1-Methyl-4- <i>tert</i> -butyl methoxy-2,6-dinitrobenzene	20-80	24.6	...	...	...	E	(80)
Monochlorohydroquinone	33-61	24.6	52.4	5370	14.33	C	(24)
Monochloroquinone	-9-16	16.5	35.9	3620	10.74	C	(24)
Naphthacene	...	28.0	39.4	6130	11.485	E	(49)
Naphthalene	15-33	15.7	34.4	3429	10.41	E	(97)
Naphthalene ^b	6-21	17.3	40.0	3783	11.597	E	(13)
Naphthalene	-50-70	17.9	43.0	4000	12.275	M	(5)
Naphthalene	10-30	19.6	...	...	...	E	(89)
Naphthalene	...	17.9	...	...	...	A	(74)
<i>meso</i> -Naphthodianthrene	...	43.1	49.9	9430	13.789	E	(49)

Table I. Continued

Compound	Temp. Range ° C.	ΔH , Kcal./ Mole	ΔS , Cal./ Mole Deg.	A	B	Method ^a	Ref.
<i>m</i> -Nitroaniline	...	21.2	...	...	...	...	(90, 95)
<i>o</i> -Nitroaniline	...	19.7	...	...	...	...	(90, 95)
<i>p</i> -Nitroaniline	...	23.6	...	...	...	...	(90, 95)
<i>o</i> -Nitrochloro- acetophenone ^b	23-54	24.8	51.9	5413	14.24	E	(7)
<i>m</i> -Nitrochloro- acetophenone ^b	26-70	26.1	51.2	5700	14.080	E	(7)
<i>o</i> -Nitrophenol	...	17.5	...	...	...	...	(90, 95)
<i>p</i> -Nitrophenol	...	21.8	...	...	...	...	(90, 95)
<i>m</i> -Nitrophenol	...	21.9	...	...	...	...	(90, 95)
<i>n</i> -Octadecane	15-25	36.6	91.3	7995	22.83	E	(15)
Ovalene	...	50.5	58.9	1104.0	15.757	E	(49)
Oxalic acid (anhyd.)	60-105	21.7	42.7	4727	12.223	A	(69)
α -Oxalic acid (anhyd.) ^b	38-52	23.4	47.0	5130	13.17	E	(14)
β -Oxalic acid (anhyd.) ^b	38-50	22.3	44.3	4875	12.57	E	(14)
Oxamic acid ^b	82-90	25.8	44.4	5639	12.58	E	(12)
Oxamide ^b	80-96	27.0	44.4	5893	12.568	E	(12)
Pentadecanolide	10-60	19.4	36.6	4245	10.890	E	(82)
Pentaerythritol- tetranitrate ^b	97-138	35.5	67.9	7750	17.73	E	(35)
Perylene	...	30.9	52.5	6770	14.350	E	(49)
Phenanthrene ^b	37-50	20.7	38.9	4519	11.388	E	(13)
Phenanthrene	...	20.1	...	...	...	...	(57)
Phenanthrene	...	20.1	...	...	...	...	(93, 95)
Phenanthrene	...	21.7	45.3	4740	12.78	E	(49)
Phenol ^b	5-32	16.2	39.1	3540	11.421	O	(7)
Phenylacetaldehyde	10-60	13.0	28.6	2846	9.139	E	(82)
Phthalic anhydride ^b	30-60	21.2	42.9	4632	12.249	B	(25)
Piperonal	20-80	21.7	...	...	...	E	(80)
Pyranthrene	...	46.4	54.7	1015	14.825	E	(49)
Pyrene	...	23.9	45.9	5230	12.903	E	(49)
Pyrene ^b	72-85	22.5	38.4	4904	11.170	E	(13)
Pyrrrole-2-carboxylic acid ^b	77-81	30.3	62.7	6633	16.60	E	(11)
Quinhydrone	...	43.3	...	...	...	G	(88)
Quinuclidine	0-89	12.2	28.5	2630	9.103	...	(20)
Quinuclidine trimethylboron	0-115	19.0	41.8	4155	12.015	...	(19)
Rubeanic acid ^b	87-105	25.2	45.0	5515	12.713	E	(12)
Salicylic acid ^b	95-134	22.7	45.5	4968.7	12.859	A	(28)
Selenophone	-30-65	11.2	...	...	...	...	(58)
Stilbene	...	21.7	...	...	...	...	(93, 95)
α -Terpineol	10-55	19.2	44.7	4186	12.646	E	(81)
Tetracene	...	29.7	...	...	...	...	(57)
Tetrachloro- hydroquinone	77-86	21.2	32.9	4650	10.08	C	(24)
Tetrachloroquinone	60-83	23.6	41.9	5170	12.06	C	(24)
Tetragonal pentaerythritol	124-137	31.4	53.3	6861	14.525	E	(14)
Tetragonal pentaerythritol	106-135	34.4	60.8	7528	16.17	E	(68)
2,2,3,3-Tetramethylene	0-65	10.4	...	...	...	...	(75)
Tetraphene	...	26.1	...	...	...	...	(57)
2-Thenoic acid ^b	42-50	23.2	48.7	5065	13.53	E	(11)
Thymol ^b	0-40	21.8	51.8	4766	14.201	E	(7)
Tolane	...	21.2	...	...	...	...	(93, 95)
1,2,3-Trichloro- benzene ^b	16-30	15.7	35.6	3440	10.662	F	(77)
1,2,4-Trichlorobenzene	6-25	14.9	34.6	3254	10.445	F	(77)
1,3,5-Trichlorobenzene ^b	9-28	13.5	33.7	2956	9.176	F	(77)
<i>B</i> -Trichlorobenzole	41-84	17.1	40.5	3743	10.73	D	(19)
Trichlorohydroquinone	41-62	24.2	48.9	5300	13.57	C	(24)
Trichloroquinone	28-54	21.2	41.9	4630	12.03	C	(24)
Trinitrophenylene	...	26.3	...	...	...	...	(57)
2,4,6-Trinitrotoluene ^b	50-143	28.3	56.9	6180	15.34	E	(34)
Urea	72-95	20.9	34.5	4579	10.44	...	(87)
Valeramide	80-100	21.3	45.8	4660	12.912	...	(21)
δ -Valerolactam	20-39	17.8	35.7	3891	10.692	C	(3)
Vanillal	20-80	24.3	...	...	...	E	(80)
Vanillin	20-80	21.2	...	...	...	E	(80)
Violanthrene	...	53.5	67.0	1168	17.532	E	(49)
1,3,5- <i>m</i> -Xylenol	...	15.1	...	...	...	...	(93, 95)
1,2,5- <i>p</i> -Xylenol	...	15.3	...	...	...	...	(93, 95)
1,3,4- <i>o</i> -Xylenol	...	17.3	...	...	...	...	(93, 95)
1,2,3- <i>o</i> -Xylenol	...	14.2	...	...	...	...	(93, 95)
1,2,3- <i>m</i> -Xylenol	...	14.7	...	...	...	...	(93, 95)
<i>p</i> -Xylohydroquinone	59-88	24.1	43.4	5280	12.36	C	(24)
<i>p</i> -Xyloquinone	0-20	18.4	39.6	4030	11.53	C	(24)

^a Methods. A, air flow method; B, McLeod gage method; C, glass fiber manometer; D, sickle cell; E, effusion method; F, Rodebush gage; G, indirect method; H, Bourdon gage; I, static method; J, fluorescence method; K, isoteniscope; L, glass membrane manometer; M, several methods employed; N, glass manometer designed by Balson; O, Chadwick and Polkin manometer.

^b Most acceptable results.

Table II. Compounds and Data Source

Compound	Ref.	Compound	Ref.	Compound	Ref.
Acetaldoxime	(6)	Cyclohexanol	(86)	1-Nitronaphthalene	(65)
Acetamide	(6, 86)	Cyclohexanone	(64)	<i>n</i> -Octadecane	(91)
Acetanilide	(2)	Cyclohexene	(29)	Oxalic acid	(40)
Acetic acid	(86)	Diacetamide	(6, 44)	Paraformaldehyde	(6)
Acetonitrile	(86)	1, 4-Dibromobenzene	(86)	<i>n</i> -Pentadecane	(91)
Acetylene	(86)	1, 2-Dibromoethane	(86)	Perylene	(48)
Acetyl glycine anilide	(2)	1, 2-Dichloroethane	(86)	Phenol	(86)
Acetyl glycine <i>N</i> -methyl amide	(2)	<i>trans</i> -1,2-Dichloroethylene	(86)	Phthaloyl chloride	(6)
Acetyl proline <i>N</i> -methyl amide	(2)	<i>n</i> -Diethyl ketone	(91)	Propionamide	(6)
Acrylic acid	(73, 86)	2,2-Dimethylpropane	(56)	Propyne	(86)
Adipic acid	(40)	1,4-Dioxane	(91)	Pyranthrone	(48)
<i>tert</i> -Amyl alcohol	(86)	Durene	(56)	Resorcinol	(6)
Anthraquinone	(86)	1,2-Ethanediamine	(45)	Salicylic acid	(83)
2, 3-Benzanthracene	(48)	Ethylamine	(86)	Succinic acid	(40)
Benzene	(86)	α -Ethylenic amides	(21)	Succinimide	(86)
Biphenyl	(2)	Ethyl isothiocyanate	(8, 86)	1, 1, 2, 2-Tetrachloro- 1, 2-difluoroethane	(86)
Borneol	(92)	Fluorobenzene	(86)	Tetrachloroethylene	(86)
1-Bromo-2-chloroethane	(86)	Formic acid	(86)	<i>n</i> -Tetradecane	(91)
1, 3-Butadiyne	(86)	Glutaric acid	(40)	1, 2, 4, 5-Tetramethylbenzene	(86)
1, 3-Butanediol	(47, 86)	<i>n</i> -Heptadecane	(91)	Tetramethyllead	(85)
<i>tert</i> -Butyl alcohol	(86)	<i>n</i> -Heptyl hexyl ketone	(91)	Thiophene	(36, 39)
2-Butyne	(42, 60)	Hexachlorobenzene	(36)	Tiglic acid	(86)
Camphene	(86)	Hexachloroethane	(86)	Trichloroacetaldehyde hydrate	(86)
<i>d</i> -Camphor	(86)	<i>n</i> -Hexadecane	(91)	Trichloroacetic acid	(86)
Capramide	(21)	Hexamethylene	(96)	1, 3, 5-Trichlorobenzene	(36)
Caproamide	(21)	Hydrocyanic acid	(86)	1, 2, 3-Trichlorobenzene	(36)
Caprylamide	(21)	Hydroquinone	(83)	1, 1, 2-Trichloro-1, 2, 2-trifluoroethane	(86)
Carbazole	(3)	α -Hydroxyisobutyric acid	(86)	α, α, α -Trifluorotoluene	(36)
Carbon tetrachloride	(86)	Indole	(3)	Trimethylgallium	(53)
Carbon tetrafluoride	(86)	Isoviolanthrone	(48)	Trinitroanisole	(65)
Cetene	(94)	Maleic acid	(40)	1, 2, 3-Trinitrobenzene	(65)
Chloranil	(30)	Maleic anhydride	(6)	1, 3, 5-Trinitrobenzene	(65)
Chloroacetic acid	(86)	Malonic acid	(40)	Trinitrochlorobenzene	(65)
4-Chloroaniline	(6, 86)	Methane	(86)	Trinitrophenetole	(65)
<i>trans</i> -Cinnamic acid	(6, 86)	Methylamine	(86)	Trinitrotoluene	(65)
Coronene	(48)	<i>N</i> -Methyl benzamide	(2)	Violanthrone	(48)
Cyanogen	(86)	Methyl bromide	(86)	2,4-Xylaldehyde	(86)
Cyanogen bromide	(86)	Methyl chloride	(86)	<i>p</i> -Xylene	(56)
Cyanogen chloride	(86)	1-Methyl-4- <i>tert</i> -butyl-3- methoxy-2,6-dinitrobenzene	(86)	2,3-Xylenol	(86)
Cyanogen fluoride	(86)	Methyl isothiocyanate	(86)	2,5-Xylenol	(86)
Cyanogen iodide	(86)	Naphthalene	(4, 93)	3,5-Xylenol	(86)
Cyclobutane	(86)	1-Naphthol	(86)		

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