

TABLE II (continued)

Substance	Di-isodecyl phthalate	Di-2-ethylhexyl sebacate	Silicone oil DC 200	Apiezon L
Acetone	0.085	0.071	0.075	0.038
Butan-2-one	0.175	0.151	0.133	0.099
Pentan-2-one	0.336	0.297	0.264	0.198
Heptan-2-one	1.48	—	0.877	0.497
Methyl acetate	0.087	0.079	0.104	0.047
Ethyl acetate	0.150	0.141	0.165	0.088
<i>n</i> -Propyl acetate	0.309	0.295	0.317	0.178
<i>n</i> -Butyl acetate	0.649	0.626	0.618	0.384
Diethyl ether	0.051	0.053	0.069	0.041
Di-isopropyl ether	0.101	0.108	0.133	0.077
Di- <i>n</i> -butyl ether	0.854	0.912	0.840	0.700
Carbon dioxide	—	0.0048	0.011	0.0024
Neopentane	0.021	0.026	0.043	0.020
Iso-octane	0.196	0.219	0.261	0.198
Water	0.124	0.086	0.144	0.129

As an illustration (see Tables I and II) we have converted the retention data of SCHOLLY AND BRENNER³, which were measured from the air peak with *n*-pentane as standard. Corrections to the dead volume have been applied where necessary.

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Relative detector response in gas chromatography

IV. Ethers and acetals

The investigation of the relative detector response of a thermal conductivity detector to organic compounds of various types is continued with a study of the relative responses to aliphatic and cyclic ethers, and to aliphatic and cyclic acetals. MESSNER *et al.*¹, using helium as the carrier gas, found that the relative detector responses to aliphatic ethers increased with an increase in molecular weight and it has been shown previously²⁻⁴ that, for other homologous series, there was such an increase in relative detector responses when nitrogen was used as the carrier gas.

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Experimental

Gas-liquid chromatography was carried out using the apparatus described previously². Nitrogen was used as the carrier gas at a flow rate of approximately 33 ml/min, and the bridge current was 100 mA. Under the conditions used no reversal of peaks was observed for any of the compounds studied.

The aliphatic ethers, which were either obtained from commercial suppliers or were prepared by standard methods, were finally purified by fractional distillation from potassium hydroxide pellets.

TABLE I
RELATIVE DETECTOR RESPONSE TO ETHERS AND ACETALS

<i>Compound</i>	<i>Mol.wt.</i>	<i>Response per mole relative to benzene (= 100)</i>
<i>Aliphatic ethers</i>		
Di-ethyl ether	74	82
<i>n</i> -Butyl methyl ether	88	102
Di- <i>n</i> -propyl ether	102	128
Di-isopropyl ether		116
<i>n</i> -Butyl ethyl ether		124
<i>n</i> -Butyl <i>n</i> -propyl ether	116	148
Di- <i>n</i> -butyl ether	130	171
<i>Cyclic ethers</i>		
Tetrahydrofuran	72	96
Tetrahydropyran	86	104
1,3-Dioxan	88	98
1,4-Dioxan		101
Furan	68	77
2-Methylfuran	82	98
2,5-Dimethylfuran	96	120
<i>Aliphatic acetals</i>		
Dimethyl acetal	90	78
Ethylal	104	106
Methyl propylal		104
Diethyl acetal	118	125
<i>n</i> -Propylal	132	148
Isopropylal		135
Ethyl propylal		149
Di- <i>n</i> -propyl acetal	146	169
Di-isopropyl acetal		158
<i>n</i> -Butylal	160	192
Isobutylal		180
<i>n</i> -Propyl propylal		194
Isopropyl propylal		178
Di- <i>n</i> -butyl acetal	174	213
Di-isobutyl acetal		203
<i>Cyclic acetals</i>		
1,3-Dioxolan	74	92
2-Methyl-1,3-dioxolan	88	103
4-Methyl-1,3-dioxolan		102
2,2-Dimethyl-1,3-dioxolan	102	114
2-Ethyl-1,3-dioxolan		116
2-Methyl-2-ethyl-1,3-dioxolan	116	125

The aliphatic acetals were prepared by standard methods and were purified by fractional distillation from potassium metal. The dioxolans were prepared by the method of LUCAS AND GUTHRIE⁵ and were purified by fractional distillation from potassium metal.

Results and discussion

The relative detector responses to a number of aliphatic and cyclic ethers and aliphatic and cyclic acetals are shown in Table I.

An examination of these results shows that there is, in each homologous series, an increase in relative response with an increase in molecular weight. The increment for each CH₂ group is approximately 22 units of response for aliphatic ethers, 21 units for the methylfurans, 21 units for the aliphatic acetals. These increments are similar to those found for other homologous series⁶. The increment for the dioxolans is only 11 units per CH₂ group.

It is also found that, in the aliphatic ethers and acetals, there is a decrease in relative response to isomeric compounds with an increase in chain branching. This decrease in relative response is similar to those found previously for isomeric alkylbenzenes³ and for isomeric aliphatic esters⁴.

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Separation and identification of amino acids by two-dimensional paper chromatography

The separation and identification of amino acids present in a mixture have been carried out by paper partition chromatography using several different solvent systems¹. In each solvent system certain amino acids have R_F values that are so similar that it is often difficult to distinguish them. This difficulty has been overcome to a certain extent by subjecting a mixture of amino acids to two-dimensional chromatography, using a different solvent system for each dimension¹⁻⁵. For this purpose, the mixture containing the unknown amino acids is generally applied to a filter paper sheet near one of its corners. After running a solvent through the paper sheet in one direction, it is dried and a second solvent is run through it in a direction at right

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