

Comparison of boiling points and water solubilities for molecules with different functional groups.

Each table shows two or more compounds of approximately the same molecular weight (MW) and shape; they differ in functional group. The table shows the boiling point (BP) and solubility in water for these compounds. Each table is in order of decreasing boiling point. Note that solubility trends are sometimes less clear than BP trends; this is for the same reason as discussed for MP trends. See Ouellette pp 272, 338 & 396 for more examples.

Your main goal... for (almost) any pair of compounds of similar MW, you should be able to predict which has the higher BP, and explain why.

Tables are, in part, based on similar Tables in a previous textbook, Bettelheim et al, Introduction to General, Organic, and Biochemistry, 6/e, 2001.

I. Alcohol vs alkane (Bettelheim 6/e Table 13.1)

<u>Structure</u>	<u>Name</u>	<u>MW</u>	<u>BP (°C)</u>	<u>Sol in H₂O</u>
CH ₃ CH ₂ OH	ethanol	46	78	infinite
CH ₃ CH ₂ CH ₃	propane	44	-42	-

II. Alcohol vs ether (Bettelheim 6/e Table 13.2)

<u>Structure</u>	<u>Name</u>	<u>MW</u>	<u>BP (°C)</u>	<u>Sol in H₂O</u>
CH ₃ CH ₂ OH	ethanol	46	78	infinite
CH ₃ OCH ₃	dimethyl ether	46	-24	+

III. Acid vs alcohol vs aldehyde (Bettelheim 6/e Table 18.2)

<u>Structure</u>	<u>Name</u>	<u>MW</u>	<u>BP (°C)</u>	<u>Sol in H₂O</u>
CH ₃ COOH	ethanoic acid	60	118	infinite
CH ₃ CH ₂ CH ₂ OH	1-propanol	60	97	infinite
CH ₃ CH ₂ CHO	propanal	58	49	++

IV. Many groups (Bettelheim 6/e Table 17.2)

<u>Structure</u>	<u>Name</u>	<u>MW</u>	<u>BP (°C)</u>	<u>Sol in H₂O</u>
CH ₃ CH ₂ COOH	propanoic acid	74	141	infinite
CH ₃ CH ₂ CH ₂ CH ₂ OH	1-butanol	74	117	+
CH ₃ CH ₂ COCH ₃	2-butanone	72	80	+++
CH ₃ CH ₂ CH ₂ CHO	butanal	72	76	+
CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	pentane	72	36	-
CH ₃ CH ₂ OCH ₂ CH ₃	diethyl ether	74	34	+