# An Empirical Model for Solvation Based on Surface Site Interaction Points

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## Supplementary Information

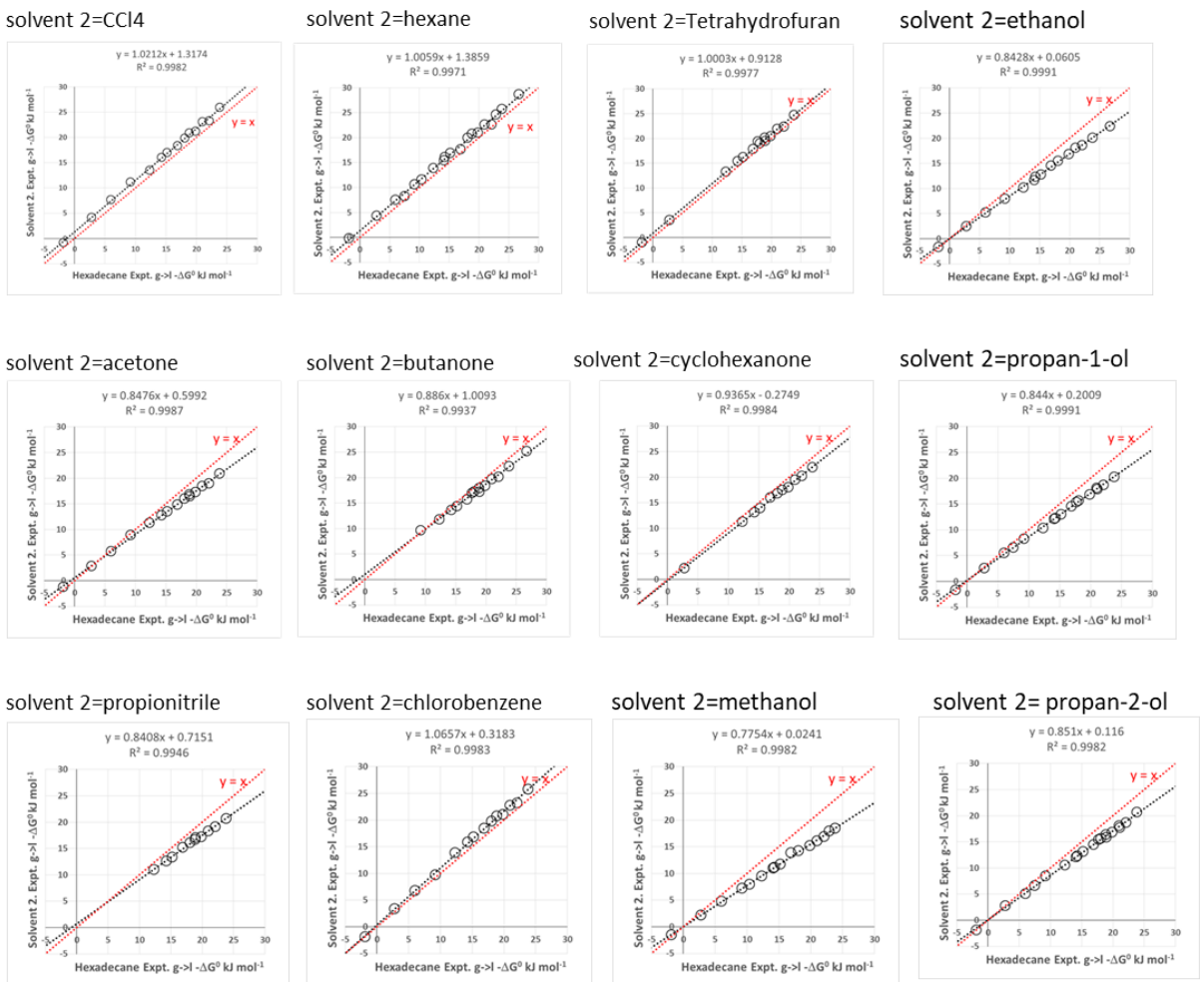
**Section 1**:

## Comparison of free energies ($-\Delta G^0$ kJ mol$^{-1}$) of transfer of alkanes from gas phase into n-hexadecane with transfer into other solvents.

**Table S1: Free energies ($-\Delta G^0$ kJ mol$^{-1}$) of transfer of alkanes from gas phase to solvent**
(Solvents were only included if at least 10 transfer values were available)

| | Hexadecane | CCl4 | Hexane | Propionitrile | Tetrahydrofuran | Chlorobenzene | Acetone | Propanone | cyclohexanone | Methanol | Ethanol | propan-1-ol | Propan-2-ol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Alkane solute** | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ | $-\Delta G^0$ |
| n-pentane | 12.3 | 13.5 | 13.9 | 11.0 | 13.3 | 13.9 | 11.3 | 11.8 | 11.3 | 9.5 | 10.2 | 10.3 | 10.6 |
| n-hexane | 15.2 | 17.0 | 16.9 | 13.4 | 16.2 | 16.8 | 13.5 | 14.4 | 13.9 | 11.7 | 12.8 | 13.0 | 13.1 |
| n-heptane | 18.1 | 19.9 | 20.0 | 16.1 | 19.1 | 19.8 | 16.0 | 17.3 | 16.8 | 14.3 | 15.5 | 15.6 | 15.6 |
| n-octane | 21.0 | 23.1 | 22.6 | 18.3 | 22.0 | 22.8 | 18.4 | 19.7 | 19.5 | 16.1 | 18.1 | 18.1 | 18.1 |
| n-nonane | 23.9 | 26.0 | 25.7 | 20.7 | 24.8 | 25.8 | 20.9 | 22.3 | 21.9 | 18.4 | 20.1 | 20.3 | 20.7 |
| n-decane | 26.7 | #N/A | 28.7 | #N/A | #N/A | #N/A | #N/A | 25.2 | #N/A | #N/A | 22.4 | #N/A | #N/A |
| 2-methylpentane | 14.3 | 16.0 | 16.1 | 12.6 | 15.4 | 15.9 | 12.8 | 13.6 | 13.1 | 11.2 | 12.3 | 12.3 | 12.3 |
| 2,5-dimethylhexane | 18.9 | 20.9 | 20.8 | 16.7 | 20.1 | 20.8 | 16.8 | 17.9 | 17.5 | #N/A | #N/A | #N/A | 16.4 |
| 2,2,4-trimethylpentane | 17.7 | #N/A | #N/A | #N/A | 19.5 | #N/A | #N/A | 16.9 | #N/A | #N/A | #N/A | 15.3 | 15.4 |
| 2,3,4-trimethylpentane | 19.9 | 21.2 | 21.0 | 17.2 | 20.5 | 21.1 | 17.3 | 18.4 | 18.0 | 15.2 | 16.8 | 16.8 | 16.8 |
| 3,3-diethylpentane | 22.9 | #N/A | 24.6 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 18.0 | #N/A | #N/A | #N/A |
| cyclopentane | 14.1 | #N/A | 15.5 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 11.0 | 11.6 | 12.1 | 12.1 |
| cyclohexane | 16.9 | 18.4 | 17.7 | 15.2 | 17.9 | 18.4 | 14.8 | 15.7 | 16.0 | 13.9 | 14.5 | 14.5 | 14.4 |
| cycloheptane | 21.1 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 17.9 | 17.7 |
| methylcyclopentane | 16.6 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A |
| methylcyclohexane | 18.9 | #N/A | #N/A | 17.1 | 19.5 | #N/A | 16.4 | 17.2 | #N/A | #N/A | #N/A | #N/A | 15.9 |
| ethylcyclohexane | 22.1 | 23.3 | 22.6 | 19.1 | 22.4 | 23.2 | 18.9 | 20.1 | 20.2 | 16.9 | 18.6 | 18.7 | 18.7 |
| methane | -1.8 | -0.8 | -0.1 | #N/A | -1.0 | -1.9 | -1.3 | #N/A | #N/A | -1.5 | -1.7 | -1.7 | -1.9 |
| ethane | 2.8 | 4.2 | 4.3 | #N/A | 3.5 | 3.4 | 2.9 | #N/A | 2.2 | 2.2 | 2.5 | 2.6 | 2.7 |
| propane | 6.0 | 7.6 | 7.5 | #N/A | #N/A | 6.7 | 5.7 | #N/A | #N/A | 4.8 | 5.2 | 5.5 | 5.1 |
| butane | 9.2 | 11.2 | 10.7 | #N/A | #N/A | 9.7 | 8.9 | 9.6 | #N/A | 7.2 | 8.0 | 8.3 | 8.5 |
| cyclopropane | 7.5 | #N/A | 8.3 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 6.6 | 6.6 |
| 2,2-dimethylpropane | 10.4 | #N/A | 11.6 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 8.0 | #N/A | #N/A | #N/A |

Figure S1: **Comparison of free energies ($-\Delta G^0$ kJ mol$^{-1}$) of transfer of alkanes from gas phase into n-hexadecane with transfer into other solvents** (x axis**:** hexadecane and y axis: solvent2)

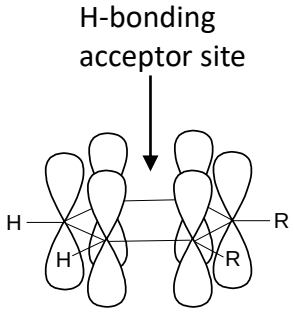


**Section 2:**

**Complex formation between aromatic acceptors and H-bond donors**

H-bond parameters for the polar interaction sites on the π-faces of aromatic hydrocarbons

| Aromatic acceptors | β |
|---|---|
| benzene | 2.00 |
| toluene | 2.20 |
| ortho-, meta- or para-xylene | 2.40 |
| mesitylene | 2.70 |
| hexamethylbenzene | 3.10 |




Solvent parameters for $CCl_4$ from ref [1] and alpha values for donors from ref [2]

$$CCl_4 \text{ solvent: } \alpha_S = 1.4 \text{ and } \beta_S = 0.6$$

$$\text{Calculated } -\Delta G^0_{CCl_4}(\text{kJ mol}^{-1}) = (\alpha - 1.4)(\beta - 0.6) - 6$$

**Figure S2:**

Calculated v experimental $-\Delta G^0$ for formation of 1:1 complexes between benzene acceptors and alcohol and phenol H-bond donors in $CCl_4$ (rmsd= 0.35 kJ $mol^{-1}$ n= 38)

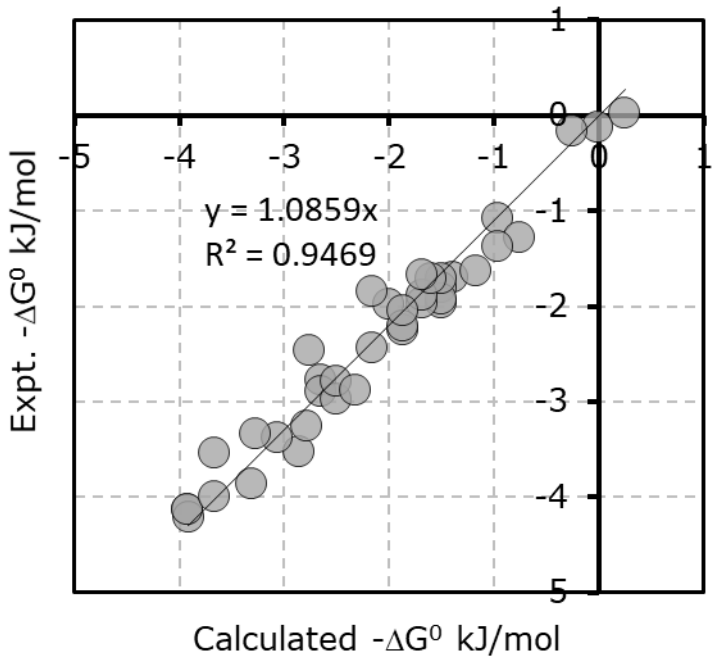



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**Table S2**

Calculated v experimental $-\Delta G^0$ for formation of 1:1 complexes between benzene acceptors and alcohol and phenol H-bond donors in $CCl_4$

| H-Bond Donor | $\alpha$ | H-Bond Acceptor | $\beta$ | $-\Delta G^0$ Calculated kJ mol$^{-1}$ | $-\Delta G^0$ Experiment kJ mol$^{-1}$ | Reference |
|---|---|---|---|---|---|---|
| Methanol | **2.90** | benzene | **2.00** | -3.90 | -4.21* | [3] |
| 2-Methylphenol | **3.50** | benzene | **2.00** | -3.06 | -3.39 | [4] |
| 4-methylphenol | **3.70** | benzene | **2.00** | -2.78 | -3.26 | [4] |
| phenol | **3.80** | benzene | **2.00** | -2.64 | -2.77 | [4] |
| 1-naphthol | **3.80** | benzene | **2.00** | -2.64 | -2.90 | [4] |
| 2-naphthol | **3.90** | benzene | **2.00** | -2.50 | -2.98 | [4] |
| 4-fluorophenol | **3.90** | benzene | **2.00** | -2.50 | -2.80 | [5] |
| 4-nitrophenol | **4.70** | benzene | **2.00** | -1.38 | -1.70 | [4] |
| tert-Butyl alcohol | **2.70** | toluene | **2.20** | -3.92 | -4.13 | [6] |
| 4-methylphenol | **3.70** | toluene | **2.20** | -2.32 | -2.89 | [4] |
| 1-naphthol | **3.80** | toluene | **2.20** | -2.16 | -2.44 | [4] |
| phenol | **3.80** | toluene | **2.20** | -2.16 | -1.86 | [4] |
| 4-fluorophenol | **3.90** | toluene | **2.20** | -2.00 | -1.98 | [5] |
| 4-methylphenol | **3.70** | o-xylene | **2.40** | -1.86 | -2.22 | [4] |
| phenol | **3.80** | o-xylene | **2.40** | -1.68 | -1.97 | [4] |
| 2-naphthol | **3.90** | o-xylene | **2.40** | -1.50 | -1.93 | [4] |
| tert-Butyl alcohol | **2.70** | m-xylene | **2.40** | -3.66 | -3.55 | [6] |
| Methanol | **2.90** | m-xylene | **2.40** | -3.30 | -3.87 | [6] |
| 4-methylphenol | **3.70** | m-xylene | **2.40** | -1.86 | -2.26 | [4] |
| 2-naphthol | **3.90** | m-xylene | **2.40** | -1.50 | -1.97 | [4] |
| tert-Butyl alcohol | **2.70** | p-xylene | **2.40** | -3.66 | -4.00 | [6] |
| 4-methylphenol | **3.70** | p-xylene | **2.40** | -1.86 | -2.05 | [4] |
| phenol | **3.80** | p-xylene | **2.40** | -1.68 | -1.89 | [4] |
| 1-naphthol | **3.80** | p-xylene | **2.40** | -1.68 | -1.68 | [4] |
| 2-naphthol | **3.90** | p-xylene | **2.40** | -1.50 | -1.81 | [4] |
| 4-fluorophenol | **3.90** | p-xylene | **2.40** | -1.50 | -1.71 | [7] |
| tert-Butyl alcohol | **2.70** | mesitylene | **2.70** | -3.27 | -3.35 | [6] |
| Methanol | **2.90** | mesitylene | **2.70** | -2.85 | -3.54 | [6] |
| 2-Methylphenol | **3.50** | mesitylene | **2.70** | -1.59 | -1.72 | [4] |
| 4-methylphenol | **3.70** | mesitylene | **2.70** | -1.17 | -1.63 | [4] |
| 1-naphthol | **3.80** | mesitylene | **2.70** | -0.96 | -1.09 | [4] |
| phenol | **3.80** | mesitylene | **2.70** | -0.96 | -1.39 | [4] |
| 4-fluorophenol | **3.90** | mesitylene | **2.70** | -0.75 | -1.28 | [5] |
| tert-Butyl alcohol | **2.70** | Hexamethylbenzene | **3.10** | -2.75 | -2.47 | [6] |
| 4-methylphenol | **3.70** | Hexamethylbenzene | **3.10** | -0.25 | -0.17 | [4] |
| phenol | **3.80** | Hexamethylbenzene | **3.10** | 0.00 | -0.13 | [4] |
| 4-fluorophenol | **3.90** | Hexamethylbenzene | **3.10** | 0.25 | 0.02 | [5] |

Footnote to table: * reported value converted from mole fraction standard state to molar standard state

**References for Section 2**


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2. Calero, C.S., et al., *Footprinting molecular electrostatic potential surfaces for calculation of solvation energies.* Phys Chem Chem Phys, 2013. **15**(41): p. 18262-73.
3. Koné, M., et al., *Can Quantum-Mechanical Calculations Yield Reasonable Estimates of Hydrogen-Bonding Acceptor Strength? The Case of Hydrogen-Bonded Complexes of Methanol.* The Journal of Physical Chemistry A, 2011. **115**(47): p. 13975-13985.
4. Joesten, M.D. and L.J. Schaad, *Hydrogen Bonding*. 1974: Marcel Dekker, New York.
5. Laurence, C., et al., *The pK(BHX) database: toward a better understanding of hydrogen-bond basicity for medicinal chemists.* J Med Chem, 2009. **52**(14): p. 4073-86.
6. Murthy, A.S.N. and C.N.R. Rao, *Spectroscopic Studies of the Hydrogen Bond.* Applied Spectroscopy Reviews, 1968. **2**(1): p. 69-191.
7. Laurence, C. and M. Berthelot, *Observations on the strength of hydrogen bonding.* Perspectives in Drug Discovery and Design, 2000. **18**(1): p. 39-60.

## Section 3:

## Substructure fragments

For each molecule the SMILES string was analysed and a SMARTS based substructure code from table S3 was assigned to each heavy atom. Aromatic groups were assigned an additional code to describe a SSIP in the centre of the π-face of each aromatic 6 membered ring.

Table S3: Description of the substructure fragments used to describe the solutes and details of the number SSIPs and the associated parameters assigned to each fragment

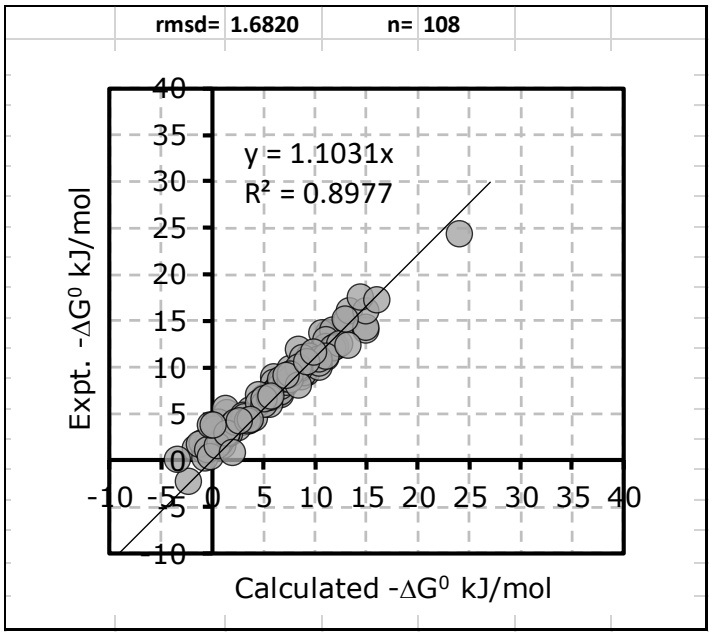
| Fragment ID | Description | Central Atom Type | SMARTS based code | no of $\alpha_1$ SSIP | $\alpha_1$ | no of $\alpha_2$ SSIP | $\alpha_2$ | no of $\beta_1$ SSIP | $\beta_1$ | no of $\beta_2$ SSIP | $\beta_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | H attached to sp3 C also bonded to one F atom | Csp3 | [H]CF | **1** | 1.70 | **0** | 0.00 | **1** | 0.20 | **0** | 0.00 |
| 2 | H attached to sp3 C also bonded to one Cl atom | Csp3 | [H]C(Cl) | **1** | 1.60 | **0** | 0.00 | **1** | 0.60 | **0** | 0.00 |
| 3 | H attached to sp3 C | Csp3 | [H]C | **1** | 1.20 | **0** | 0.00 | **1** | 0.60 | **0** | 0.00 |
| 4 | sp2 C with H attached | Csp2 aliphatic | [H][C](C)=C | **1** | 1.20 | **0** | 0.00 | **2** | 1.31 | **1** | 0.60 |
| 5 | sp2 C with two H attached | Csp2 aliphatic | [H][C]([H])=C | **2** | 1.20 | **0** | 0.00 | **2** | 1.31 | **2** | 0.60 |
| 6 | H attached to sp2 C in a formamide | Csp2 aliphatic | [H][C](N)=O | **1** | 1.20 | **0** | 0.00 | **1** | 0.60 | **0** | 0.00 |
| 7 | sp2 C with no attached H | Csp2 aliphatic | C[C](C)=C | **0** | 0.00 | **0** | 0.00 | **2** | 1.31 | **0** | 0.00 |
| 8 | sp2 C in a ketone | Csp2 aliphatic | C[C](C)=O | **2** | 1.50 | **0** | 0.00 | **0** | 0.00 | **0** | 0.00 |
| 9 | sp2 C in an amide | Csp2 aliphatic | C[C](N)=O | **2** | 1.50 | **0** | 0.00 | **0** | 0.00 | **0** | 0.00 |
| 10 | CH in benzene or pyridine ring | Csp2 aromatic | c[c]([H])c or n[c]([H])c | **1** | 1.40 | **0** | 0.00 | **2** | 0.70 | **0** | 0.00 |
| 11 | Quaternary aromatic sp2 C atom | Csp2 aromatic | c[c](*)c or n[c]( *)c | **0** | 0.00 | **0** | 0.00 | **2** | 0.88 | **0** | 0.00 |
| 12 | sp C in nitrile | Csp_C#N | C[C]#N | **4** | 1.50 | **0** | 0.00 | **0** | 0.00 | **0** | 0.00 |
| 13 | NH in secondary amide | Nsp3 | [H][N](C=O)C | **1** | 2.81 | **0** | 0.00 | **2** | 2.71 | **0** | 0.00 |
| 14 | N in tertiary amide | Nsp3 | C[N](C=O)C | **0** | 0.00 | **0** | 0.00 | **2** | 2.71 | **0** | 0.00 |
| 15 | NH3 in ammonia | Nsp3 | [H]N([H])[H] | **3** | 1.59 | **0** | 0.00 | **1** | 6.80 | **1** | 0.81 |
| 16 | NH2 in primary amine | Nsp3 | [H][N]([H])C | **2** | 1.59 | **0** | 0.00 | **1** | 8.00 | **1** | 0.95 |
| 17 | NH in secondary amine | Nsp3 | [H][N](C)C | **1** | 1.59 | **0** | 0.00 | **1** | 7.90 | **1** | 2.44 |
| 18 | N in tertiary amine | Nsp3 | C[N](C)C | **0** | 0.00 | **0** | 0.00 | **1** | 7.50 | **1** | 3.59 |
| 19 | sp2 N in pyridine ring | Nsp2 aromatic | [n]1ccccc1 | **0** | 0.00 | **0** | 0.00 | **1** | 7.30 | **2** | 1.00 |
| 20 | sp N in nitrile | Nsp | C#[N] | **0** | 0.00 | **0** | 0.00 | **1** | 5.15 | **4** | 1.17 |
| 21 | H2O water monomer | Osp3 | [H][O][H] | **2** | 2.80 | **0** | 0.00 | **2** | 4.50 | **0** | 0.00 |
| 22 | OH in a phenol | Osp3 | [H][O]c1ccccc1 | **1** | 3.80 | **0** | 0.00 | **1** | 3.10 | **2** | 2.15 |
| 23 | OH in alcohol | Osp3 | [H][O]C | **1** | 2.70 | **0** | 0.00 | **1** | 5.30 | **1** | 3.98 |
| 24 | sp3 O in cyclic ether | Osp3 | C[O;R]C | **0** | 0.00 | **0** | 0.00 | **1** | 5.30 | **1** | 2.53 |
| 25 | sp3 O in acyclic dialkyl ether | Osp3 | C[O]R | **0** | 0.00 | **0** | 0.00 | **1** | 5.30 | **1** | 2.53 |
| 26 | lone pair on sp2 O in ketone | Osp2 | lone pair electrons [O]=C(C)C | **0** | 0.00 | **0** | 0.00 | **1** | 5.80 | **1** | 3.77 |
| 27 | pi orbital electrons sp2 O in ketone | Osp2 | Pi electrons [O]=C(C)C | **0** | 0.00 | **0** | 0.00 | **2** | 0.60 | **0** | 0.00 |
| 28 | lone pair on sp2 O in amide | Osp2 | lone pair electrons [O]=C(N) | **0** | 0.00 | **0** | 0.00 | **1** | 8.50 | **1** | 2.74 |
| 29 | pi orbital electrons sp2 O in amide | Osp2 | Pi electrons [O]=C(N) | **0** | 0.00 | **0** | 0.00 | **2** | 0.60 | **0** | 0.00 |
| 30 | Single F attached to sp3 C | F | [F]C([H]) | **1** | 0.80 | **0** | 0.00 | **1** | 3.10 | **0** | 0.00 |
| 31 | F in perfluoroalkane (includes CF4) | F | [F]C(F)C(F)(F) | **1** | 1.20 | **0** | 0.00 | **1** | 0.60 | **0** | 0.00 |
| 32 | F attached to benzene ring | F | [F]c1ccccc1 | **1** | 1.52 | **0** | 0.00 | **1** | 1.52 | **0** | 0.00 |
| 33 | S in dialkyl sulphide | S | C[S]C | **0** | 0.00 | **0** | 0.00 | **1** | 3.80 | **3** | 1.39 |
| 34 | Single Cl attached to sp3 C | Cl | [Cl]CC | **2** | 1.20 | **0** | 0.00 | **1** | 2.30 | **2** | 0.60 |
| 35 | Cl in tetrachloromethane | Cl | [Cl]C(Cl)(Cl)Cl | **2** | 1.40 | **0** | 0.00 | **3** | 0.60 | **0** | 0.00 |
| 36 | Cl attached to benzene ring | Cl | [Cl]c1ccccc1 | **2** | 1.50 | **0** | 0.00 | **1** | 0.85 | **2** | 0.85 |
| | | | | | | | | | | | |
| | **Aromatic Ring Description** | | Code | no of $\alpha_1$ SSIP | $\alpha_1$ | no of $\alpha_2$ SSIP | $\alpha_2$ | no of $\beta_1$ SSIP | $\beta_1$ | no of $\beta_2$ SSIP | $\beta_2$ |
| A1 | Default e.g Benzene | | A1 | **0** | 0.00 | **0** | 0.00 | **1** | 2.00 | **0** | 0.00 |
| A2 | Mono alkyl e.g Toluene | | A2 | **0** | 0.00 | **0** | 0.00 | **1** | 2.20 | **0** | 0.00 |
| A3 | di-alkyl e.g. xylenes | | A3 | **0** | 0.00 | **0** | 0.00 | **1** | 2.40 | **0** | 0.00 |
| A4 | s-trialkyl e.g. mesitylene | | A4 | **0** | 0.00 | **0** | 0.00 | **1** | 2.70 | **0** | 0.00 |
| A5 | poly-alkyl benzene (n=4,5 or6) | | A5 | **0** | 0.00 | **0** | 0.00 | **1** | 3.10 | **0** | 0.00 |
| A6 | polycyclic aromatic | | A6 | **0** | 0.00 | **0** | 0.00 | **1** | 1.85 | **0** | 0.00 |
| A7 | fluorobenzene | | A7 | **0** | 0.00 | **0** | 0.00 | **1** | 1.40 | **0** | 0.00 |
| A8 | chlorobenzene | | A8 | **0** | 0.00 | **0** | 0.00 | **1** | 1.40 | **0** | 0.00 |
| A9 | di-halobenzene | | A9 | **0** | 0.00 | **0** | 0.00 | **1** | 1.05 | **0** | 0.00 |
| A10 | phenol | | A10 | **0** | 0.00 | **0** | 0.00 | **1** | 2.15 | **0** | 0.00 |
| A11 | mono-halophenol | | A11 | **0** | 0.00 | **0** | 0.00 | **1** | 1.60 | **0** | 0.00 |
| A12 | di-halophenol | | A12 | **0** | 0.00 | **0** | 0.00 | **1** | 1.25 | **0** | 0.00 |
| A13 | pyridine | | A13 | **0** | 0.00 | **0** | 0.00 | **1** | 1.60 | **0** | 0.00 |
| A14 | monoalkyl phenol | | A14 | **0** | 0.00 | **0** | 0.00 | **1** | 2.35 | **0** | 0.00 |
| A15 | di-alkyl phenol | | A15 | **0** | 0.00 | **0** | 0.00 | **1** | 2.55 | **0** | 0.00 |
| A16 | mono-methyl pryridines | | A16 | **0** | 0.00 | **0** | 0.00 | **1** | 2.00 | **0** | 0.00 |
| A17 | di-methyl pyridines | | A17 | **0** | 0.00 | **0** | 0.00 | **1** | 2.40 | **0** | 0.00 |
| A18 | quinoline | | A18 | **0** | 0.00 | **0** | 0.00 | **1** | 1.60 | **0** | 0.00 |
| A19 | isoquinoline | | A19 | **0** | 0.00 | **0** | 0.00 | **1** | 1.60 | **0** | 0.00 |

**Section 4:**
**Free Energy of Formation for H-bonded 1:1 complexes**

## a) Benzene

| Solvent | | $\alpha_s$ | $C_\alpha$ | $\beta_s$ | $C_\beta$ |
|---|---|---|---|---|---|
| **Benzene** | | 1.40 | 2.50 | 2.00 | 1.09 |

**Figure S4a**




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

| Table S4a | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **α** | **A** | **β** | **-ΔG⁰** | **-ΔG⁰** |
| **[1]** | phenol | **3.80** | pyridine | **7.20** | 6.09 | 8.90 |
| **[1]** | propan-2-ol | **2.70** | pyridine | **7.20** | 0.37 | 1.72 |
| **[1]** | Ethanol | **2.70** | Propan-2-one | **5.70** | -1.58 | 1.16 |
| **[1]** | 3-fluorophenol | **4.10** | pyridine | **7.20** | 7.65 | 9.84 |
| **[1]** | 3-fluorophenol | **4.10** | dimethyl sulphoxide | **8.60** | 11.43 | 13.72 |
| **[1]** | 3-fluorophenol | **4.10** | Ethyl ethanoate | **5.40** | 2.79 | 3.99 |
| **[1]** | butan-1-ol | **2.70** | pyridine | **7.20** | 0.37 | 1.72 |
| **[1]** | 3-fluorophenol | **4.10** | triethylamine | **7.50** | 8.46 | 11.86 |
| **[1]** | 2,2,2-trifluoroethanol | **3.70** | benzophenone | **5.40** | 1.43 | 5.03 |
| **[2]** | 2,2,2-Trifluoro-1,1-bis(trifluoromethyl)ethanol | **4.90** | Tributylphosphine oxide | **10.70** | 24.06 | 24.29 |
| **[3]** | Ethanol | **2.70** | Ethanol | **5.20** | -2.23 | -2.26 |
| **[4]** | phenol | **3.80** | tetrahydrofuran | **5.90** | 2.97 | 3.99 |
| [5] | 4-nitrophenol | **4.70** | Benzylamine | **7.20** | 10.77 | 13.64 |
| [5] | 4-nitrophenol | **4.70** | pyridine | **7.20** | 10.77 | 11.80 |
| [5] | 4-nitrophenol | **4.70** | tributylamine | **6.80** | 9.45 | 10.59 |
| [5] | 4-nitrophenol | **4.70** | tripropylamine | **6.60** | 8.79 | 10.21 |
| [5] | 4-nitrophenol | **4.70** | triethylamine | **7.50** | 11.76 | 13.89 |
| [5] | 4-nitrophenol | **4.70** | di-n-butylamine | **7.90** | 13.08 | 15.02 |
| [5] | 4-nitrophenol | **4.70** | n-butylamine | **8.00** | 13.41 | 16.07 |

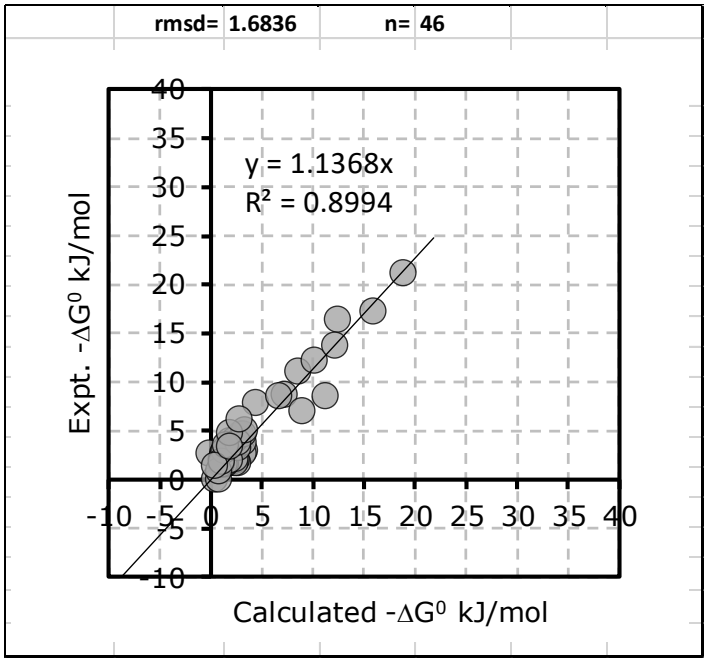
| | | | | | | |
|---|---|---|---|---|---|---|
| [6] | 2,2,3,3-Tetrafluoropropan-1-ol | **3.50** | di-n-butylamine | **7.90** | 6.00 | 8.34 |
| [6] | 2,2,3,3-Tetrafluoropropan-1-ol | **3.50** | Trioctylamine | **7.00** | 4.11 | 4.44 |
| [6] | 2,2,3,3-Tetrafluoropropan-1-ol | **3.50** | tributylamine | **6.80** | 3.69 | 5.44 |
| [6] | phenol | **3.80** | Trioctylamine | **7.00** | 5.61 | 7.02 |
| [6] | phenol | **3.80** | tributylamine | **6.80** | 5.13 | 6.71 |
| [6] | Propan-1-ol | **2.60** | di-n-butylamine | **7.90** | 0.69 | 3.99 |
| [6] | Propan-1-ol | **2.60** | Trioctylamine | **7.00** | -0.39 | 1.72 |
| [6] | Propan-1-ol | **2.60** | tributylamine | **6.80** | -0.63 | 1.00 |
| **[4]** | 2,6-Dimethylphenol | **3.30** | tetrahydrofuran | **5.90** | 1.02 | 1.46 |
| **[4]** | phenol | **3.80** | tetrahydrofuran | **5.90** | 2.97 | 3.99 |
| [6] | 4-tert-Butylphenol | **3.60** | acetophenone | **5.50** | 1.31 | 5.55 |
| [7] | phenol | **3.80** | acetophenone | **5.50** | 2.01 | 3.67 |
| [7] | 4-bromophenol | **4.10** | acetophenone | **5.50** | 3.06 | 4.75 |
| [7] | 4-fluorophenol | **3.90** | N,N-dimethylacetamide | **8.50** | 9.86 | 11.10 |
| [7] | 4-bromophenol | **4.10** | N,N-dimethylacetamide | **8.50** | 11.16 | 12.11 |
| [7] | 4-nitrophenol | **4.70** | N,N-dimethylacetamide | **8.50** | 15.06 | 14.01 |
| [7] | 4-bromophenol | **4.10** | Propan-2-one | **5.70** | 3.60 | 4.13 |
| [7] | phenol | **3.80** | Propan-2-one | **5.70** | 2.49 | 3.51 |
| [7] | phenol | **3.80** | 1,1,3,3-Tetramethylurea | **8.50** | 9.21 | 9.32 |
| [7] | 4-chlorophenol | **4.10** | 1,1,3,3-Tetramethylurea | **8.50** | 11.16 | 11.00 |
| [7] | 4-bromophenol | **4.10** | 1,1,3,3-Tetramethylurea | **8.50** | 11.16 | 12.91 |
| [7] | 4-nitrophenol | **4.70** | 1,1,3,3-Tetramethylurea | **8.50** | 15.06 | 14.20 |
| [7] | 4-tert-Butylphenol | **3.60** | Propan-2-one | **5.70** | 1.75 | 2.80 |
| [8] | 2-Methoxyphenol | **2.40** | triethylamine | **7.50** | -0.89 | 1.79 |
| [8] | 2-Methoxyphenol | **2.40** | N,N-Dimethylformamide | **7.70** | -0.69 | 0.14 |
| [9] | 2-Methoxyphenol | **2.40** | dimethyl sulphoxide | **8.60** | 0.21 | 3.27 |
| [9] | phenol | **3.80** | dimethyl sulphoxide | **8.60** | 9.45 | 11.07 |
| [10] | 2-Methoxyphenol | **2.40** | pyridine | **7.20** | -1.19 | 1.61 |
| [11] | butan-1-ol | **2.70** | tripropylamine | **6.60** | -0.41 | 1.10 |
| [11] | butan-1-ol | **2.70** | triethylamine | **7.50** | 0.76 | 1.80 |
| [11] | butan-1-ol | **2.70** | tributylamine | **6.80** | -0.15 | 0.40 |
| [6] | phenol | **3.80** | diethyl ether | **5.30** | 1.53 | 2.65 |
| [6] | phenol | **3.80** | Hexamethylphosphoramide | **10.90** | 14.97 | 16.00 |
| [6] | 3-methylphenol | **3.70** | pyridine | **7.20** | 5.57 | 6.90 |
| [6] | 4-methylphenol | **3.70** | pyridine | **7.20** | 5.57 | 6.50 |
| [6] | 4-Methoxyphenol | **3.70** | 2-methylpyridine | **7.60** | 6.49 | 7.18 |
| [6] | 4-methylphenol | **3.70** | 2-methylpyridine | **7.60** | 6.49 | 7.70 |
| [6] | 3-methylphenol | **3.70** | 2-methylpyridine | **7.60** | 6.49 | 7.07 |
| [6] | phenol | **3.80** | 2-methylpyridine | **7.60** | 7.05 | 7.98 |
| [6] | 4-chlorophenol | **4.10** | 2-methylpyridine | **7.60** | 8.73 | 8.86 |
| [6] | 4-nitrophenol | **4.70** | 2-methylpyridine | **7.60** | 12.09 | 12.12 |
| [6] | 4-Methoxyphenol | **3.70** | 3-methylpyridine | **7.50** | 6.26 | 7.01 |
| [6] | 4-methylphenol | **3.70** | 3-methylpyridine | **7.50** | 6.26 | 7.18 |
| [6] | 3-methylphenol | **3.70** | 3-methylpyridine | **7.50** | 6.26 | 7.51 |
| [6] | phenol | **3.80** | 3-methylpyridine | **7.50** | 6.81 | 8.44 |
| [6] | 4-chlorophenol | **4.10** | 3-methylpyridine | **7.50** | 8.46 | 9.46 |
| [6] | 4-nitrophenol | **4.70** | 3-methylpyridine | **7.50** | 11.76 | 12.05 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [6] | 4-Methoxyphenol | **3.70** | 4-methylpyridine | **7.70** | 6.72 | 7.04 |
| [6] | 4-methylphenol | **3.70** | 4-methylpyridine | **7.70** | 6.72 | 7.29 |
| [6] | 3-methylphenol | **3.70** | 4-methylpyridine | **7.70** | 6.72 | 7.84 |
| [6] | phenol | **3.80** | 4-methylpyridine | **7.70** | 7.29 | 8.32 |
| [6] | 4-chlorophenol | **4.10** | 4-methylpyridine | **7.70** | 9.00 | 9.29 |
| [6] | 4-Methoxyphenol | **3.70** | pyridine | **7.20** | 5.57 | 5.94 |
| [6] | 4-nitrophenol | **4.70** | 4-methylpyridine | **7.70** | 12.42 | 12.49 |
| [6] | 4-Methoxyphenol | **3.70** | 4-N,N-dimethylaminopyridine | **9.30** | 10.40 | 10.01 |
| [6] | 4-methylphenol | **3.70** | 4-N,N-dimethylaminopyridine | **9.30** | 10.40 | 10.44 |
| [6] | 3-methylphenol | **3.70** | 4-N,N-dimethylaminopyridine | **9.30** | 10.40 | 10.78 |
| [6] | phenol | **3.80** | 4-N,N-dimethylaminopyridine | **9.30** | 11.13 | 11.08 |
| [6] | 4-chlorophenol | **4.10** | 4-N,N-dimethylaminopyridine | **9.30** | 13.32 | 12.32 |
| [11] | 3-methylphenol | **3.70** | dibutyl ether | **5.00** | 0.51 | 1.59 |
| [11] | 3-methylphenol | **3.70** | 1,4-dioxane | **4.70** | -0.18 | 3.73 |
| [11] | 3-methylphenol | **3.70** | anisole | **3.30** | -3.40 | 0.00 |
| [11] | 3-methylphenol | **3.70** | N,N-Dimethylformamide | **7.70** | 6.72 | 8.66 |
| [11] | 3-methylphenol | **3.70** | N,N-dimethylacetamide | **8.50** | 8.56 | 9.84 |
| [11] | 3-methylphenol | **3.70** | cyclohexanone | **6.20** | 3.27 | 4.60 |
| [11] | 3-methylphenol | **3.70** | dimethyl sulphoxide | **8.60** | 8.79 | 11.04 |
| [11] | 3-methylphenol | **3.70** | tetrahydropyran | **5.80** | 2.35 | 4.09 |
| [11] | 3-methylphenol | **3.70** | Ethyl ethanoate | **5.40** | 1.43 | 2.88 |
| [12] | phenol | **3.80** | 1,4-dioxane | **4.70** | 0.09 | 3.78 |
| [13] | 2,3-Dimethylphenol | **3.50** | pyridine | **7.20** | 4.53 | 7.02 |
| [13] | 2,4-Dimethylphenol | **3.50** | pyridine | **7.20** | 4.53 | 6.11 |
| [13] | 2,5-Dimethylphenol | **3.60** | pyridine | **7.20** | 5.05 | 5.94 |
| [13] | 3,5-Dimethylphenol | **3.70** | pyridine | **7.20** | 5.57 | 6.71 |
| [6] | 4-bromophenol | **4.10** | pyridine | **7.20** | 7.65 | 8.66 |
| [6] | 4-bromophenol | **4.10** | triethylamine | **7.50** | 8.46 | 9.91 |
| [6] | 4-chlorophenol | **4.10** | pyridine | **7.20** | 7.65 | 9.17 |
| [6] | 4-chlorophenol | **4.10** | triethylamine | **7.50** | 8.46 | 8.05 |
| [6] | 3,4-Dimethylphenol | **3.60** | pyridine | **7.20** | 5.05 | 6.54 |
| [6] | 3,4-Dimethylphenol | **3.60** | triethylamine | **7.50** | 5.71 | 6.87 |
| [6] | 2,6-Dimethylphenol | **3.30** | pyridine | **7.20** | 3.49 | 4.13 |
| [12] | phenol | **3.80** | N,N-Dimethylformamide | **7.70** | 7.29 | 9.02 |
| [12] | phenol | **3.80** | N,N-dimethylacetamide | **8.50** | 9.21 | 10.57 |
| [12] | phenol | **3.80** | cyclohexanone | **6.20** | 3.69 | 4.40 |
| [12] | phenol | **3.80** | tetrahydropyran | **5.80** | 2.73 | 4.13 |
| [14] | tert-Butyl alcohol | **2.70** | N,N-diethylacetamide | **8.50** | 2.06 | 0.85 |
| [15] | phenol | **3.80** | Tributylphosphine oxide | **10.70** | 14.49 | 17.46 |
| [15] | phenol | **3.80** | triethyl phosphate | **8.80** | 9.93 | 11.58 |
| [15] | 4-nitrophenol | **4.70** | triethyl phosphate | **8.80** | 16.05 | 17.17 |
| [15] | phenol | **3.80** | triphenylphosphine oxide | **10.10** | 13.05 | 15.12 |

## b) Toluene

| Solvent | | $\alpha_s$ | $c_\alpha$ | $\beta_s$ | $c_\beta$ |
|---|---|---|---|---|---|
| **Toluene** | | 1.40 | 2.50 | 2.00 | 1.09 |

## Figure S4b




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

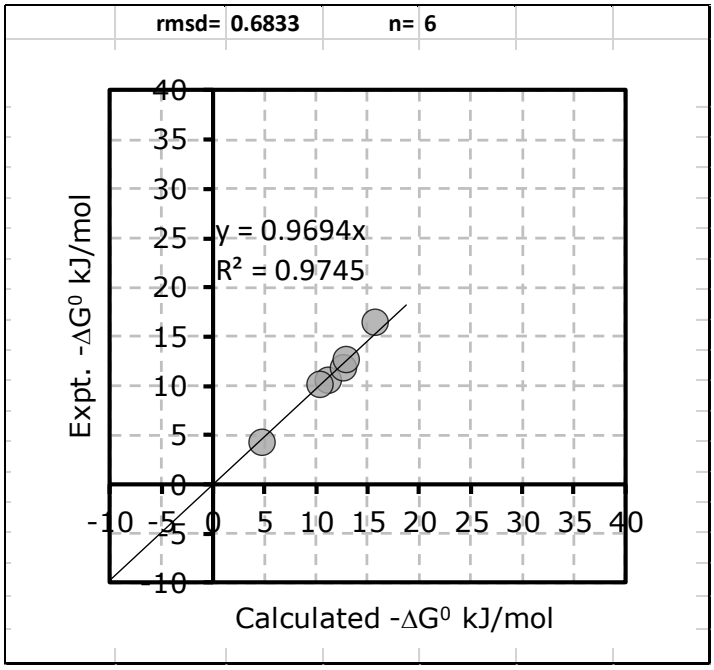
| Table S4b | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **Alpha** | **A** | **Beta** | **-ΔG⁰** | **-ΔG⁰** |
| **[16]** | 4-methylphenol | **3.70** | Methyl ethanoate | **4.70** | -0.18 | 2.72 |
| [16] | 4-methylphenol | **3.70** | N,N-diethylacetamide | **8.50** | 8.56 | 11.04 |
| [17] | 4-phenylazophenol | **4.30** | Tributylphosphine oxide | **10.70** | 18.84 | 21.11 |
| [16] | 4-methylphenol | **3.70** | Ethyl ethanoate | **5.40** | 1.43 | 2.72 |
| [16] | 4-methylphenol | **3.70** | Ethyl 4-methylbenzoate | **5.40** | 1.43 | 2.72 |
| [16] | 4-methylphenol | **3.70** | N,N-diethyl-4-methylbenzamide | **7.90** | 7.18 | 8.66 |
| [18] | 3,5,5-Trimethyl-hexanoic acid phenylamide | **2.90** | Diethyl ethylphosphonate | **9.20** | 4.41 | 7.87 |
| [19] | 4-methylphenol | **3.70** | Diethyl ethylphosphonate | **9.20** | 10.17 | 12.24 |
| [20] | 4-methylphenol | **3.70** | diethyl ether | **5.30** | 1.20 | 2.72 |
| [21] | 4-methylphenol | **3.70** | n-butyl-di-tert-butylphosphine oxide | **10.20** | 12.47 | 16.44 |
| [22] | 4-phenylazophenol | **4.30** | N,N-di-n-hexylacetamide | **8.40** | 12.17 | 13.75 |
| [23] | 4-methylphenol | **3.70** | 4-methylpyridine | **7.70** | 6.72 | 8.51 |
| [24] | 2,6-Dimethylphenol | **3.30** | tetrahydrofuran | **5.90** | 1.02 | 2.17 |
| [25] | pyrrole | **3.00** | 2,4,6-trimethylpyridine | **8.10** | 3.37 | 2.95 |
| [25] | pyrrole | **3.00** | 3,5-Dimethylpyridine | **8.00** | 3.21 | 2.65 |
| [25] | pyrrole | **3.00** | 4-methylpyridine | **7.70** | 2.73 | 1.68 |
| [25] | pyrrole | **3.00** | pyridine | **7.20** | 1.93 | 1.68 |
| [25] | pyrrole | **3.00** | 2-methylpyridine | **7.60** | 2.57 | 1.99 |
| [25] | pyrrole | **3.00** | 3-methylpyridine | **7.50** | 2.41 | 1.67 |
| [25] | pyrrole | **3.00** | triethylamine | **7.50** | 2.41 | 2.17 |
| [26] | propan-2-ol | **2.70** | 2,4,6-trimethylpyridine | **8.10** | 1.54 | 1.50 |
| [26] | propan-2-ol | **2.70** | pyridine | **7.20** | 0.37 | 0.02 |
| [26] | benzyl alcohol | **3.00** | pyridine | **7.20** | 1.93 | 3.95 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [26] | propan-2-ol | **2.70** | triethylamine | **7.50** | 0.76 | -0.02 |
| [26] | benzyl alcohol | **3.00** | triethylamine | **7.50** | 2.41 | 3.24 |
| [26] | propan-2-ol | **2.70** | 3,5-Dimethylpyridine | **8.00** | 1.41 | 1.49 |
| [26] | benzyl alcohol | **3.00** | 3,5-Dimethylpyridine | **8.00** | 3.21 | 3.84 |
| [26] | benzyl alcohol | **3.00** | 4-methylpyridine | **7.70** | 2.73 | 3.18 |
| [26] | propan-2-ol | **2.70** | 4-methylpyridine | **7.70** | 1.02 | 1.49 |
| G12 | pyrrole | **3.00** | 2,4-Dimethylpyridine | **7.20** | 1.93 | 2.00 |
| G6 | phenol | **3.80** | tetrahydrofuran | **5.90** | 2.97 | 4.68 |
| G77 | 3-Chlorophenol | **4.20** | triethylamine | **7.50** | 9.01 | 6.98 |
| G77 | 3-nitrophenol | **4.60** | triethylamine | **7.50** | 11.21 | 8.49 |
| G100 | phenol | **3.80** | Tri-n-octylphosphine oxide | **11.30** | 15.93 | 17.27 |
| [26] | propan-2-ol-D | **2.70** | triethylamine | **7.50** | 0.76 | 0.78 |
| [26] | benzyl alcohol-D | **3.00** | triethylamine | **7.50** | 2.41 | 4.07 |
| [26] | propan-2-ol-D | **2.70** | 3,5-Dimethylpyridine | **8.00** | 1.41 | 2.95 |
| [26] | benzyl alcohol-D | **3.00** | 3,5-Dimethylpyridine | **8.00** | 3.21 | 4.58 |
| [26] | propan-2-ol-D | **2.70** | 4-methylpyridine | **7.70** | 1.02 | 1.85 |
| [26] | benzyl alcohol-D | **3.00** | 4-methylpyridine | **7.70** | 2.73 | 3.80 |
| [26] | benzyl alcohol-D | **3.00** | 2,4,6-trimethylpyridine | **8.10** | 3.37 | 5.02 |
| [26] | propan-2-ol-D | **2.70** | 2,4,6-trimethylpyridine | **8.10** | 1.54 | 3.52 |
| [27] | Methanol-D | **2.90** | triethylamine | **7.50** | 1.86 | 4.74 |
| [27] | Methanol-D | **2.90** | 2,4,6-trimethylpyridine | **8.10** | 2.76 | 6.18 |
| [20] | propan-2-ol-D | **2.70** | pyridine | **7.20** | 0.37 | 1.46 |
| [20] | benzyl alcohol-D | **3.00** | pyridine | **7.20** | 1.93 | 3.33 |

## c) Hexane

| Solvent | | $\alpha_s$ | $C_\alpha$ | $\beta_s$ | $C_\beta$ |
|---|---|---|---|---|---|
| **Hexane** | | 1.20 | 2.62 | 0.60 | 2.62 |

**Figure S4c**




Free energy calculation for 1:1 Association

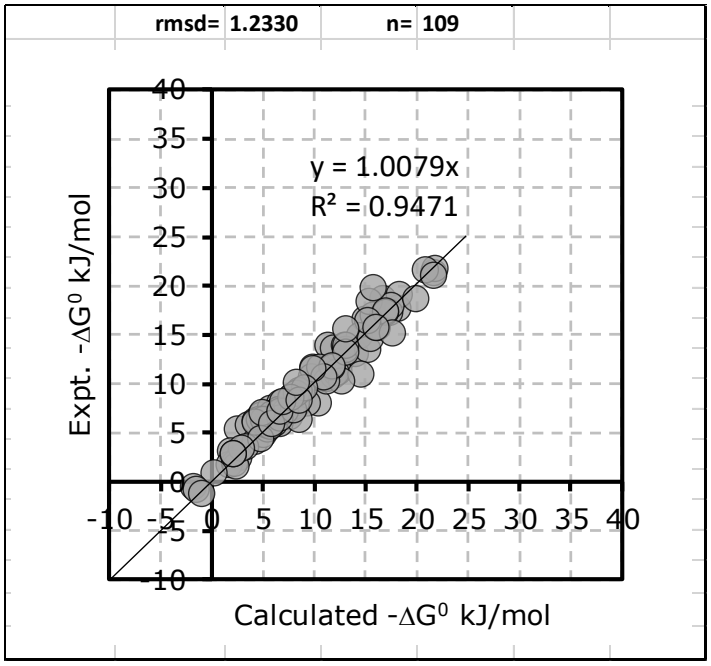
$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

| Table S4c | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **Alpha** | **A** | **Beta** | **-ΔG⁰** | **-ΔG⁰** |
| [28] | 2,2,2-trifluoroethanol | **3.70** | triethylamine | **7.50** | 11.25 | 10.46 |
| [1] | Hexafluoropropan-2-ol | **4.50** | pyridine | **7.20** | 15.78 | 16.34 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | 2,4,6-trimethylpyridine | **8.10** | 12.75 | 11.72 |
| [1] | 2,2,2-trifluoroethanol | **3.70** | pyridine | **7.20** | 10.50 | 10.10 |
| [28] | 1-naphthol | **3.80** | di-n-butylamine | **7.90** | 12.98 | 12.61 |
| [28] | Hexafluoropropan-2-ol | **4.50** | tetrahydrothiophene | **3.90** | 4.89 | 4.18 |

## d) Cyclohexane

| Solvent | $\alpha_s$ | $C_\alpha$ | $\beta_s$ | $C_\beta$ |
|---|---|---|---|---|
| **Cyclohexane** | 1.20 | 2.61 | 0.60 | 2.61 |

**Figure S4d**




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

| Table S4d | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **Alpha** | **A** | **Beta** | **$-\Delta G^0$** | **$-\Delta G^0$** |
| [1] | phenol | **3.80** | tetrahydrothiophene | **3.90** | 2.58 | 5.31 |
| [1] | 4-chlorophenol | **4.10** | tetrahydrothiophene | **3.90** | 3.57 | 5.71 |
| [1] | Hexafluoropropan-2-ol | **4.50** | tetrahydrothiophene | **3.90** | 4.89 | 6.68 |
| [1] | 4-nitrophenol | **4.70** | diethyl ether | **5.30** | 10.45 | 7.99 |
| [1] | 4-tert-Butylphenol | **3.60** | tetrahydrothiophene | **3.90** | 1.92 | 3.02 |
| [1] | 4-chlorophenol | **4.10** | tripropylamine | **6.60** | 11.40 | 13.81 |
| [29] | 4-fluorophenol | **3.90** | triethylamine | **7.50** | 12.63 | 12.22 |
| [28] | 3-trifluoromethylphenol | **4.30** | tetrahydrothiophene | **3.90** | 4.23 | 4.10 |
| [1] | 2,2,2-trifluoroethanol | **3.70** | pyridine N-oxide | **9.00** | 15.00 | 16.54 |
| [1] | 4-chlorophenol | **4.10** | tributylamine | **6.80** | 11.98 | 13.64 |
| [1] | 4-fluorophenol | **3.90** | pyridine N-oxide | **9.00** | 16.68 | 18.66 |
| [1] | 4-chlorophenol | **4.10** | tetrahydrofuran | **5.90** | 9.37 | 8.04 |
| [1] | 3-methylphenol | **3.70** | 1,4-dioxane | **4.70** | 4.25 | 6.16 |
| [1] | 4-chlorophenol | **4.10** | triethylamine | **7.50** | 14.01 | 13.06 |
| [1] | 4-tert-Butylphenol | **3.60** | N,N-dimethylacetamide | **8.50** | 12.96 | 13.81 |
| [1] | 4-chlorophenol | **4.10** | diethyl ether | **5.30** | 7.63 | 6.56 |
| [1] | phenol | **3.80** | triethylamine | **7.50** | 11.94 | 11.01 |
| [1] | 3-nitrophenol | **4.60** | diethyl ether | **5.30** | 9.98 | 11.70 |
| [1] | 4-fluorophenol | **3.90** | 1,4-dioxane | **4.70** | 5.07 | 4.74 |
| [1] | Propan-1-ol | **2.60** | pyridine N-oxide | **9.00** | 5.76 | 7.36 |
| [1] | 4-nitrophenol | **4.70** | triethylamine | **7.50** | 18.15 | 17.69 |
| [1] | 1-naphthol | **3.80** | 4-methylpyridine | **7.70** | 12.46 | 11.18 |
| [1] | phenol | **3.80** | pyridine N-oxide | **9.00** | 15.84 | 17.00 |

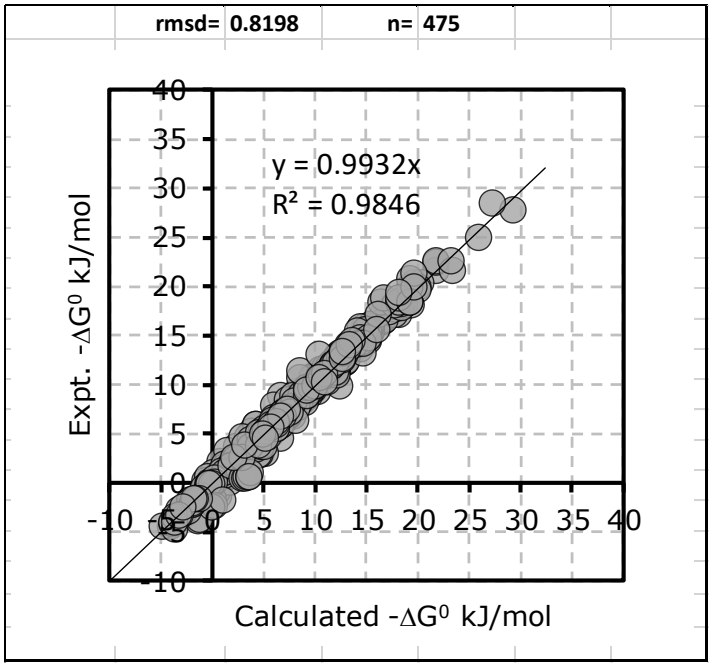
| | | | | | | |
|---|---|---|---|---|---|---|
| [1] | 4-tert-Butylphenol | **3.60** | tetrahydrofuran | **5.90** | 6.72 | 7.99 |
| [1] | Hexafluoropropan-2-ol | **4.50** | pyridine N-oxide | **9.00** | 21.72 | 21.28 |
| [1] | 1-naphthol | **3.80** | pyridine | **7.20** | 11.16 | 10.44 |
| [1] | 4-fluorophenol | **3.90** | Hexamethylphosphoramide | **10.90** | 21.81 | 21.68 |
| [1] | 1-naphthol | **3.80** | tetrahydrofuran | **5.90** | 7.78 | 7.42 |
| [1] | tert-Butyl alcohol | **2.70** | pyridine N-oxide | **9.00** | 6.60 | 7.19 |
| [1] | 4-tert-Butylphenol | **3.60** | pyridine | **7.20** | 9.84 | 10.61 |
| [1] | 2-naphthol | **3.90** | diethyl ether | **5.30** | 6.69 | 5.93 |
| [1] | propan-2-ol | **2.70** | pyridine N-oxide | **9.00** | 6.60 | 7.25 |
| [1] | 3-trifluoromethylphenol | **4.30** | Ethyl ethanoate | **5.40** | 8.88 | 9.30 |
| [1] | 3-trifluoromethylphenol | **4.30** | pyridine | **7.20** | 14.46 | 14.83 |
| [1] | 1-naphthol | **3.80** | diethyl ether | **5.30** | 6.22 | 5.93 |
| [1] | 2-naphthol | **3.90** | tetrahydrofuran | **5.90** | 8.31 | 7.64 |
| [1] | 3-trifluoromethylphenol | **4.30** | cyclohexanone | **6.20** | 11.36 | 10.55 |
| [1] | 3-fluorophenol | **4.10** | diethyl sulphide | **3.60** | 2.70 | 2.34 |
| [1] | 4-chlorophenol | **4.10** | pyridine N-oxide | **9.00** | 18.36 | 19.11 |
| [1] | 4-tert-Butylphenol | **3.60** | triethylamine | **7.50** | 10.56 | 11.58 |
| [1] | 1-naphthol | **3.80** | 3-methylpyridine | **7.50** | 11.94 | 10.84 |
| [1] | 3,5-dichlorophenol | **4.50** | triethylamine | **7.50** | 16.77 | 16.89 |
| [1] | 3-nitrophenol | **4.60** | triethylamine | **7.50** | 17.46 | 17.23 |
| [1] | Ethanol | **2.70** | pyridine N-oxide | **9.00** | 6.60 | 7.30 |
| [28] | 4-chlorophenol | **4.10** | pyridine | **7.20** | 13.14 | 13.39 |
| [28] | 3-trifluoromethylphenol | **4.30** | diethyl sulphide | **3.60** | 3.30 | 3.56 |
| [1] | 4-chlorophenol | **4.10** | 1,4-dioxane | **4.70** | 5.89 | 6.85 |
| [1] | 1-naphthol | **3.80** | 2-methylpyridine | **7.60** | 12.20 | 11.07 |
| [1] | phenol | **3.80** | dibutyl ether | **5.00** | 5.44 | 5.31 |
| [1] | phenol | **3.80** | diethyl sulphide | **3.60** | 1.80 | 1.71 |
| [1] | 4-fluorophenol | **3.90** | benzonitrile | **4.80** | 5.34 | 5.71 |
| [1] | 3-methylphenol | **3.70** | diethyl ether | **5.30** | 5.75 | 5.71 |
| [1] | 3-methylphenol | **3.70** | tetrahydrofuran | **5.90** | 7.25 | 7.30 |
| [1] | Methanol | **2.90** | pyridine N-oxide | **9.00** | 8.28 | 7.99 |
| [1] | 3-fluorophenol | **4.10** | dibutyl ether | **5.00** | 6.76 | 7.02 |
| [1] | 4-fluorophenol | **3.90** | 4-N,N-dimethylaminopyridine | **9.30** | 17.49 | 17.97 |
| [1] | 4-fluorophenol | **3.90** | Diethyl chloromethylphosphonate | **8.50** | 15.33 | 13.52 |
| [1] | phenol | **3.80** | Diethyl chloromethylphosphonate | **8.50** | 14.54 | 10.86 |
| [1] | 2-tert-Butylphenol | **3.40** | Diethyl isopropylphosphonate | **9.10** | 12.70 | 10.27 |
| [1] | 4-fluorophenol | **3.90** | pyridine | **7.20** | 11.82 | 11.58 |
| [1] | 4-fluorophenol | **3.90** | 3-bromopyridine | **6.00** | 8.58 | 6.33 |
| [1] | 3-fluorophenol | **4.10** | pyridine | **7.20** | 13.14 | 13.81 |
| [1] | 3-fluorophenol | **4.10** | Ethyl ethanoate | **5.40** | 7.92 | 8.73 |
| [1] | 1-naphthol | **3.80** | 1,4-dioxane | **4.70** | 4.66 | 6.33 |
| [1] | 2-naphthol | **3.90** | 1,4-dioxane | **4.70** | 5.07 | 6.33 |
| [30] | 4-fluorophenol | **3.90** | dimethyl sulphoxide | **8.60** | 15.60 | 14.61 |
| [30] | 4-fluorophenol | **3.90** | N,N-Dimethylformamide | **7.70** | 13.17 | 13.12 |
| [28] | 4-chlorophenol | **4.10** | n-butylamine | **8.00** | 15.46 | 18.41 |
| [28] | 4-methylphenol | **3.70** | triethylamine | **7.50** | 11.25 | 10.17 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [28] | 4-methylphenol | **3.70** | diethyl ether | **5.30** | 5.75 | 5.67 |
| [28] | 4-methylphenol | **3.70** | tetrahydrofuran | **5.90** | 7.25 | 7.21 |
| [28] | 4-methylphenol | **3.70** | 1,4-dioxane | **4.70** | 4.25 | 5.98 |
| [28] | 4-methylphenol | **3.70** | Propan-2-one | **5.70** | 6.75 | 6.46 |
| [28] | 4-methylphenol | **3.70** | cyclohexanone | **6.20** | 8.00 | 7.28 |
| [28] | 4-methylphenol | **3.70** | tetrahydrothiophene | **3.90** | 2.25 | 1.84 |
| [3] | butan-1-ol | **2.70** | cyclohexanone | **6.20** | 2.40 | 1.50 |
| [31] | Butan-2-ol | **2.50** | pyridine N-oxide | **9.00** | 4.92 | 7.02 |
| [29] | 4-fluorophenol | **3.90** | 2,2,2-Trifluoroethylamine | **4.60** | 4.80 | 4.39 |
| [29] | 4-fluorophenol | **3.90** | Benzylamine | **7.20** | 11.82 | 11.76 |
| [29] | 4-fluorophenol | **3.90** | Cyclopropylamine | **6.90** | 11.01 | 10.61 |
| [29] | 4-fluorophenol | **3.90** | Pyrrolidine | **8.80** | 16.14 | 15.74 |
| [29] | 4-fluorophenol | **3.90** | quinuclidine | **9.10** | 16.95 | 17.19 |
| [29] | 4-fluorophenol | **3.90** | 3,5-Dichloropyridine | **5.00** | 5.88 | 5.82 |
| [29] | 4-fluorophenol | **3.90** | 3-Chloropyridine | **6.00** | 8.58 | 9.27 |
| [29] | 4-fluorophenol | **3.90** | 1-Methyl-1H-imidazole | **9.10** | 16.95 | 17.33 |
| [29] | 4-fluorophenol | **3.90** | Dimethylcyanamide | **6.50** | 9.93 | 11.47 |
| [29] | 4-fluorophenol | **3.90** | tetrahydrofuran | **5.90** | 8.31 | 8.94 |
| [29] | 4-fluorophenol | **3.90** | diethyl ether | **5.30** | 6.69 | 7.12 |
| [29] | 4-fluorophenol | **3.90** | 2,2,5,5-tetramethyltetrahydrofuran | **6.20** | 9.12 | 9.53 |
| [29] | 4-fluorophenol | **3.90** | Propan-2-one | **5.70** | 7.77 | 8.55 |
| [29] | 4-fluorophenol | **3.90** | Ethyl ethanoate | **5.40** | 6.96 | 8.06 |
| [29] | 4-fluorophenol | **3.90** | N,N-dimethylacetamide | **8.50** | 15.33 | 16.39 |
| [29] | 4-fluorophenol | **3.90** | dibutyl sulphoxide | **8.70** | 15.87 | 19.82 |
| [29] | 4-fluorophenol | **3.90** | N,N-Dimethylthioacetamide | **6.00** | 8.58 | 8.33 |
| [29] | 4-fluorophenol | **3.90** | tetrahydrothiophene | **3.90** | 2.91 | 3.31 |
| [29] | 4-fluorophenol | **3.90** | diethyl sulphide | **3.60** | 2.10 | 2.83 |
| [29] | 4-fluorophenol | **3.90** | dibutyl sulphide | **3.60** | 2.10 | 2.80 |
| [29] | 4-fluorophenol | **3.90** | 1-Fluoropentane | **2.90** | 0.21 | 0.82 |
| [29] | 4-fluorophenol | **3.90** | 1-Chloropentane | **2.20** | -1.68 | -0.59 |
| [29] | 4-fluorophenol | **3.90** | 1-Bromopentane | **2.30** | -1.41 | -0.77 |
| [29] | 4-fluorophenol | **3.90** | 1-Iodopentane | **2.50** | -0.87 | -1.27 |
| [28] | 4-nitrophenol | **4.70** | n-butylamine | **8.00** | 19.90 | 18.58 |
| [28] | 4-nitrophenol | **4.70** | 1,4-dioxane | **4.70** | 8.35 | 10.08 |
| [28] | 3-Chlorophenol | **4.20** | N,N-dimethylacetamide | **8.50** | 17.70 | 15.06 |
| [1] | 4-chlorophenol | **4.10** | morpholine | **7.20** | 13.14 | 15.52 |
| [1] | 3-trifluoromethyl-4-nitrophenol | **5.10** | triethylamine | **7.50** | 20.91 | 21.62 |
| [1] | Pentafluorophenol | **4.50** | pyridine N-oxide | **9.00** | 21.72 | 21.05 |
| [1] | 3,4-dichlorophenol | **4.40** | triethylamine | **7.50** | 16.08 | 15.69 |
| [1] | 4-cyanophenol | **4.60** | triethylamine | **7.50** | 17.46 | 16.94 |

## e) Carbon Tetrachloride

| Solvent | | $\alpha_S$ | $C_\alpha$ | $\beta_S$ | $C_\beta$ |
|---|---|---|---|---|---|
| **CCl4** | | 1.40 | 2.58 | 0.60 | 2.58 |

**Figure S4e**




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

in CCl4 solvent $C_\alpha = C_\beta = 2.58$ therefore:

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - 5.16$$

$$= \alpha\beta - \alpha\beta_S - \alpha_S\beta + \alpha_S\beta_S - 6$$

$$= (\alpha - \alpha_S)(\beta - \beta_S) - 6$$

| Table S4e | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **Alpha** | **A** | **Beta** | **$-\Delta G^0$** | **$-\Delta G^0$** |
| [1] | 3-Chlorophenol | **4.20** | aniline | **4.50** | 4.92 | 4.22 |
| [1] | 3-Chlorophenol | **4.20** | pyridine | **7.20** | 12.48 | 9.81 |
| [28] | phenol | **3.80** | tetrahydrothiophene | **3.90** | 1.92 | 0.83 |
| [28] | 1-naphthol | **3.80** | toluene | **2.20** | -2.16 | -2.44 |
| [28] | 3-trifluoromethylphenol | **4.30** | tetrahydrothiophene | **3.90** | 3.57 | 2.63 |
| [29] | 4-chlorophenol | **4.10** | tetrahydrofuran | **5.90** | 8.31 | 8.22 |
| [28] | 4-chlorophenol | **4.10** | triethylamine | **7.50** | 12.63 | 12.06 |
| [28] | 4-chlorophenol | **4.10** | diethyl ether | **5.30** | 6.69 | 6.12 |
| [28] | phenol | **3.80** | triethylamine | **7.50** | 10.56 | 10.49 |
| [32] | 4-fluorophenol | **3.90** | 1,4-dioxane | **4.70** | 4.25 | 5.88 |
| [29] | 4-nitrophenol | **4.70** | triethylamine | **7.50** | 16.77 | 16.44 |
| [28] | phenol | **3.80** | pyridine N-oxide | **9.00** | 14.16 | 14.41 |
| [28] | 1-naphthol | **3.80** | pyridine | **7.20** | 9.84 | 10.74 |
| [33] | Ethanol | **2.70** | pyridine N-oxide | **9.00** | 4.92 | 4.48 |
| [29] | 4-chlorophenol | **4.10** | pyridine | **7.20** | 11.82 | 11.98 |
| [28] | phenol | **3.80** | diethyl sulphide | **3.60** | 1.20 | 0.24 |
| [34] | 4-fluorophenol | **3.90** | benzonitrile | **4.80** | 4.50 | 4.56 |
| [28] | 3-fluorophenol | **4.10** | dibutyl ether | **5.00** | 5.88 | 5.96 |
| [28] | 4-fluorophenol | **3.90** | 4-N,N-dimethylaminopyridine | **9.30** | 15.75 | 16.05 |
| [28] | 1-naphthol | **3.80** | triethylamine | **7.50** | 10.56 | 11.43 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | triethylamine | **7.50** | 9.87 | 10.56 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [29] | phenol | **3.80** | pyridine | **7.20** | 9.84 | 9.64 |
| [28] | Ethanol | **2.70** | N,N-dimethylacetamide | **8.50** | 4.27 | 3.92 |
| [29] | 2,2,2-trifluoroethanol | **3.70** | N,N-dimethylacetamide | **8.50** | 12.17 | 11.40 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | dimethyl sulphoxide | **8.60** | 12.40 | 12.13 |
| [29] | 2,2,2-trifluoroethanol | **3.70** | Hexamethylphosphoramide | **10.90** | 17.69 | 17.63 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | diethyl ether | **5.30** | 4.81 | 4.18 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | Propan-2-one | **5.70** | 5.73 | 4.93 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | N,N-Dimethylformamide | **7.70** | 10.33 | 9.20 |
| [28] | phenol | **3.80** | Propanaldehyde | **4.60** | 3.60 | 3.66 |
| [28] | phenol | **3.80** | diethyl ether | **5.30** | 5.28 | 5.40 |
| [28] | phenol | **3.80** | N,N-dimethylacetamide | **8.50** | 12.96 | 12.14 |
| [29] | phenol | **3.80** | Propan-2-one | **5.70** | 6.24 | 5.89 |
| [28] | phenol | **3.80** | Hexamethylphosphoramide | **10.90** | 18.72 | 18.36 |
| [28] | phenol | **3.80** | benzene | **2.00** | -2.64 | -2.77 |
| [28] | phenol | **3.80** | dimethyl sulphoxide | **8.60** | 13.20 | 13.15 |
| [35] | Methanol | **2.90** | Propan-2-one | **5.70** | 1.65 | 1.03 |
| [28] | Methanol | **2.90** | Triethylphosphine oxide | **10.10** | 8.25 | 9.20 |
| [33] | Ethanol | **2.70** | Ethanol | **5.20** | -0.02 | -1.11 |
| [33] | Octan-1-ol | **2.70** | Octan-1-ol | **5.30** | 0.11 | -0.65 |
| [33] | tert-Butyl alcohol | **2.70** | tert-Butyl alcohol | **5.70** | 0.63 | -1.34 |
| [28] | propan-2-ol | **2.70** | N,N-dimethylacetamide | **8.50** | 4.27 | 2.60 |
| [31] | 4-fluorophenol | **3.90** | 3-bromopyridine | **6.00** | 7.50 | 7.72 |
| [28] | 4-fluorophenol | **3.90** | triethyl phosphate | **8.80** | 14.50 | 13.98 |
| [29] | Methanol | **2.90** | diethyl ether | **5.30** | 1.05 | 0.41 |
| [35] | Methanol | **2.90** | acetonitrile | **5.10** | 0.75 | 0.78 |
| [28] | Methanol | **2.90** | Trimethylphosphine oxide | **10.70** | 9.15 | 9.05 |
| [28] | Methanol | **2.90** | triethyl phosphate | **8.80** | 6.30 | 6.69 |
| [29] | Methanol | **2.90** | dimethyl sulphoxide | **8.60** | 6.00 | 5.24 |
| [28] | Methanol | **2.90** | N,N-Dimethylformamide | **7.70** | 4.65 | 4.22 |
| [29] | 4-chlorophenol | **4.10** | N,N-dimethylacetamide | **8.50** | 15.33 | 14.39 |
| [28] | 4-fluorophenol | **3.90** | Benzaldehyde | **4.80** | 4.50 | 4.44 |
| [28] | 4-fluorophenol | **3.90** | diethyl sulphide | **3.60** | 1.50 | 0.65 |
| [28] | propan-2-ol | **2.70** | pyridine | **7.20** | 2.58 | 2.09 |
| [28] | propan-2-ol | **2.70** | diethyl ether | **5.30** | 0.11 | -0.55 |
| [28] | tert-Butyl alcohol | **2.70** | N,N-Dimethylformamide | **7.70** | 3.23 | 2.64 |
| [28] | tert-Butyl alcohol | **2.70** | pyridine | **7.20** | 2.58 | 0.83 |
| [28] | tert-Butyl alcohol | **2.70** | diethyl ether | **5.30** | 0.11 | -0.74 |
| [28] | tert-Butyl alcohol | **2.70** | toluene | **2.20** | -3.92 | -4.13 |
| [28] | phenol | **3.80** | Benzaldehyde | **4.80** | 4.08 | 3.82 |
| [28] | phenol | **3.80** | N,N-Dimethylformamide | **7.70** | 11.04 | 10.71 |
| [28] | phenol | **3.80** | tributylamine | **6.80** | 8.88 | 8.20 |
| [28] | phenol | **3.80** | pyrimidine | **5.40** | 5.52 | 5.44 |
| [28] | phenol | **3.80** | diethylamine | **7.90** | 11.52 | 11.39 |
| [28] | phenol | **3.80** | isopropylamine | **8.00** | 11.76 | 11.52 |
| [28] | phenol | **3.80** | aniline | **4.50** | 3.36 | 3.46 |
| [28] | phenol | **3.80** | Methyl ethanoate | **4.70** | 3.84 | 5.18 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [28] | phenol | **3.80** | Ethyl ethanoate | **5.40** | 5.52 | 5.56 |
| [28] | phenol | **3.80** | anisole | **3.30** | 0.48 | 0.00 |
| [28] | phenol | **3.80** | tetrahydrofuran | **5.90** | 6.72 | 6.87 |
| [28] | phenol | **3.80** | acetophenone | **5.50** | 5.76 | 5.16 |
| [29] | phenol | **3.80** | acetonitrile | **5.10** | 4.80 | 4.89 |
| [28] | phenol | **3.80** | benzonitrile | **4.80** | 4.08 | 3.03 |
| [28] | phenol | **3.80** | Tributylphosphine oxide | **10.70** | 18.24 | 17.12 |
| [28] | phenol | **3.80** | triphenylphosphine oxide | **10.10** | 16.80 | 16.74 |
| [28] | phenol | **3.80** | triethyl phosphate | **8.80** | 13.68 | 13.34 |
| [28] | phenol | **3.80** | cyclohexyl fluoride | **3.30** | 0.48 | -0.29 |
| [28] | phenol | **3.80** | cyclohexyl chloride | **2.50** | -1.44 | -2.09 |
| [28] | phenol | **3.80** | cyclohexyl bromide | **2.50** | -1.44 | -2.21 |
| [28] | phenol | **3.80** | cyclohexyl iodide | **2.30** | -1.92 | -2.33 |
| [28] | 4-fluorophenol | **3.90** | 1-methyl-2-pyridone | **8.80** | 14.50 | 13.58 |
| [28] | 4-fluorophenol | **3.90** | anisole | **3.30** | 0.75 | 2.06 |
| [28] | pentachlorophenol | **3.60** | triphenylphosphine oxide | **10.10** | 14.90 | 15.87 |
| [28] | pentachlorophenol | **3.60** | Propan-2-one | **5.70** | 5.22 | 5.38 |
| [28] | pentachlorophenol | **3.60** | triethyl phosphate | **8.80** | 12.04 | 12.25 |
| [31] | 4-fluorophenol | **3.90** | triphenylphosphine oxide | **10.10** | 17.75 | 17.12 |
| [28] | 4-fluorophenol | **3.90** | diphenyl sulphoxide | **7.50** | 11.25 | 11.53 |
| [28] | 1-naphthol | **3.80** | triphenylphosphine oxide | **10.10** | 16.80 | 17.20 |
| [28] | Methanol | **2.90** | pyridine | **7.20** | 3.90 | 2.72 |
| [28] | Ethanol | **2.70** | Propan-2-one | **5.70** | 0.63 | 0.45 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | Ethyl ethanoate | **5.40** | 5.04 | 4.79 |
| [28] | Hexafluoropropan-2-ol | **4.50** | 1,4-dioxane | **4.70** | 6.71 | 8.84 |
| [28] | tert-Butyl alcohol | **2.70** | Ethyl ethanoate | **5.40** | 0.24 | -0.43 |
| [32] | 4-fluorophenol | **3.90** | (Me2N)2C=NH | **10.20** | 18.00 | 18.31 |
| [28] | 3-fluorophenol | **4.10** | pyridine | **7.20** | 11.82 | 11.55 |
| [28] | 3-fluorophenol | **4.10** | dimethyl sulphoxide | **8.60** | 15.60 | 15.24 |
| [28] | 3-fluorophenol | **4.10** | Ethyl ethanoate | **5.40** | 6.96 | 7.31 |
| [28] | Propan-1-ol | **2.60** | pyridine | **7.20** | 1.92 | 1.46 |
| [28] | tert-Butyl alcohol | **2.70** | Propan-2-one | **5.70** | 0.63 | 0.00 |
| [28] | 4-Methoxyphenol | **3.70** | triethylamine | **7.50** | 9.87 | 9.32 |
| [28] | 2-Isopropylphenol | **3.60** | tetrahydrofuran | **5.90** | 5.66 | 5.15 |
| [28] | 2-tert-Butylphenol | **3.40** | N,N-dimethylacetamide | **8.50** | 9.80 | 10.68 |
| [28] | 3-methylphenol | **3.70** | pyridine | **7.20** | 9.18 | 8.94 |
| [28] | 2-Isopropylphenol | **3.60** | dibutyl ether | **5.00** | 3.68 | 2.76 |
| [28] | 2-tert-Butylphenol | **3.40** | dibutyl ether | **5.00** | 2.80 | 2.67 |
| [28] | 2-Methylphenol | **3.50** | dibutyl ether | **5.00** | 3.24 | 2.40 |
| [28] | 2-Methylphenol | **3.50** | diethyl ether | **5.30** | 3.87 | 3.07 |
| [28] | 2-Methylphenol | **3.50** | tetrahydrofuran | **5.90** | 5.13 | 4.28 |
| [28] | 4-nitrophenol | **4.70** | benzene | **2.00** | -1.38 | -1.70 |
| [28] | 4-nitrophenol | **4.70** | aniline | **4.50** | 6.87 | 6.96 |
| [28] | butan-1-ol | **2.70** | pyridine | **7.20** | 2.58 | 2.37 |
| [28] | 3-trifluoromethylphenol | **4.30** | N,N-dimethylacetamide | **8.50** | 16.91 | 16.46 |
| [28] | phenol | **3.80** | tripropylamine | **6.60** | 8.40 | 8.68 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [28] | 1-naphthol | **3.80** | benzene | **2.00** | -2.64 | -2.90 |
| [28] | 1-naphthol | **3.80** | mesitylene | **2.70** | -0.96 | -1.09 |
| [1] | 4-tert-Butylphenol | **3.60** | N,N-dimethylacetamide | **8.50** | 11.38 | 10.83 |
| [28] | 2-naphthol | **3.90** | p-xylene | **2.40** | -1.50 | -1.81 |
| [1] | 4-tert-Butylphenol | **3.60** | pyridine | **7.20** | 8.52 | 10.61 |
| [28] | 2-naphthol | **3.90** | m-xylene | **2.40** | -1.50 | -1.97 |
| [28] | 2-naphthol | **3.90** | o-xylene | **2.40** | -1.50 | -1.93 |
| [1] | 3,5-dichlorophenol | **4.50** | triethylamine | **7.50** | 15.39 | 15.47 |
| [1] | 3,5-dichlorophenol | **4.50** | aniline | **4.50** | 6.09 | 6.20 |
| [28] | 2-naphthol | **3.90** | benzene | **2.00** | -2.50 | -2.98 |
| [36] | Ethanol | **2.70** | 1-methyl-2-pyrrolidone | **8.30** | 4.01 | 4.28 |
| [35] | Methanol | **2.90** | triethylamine | **7.50** | 4.35 | 3.96 |
| [33] | Ethanol | **2.70** | triethylamine | **7.50** | 2.97 | 2.61 |
| [31] | 4-fluorophenol | **3.90** | cyclohexyl fluoride | **3.30** | 0.75 | 0.62 |
| [37] | 4-fluorophenol | **3.90** | Dichloromethane | **2.00** | -2.50 | -2.85 |
| [37] | 4-fluorophenol | **3.90** | 1,2-Dichloroethane | **2.40** | -1.50 | -1.77 |
| [37] | 4-fluorophenol | **3.90** | cyclohexyl chloride | **2.50** | -1.25 | -1.54 |
| [37] | 4-fluorophenol | **3.90** | cyclohexyl bromide | **2.50** | -1.25 | -1.43 |
| [37] | 4-fluorophenol | **3.90** | cyclohexyl iodide | **2.30** | -1.75 | -1.83 |
| [38] | 4-fluorophenol | **3.90** | benzene | **2.00** | -2.50 | -2.80 |
| [38] | 4-fluorophenol | **3.90** | Octan-1-ol | **5.30** | 5.75 | 5.93 |
| [28] | 4-fluorophenol | **3.90** | Chlorobenzene | **1.40** | -4.00 | -4.54 |
| [29] | 4-fluorophenol | **3.90** | pyridine | **7.20** | 10.50 | 10.73 |
| [32] | 4-fluorophenol | **3.90** | ammonia | **6.80** | 9.50 | 9.58 |
| [38] | 4-fluorophenol | **3.90** | trimethylamine | **7.80** | 12.00 | 12.15 |
| [38] | 4-fluorophenol | **3.90** | tripropylamine | **6.60** | 9.00 | 8.39 |
| [38] | 4-fluorophenol | **3.90** | tributylamine | **6.80** | 9.50 | 8.84 |
| [31] | 4-fluorophenol | **3.90** | 1-methyl-2-pyrrolidone | **8.30** | 13.25 | 14.02 |
| [38] | 4-fluorophenol | **3.90** | methanol | **4.80** | 4.50 | 4.68 |
| [38] | 4-fluorophenol | **3.90** | Ethanol | **5.20** | 5.50 | 5.82 |
| [38] | 4-fluorophenol | **3.90** | water | **4.50** | 3.75 | 3.71 |
| [32] | 4-fluorophenol | **3.90** | pyrimidine | **5.40** | 6.00 | 7.82 |
| [2] | 2,2,2-Trifluoro-1,1-bis(trifluoromethyl)ethanol | **4.90** | Tributylphosphine oxide | **10.70** | 29.35 | 27.67 |
| [36] | Butan-2-ol | **2.50** | 1-methyl-2-pyrrolidone | **8.30** | 2.47 | 3.71 |
| [39] | 4-fluorophenol | **3.90** | Tetramethylene sulfone | **6.30** | 8.25 | 8.39 |
| [28] | phenol | **3.80** | Diphenyl Sulfone | **5.90** | 6.72 | 4.44 |
| [39] | 4-fluorophenol | **3.90** | Diphenyl Sulfone | **5.90** | 7.25 | 6.90 |
| [39] | 4-fluorophenol | **3.90** | Dimethyl Sulfone | **6.20** | 8.00 | 7.99 |
| [28] | phenol | **3.80** | Dibutyl Sulfone | **6.40** | 7.92 | 6.71 |
| [39] | 4-fluorophenol | **3.90** | Dibutyl Sulfone | **6.40** | 8.50 | 8.67 |
| [36] | 4-bromophenol | **4.10** | 1-methyl-2-pyrrolidone | **8.30** | 14.79 | 15.18 |
| [29] | 4-chlorophenol | **4.10** | 1-methyl-2-pyrrolidone | **8.30** | 14.79 | 15.34 |
| [36] | 1-naphthol | **3.80** | 1-methyl-2-pyrrolidone | **8.30** | 12.48 | 13.18 |
| [29] | 4-Methoxyphenol | **3.70** | 1-methyl-2-pyrrolidone | **8.30** | 11.71 | 12.15 |
| [29] | phenol | **3.80** | 1-methyl-2-pyrrolidone | **8.30** | 12.48 | 12.20 |
| [36] | 4-methylphenol | **3.70** | 1-methyl-2-pyrrolidone | **8.30** | 11.71 | 11.70 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [36] | pentachlorophenol | **3.60** | 1-methyl-2-pyrrolidone | **8.30** | 10.94 | 11.58 |
| [36] | Hexafluoropropan-2-ol | **4.50** | 1-methyl-2-pyrrolidone | **8.30** | 17.87 | 17.69 |
| [36] | 2,2,2-trifluoroethanol | **3.70** | 1-methyl-2-pyrrolidone | **8.30** | 11.71 | 11.30 |
| [29] | phenol | **3.80** | Nitrobenzene | **3.70** | 1.44 | 3.27 |
| [29] | phenol | **3.80** | cyclohexanone | **6.20** | 7.44 | 6.66 |
| [29] | phenol | **3.80** | Trimethyl phosphate | **8.50** | 12.96 | 12.53 |
| [29] | phenol | **3.80** | 2,6-dimethylpyridine | **7.80** | 11.28 | 10.79 |
| [29] | phenol | **3.80** | 2,4,6-trimethylpyridine | **8.10** | 12.00 | 11.66 |
| [29] | phenol | **3.80** | 1,1,3,3-Tetramethylurea | **8.50** | 12.96 | 12.17 |
| [29] | phenol | **3.80** | 4-methylpyridine | **7.70** | 11.04 | 10.39 |
| [29] | 4-fluorophenol | **3.90** | acetonitrile | **5.10** | 5.25 | 5.13 |
| [31] | 4-fluorophenol | **3.90** | Ethyl ethanoate | **5.40** | 6.00 | 6.52 |
| [29] | 4-fluorophenol | **3.90** | cyclohexanone | **6.20** | 8.00 | 7.53 |
| [29] | 4-fluorophenol | **3.90** | diethyl ether | **5.30** | 5.75 | 5.76 |
| [31] | 4-fluorophenol | **3.90** | Trimethyl phosphate | **8.50** | 13.75 | 14.12 |
| [31] | 4-fluorophenol | **3.90** | tetrahydrofuran | **5.90** | 7.25 | 7.42 |
| [29] | 4-fluorophenol | **3.90** | dimethyl sulphoxide | **8.60** | 14.00 | 14.43 |
| [40] | 4-fluorophenol | **3.90** | 1,1,3,3-Tetramethylurea | **8.50** | 13.75 | 13.92 |
| [29] | 4-fluorophenol | **3.90** | N,N-dimethylaniline | **4.20** | 3.00 | 2.57 |
| [40] | 4-fluorophenol | **3.90** | N,N-Dimethylformamide | **7.70** | 11.75 | 11.98 |
| [31] | 4-fluorophenol | **3.90** | N,N-dimethylacetamide | **8.50** | 13.75 | 13.82 |
| [29] | 4-fluorophenol | **3.90** | Hexamethylphosphoramide | **10.90** | 19.75 | 20.31 |
| [31] | 4-fluorophenol | **3.90** | 4-methylpyridine | **7.70** | 11.75 | 11.92 |
| [29] | 4-fluorophenol | **3.90** | triethylamine | **7.50** | 11.25 | 11.01 |
| [29] | 4-chlorophenol | **4.10** | Ethyl ethanoate | **5.40** | 6.96 | 6.84 |
| [29] | 4-chlorophenol | **4.10** | Propan-2-one | **5.70** | 7.77 | 7.90 |
| [29] | 4-chlorophenol | **4.10** | dimethyl sulphoxide | **8.60** | 15.60 | 15.42 |
| [29] | 4-chlorophenol | **4.10** | 1,1,3,3-Tetramethylurea | **8.50** | 15.33 | 14.97 |
| [29] | 4-chlorophenol | **4.10** | N,N-Dimethylformamide | **7.70** | 13.17 | 12.30 |
| [29] | 4-chlorophenol | **4.10** | Hexamethylphosphoramide | **10.90** | 21.81 | 21.59 |
| [29] | 4-bromophenol | **4.10** | cyclohexanone | **6.20** | 9.12 | 8.12 |
| [29] | 4-bromophenol | **4.10** | dimethyl sulphoxide | **8.60** | 15.60 | 15.80 |
| [29] | 4-bromophenol | **4.10** | 1,1,3,3-Tetramethylurea | **8.50** | 15.33 | 15.15 |
| [29] | 4-bromophenol | **4.10** | N,N-dimethylacetamide | **8.50** | 15.33 | 14.68 |
| [29] | 4-bromophenol | **4.10** | Hexamethylphosphoramide | **10.90** | 21.81 | 22.39 |
| [29] | 4-bromophenol | **4.10** | pyridine | **7.20** | 11.82 | 11.84 |
| [29] | 4-bromophenol | **4.10** | triethylamine | **7.50** | 12.63 | 12.41 |
| [29] | 4-Iodophenol | **4.10** | dimethyl sulphoxide | **8.60** | 15.60 | 16.12 |
| [29] | 4-Iodophenol | **4.10** | 1,1,3,3-Tetramethylurea | **8.50** | 15.33 | 15.16 |
| [29] | 4-Iodophenol | **4.10** | 1-methyl-2-pyrrolidone | **8.30** | 14.79 | 15.27 |
| [29] | 4-Iodophenol | **4.10** | Hexamethylphosphoramide | **10.90** | 21.81 | 22.56 |
| [29] | 4-Iodophenol | **4.10** | pyridine | **7.20** | 11.82 | 11.03 |
| [29] | 4-Iodophenol | **4.10** | triethylamine | **7.50** | 12.63 | 12.96 |
| [29] | 3-methylphenol | **3.70** | cyclohexanone | **6.20** | 6.88 | 5.98 |
| [29] | 3-methylphenol | **3.70** | dimethyl sulphoxide | **8.60** | 12.40 | 12.41 |
| [29] | 3-methylphenol | **3.70** | 1,1,3,3-Tetramethylurea | **8.50** | 12.17 | 11.58 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [28] | 3-methylphenol | **3.70** | N,N-dimethylacetamide | **8.50** | 12.17 | 11.30 |
| [29] | 3-methylphenol | **3.70** | 1-methyl-2-pyrrolidone | **8.30** | 11.71 | 11.96 |
| [29] | 3-methylphenol | **3.70** | Hexamethylphosphoramide | **10.90** | 17.69 | 18.02 |
| [29] | 3-methylphenol | **3.70** | triethylamine | **7.50** | 9.87 | 9.85 |
| [29] | 4-Methoxyphenol | **3.70** | Propan-2-one | **5.70** | 5.73 | 5.63 |
| [29] | 4-Methoxyphenol | **3.70** | cyclohexanone | **6.20** | 6.88 | 5.92 |
| [29] | 4-Methoxyphenol | **3.70** | dimethyl sulphoxide | **8.60** | 12.40 | 12.41 |
| [29] | 4-Methoxyphenol | **3.70** | 1,1,3,3-Tetramethylurea | **8.50** | 12.17 | 11.60 |
| [29] | 4-Methoxyphenol | **3.70** | N,N-dimethylacetamide | **8.50** | 12.17 | 11.25 |
| [29] | 4-Methoxyphenol | **3.70** | Hexamethylphosphoramide | **10.90** | 17.69 | 17.90 |
| [29] | 4-Methoxyphenol | **3.70** | pyridine | **7.20** | 9.18 | 8.81 |
| [29] | 4-nitrophenol | **4.70** | Nitrobenzene | **3.70** | 4.23 | 4.08 |
| [29] | 4-nitrophenol | **4.70** | dimethyl sulphoxide | **8.60** | 20.40 | 20.30 |
| [29] | 4-nitrophenol | **4.70** | 1,1,3,3-Tetramethylurea | **8.50** | 20.07 | 19.87 |
| [28] | 4-nitrophenol | **4.70** | N,N-dimethylacetamide | **8.50** | 20.07 | 19.66 |
| [29] | 4-nitrophenol | **4.70** | 1-methyl-2-pyrrolidone | **8.30** | 19.41 | 18.01 |
| [29] | Methanol | **2.90** | Ethyl ethanoate | **5.40** | 1.20 | 0.84 |
| [28] | Methanol | **2.90** | Trimethyl phosphate | **8.50** | 5.85 | 5.86 |
| [29] | Methanol | **2.90** | 2,6-dimethylpyridine | **7.80** | 4.80 | 2.88 |
| [29] | Methanol | **2.90** | 2,4,6-trimethylpyridine | **8.10** | 5.25 | 2.97 |
| [29] | Methanol | **2.90** | Hexamethylphosphoramide | **10.90** | 9.45 | 9.08 |
| [29] | Methanol | **2.90** | 4-methylpyridine | **7.70** | 4.65 | 2.80 |
| [29] | Ethanol | **2.70** | Ethyl ethanoate | **5.40** | 0.24 | 0.09 |
| [29] | Ethanol | **2.70** | diethyl ether | **5.30** | 0.11 | -0.72 |
| [29] | Ethanol | **2.70** | 1,1,3,3-Tetramethylurea | **8.50** | 4.27 | 4.18 |
| [29] | Ethanol | **2.70** | N,N-Dimethylformamide | **7.70** | 3.23 | 3.09 |
| [29] | Ethanol | **2.70** | Hexamethylphosphoramide | **10.90** | 7.39 | 8.47 |
| [29] | Ethanol | **2.70** | pyridine | **7.20** | 2.58 | 2.17 |
| [29] | butan-1-ol | **2.70** | Propan-2-one | **5.70** | 0.63 | 0.65 |
| [29] | butan-1-ol | **2.70** | cyclohexanone | **6.20** | 1.28 | 1.50 |
| [28] | butan-1-ol | **2.70** | diethyl ether | **5.30** | 0.11 | -0.78 |
| [29] | butan-1-ol | **2.70** | tetrahydrofuran | **5.90** | 0.89 | 0.23 |
| [28] | butan-1-ol | **2.70** | triethylamine | **7.50** | 2.97 | 2.88 |
| [29] | tert-Butyl alcohol | **2.70** | Hexamethylphosphoramide | **10.90** | 7.39 | 6.87 |
| [29] | 2,2,2-trifluoroethanol | **3.70** | acetonitrile | **5.10** | 4.35 | 4.24 |
| [29] | 2,2,2-trifluoroethanol | **3.70** | Trimethyl phosphate | **8.50** | 12.17 | 12.38 |
| [29] | 2,2,2-trifluoroethanol | **3.70** | 2,4,6-trimethylpyridine | **8.10** | 11.25 | 10.16 |
| [29] | 2,2,2-trifluoroethanol | **3.70** | 1,1,3,3-Tetramethylurea | **8.50** | 12.17 | 11.42 |
| [29] | 2,2,2-trifluoroethanol | **3.70** | pyridine | **7.20** | 9.18 | 8.83 |
| [29] | Hexafluoropropan-2-ol | **4.50** | acetonitrile | **5.10** | 7.95 | 8.80 |
| [29] | Hexafluoropropan-2-ol | **4.50** | Ethyl ethanoate | **5.40** | 8.88 | 8.95 |
| [29] | Hexafluoropropan-2-ol | **4.50** | Propan-2-one | **5.70** | 9.81 | 9.64 |
| [29] | Hexafluoropropan-2-ol | **4.50** | diethyl ether | **5.30** | 8.57 | 8.17 |
| [29] | Hexafluoropropan-2-ol | **4.50** | tetrahydrofuran | **5.90** | 10.43 | 10.78 |
| [29] | Hexafluoropropan-2-ol | **4.50** | 2,4,6-trimethylpyridine | **8.10** | 17.25 | 17.32 |
| [29] | Hexafluoropropan-2-ol | **4.50** | dimethyl sulphoxide | **8.60** | 18.80 | 18.01 |

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|---|---|---|---|---|---|---|
| [29] | Hexafluoropropan-2-ol | **4.50** | 1,1,3,3-Tetramethylurea | **8.50** | 18.49 | 17.77 |
| [29] | Hexafluoropropan-2-ol | **4.50** | N,N-dimethylacetamide | **8.50** | 18.49 | 18.15 |
| [29] | Hexafluoropropan-2-ol | **4.50** | Hexamethylphosphoramide | **10.90** | 25.93 | 24.93 |
| [29] | Hexafluoropropan-2-ol | **4.50** | pyridine | **7.20** | 14.46 | 15.88 |
| [31] | 4-fluorophenol | **3.90** | quinuclidine | **9.10** | 15.25 | 15.22 |
| [28] | Methanol | **2.90** | tributylamine | **6.80** | 3.30 | 3.46 |
| [28] | Methanol | **2.90** | tripropylamine | **6.60** | 3.00 | 3.00 |
| [28] | Methanol | **2.90** | 3-bromopyridine | **6.00** | 2.10 | 1.45 |
| [28] | Methanol | **2.90** | 2-methylpyridine | **7.60** | 4.50 | 2.76 |
| [28] | Methanol | **2.90** | 1,4-dioxane | **4.70** | 0.15 | 1.00 |
| [28] | Ethanol | **2.70** | 1,4-dioxane | **4.70** | -0.67 | 0.13 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | 1,4-dioxane | **4.70** | 3.43 | 4.60 |
| [28] | Propan-1-ol | **2.60** | triethylamine | **7.50** | 2.28 | 1.72 |
| [28] | Butan-2-ol | **2.50** | triethylamine | **7.50** | 1.59 | 1.30 |
| [28] | Butan-2-ol | **2.50** | pyridine | **7.20** | 1.26 | 1.87 |
| [28] | phenol | **3.80** | dibutyl ether | **5.00** | 4.56 | 4.56 |
| [28] | phenol | **3.80** | tetrahydropyran | **5.80** | 6.48 | 6.43 |
| [28] | phenol | **3.80** | 1,4-dioxane | **4.70** | 3.84 | 3.89 |
| [28] | phenol | **3.80** | n-hexylamine | **7.70** | 11.04 | 10.73 |
| [28] | 4-chlorophenol | **4.10** | 1,4-Diazabicyclo[2.2.2]octane | **8.90** | 16.41 | 18.41 |
| [31] | 4-fluorophenol | **3.90** | tetrahydropyran | **5.80** | 7.00 | 7.12 |
| [41] | 4-fluorophenol | **3.90** | dibutyl ether | **5.00** | 5.00 | 5.02 |
| [41] | 4-fluorophenol | **3.90** | 1,3-Dioxolane | **4.10** | 2.75 | 2.57 |
| [32] | 4-fluorophenol | **3.90** | 1-Methyl-1H-imidazole | **9.10** | 15.25 | 15.52 |
| [31] | 4-fluorophenol | **3.90** | 1-Methylpyrrolidine | **7.90** | 12.25 | 12.85 |
| [42] | 4-fluorophenol | **3.90** | Dimethylcyanamide | **6.50** | 8.75 | 8.90 |
| [42] | 4-fluorophenol | **3.90** | propionitrile | **5.20** | 5.50 | 5.48 |
| [31] | 4-fluorophenol | **3.90** | chloroacetonitrile | **3.90** | 2.25 | 2.42 |
| [42] | 4-fluorophenol | **3.90** | 3,5-Dichloropyridine | **5.00** | 5.00 | 4.85 |
| [42] | 4-fluorophenol | **3.90** | 3-Chloropyridine | **6.00** | 7.50 | 7.47 |
| [42] | 4-fluorophenol | **3.90** | 3-Fluoropyridine | **6.10** | 7.75 | 7.70 |
| [42] | 4-fluorophenol | **3.90** | 2-methylpyridine | **7.60** | 11.50 | 11.58 |
| [31] | 4-fluorophenol | **3.90** | 3-methylpyridine | **7.50** | 11.25 | 11.52 |
| [42] | 4-fluorophenol | **3.90** | Benzylamine | **7.20** | 10.50 | 10.73 |
| [31] | 4-fluorophenol | **3.90** | N,N-Dimethylbenzamide | **8.00** | 12.50 | 12.92 |
| [31] | 4-fluorophenol | **3.90** | Methyl ethanoate | **4.70** | 4.25 | 5.92 |
| [43] | 4-fluorophenol | **3.90** | Nitrobenzene | **3.70** | 1.75 | 1.71 |
| [31] | 4-fluorophenol | **3.90** | N,N-Dimethylthioacetamide | **6.00** | 7.50 | 6.92 |
| [44] | 4-fluorophenol | **3.90** | cyclopentanone | **5.90** | 7.25 | 7.25 |
| [44] | 4-fluorophenol | **3.90** | 3-Methylbutan-2-one | **5.70** | 6.75 | 6.85 |
| [44] | 4-fluorophenol | **3.90** | Propan-2-one | **5.70** | 6.75 | 6.73 |
| [44] | 4-fluorophenol | **3.90** | Pentan-3-one | **5.60** | 6.50 | 6.50 |
| [44] | 4-fluorophenol | **3.90** | acetophenone | **5.50** | 6.25 | 6.33 |
| [44] | 4-fluorophenol | **3.90** | benzophenone | **5.40** | 6.00 | 6.10 |
| [45] | 4-fluorophenol | **3.90** | 2,4,6-trimethylpyridine | **8.10** | 12.75 | 13.06 |
| [31] | 4-fluorophenol | **3.90** | 2,6-dimethylpyridine | **7.80** | 12.00 | 11.92 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [31] | 4-fluorophenol | **3.90** | 2-Chloropyridine | **5.40** | 6.00 | 6.12 |
| [45] | 4-fluorophenol | **3.90** | 2-Fluoropyridine | **5.20** | 5.50 | 5.42 |
| [37] | 4-fluorophenol | **3.90** | 1,1,1-Trichloroethane | **1.50** | -3.75 | -3.99 |
| [46] | 4-fluorophenol | **3.90** | isopropylamine | **8.00** | 12.50 | 12.67 |
| [31] | 4-fluorophenol | **3.90** | 2,2,2-Trifluoroethylamine | **4.60** | 4.00 | 4.35 |
| [32] | 4-fluorophenol | **3.90** | p-xylene | **2.40** | -1.50 | -1.71 |
| [32] | 4-fluorophenol | **3.90** | tetrahydrothiophene | **3.90** | 2.25 | 1.71 |
| [32] | 4-fluorophenol | **3.90** | aniline | **4.50** | 3.75 | 3.19 |
| [31] | 4-fluorophenol | **3.90** | pyridine N-oxide | **9.00** | 15.00 | 15.52 |
| [32] | 4-fluorophenol | **3.90** | Triethylphosphine oxide | **10.10** | 17.75 | 18.03 |
| [28] | phenol | **3.80** | dibutyl sulphoxide | **8.70** | 13.44 | 13.34 |
| [3] | Propan-1-ol | **2.60** | Propan-1-ol | **5.30** | -0.36 | 0.55 |
| [3] | propan-2-ol | **2.70** | Propan-2-ol | **5.50** | 0.37 | -0.67 |
| [3] | butan-1-ol | **2.70** | cyclopentanone | **5.90** | 0.89 | 1.07 |
| [28] | phenol | **3.80** | cyclopentanone | **5.90** | 6.72 | 6.69 |
| [28] | phenol | **3.80** | Triethylphosphine oxide | **10.10** | 16.80 | 18.83 |
| [3] | phenol | **3.80** | Trimethylphosphine oxide | **10.70** | 18.24 | 18.31 |
| [28] | Methanol | **2.90** | triphenylphosphine oxide | **10.10** | 8.25 | 7.53 |
| [29] | Methanol | **2.90** | Diethyl ethylphosphonate | **9.20** | 6.90 | 6.97 |
| [29] | Methanol | **2.90** | Diethyl chloromethylphosphonate | **8.50** | 5.85 | 5.82 |
| [3] | Methanol | **2.90** | m-xylene | **2.40** | -3.30 | -3.87 |
| [3] | Methanol | **2.90** | mesitylene | **2.70** | -2.85 | -3.54 |
| [3] | Methanol | **2.90** | Chlorobenzene | **1.40** | -4.80 | -4.54 |
| [3] | 2-Isopropylphenol | **3.60** | nitromethane | **3.70** | 0.82 | 0.45 |
| [3] | Methanol | **2.90** | nitromethane | **3.70** | -1.35 | -3.99 |
| [3] | 2-Isopropylphenol | **3.60** | acetophenone | **5.50** | 4.78 | 4.68 |
| [3] | 2-Isopropylphenol | **3.60** | benzophenone | **5.40** | 4.56 | 3.67 |
| [3] | 2-Isopropylphenol | **3.60** | diethyl ether | **5.30** | 4.34 | 3.37 |
| [3] | 2-Isopropylphenol | **3.60** | 1,4-dioxane | **4.70** | 3.02 | 4.56 |
| [35] | Methanol | **2.90** | benzene | **2.00** | -3.90 | -4.21 |
| [35] | Methanol | **2.90** | Ethylamine | **7.90** | 4.95 | 4.71 |
| [35] | Methanol | **2.90** | Methylamine | **7.80** | 4.80 | 4.38 |
| [35] | Methanol | **2.90** | diethylamine | **7.90** | 4.95 | 4.41 |
| [35] | Methanol | **2.90** | trimethylamine | **7.80** | 4.80 | 3.62 |
| [35] | Methanol | **2.90** | quinuclidine | **9.10** | 6.75 | 5.74 |
| [35] | Methanol | **2.90** | 3,5-Dichloropyridine | **5.00** | 0.60 | -1.02 |
| [35] | Methanol | **2.90** | 3-Fluoropyridine | **6.10** | 2.25 | 0.85 |
| [35] | Methanol | **2.90** | 3,5-Dimethylpyridine | **8.00** | 5.10 | 3.64 |
| [35] | Methanol | **2.90** | 1,3-Dioxolane | **4.10** | -0.75 | -0.51 |
| [35] | Methanol | **2.90** | tetrahydrofuran | **5.90** | 1.95 | 0.75 |
| [35] | Methanol | **2.90** | tetrahydrothiophene | **3.90** | -1.05 | -2.00 |
| [35] | Methanol | **2.90** | cyclohexyl fluoride | **3.30** | -1.95 | -2.37 |
| [35] | Methanol | **2.90** | cyclohexyl chloride | **2.50** | -3.15 | -2.80 |
| [31] | 4-fluorophenol | **3.90** | dibutyl sulphoxide | **8.70** | 14.25 | 15.42 |
| [31] | 4-fluorophenol | **3.90** | toluene | **2.20** | -2.00 | -1.98 |
| [31] | 4-fluorophenol | **3.90** | mesitylene | **2.70** | -0.75 | -1.28 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [31] | 4-fluorophenol | **3.90** | Hexamethylbenzene | **3.10** | 0.25 | 0.02 |
| [31] | 4-fluorophenol | **3.90** | n-butylamine | **8.00** | 12.50 | 12.32 |
| [31] | 4-fluorophenol | **3.90** | di-n-butylamine | **7.90** | 12.25 | 12.12 |
| [31] | 4-fluorophenol | **3.90** | diethylamine | **7.90** | 12.25 | 12.72 |
| [31] | 4-fluorophenol | **3.90** | 1,4-Diazabicyclo[2.2.2]octane | **8.90** | 14.75 | 13.12 |
| [31] | 4-fluorophenol | **3.90** | cyclohexyldimethylamine | **7.80** | 12.00 | 12.22 |
| [31] | 4-fluorophenol | **3.90** | 3,5-Dimethylpyridine | **8.00** | 12.50 | 12.42 |
| [31] | 4-fluorophenol | **3.90** | 2,2,5,5-tetramethyltetrahydrofuran | **6.20** | 8.00 | 8.32 |
| [31] | 4-fluorophenol | **3.90** | Ethyl formate | **4.50** | 3.75 | 4.32 |
| [31] | 4-fluorophenol | **3.90** | Methyl formate | **4.50** | 3.75 | 3.62 |
| [31] | 4-fluorophenol | **3.90** | nitromethane | **3.70** | 1.75 | 0.02 |
| [31] | 4-fluorophenol | **3.90** | Trimethylphosphine oxide | **10.70** | 19.25 | 19.92 |
| [31] | 4-fluorophenol | **3.90** | Tributylphosphine oxide | **10.70** | 19.25 | 20.72 |
| [31] | 4-fluorophenol | **3.90** | dimethyl sulphide | **3.50** | 1.25 | 0.72 |
| [31] | 4-fluorophenol | **3.90** | dibutyl sulphide | **3.60** | 1.50 | 1.12 |
| [31] | 4-fluorophenol | **3.90** | 1-Fluoropentane | **2.90** | -0.25 | 0.02 |
| [31] | 4-fluorophenol | **3.90** | 1-Chloropentane | **2.20** | -2.00 | -1.88 |
| [31] | 4-fluorophenol | **3.90** | 1-Bromopentane | **2.30** | -1.75 | -1.98 |
| [31] | 4-fluorophenol | **3.90** | 1-Iodopentane | **2.50** | -1.25 | -3.78 |
| [28] | Methanol | **2.90** | benzophenone | **5.40** | 1.20 | 1.00 |
| [28] | Ethanol | **2.70** | benzophenone | **5.40** | 0.24 | 0.46 |
| [28] | 2,2,2-trifluoroethanol | **3.70** | tetrahydrofuran | **5.90** | 6.19 | 5.86 |
| [28] | Propan-1-ol | **2.60** | diethyl ether | **5.30** | -0.36 | -0.25 |
| [28] | Propan-1-ol | **2.60** | Propan-2-one | **5.70** | 0.12 | -1.72 |
| [28] | Propan-1-ol | **2.60** | benzophenone | **5.40** | -0.24 | -0.13 |
| [28] | butan-1-ol | **2.70** | 1,4-Diazabicyclo[2.2.2]octane | **8.90** | 4.79 | 5.23 |
| [28] | tert-Butyl alcohol | **2.70** | benzophenone | **5.40** | 0.24 | 0.04 |
| [28] | phenol | **3.80** | benzophenone | **5.40** | 5.52 | 5.02 |
| [28] | phenol | **3.80** | 3-Methylbutan-2-one | **5.70** | 6.24 | 5.44 |
| [28] | phenol | **3.80** | propionitrile | **5.20** | 5.04 | 5.40 |
| [28] | phenol | **3.80** | chloroacetonitrile | **3.90** | 1.92 | 1.72 |
| [28] | phenol | **3.80** | Dimethylcyanamide | **6.50** | 8.16 | 6.28 |
| [28] | phenol | **3.80** | Diethyl chloromethylphosphonate | **8.50** | 12.96 | 12.97 |
| [28] | phenol | **3.80** | Diethyl isopropylphosphonate | **9.10** | 14.40 | 14.64 |
| [28] | phenol | **3.80** | Diethyl ethylphosphonate | **9.20** | 14.64 | 14.23 |
| [28] | phenol | **3.80** | toluene | **2.20** | -2.16 | -1.86 |
| [28] | phenol | **3.80** | o-xylene | **2.40** | -1.68 | -1.97 |
| [28] | phenol | **3.80** | p-xylene | **2.40** | -1.68 | -1.89 |
| [28] | phenol | **3.80** | mesitylene | **2.70** | -0.96 | -1.39 |
| [28] | phenol | **3.80** | Hexamethylbenzene | **3.10** | 0.00 | -0.13 |
| [28] | 4-methylphenol | **3.70** | Hexamethylbenzene | **3.10** | -0.25 | -0.17 |
| [28] | phenol | **3.80** | Tetramethylene sulfone | **6.30** | 7.68 | 7.11 |
| [28] | phenol | **3.80** | 1,4-Diazabicyclo[2.2.2]octane | **8.90** | 13.92 | 14.02 |
| [28] | propan-2-ol | **2.70** | 2-methylpyridine | **7.60** | 3.10 | 0.50 |
| [28] | propan-2-ol | **2.70** | 3-methylpyridine | **7.50** | 2.97 | 0.46 |
| [28] | propan-2-ol | **2.70** | 4-methylpyridine | **7.70** | 3.23 | 0.46 |

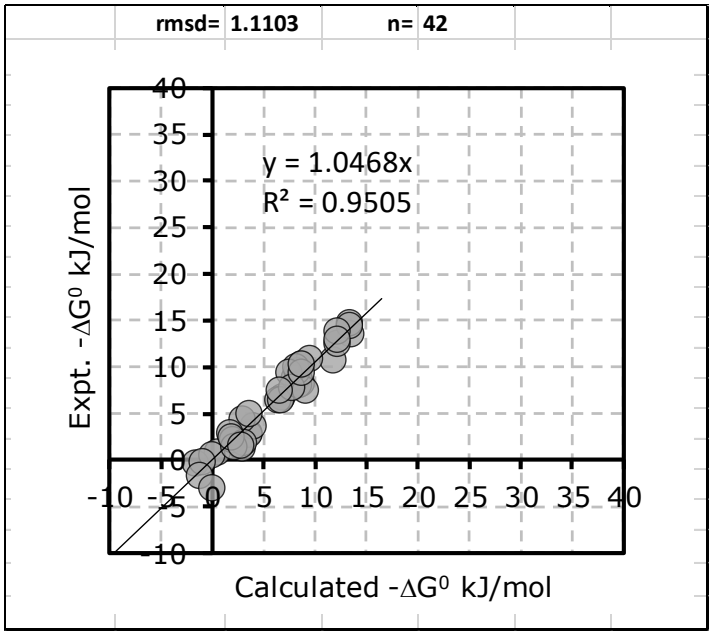
| | | | | | | |
|---|---|---|---|---|---|---|
| [28] | propan-2-ol | **2.70** | 2-Chloropyridine | **5.40** | 0.24 | -2.38 |
| [28] | propan-2-ol | **2.70** | 2-Fluoropyridine | **5.20** | -0.02 | -2.51 |
| [28] | propan-2-ol | **2.70** | 3-Chloropyridine | **6.00** | 1.02 | -1.84 |
| [28] | propan-2-ol | **2.70** | 2,6-dimethylpyridine | **7.80** | 3.36 | 0.54 |
| [28] | propan-2-ol | **2.70** | 3,5-Dimethylpyridine | **8.00** | 3.62 | 0.59 |
| [28] | propan-2-ol | **2.70** | 2,4,6-trimethylpyridine | **8.10** | 3.75 | 0.92 |
| [28] | 4-fluorophenol | **3.90** | Cyclopropylamine | **6.90** | 9.75 | 9.37 |
| [28] | 3-fluorophenol | **4.10** | N,N-dimethylacetamide | **8.50** | 15.33 | 14.64 |
| [16] | 4-methylphenol | **3.70** | triethylamine | **7.50** | 9.87 | 9.72 |
| [28] | 4-methylphenol | **3.70** | N,N-dimethylacetamide | **8.50** | 12.17 | 10.88 |
| [16] | 4-methylphenol | **3.70** | pyridine | **7.20** | 9.18 | 8.80 |
| [16] | 4-methylphenol | **3.70** | aniline | **4.50** | 2.97 | 2.48 |
| [28] | 4-methylphenol | **3.70** | benzene | **2.00** | -2.78 | -3.26 |
| [28] | 4-methylphenol | **3.70** | toluene | **2.20** | -2.32 | -2.89 |
| [28] | 4-methylphenol | **3.70** | m-xylene | **2.40** | -1.86 | -2.26 |
| [28] | 4-methylphenol | **3.70** | o-xylene | **2.40** | -1.86 | -2.22 |
| [28] | 4-methylphenol | **3.70** | p-xylene | **2.40** | -1.86 | -2.05 |
| [28] | 4-methylphenol | **3.70** | mesitylene | **2.70** | -1.17 | -1.63 |
| [28] | 3-nitrophenol | **4.60** | N,N-dimethylacetamide | **8.50** | 19.28 | 18.41 |
| [28] | 2-Methylphenol | **3.50** | benzene | **2.00** | -3.06 | -3.39 |
| [28] | 2-Methylphenol | **3.50** | mesitylene | **2.70** | -1.59 | -1.72 |
| [28] | 1-naphthol | **3.80** | p-xylene | **2.40** | -1.68 | -1.68 |
| [28] | 2-tert-Butylphenol | **3.40** | N-Methylacetamide | **8.20** | 9.20 | 9.62 |
| [28] | 2-tert-Butylphenol | **3.40** | tetrahydrofuran | **5.90** | 4.60 | 5.02 |
| [28] | 4-chlorophenol | **4.10** | dibutyl ether | **5.00** | 5.88 | 6.28 |
| [28] | 4-chlorophenol | **4.10** | benzophenone | **5.40** | 6.96 | 6.69 |
| [28] | 4-chlorophenol | **4.10** | dibutyl sulphide | **3.60** | 2.10 | 2.51 |
| [28] | 4-Methoxyphenol | **3.70** | benzophenone | **5.40** | 5.04 | 5.02 |
| [28] | pentachlorophenol | **3.60** | N,N-Dimethylformamide | **7.70** | 9.62 | 9.62 |
| [28] | pentachlorophenol | **3.60** | N,N-diethylacetamide | **8.50** | 11.38 | 11.72 |
| [28] | pentachlorophenol | **3.60** | 1-methyl-2-pyridone | **8.80** | 12.04 | 12.13 |
| [28] | pentachlorophenol | **3.60** | pyridine | **7.20** | 8.52 | 11.30 |
| [28] | pentachlorophenol | **3.60** | 2,4,6-trimethylpyridine | **8.10** | 10.50 | 12.97 |
| [28] | pentachlorophenol | **3.60** | tetrahydropyran | **5.80** | 5.44 | 4.60 |
| [28] | pentachlorophenol | **3.60** | Ethyl ethanoate | **5.40** | 4.56 | 3.77 |
| [28] | pentachlorophenol | **3.60** | cyclohexanone | **6.20** | 6.32 | 5.44 |
| [28] | pentachlorophenol | **3.60** | Trimethylphosphine oxide | **10.70** | 16.22 | 17.15 |
| [28] | pentachlorophenol | **3.60** | Diethyl chloromethylphosphonate | **8.50** | 11.38 | 11.30 |
| [28] | pentachlorophenol | **3.60** | Trimethyl phosphate | **8.50** | 11.38 | 11.30 |
| [28] | pentachlorophenol | **3.60** | Diethyl ethylphosphonate | **9.20** | 12.92 | 12.97 |
| [47] | 1-naphthol | **3.80** | Trimethylphosphine oxide | **10.70** | 18.24 | 18.71 |
| [28] | phenol | **3.80** | quinoline | **7.30** | 10.08 | 9.85 |
| [28] | phenol | **3.80** | tert-butylamine | **8.10** | 12.00 | 11.24 |
| [28] | Pentafluorophenol | **4.50** | triphenylphosphine oxide | **10.10** | 23.45 | 21.55 |
| [1] | 3,4-dichlorophenol | **4.40** | triethylamine | **7.50** | 14.70 | 14.16 |
| [1] | 4-cyanophenol | **4.60** | triethylamine | **7.50** | 16.08 | 15.57 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [28] | 4-fluorophenol | **3.90** | Pyridazine | **6.70** | 9.25 | 9.41 |
| [38] | 4-fluorophenol | **3.90** | Pyrazine | **5.10** | 5.25 | 5.25 |
| [36] | 3-Isopropylphenol | **3.70** | 1-methyl-2-pyrrolidone | **8.30** | 11.71 | 11.81 |
| [36] | Cyclohexanol | **2.60** | 1-methyl-2-pyrrolidone | **8.30** | 3.24 | 3.82 |
| [39] | 4-fluorophenol | **3.90** | N,N-Dimethylmethanesulfonamide | **5.95** | 7.37 | 7.42 |
| [36] | benzyl alcohol | **3.00** | 1-methyl-2-pyrrolidone | **8.30** | 6.32 | 5.88 |
| [41] | 4-fluorophenol | **3.90** | 1,2-Dimethoxyethane | **5.30** | 5.75 | 5.82 |
| [42] | 4-fluorophenol | **3.90** | piperidine | **8.30** | 13.25 | 13.58 |
| [42] | 4-fluorophenol | **3.90** | N-methylpiperidine | **7.70** | 11.75 | 12.04 |
| [42] | 4-fluorophenol | **3.90** | quinoline | **7.30** | 10.75 | 10.78 |
| [42] | 4-fluorophenol | **3.90** | tert-butylamine | **8.10** | 12.75 | 12.49 |
| [34] | 4-fluorophenol | **3.90** | N,N-Diethylformamide | **7.70** | 11.75 | 11.87 |
| [44] | 4-fluorophenol | **3.90** | 2,4-Dimethyl-3-pentanone | **5.50** | 6.25 | 6.16 |
| [44] | 4-fluorophenol | **3.90** | 3,3-Dimethyl-2-butanone | **5.70** | 6.75 | 6.68 |
| [48] | 4-fluorophenol | **3.90** | 3,4-Dimethylpyridine | **8.00** | 12.50 | 12.78 |
| [48] | 4-fluorophenol | **3.90** | 4-Methoxypyridine | **7.80** | 12.00 | 12.15 |
| [48] | 4-fluorophenol | **3.90** | 2-Methoxypyridine | **5.30** | 5.75 | 5.65 |
| [48] | 4-fluorophenol | **3.90** | 2-Cyanopyridine | **5.00** | 5.00 | 4.85 |
| [46] | 4-fluorophenol | **3.90** | 2-Propen-1-amine | **7.40** | 11.00 | 11.07 |
| [32] | 4-fluorophenol | **3.90** | morpholine | **7.20** | 10.50 | 10.61 |
| [35] | Methanol | **2.90** | Dimethylamine | **8.10** | 5.25 | 4.44 |
| [31] | 4-fluorophenol | **3.90** | c-hexylamine | **8.10** | 12.75 | 13.22 |
| [31] | 4-fluorophenol | **3.90** | Dimethylamine | **8.10** | 12.75 | 12.62 |
| [31] | 4-fluorophenol | **3.90** | N-Methylformamide | **7.40** | 11.00 | 10.22 |
| [28] | propan-2-ol | **2.70** | 3,4-Dimethylpyridine | **8.00** | 3.62 | 0.50 |
| [28] | 4-cyanophenol | **4.60** | N,N-dimethylacetamide | **8.50** | 19.28 | 18.41 |
| [49] | 4-phenylazophenol | **4.30** | Tributylphosphine oxide | **10.70** | 23.29 | 22.61 |
| [49] | 4-nitrophenol | **4.70** | Tributylphosphine oxide | **10.70** | 27.33 | 28.49 |
| [47] | 1-naphthol | **3.80** | Tri-cyclohexylphosphine oxide | **11.30** | 19.68 | 21.29 |
| [47] | 1-naphthol | **3.80** | Tri-n-octylphosphine oxide | **11.30** | 19.68 | 19.84 |
| [47] | 1-naphthol | **3.80** | Tributylphosphine oxide | **10.70** | 18.24 | 19.39 |
| [47] | 1-naphthol | **3.80** | triethyl phosphate | **8.80** | 13.68 | 14.44 |
| [47] | 1-naphthol | **3.80** | dibutyl sulphoxide | **8.70** | 13.44 | 14.05 |
| [47] | 1-naphthol | **3.80** | N,N-di-n-hexylacetamide | **8.40** | 12.72 | 13.36 |
| [3] | tert-Butyl alcohol | **2.70** | toluene | **2.20** | -3.92 | -4.13 |
| [3] | tert-Butyl alcohol | **2.70** | o-xylene | **2.40** | -3.66 | -4.72 |
| [3] | tert-Butyl alcohol | **2.70** | m-xylene | **2.40** | -3.66 | -3.55 |
| [3] | tert-Butyl alcohol | **2.70** | p-xylene | **2.40** | -3.66 | -4.00 |
| [3] | tert-Butyl alcohol | **2.70** | mesitylene | **2.70** | -3.27 | -3.35 |
| [3] | tert-Butyl alcohol | **2.70** | Hexamethylbenzene | **3.10** | -2.75 | -2.47 |

**f) Dichloromethane**

| Solvent | | $\alpha_s$ | $C_\alpha$ | $\beta_s$ | $C_\beta$ |
|---|---|---|---|---|---|
| CH2Cl2 | | 1.80 | 2.16 | 1.40 | 1.76 |

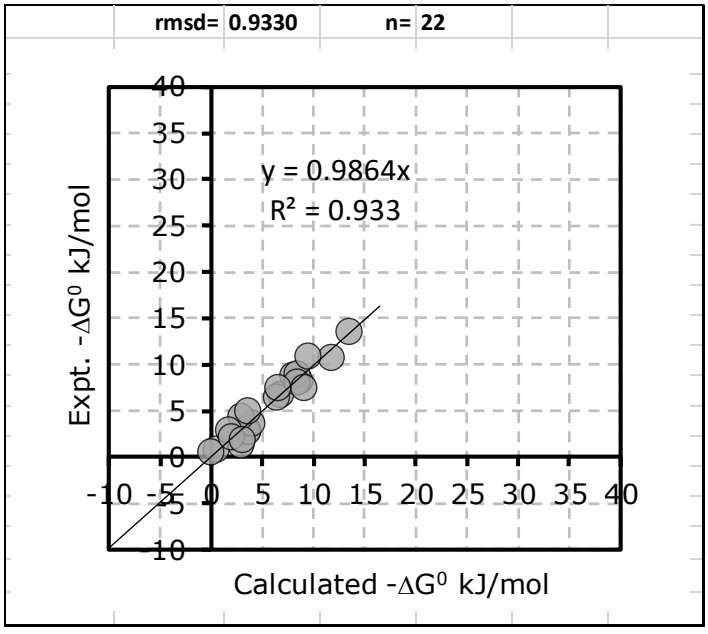
**Figure S4f.1 Dichloromethane: All donors**




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

**Figure S4f.2 Dichloromethane: H-bond acceptors with 4-fluorophenol as acceptor**




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

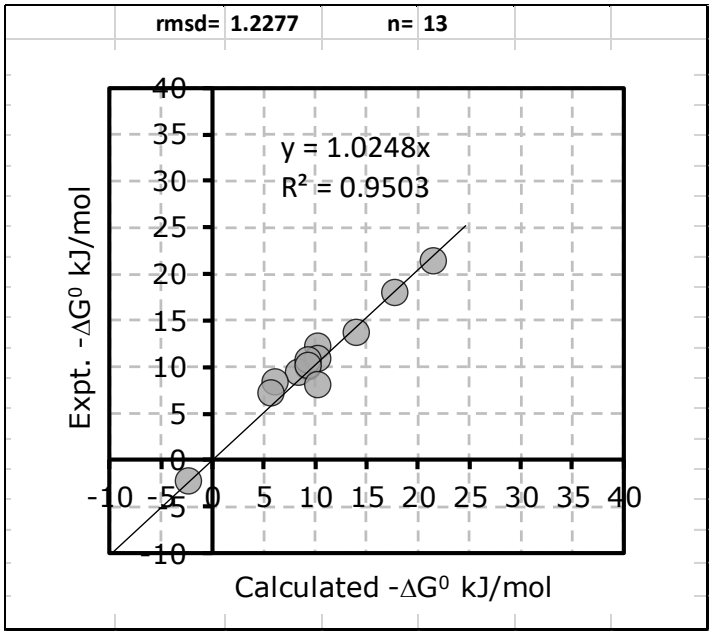
| Table S4f | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| Reference | DH | Alpha | A | Beta | $-\Delta G^0$ | $-\Delta G^0$ |
| [1] | 4-fluorophenol | **3.90** | 1,4-dioxane | **4.70** | 0.49 | 0.83 |
| [1] | phenol | **3.80** | pyridine N-oxide | **9.00** | 8.76 | 10.27 |
| [1] | 4-fluorophenol | **3.90** | Hexamethylphosphoramide | **10.90** | 13.51 | 13.52 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [1] | 4-fluorophenol | **3.90** | N,N-Dimethylformamide | **7.70** | 6.79 | 6.71 |
| [1] | 4-fluorophenol | **3.90** | dimethyl sulphoxide | **8.60** | 8.68 | 8.23 |
| [1] | 4-fluorophenol | **3.90** | cyclohexanone | **6.20** | 3.64 | 2.88 |
| [1] | 4-fluorophenol | **3.90** | triphenylphosphine oxide | **10.10** | 11.83 | 10.68 |
| [1] | 4-fluorophenol | **3.90** | diphenyl sulphoxide | **7.50** | 6.37 | 6.36 |
| [36] | 2,2,2-trifluoroethanol | **3.70** | 1-methyl-2-pyrrolidone | **8.30** | 6.67 | 6.33 |
| [36] | 4-fluorophenol | **3.90** | 1-methyl-2-pyrrolidone | **8.30** | 8.05 | 8.84 |
| [36] | Hexafluoropropan-2-ol | **4.50** | 1-methyl-2-pyrrolidone | **8.30** | 12.19 | 12.49 |
| [36] | Butan-2-ol | **2.50** | 1-methyl-2-pyrrolidone | **8.30** | -1.61 | -0.34 |
| [39] | 4-fluorophenol | **3.90** | Diphenyl Sulfone | **5.90** | 3.01 | 1.26 |
| [39] | 4-fluorophenol | **3.90** | Dimethyl Sulfone | **6.20** | 3.64 | 2.68 |
| [39] | 4-fluorophenol | **3.90** | Dibutyl Sulfone | **6.40** | 4.06 | 3.59 |
| [29] | 4-fluorophenol | **3.90** | tetrahydrofuran | **5.90** | 3.01 | 4.29 |
| [29] | 4-fluorophenol | **3.90** | diethyl ether | **5.30** | 1.75 | 2.83 |
| [29] | 4-fluorophenol | **3.90** | 2,2,5,5-tetramethyltetrahydrofuran | **6.20** | 3.64 | 4.97 |
| [29] | 4-fluorophenol | **3.90** | Ethyl formate | **4.50** | 0.07 | 0.47 |
| [29] | 4-fluorophenol | **3.90** | Ethyl ethanoate | **5.40** | 1.96 | 2.18 |
| [29] | 4-fluorophenol | **3.90** | N,N-dimethylacetamide | **8.50** | 8.47 | 8.97 |
| [29] | 4-fluorophenol | **3.90** | pyridine N-oxide | **9.00** | 9.52 | 10.87 |
| [29] | 4-fluorophenol | **3.90** | Trimethyl phosphate | **8.50** | 8.47 | 7.98 |
| [29] | 4-fluorophenol | **3.90** | triethyl phosphate | **8.80** | 9.10 | 7.51 |
| [36] | Cyclohexanol | **2.60** | 1-methyl-2-pyrrolidone | **8.30** | -0.92 | -0.23 |
| [39] | 4-fluorophenol | **3.90** | N,N-Dimethylmethanesulfonamide | **5.95** | 3.11 | 1.83 |
| [18] | 3,5,5-Trimethyl-hexanoic acid phenylamide | **2.90** | Diethyl ethylphosphonate | **9.20** | 2.14 | 1.31 |
| [50] | Pentafluorophenol | **4.50** | water | **4.50** | 1.93 | 2.40 |
| [47] | 1-naphthol | **3.80** | Tri-cyclohexylphosphine oxide | **11.30** | 13.36 | 14.65 |
| [47] | 1-naphthol | **3.80** | Tri-n-octylphosphine oxide | **11.30** | 13.36 | 14.44 |
| [47] | 1-naphthol | **3.80** | Tributylphosphine oxide | **10.70** | 12.16 | 13.78 |
| [47] | 1-naphthol | **3.80** | Trimethylphosphine oxide | **10.70** | 12.16 | 12.87 |
| [47] | 1-naphthol | **3.80** | triethyl phosphate | **8.80** | 8.36 | 9.54 |
| [47] | 1-naphthol | **3.80** | dibutyl sulphoxide | **8.70** | 8.16 | 9.93 |
| [47] | 1-naphthol | **3.80** | N,N-di-n-hexylacetamide | **8.40** | 7.56 | 9.32 |
| [6] | 1-naphthol | **3.80** | 1,1,3,3-Tetramethylurea | **8.50** | 7.76 | 7.70 |
| [51] | Indole | **3.10** | N,N-diethylacetamide | **8.50** | 2.79 | 1.49 |
| [51] | Indole | **3.10** | Ethyl ethanoate | **5.40** | -1.24 | -1.76 |
| [51] | tert-Butyl alcohol | **2.70** | N,N-diethylacetamide | **8.50** | -0.05 | -3.06 |
| [52] | 4-fluorophenol | **3.90** | N,N-Dicyclohexyl-2,2-dimethylpropionamide | **7.60** | 6.58 | 7.48 |
| [6] | 1-naphthol | **3.80** | pyridine N-oxide | **9.00** | 8.76 | 9.35 |
| [28] | phenol | **3.80** | pyridine N-oxide | **9.00** | 8.76 | 10.25 |

## g) Chloroform

| Solvent | | $\alpha_s$ | $C_\alpha$ | $\beta_s$ | $C_\beta$ |
|---|---|---|---|---|---|
| **CHCl3** | | 2.10 | 1.78 | 1.30 | 2.11 |

**Figure S4g**




Free energy calculation for 1:1 Association

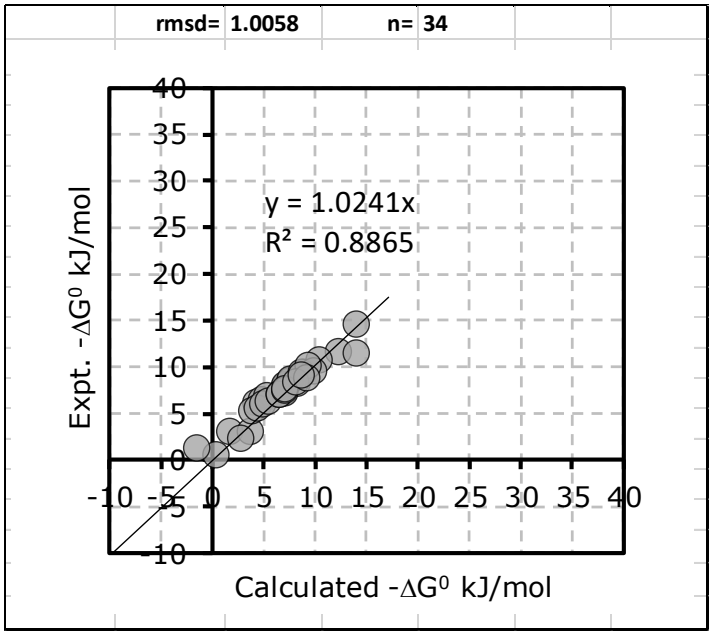
$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

| Table S4g | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **Alpha** | **A** | **Beta** | **$-\Delta G^0$** | **$-\Delta G^0$** |
| [49] | 4-phenylazophenol | **4.30** | Tributylphosphine oxide | **10.70** | 14.06 | 13.58 |
| [49] | 4-nitrophenol | **4.70** | Tributylphosphine oxide | **10.70** | 17.82 | 17.95 |
| [49] | 3-trifluoromethyl-4-nitrophenol | **5.10** | Tributylphosphine oxide | **10.70** | 21.58 | 21.29 |
| [53] | phenol | **3.80** | Tributylphosphine oxide | **10.70** | 9.36 | 9.90 |
| [53] | 4-Methoxyphenol | **3.70** | Tributylphosphine oxide | **10.70** | 8.42 | 9.30 |
| [47] | 1-naphthol | **3.80** | Tri-cyclohexylphosphine oxide | **11.30** | 10.38 | 12.17 |
| [47] | 1-naphthol | **3.80** | Tri-n-octylphosphine oxide | **11.30** | 10.38 | 10.89 |
| [47] | 1-naphthol | **3.80** | Tributylphosphine oxide | **10.70** | 9.36 | 10.76 |
| [47] | 1-naphthol | **3.80** | Trimethylphosphine oxide | **10.70** | 9.36 | 10.06 |
| [47] | 1-naphthol | **3.80** | triethyl phosphate | **8.80** | 6.13 | 8.34 |
| [9] | phenol | **3.80** | dimethyl sulphoxide | **8.60** | 5.79 | 7.15 |
| [51] | tert-Butyl alcohol | **2.70** | N,N-diethylacetamide | **8.50** | -2.30 | -2.33 |
| [6] | phenol | **3.80** | Tri-n-octylphosphine oxide | **11.30** | 10.38 | 8.03 |

## h) 1,2-Dichloroethane

| Solvent | $\alpha_s$ | $c_\alpha$ | $\beta_s$ | $c_\beta$ |
|---|---|---|---|---|
| CH2Cl2CH2Cl2 | 1.70 | 2.23 | 1.60 | 1.41 |

**Figure S4h**




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

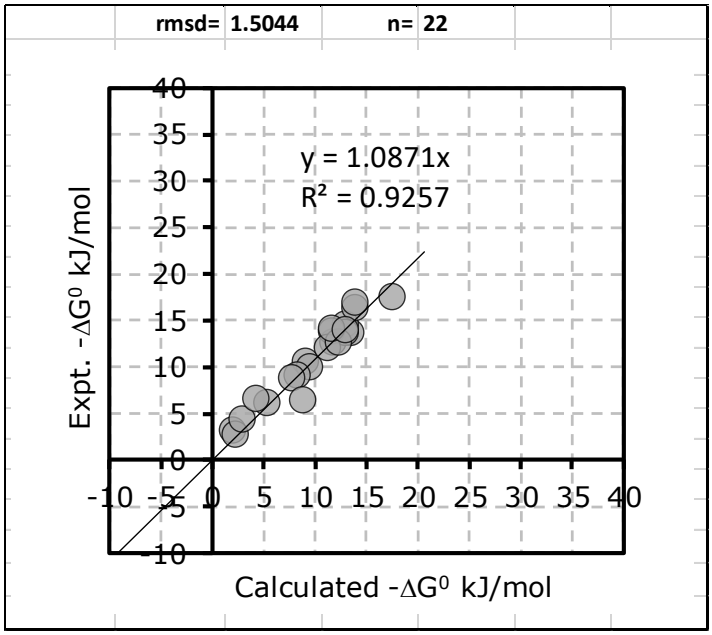
| Table S4h | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| Reference | DH | Alpha | A | Beta | $-\Delta G^0$ | $-\Delta G^0$ |
| [1] | 4-fluorophenol | **3.90** | 1,4-dioxane | **4.70** | 0.46 | 0.45 |
| [1] | 4-fluorophenol | **3.90** | Hexamethylphosphoramide | **10.90** | 14.10 | 14.55 |
| [1] | 4-fluorophenol | **3.90** | N,N-Dimethylformamide | **7.70** | 7.06 | 7.30 |
| [1] | 3-fluorophenol | **4.10** | dibutyl ether | **5.00** | 1.80 | 2.96 |
| [1] | 4-fluorophenol | **3.90** | dimethyl sulphoxide | **8.60** | 9.04 | 9.43 |
| [1] | 4-fluorophenol | **3.90** | cyclohexanone | **6.20** | 3.76 | 2.96 |
| [1] | 4-fluorophenol | **3.90** | triphenylphosphine oxide | **10.10** | 12.34 | 11.65 |
| [1] | 3-fluorophenol | **4.10** | dimethyl sulphoxide | **8.60** | 10.44 | 10.63 |
| [1] | 3-fluorophenol | **4.10** | Ethyl ethanoate | **5.40** | 2.76 | 2.27 |
| [9] | 2-Methoxyphenol | **2.40** | dimethyl sulphoxide | **8.60** | -1.46 | 1.26 |
| [9] | phenol | **3.80** | dimethyl sulphoxide | **8.60** | 8.34 | 8.19 |
| [54] | 3,4-Dimethylphenol | **3.60** | 3-Methyl-4-pyrimidone | **7.20** | 4.28 | 6.12 |
| [54] | 4-Methoxyphenol | **3.70** | 3-Methyl-4-pyrimidone | **7.20** | 4.84 | 6.34 |
| [54] | phenol | **3.80** | 3-Methyl-4-pyrimidone | **7.20** | 5.40 | 6.82 |
| [54] | 3-fluorophenol | **4.10** | 3-Methyl-4-pyrimidone | **7.20** | 7.08 | 7.09 |
| [54] | 4-chlorophenol | **4.10** | 3-Methyl-4-pyrimidone | **7.20** | 7.08 | 7.90 |
| [54] | 4-bromophenol | **4.10** | 3-Methyl-4-pyrimidone | **7.20** | 7.08 | 8.00 |
| [54] | 3-Chlorophenol | **4.20** | 3-Methyl-4-pyrimidone | **7.20** | 7.64 | 8.50 |
| [54] | 3-Bromophenol | **4.20** | 3-Methyl-4-pyrimidone | **7.20** | 7.64 | 8.61 |
| [54] | 3,4-dichlorophenol | **4.40** | 3-Methyl-4-pyrimidone | **7.20** | 8.76 | 9.42 |
| [54] | 3-nitrophenol | **4.60** | 3-Methyl-4-pyrimidone | **7.20** | 9.88 | 9.54 |
| [54] | 3,5-dichlorophenol | **4.50** | 3-Methyl-4-pyrimidone | **7.20** | 9.32 | 10.14 |

| | | | | | | |
|---|---|---|---|---|---|---|
| [54] | 3,4-Dimethylphenol | **3.60** | 1,3-Dimethyluracil | **7.00** | 3.90 | 5.28 |
| [54] | 4-Methoxyphenol | **3.70** | 1,3-Dimethyluracil | **7.00** | 4.44 | 5.46 |
| [54] | phenol | **3.80** | 1,3-Dimethyluracil | **7.00** | 4.98 | 5.91 |
| [54] | 4-fluorophenol | **3.90** | 1,3-Dimethyluracil | **7.00** | 5.52 | 6.22 |
| [54] | 4-chlorophenol | **4.10** | 1,3-Dimethyluracil | **7.00** | 6.60 | 6.95 |
| [54] | 4-bromophenol | **4.10** | 1,3-Dimethyluracil | **7.00** | 6.60 | 7.02 |
| [54] | 3-Chlorophenol | **4.20** | 1,3-Dimethyluracil | **7.00** | 7.14 | 7.40 |
| [54] | 3-Bromophenol | **4.20** | 1,3-Dimethyluracil | **7.00** | 7.14 | 7.54 |
| [54] | 3,4-dichlorophenol | **4.40** | 1,3-Dimethyluracil | **7.00** | 8.22 | 8.38 |
| [54] | 3-nitrophenol | **4.60** | 1,3-Dimethyluracil | **7.00** | 9.30 | 8.79 |
| [54] | 3,5-dichlorophenol | **4.50** | 1,3-Dimethyluracil | **7.00** | 8.76 | 9.04 |
| [6] | phenol | **3.80** | Tri-n-octylphosphine oxide | **11.30** | 14.01 | 11.45 |

## i) Chlorobenzene

| Solvent | $\alpha_S$ | $C_\alpha$ | $\beta_S$ | $C_\beta$ |
|---|---|---|---|---|
| **Chlorobenzene** | 1.40 | 2.51 | 1.40 | 1.71 |

**Figure S4i**




Free energy calculation for 1:1 Association

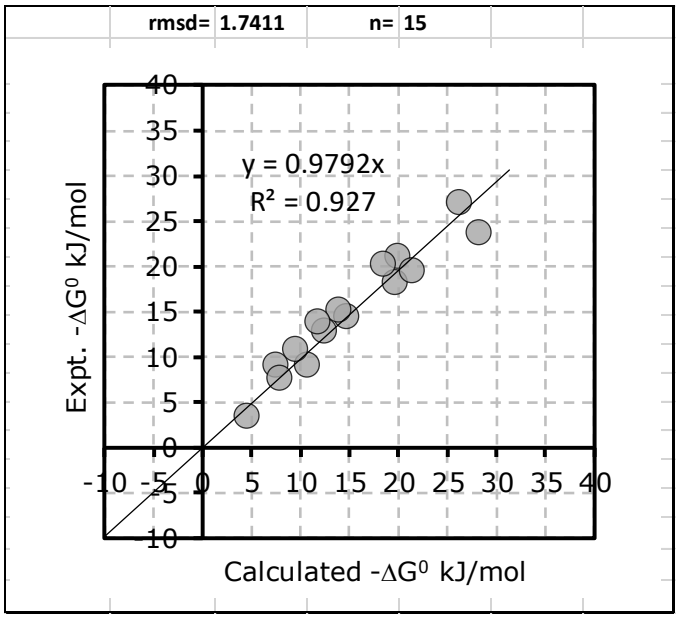
$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

| Table S4i | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **Alpha** | **A** | **Beta** | **$-\Delta G^0$** | **$-\Delta G^0$** |
| [1] | 4-fluorophenol | **3.90** | triethylamine | **7.50** | 9.07 | 10.49 |
| [1] | 4-fluorophenol | **3.90** | 1,4-dioxane | **4.70** | 2.07 | 3.10 |
| [1] | 4-fluorophenol | **3.90** | Hexamethylphosphoramide | **10.90** | 17.57 | 17.46 |
| [1] | 4-fluorophenol | **3.90** | N,N-Dimethylformamide | **7.70** | 9.57 | 9.93 |
| [1] | 4-fluorophenol | **3.90** | benzonitrile | **4.80** | 2.32 | 2.72 |
| [1] | 4-fluorophenol | **3.90** | 4-N,N-dimethylaminopyridine | **9.30** | 13.57 | 13.58 |
| [1] | 4-fluorophenol | **3.90** | pyridine | **7.20** | 8.32 | 9.14 |
| [1] | 4-fluorophenol | **3.90** | 3-bromopyridine | **6.00** | 5.32 | 6.16 |
| [1] | 4-fluorophenol | **3.90** | dimethyl sulphoxide | **8.60** | 11.82 | 12.57 |
| [1] | Methanol | **2.90** | triethylamine | **7.50** | 2.97 | 4.36 |
| [5] | 4-nitrophenol | **4.70** | Benzylamine | **7.20** | 12.96 | 14.50 |
| [5] | 4-nitrophenol | **4.70** | pyridine | **7.20** | 12.96 | 13.68 |
| [5] | 4-nitrophenol | **4.70** | tributylamine | **6.80** | 11.64 | 13.81 |
| [5] | 4-nitrophenol | **4.70** | triethylamine | **7.50** | 13.95 | 16.32 |
| [6] | phenol | **3.80** | pyridine | **7.20** | 7.74 | 8.84 |
| [6] | 3,4-dichlorophenol | **4.40** | pyridine | **7.20** | 11.22 | 12.00 |
| [6] | 3-nitrophenol | **4.60** | pyridine | **7.20** | 12.38 | 12.64 |
| [6] | 2-Chlorophenol | **4.00** | pyridine | **7.20** | 8.90 | 6.36 |
| [6] | 2,6-Dichlorophenol | **3.20** | pyridine | **7.20** | 4.26 | 6.56 |
| [6] | 4-nitrophenol-D | **4.70** | triethylamine | **7.50** | 13.95 | 16.89 |
| [6] | 4-nitrophenol-D | **4.70** | tributylamine | **6.80** | 11.64 | 14.09 |
| [6] | 4-nitrophenol-D | **4.70** | pyridine | **7.20** | 12.96 | 13.97 |

## j) Perfluorohexane

| Solvent | $\alpha_s$ | $c_\alpha$ | $\beta_s$ | $c_\beta$ |
|---|---|---|---|---|
| **Perfluorohexane** | 1.2 | 2.41 | 0.60 | 2.41 |

**Figure S4j**




Free energy calculation for 1:1 Association

$$-\Delta G^0 = \alpha\beta - \alpha\beta_S - \alpha_S\beta - C_\alpha - C_\beta$$

| Table S4j | Donor | | Acceptor | | Calc. | Expt. |
|---|---|---|---|---|---|---|
| **Reference** | **DH** | **Alpha** | **A** | **Beta** | **-ΔG⁰** | **-ΔG⁰** |
| **[1]** | 2,2,2-trifluoroethanol | **3.70** | dimethyl sulphoxide | **8.60** | 14.75 | 14.52 |
| [1] | 2,2,2-trifluoroethanol | **3.70** | Propan-2-one | **5.70** | 7.50 | 9.05 |
| [1] | 2,2,2-trifluoroethanol | **3.70** | N,N-Dimethylformamide | **7.70** | 12.50 | 12.83 |
| [1] | 2,2,2-trifluoroethanol | **3.70** | Tributylphosphine oxide | **10.70** | 20.00 | 21.05 |
| [1] | 3-trifluoromethylphenol | **4.30** | Tributylphosphine oxide | **10.70** | 26.24 | 26.97 |
| [1] | 3-trifluoromethylphenol | **4.30** | dimethyl sulphoxide | **8.60** | 19.73 | 18.14 |
| [1] | 2,2,2-Trifluoro-1,1-bis(trifluoromethyl)ethanol | **4.90** | N,N-Dimethylformamide | **7.70** | 21.38 | 19.55 |
| [1] | Hexafluoropropan-2-ol | **4.50** | N,N-Dimethylformamide | **7.70** | 18.42 | 20.29 |
| [1] | 2,2,2-Trifluoro-1,1-bis(trifluoromethyl)ethanol | **4.90** | Propan-2-one | **5.70** | 13.98 | 15.15 |
| [1] | Hexafluoropropan-2-ol | **4.50** | Propan-2-one | **5.70** | 11.82 | 13.81 |
| [1] | 3-trifluoromethylphenol | **4.30** | Propan-2-one | **5.70** | 10.74 | 9.11 |
| [1] | 2,2,2-Trifluoro-1,1-bis(trifluoromethyl)ethanol | **4.90** | Methyl formate | **4.50** | 9.54 | 10.81 |
| [1] | Hexafluoropropan-2-ol | **4.50** | Methyl formate | **4.50** | 7.86 | 7.58 |
| [1] | 2,2,2-trifluoroethanol | **3.70** | Methyl formate | **4.50** | 4.50 | 3.40 |
| [55] | Hexafluoropropan-2-ol | **4.50** | Tributylphosphine oxide | **10.70** | 28.32 | 23.74 |

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## Section 5:
## Individually optimised solvent constants

**Table S5:**

**Individually optimised constants for polar organic solvents and comparison of calculated transfer free energies with experimental data**

| Solvent | Conc. of polar atom. X=O or N | Solvent descriptors | | | | | | | | | solvent/water partition | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RTln[X] kJ mol$^{-1}$ | $\alpha_{S1}$ | $C_{\alpha 1}$ | $\beta_{S1}$ | $C_{\beta 1}$ | $\alpha_{S2}$ | $C_{\alpha 2}$ | $\beta_{S2}$ | $C_{\beta 2}$ | $C_0$ | N | rmsd kJ mol$^{-1}$ |
| Tetrahydrofuran | 6.22 | 1.20 | ***2.62*** | 0.60 | ***2.78*** | | | 5.30 | ***-3.46*** | ***3.26*** | 49 | 1.6 |
| Diethyl Ether | 5.61 | 1.20 | ***2.54*** | 0.60 | ***3.07*** | | | 5.30 | ***-3.62*** | ***2.17*** | 25 | 1.1 |
| Di-n-butyl ether | 4.4 | 1.2 | ***2.63*** | 0.6 | ***3.09*** | | | 5.30 | ***-4.58*** | ***1.18*** | 35 | 1.0 |
| Acetonitrile | 7.31 | 1.20 | ***-0.78*** | 0.60 | ***2.56*** | 1.50 | ***2.68*** | 5.15 | ***-4.26*** | ***6.01*** | 24 | 1.7 |
| Propionitrile | 6.54 | 1.20 | ***-0.81*** | 0.60 | ***2.63*** | 1.50 | ***2.68*** | 5.15 | ***-3.45*** | ***3.80*** | 21 | 1.6 |
| Butyronitrile | 6.05 | 1.20 | ***-0.79*** | 0.60 | ***2.72*** | 1.50 | ***2.69*** | 5.15 | ***-3.10*** | ***1.41*** | 31 | 0.9 |
| Acetone | 6.45 | 1.20 | ***-0.60*** | 0.60 | ***2.77*** | 1.50 | ***2.71*** | 5.80 | ***-4.12*** | ***2.32*** | 46 | 1.4 |
| Butanone | 5.98 | 1.20 | ***-0.86*** | 0.60 | ***2.86*** | 1.50 | ***2.71*** | 5.80 | ***-4.12*** | ***1.82*** | 42 | 1.4 |
| Cyclohexanone | 5.62 | 1.20 | ***-0.90*** | 0.60 | ***2.82*** | 1.50 | ***2.72*** | 5.80 | ***-4.05*** | ***1.52*** | 30 | 1.3 |
| Methanol | 7.95 | 1.20 | ***2.77*** | 0.60 | ***2.65*** | 3.50 | ***-5.03*** | 6.90 | ***-6.49*** | ***2.69*** | 64 | 1.2 |
| Ethanol | 7.04 | 1.20 | ***2.77*** | 0.60 | ***2.85*** | 3.50 | ***-5.62*** | 6.90 | ***-6.39*** | ***0.91*** | 44 | 1.4 |
| Propan-1-ol | 6.42 | 1.20 | ***2.76*** | 0.60 | ***2.89*** | 3.50 | ***-5.97*** | 6.90 | ***-6.52*** | ***0.66*** | 48 | 1.3 |
| Propan-2-ol | 6.37 | 1.20 | ***2.73*** | 0.60 | ***2.99*** | 3.50 | ***-5.80*** | 6.90 | ***-6.35*** | ***-0.21*** | 62 | 1.5 |
| Butan-1-ol | 5.93 | 1.20 | ***2.68*** | 0.60 | ***2.98*** | 3.50 | ***-6.91*** | 6.90 | ***-6.26*** | ***0.73*** | 57 | 1.3 |
| Butan-2-ol | 5.92 | 1.20 | ***2.69*** | 0.60 | ***2.89*** | 3.50 | ***-6.39*** | 6.90 | ***-6.38*** | ***1.28*** | 29 | 1.3 |
| 2-Methylpropan-1-ol | 5.90 | 1.20 | ***2.73*** | 0.60 | ***3.00*** | 3.50 | ***-5.94*** | 6.90 | ***-6.67*** | ***0.69*** | 38 | 1.1 |
| 2-Methylpropan-2-ol | 5.82 | 1.20 | ***2.72*** | 0.60 | ***2.97*** | 3.50 | ***-5.93*** | 6.90 | ***-6.82*** | ***1.06*** | 44 | 1.4 |
| Pentan-1-ol | 5.50 | 1.20 | ***2.75*** | 0.60 | ***2.91*** | 3.50 | ***-6.31*** | 6.90 | ***-6.51*** | ***0.95*** | 44 | 1.1 |
| 3-Methylbutan-1-ol | 5.50 | 1.20 | ***2.77*** | 0.60 | ***3.00*** | 3.50 | ***-5.68*** | 6.90 | ***-6.82*** | ***0.39*** | 22 | 0.9 |
| Hexan-1-ol | 5.16 | 1.20 | ***2.84*** | 0.60 | ***2.94*** | 3.50 | ***-5.90*** | 6.90 | ***-6.88*** | ***-0.38*** | 30 | 1.0 |
| Heptan-1-ol | 4.84 | 1.20 | ***2.76*** | 0.60 | ***3.02*** | 3.50 | ***-6.19*** | 6.90 | ***-6.30*** | ***-0.08*** | 21 | 0.8 |
| Octan-1-ol | 4.57 | 1.20 | ***2.76*** | 0.60 | ***3.03*** | 3.50 | ***-7.03*** | 6.90 | ***-6.66*** | ***-0.88*** | 74 | 1.2 |
| Decan-1-ol | 4.10 | 1.20 | ***2.83*** | 0.60 | ***2.95*** | 3.50 | ***-6.22*** | 6.90 | ***-6.49*** | ***-1.29*** | 27 | 0.8 |

Footnote to table S5.

The H-bond parameters $\alpha_S$ and $\beta_S$ were previously derived using Equation (1) (see Section 6). The constants in italic bold were optimised in order to minimise the rmsd between calculated and experimental free energies in the solvent/water partition models.

## Section 6:
## Solvent H-bond parameters $\alpha_S$ and $\beta_S$

$$\Delta G° \text{ / kJ mol}^{-1} = -(\alpha - \alpha_S)(\beta - \beta_S) + 6 \qquad (1)$$

**Table S6a**

Values of $\alpha_S$ and $\beta_S$ used to model partition into non-polar organic solvents as compared with published values derived from equation (1).

| | Partition model | Association (eqn. 1) | Partition model | Association (eqn. 1) | |
|---|---|---|---|---|---|
| | $\alpha_S$ | Published range | $\beta_S$ | Published range | References |
| **Simple solvents** | | | | | |
| Alkanes | **1.20** | 0.4-1.2 | **0.60** | 0.3-0.6 | [1-4] |
| Carbon tetrachloride | **1.40** | | **0.60** | | [1, 4-6] |
| Dichloromethane | **1.80** | 1.7-1.9 | **1.40** | 1.4-2.0 | [2, 4, 7, 8] |
| Chloroform | **2.10** | 2.1-2.4 | **1.30** | 0.8-1.3 | [1, 4-9] |
| 1,2-Dichloroethane | **1.70** | 1.7 | **1.60** | 1.6 | [2] |
| Chlorobenzene | **1.40** | 1.4 | **1.40** | 1.1-1.8 | [2] |
| Benzene | **1.40** | 1.0-1.3 | **2.00** | 1.6-2.2 | [1, 2, 4] |
| Toluene | **1.40** | 1.0-1.1 | **2.00** | 1.6-2.2 | [7, 10-15] |
| | | | | | |

**Table S6b**

Values of $\alpha_S$ and $\beta_S$ used to model partition into polar organic solvents compared with published values derived from equation (1) (N.B. To model partition of solutes, additional descriptors are required to model the alkane component of the solvent with $\alpha_S$ =1.2 and $\beta_S$ =0.6)

| | Partition model | Association (eqn. 1) | Partition model | Association (eqn. 1) | |
|---|---|---|---|---|---|
| | $\alpha_S$ | Published range | $\beta_S$ | Published range | References |
| **Ethers** | | | | | |
| Diethyl Ether | **1.20** | | **5.30** | | |
| Di-n-octyl ether | | 0.9 | | 5-5.3 | [11] |
| Di-n-hexyl ether | | 1.0 | | 5.3 | [3] |
| Di-n-butyl ether | **1.20** | | **5.30** | | |
| Tetrahydrofuran | **1.20** | 0.9 | **5.90** | 5.3-5.9 | [1, 9] |
| | | | | | |
| **Nitriles** | | | | | |
| Acetonitrile | **1.50** | 1.5-1.7 | **5.15** | 4.7-5.1 | [1, 5, 6] |
| Propionitrile | **1.50** | | **5.15** | | |
| Butyronitrile | **1.50** | | **5.15** | | |
| n-butyl cyanide | | 1.7 | | 5.2 | [11] |
| | | | | | |
| **Ketones** | | | | | |
| Acetone | **1.50** | 1.2-1.5 | **5.80** | 5.7-5.8 | [1, 4, 6, 7] |
| Butanone | **1.50** | | **5.80** | | |
| Cyclohexanone | **1.50** | 1.5 | **5.80** | 5.8 | [12] |
| 2-Heptanone | **1.50** | 1.5 | **5.80** | 5.8 | [11] |

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## Section 7:
## Calculated and experimental free energies of transfer in workbook Excel 1.xlsx

Free energies of transfer are expressed as $-\Delta G^0$ in kJ $mol^{-1}$ and therefore increasing values of free energy correspond to increasing values of partition coefficient. Experimental and calculated free energies of transfer are listed and compared in the five worksheets of the workbook Excel 1.xlsx:

**1 Training set expt. v calc.**
This sheet contains a list of the 219 solutes that comprise the training set for the model. For each solute are listed the name and SMILES string with experimental and calculated free energy of transfer ($-\Delta G^0$) from water to 35 different solvents. A summary table (B2:D39) lists the number of data points and rmsd between calculated and experimental values for each solvent and a graph displays calculated (y axis) versus experimental (x axis) values.

**2 Validation set expt. v calc.**
This sheet contains a list of 84 solutes that had not been used for training the model. For each solute are listed the name and SMILES string with experimental and calculated free energy of transfer from water to hexadecane and water to wet octanol. The rmsd between calculated and experimental values for each solvent is summarised in a table (B2:D4) and a graph displays calculated (y axis) versus experimental (x axis) values.

**3 Expt. v calc. by SSIMPLE**
This sheet contains a list of the same set of 219 solutes as listed in sheet 1 together with experimental free energy of transfer ($-\Delta G^0$) from water to 34 different solvents and results of calculations performed using the SSIMPLE approach described previously[1, 2]. The SSIP descriptions of the molecules were obtained using the in house footprinting code (version 6.0.0, commit ID 18b2ca65) which implements these methods. A summary table (B2:D39) lists the number of data points and rmsd between values calculated with SSIMPLE and experimental values for each solvent and a graph displays calculated (y axis) versus experimental (x axis) values.

**4 Octanol_water comparison**
This sheet contains a list of 189 solutes for which free energy of transfer ($-\Delta G^0$) from water to wet octanol was available. These values are compared with calculated values using three different methods:
a) Abraham solvation equation[3] using solvent coefficients for octanol taken from reference [4]. Calculated logP values are in column I and are converted to $-\Delta G^0$ in column K.
Rmsd between calculated and experimental 1.1 kJ $mol^{-1}$
b) cLogP calculated using Advanced Algorithm Builder software [5]. Calculated logP values are in column N and are converted to $-\Delta G^0$ in column P.
Rmsd between calculated and experimental 0.8 kJ $mol^{-1}$
c) $-\Delta G^0$ calculated by our new method are in column T.
Rmsd between calculated and experimental 1.6 kJ $mol^{-1}$

**5 Expt. gas to solvent**
This sheet contains a list of the 219 solutes that were used as the training set for the model. For each solute is listed the name and SMILES string and experimental free energy of transfer ($-\Delta G^0$) from gas to 35 different solvents.

**Sources of Data**

Experimental values of gas to solvent transfer free energies were obtained from literature sources as described below. These values were used to obtain water to solvent transfer free energies.

Acree and co-workers have published Abraham model correlations for describing logK, where *K* is the dimensionless gas-to-solvent partition constant (see Eq. (S7.1))

$$K = \frac{\text{molar concentration of solute in extraction solvent}}{\text{molar concentration of solute in the gas phase}} \qquad \text{(S7.1)}$$

Experimental values of logK (with concentrations in each phase defined in terms of mol litre$^{-1}$) have been reported for more than 50 common solvents. The values for logK were usually derived by conversion from other experimental measures such as:

- Raoult's law infinite dilution activity coefficients, $\gamma^{\infty}_{solute}$

  $$\log K = \log\left(\frac{RT}{\gamma^{\infty}_{solute} V_{solvent} \left(VP\right)^{0}_{solute}}\right)$$

  $R = G$as constant; $T =$ Temperature; $V_{solvent} = M$olar volume of the solvent

  $\left(VP\right)^{0}_{solute} = V$apour pressure of the solute at T

- Henry's law constants, $K_{Henry}$

  $$\log K = \log\left(\frac{RT}{K_{henry} V_{solvent}}\right)$$

  $V_{solvent} = M$olar volume of the solvent

- Solubilities: where data was available for crystalline solutes dissolved in both the anhydrous solvent and water and where the solute gas-to-water partition coefficient, $K_w$, is known.

Further details can be found in publications by Abraham, Acree and co-workers[6-13]

Experimentally determined values of logK at 298 K were extracted from the appropriate references and converted into the free energy ($-\Delta G^0$ /kJ mol$^{-1}$) for transfer from gas phase to solvent by the usual formula i.e. eqn. (S7.2).

$$-\Delta G^{0}_{Gas->Solvent} = RT \ln K = 2.303RT \log K \qquad \text{(S7.2)}$$

$R =$ Gas constant=0.0083145 kJ mol$^{-1}$ K$^{-1}$

$T =$ Temperature K

A list of solvents and references to the published data can be found in Table S7. Some additional values for partition of water from gas to propan-2-ol, acetone and tetrahydrofuran were derived from published values of the infinite infinite dilution activity coefficients. [14]

Free energies of transfer ($-\Delta G^0$) from water to wet octanol were derived from $\log P_{octanol}$ values extracted from various commercially available databases. If several alternative $\log P_{octanol}$ values were available then an average value was used.

The values of $-\Delta G^{0}_{Solvent1->Solvent2}$ observed for transfer of a solute between two solvents were calculated from the experimentally determined gas-to-solvent values (eqn. (S7.3)}. Values calculated in this way for partition between water and an organic solvent refer to a hypothetical dry solvent:

$$-\Delta G^{0}_{Solvent1->Solvent2} = -\Delta G^{0}_{Gas->Solvent2} - (-\Delta G^{0}_{gas->Solvent1}) \qquad \text{(S7.3)}$$

In order to conduct the feasibility study it was desirable to limit the size of the initial data set. Compounds were only selected if they had measured gas-to-solvent logK values available for water and several other solvents. An easily manageable set of 219 compounds was chosen as an initial training set and included a variety of common functional groups. Another set of 84 similar compounds was identified for which $\log P_{octanol}$ values and experimental gas to hexadecane and gas to water logK were available. This set of 84 solutes was used for validation of the parameters derived by analysis of the training set. New descriptors will need to be

added in future in order to extend the model to include solutes that contain other functiomal groups and to deal with intramolecular interactions.

**Table S7: Solvents and references to experimental logK data.**

| | |
|---|---|
| Hexadecane (i.e. Abraham L descriptor)[6-13] | 3-Methylbutan-1-ol[8] |
| Hexane[15-17] | 2-Methylpropan-2-ol[8] |
| Cyclohexane[15, 16] | 2-Methylpropan-1-ol[8] |
| Water[6, 10, 11, 18] | Butan-2-ol[8] |
| Carbon tetrachloride[9, 15, 16] | Propan-2-ol[8] |
| Acetone[10] | Decan-1-ol[8] |
| Tetrahydrofuran[13, 15, 16] | Octan-1-ol[8] |
| Diethyl Ether[8, 13] | Heptan-1-ol[8] |
| Di-n-butyl ether[8, 15, 16, 19] | Hexan-1-ol[8] |
| Acetonitrile[15, 16, 18] | Pentan-1-ol[8] |
| Propionitrile[7, 15, 16] | Butan-1-ol[8] |
| Butyronitrile[7, 15, 16] | Propan-1-ol[8, 18] |
| Butanone[6, 10] | Ethanol[8, 15, 16] |
| Cyclohexanone[6, 10] | Methanol[8] |
| Dichloromethane[9] | Chlorobenzene[11, 15, 16] |
| Chloroform[9, 15, 16] | Benzene[15, 16] |
| 1,2-Dichloroethane[12, 15, 16] | Toluene[15, 16] |
| Perfluoroalkane[20] | |

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**Section 8:**
**Correlation between Molecular Surface Area and the number of Surface Site Interaction Points**

The Van der Waals surface areas were determined using the 0.002 e bohr$^{-3}$ isosurface calculated with NWChem (Density Functional Theory B3LYP/6-31G* basis set)[1]. The surface areas were calculated by summing the number of points on the isosurface, but scaling the contribution of each point by the local density of points within a radius of 0.5 Å.

**Figure S8. Plot of number of SSIPs (x axis) v molecular surface area (Å$^2$) (y axis)**

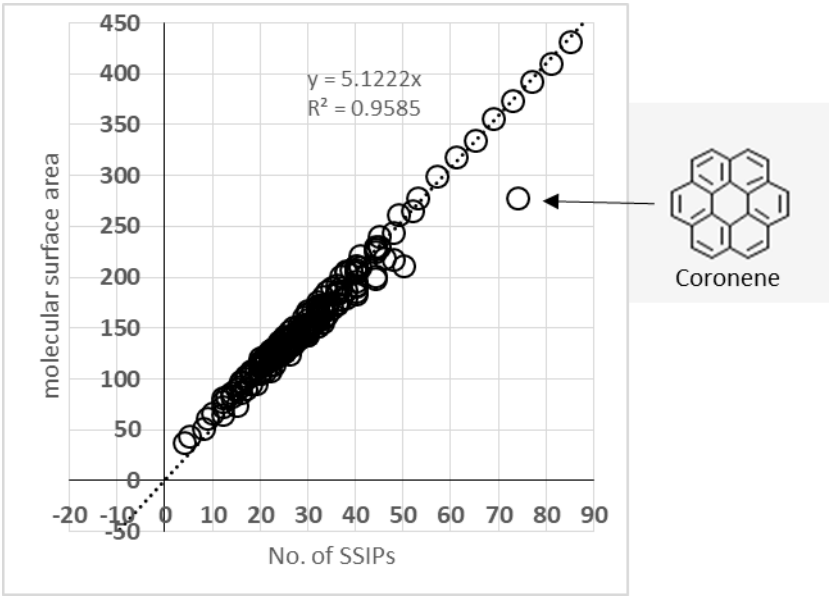


**Table S8: Molecular Surface Areas and Numbers of SSIPs for 219 Compounds of the Training Set**

| SMILES | Solute name | Compound Class | Molecular Surface Area (Å$^2$) | No. of SSIPs |
|---|---|---|---|---|
| CCCCC | n-pentane | Alkane-Acyclic Linear | 132.2 | 24 |
| CCCCCC | n-hexane | Alkane-Acyclic Linear | 152.8 | 28 |
| CCCCCCC | n-heptane | Alkane-Acyclic Linear | 172.4 | 32 |
| CCCCCCCC | n-octane | Alkane-Acyclic Linear | 191.9 | 36 |
| CCCCCCCCC | n-nonane | Alkane-Acyclic Linear | 211.6 | 40 |
| CCCCCCCCCC | n-decane | Alkane-Acyclic Linear | 230.7 | 44 |
| CCC(C)C | isopentane | Alkane Acyclic Branched | 128.5 | 24 |
| CCCC(C)C | 2-methylpentane | Alkane Acyclic Branched | 148.2 | 28 |
| CCC(C)CC | 3-methylpentane | Alkane Acyclic Branched | 145.7 | 28 |
| CCCC(C)CC | 3-methylhexane | Alkane Acyclic Branched | 165.9 | 32 |
| CCCC(C)(C)C | 2,2-dimethylpentane | Alkane Acyclic Branched | 160.9 | 32 |
| CCCCC(C)CC | 3-methylheptane | Alkane Acyclic Branched | 185.7 | 36 |
| CC(C)CCC(C)C | 2,5-dimethylhexane | Alkane Acyclic Branched | 183.3 | 36 |
| CC(C)CC(C)(C)C | 2,2,4-trimethylpentane | Alkane iso-octane | 175.3 | 36 |
| CC(C)C(C)C(C)C | 2,3,4-trimethylpentane | Alkane iso-octane | 173.2 | 36 |
| CCCCCCC(C)C | 2-methyloctane | Alkane Acyclic Branched | 208.0 | 40 |
| CC(C)CCC(C)(C)C | 2,2,5-trimethylhexane | Alkane Acyclic Branched | 195.9 | 40 |
| CCC(CC)(CC)CC | 3,3-diethylpentane | Alkane Acyclic Branched | 185.6 | 40 |
| CCCCCCCC(C)C | 2-methylnonane | Alkane Acyclic Branched | 227.1 | 44 |
| C1CCCC1 | cyclopentane | Alkane-Cyclic | 115.2 | 20 |
| C1CCCCC1 | cyclohexane | Alkane-Cyclic | 130.1 | 24 |
| C1CCCCCCC1 | cyclooctane | Alkane-Cyclic | 162.7 | 32 |
| CC1CCCC1 | methylcyclopentane | Alkane-Cyclic Branched | 133.6 | 24 |
| CC1CCCCC1 | methylcyclohexane | Alkane-Cyclic Branched | 147.5 | 28 |
| CCC1CCCCC1 | ethylcyclohexane | Alkane-Cyclic Branched | 165.2 | 32 |
| C[C@@H]1([C@@H](CCCC1)(C)) | cis-1,2-dimethylcyclohexane | Alkane-Cyclic Branched | 162.7 | 32 |
| CC1CCC(C)CC1 | trans-1,4-dimethylcyclohexane | Alkane-Cyclic Branched | 165.2 | 32 |

| | | | | |
|---|---|---|---|---|
| [Cl]C([Cl])([Cl])[Cl] | tetrachloromethane | Chlorosolvent-CCl4 | 121.1 | 20 |
| c1ccccc1 | benzene | Benzene | 112.2 | 20 |
| O([H])[H] | water | Water | 37.5 | 4 |
| CO | methanol | Alcohol-Methanol | 61.4 | 9 |
| CCO | ethanol | Alcohol-Primary | 82.3 | 13 |
| CCCO | propan-1-ol | Alcohol-Primary | 102.5 | 17 |
| CCCCO | butan-1-ol | Alcohol-Primary | 122.0 | 21 |
| CCCCCO | pentan-1-ol | Alcohol-Primary | 142.0 | 25 |
| CCCCCCO | hexan-1-ol | Alcohol-Primary | 161.5 | 29 |
| CCCCCCCO | heptan-1-ol | Alcohol-Primary | 181.5 | 33 |
| CCCCCCCCO | octan-1-ol | Alcohol-Primary | 201.3 | 37 |
| CCCCCCCCCO | nonan-1-ol | Alcohol-Primary | 221.5 | 41 |
| CCCCCCCCCCO | decan-1-ol | Alcohol-Primary | 240.9 | 45 |
| COC | dimethylether | Ether-Dimethyl | 83.0 | 14 |
| CCOCC | diethyl ether | Ether-Dialkyl | 124.8 | 22 |
| CCCOCCC | dipropylether | Ether-Dialkyl | 164.4 | 30 |
| CCCCOCCCC | dibutylether | Ether-Dialkyl | 204.5 | 38 |
| [Cl]c1ccccc1 | chlorobenzene | Benzene-Chloro | 128.9 | 24 |
| [Cl]c1ccccc1[Cl] | 1,2-dichlorobenzene | Benzene-Dichloro | 144.6 | 28 |
| [Cl]CC[Cl] | 1,2-dichloroethane | Chlorosolvent-CH2ClCH2Cl | 108.5 | 18 |
| C | methane | Alkane-Methane | 50.9 | 8 |
| CC | ethane | Alkane-Acyclic Linear | 72.8 | 12 |
| CCC | propane | Alkane-Acyclic Linear | 93.1 | 16 |
| CCCC | butane | Alkane-Acyclic Linear | 112.7 | 20 |
| CN(C)C | trimethylamine | Amine-Tertiary | 105.4 | 20 |
| CCN(CC)CC | triethylamine | Amine-Tertiary | 161.2 | 32 |
| C1CCNCC1 | piperidine | Amine-Secondary Cyclic | 125.7 | 23 |
| CCNCC | diethylamine | Amine-Secondary | 127.9 | 23 |
| CCCNCCC | dipropylamine | Amine-Secondary | 167.5 | 31 |
| CCCCNCCCC | dibutylamine | Amine-Secondary | 207.2 | 39 |
| CN | methylamine | Amine-Primary | 66.9 | 10 |
| CCN | ethylamine | Amine-Primary | 87.2 | 14 |
| CCCN | n-propylamine | Amine-Primary | 107.3 | 18 |
| CCCCN | n-butylamine | Amine-Primary | 127.0 | 22 |
| CCCCCN | pentylamine | Amine-Primary | 146.6 | 26 |
| CCCCCCN | hexylamine | Amine-Primary | 166.6 | 30 |
| CCCCCCCN | heptylamine | Amine-Primary | 185.9 | 34 |
| CCCCCCCCN | n-octylamine | Amine-Primary | 205.9 | 38 |
| NC1CCCCC1 | cyclohexylamine | Amine-Primary | 142.4 | 26 |
| CCc1ccccc1 | ethyl benzene | Benzene-Alkyl Substituted | 150.9 | 29 |
| Cc1ccccc1 | toluene | Benzene-Methyl substituted | 131.1 | 25 |
| Cc1ccccc1C | o-xylene | Benzene-Methyl substituted | 147.4 | 30 |
| Cc1cccc(C)c1 | m-xylene | Benzene-Methyl substituted | 150.7 | 30 |
| Cc1ccc(C)cc1 | p-xylene | Benzene-Methyl substituted | 150.8 | 30 |
| Cc1cc(C)cc(C)c1 | mesitylene | Benzene-Methyl substituted | 170.3 | 35 |
| Cc1cc(C)c(C)cc1C | 1,2,4,5-tetramethylbenzene | Benzene-Methyl substituted | 183.8 | 40 |
| CC(C)=O | propanone | Ketone-Dialkyl | 95.7 | 18 |
| CCC(C)=O | butanone | Ketone-Dialkyl | 114.6 | 22 |
| CCCC(C)=O | pentan-2-one | Ketone-Dialkyl | 134.2 | 26 |
| CCC(=O)CC | pentan-3-one | Ketone-Dialkyl | 133.7 | 26 |
| CCCCC(C)=O | hexan-2-one | Ketone-Dialkyl | 153.9 | 30 |
| CCCC(=O)CC | hexan-3-one | Ketone-Dialkyl | 153.4 | 30 |
| CCCC(=O)CCC | heptan-4-one | Ketone-Dialkyl | 173.3 | 34 |
| CC(C)CC(C)=O | 4-methylpentan-2-one | Ketone-Dialkyl | 149.7 | 30 |
| O=C1CCCC1 | cyclopentanone | Ketone-Cycloalkyl | 118.4 | 22 |
| O=C1CCCCC1 | cyclohexanone | Ketone-Cycloalkyl | 133.3 | 26 |
| O=C1CCCCCC1 | cycloheptanone | Ketone-Cycloalkyl | 148.5 | 30 |
| O=C1CCCCCCC1 | cyclooctanone | Ketone-Cycloalkyl | 163.0 | 34 |
| Oc1ccccc1 | phenol | Phenol | 120.3 | 23 |
| Cc1cccc(O)c1 | 3-methylphenol | Phenol-methyl substituted | 140.1 | 28 |
| Cc1ccc(O)cc1 | 4-methylphenol | Phenol-methyl substituted | 140.3 | 28 |
| Cc1ccc(O)cc1C | 3,4-dimethylphenol | Phenol-methyl substituted | 156.3 | 33 |
| Cc1cc(C)cc(O)c1 | 3,5-dimethylphenol | Phenol-methyl substituted | 159.3 | 33 |
| Oc1cccc([Cl])c1 | 3-chlorophenol | Phenol-Chloro substituted | 138.1 | 27 |
| Oc1ccc([Cl])cc1 | 4-chlorophenol | Phenol-Chloro substituted | 138.4 | 27 |
| Oc1ccc([Cl])c([Cl])c1 | 3,4-dichlorophenol | Phenol-Chloro substituted | 153.6 | 31 |
| Oc1cc([Cl])cc([Cl])c1 | 3,5-dichlorophenol | Phenol-Chloro substituted | 155.4 | 31 |
| [Cl]CC | chloroethane | Alkane-Monochloro | 91.0 | 15 |
| CCC[Cl] | 1-chloropropane | Alkane-Monochloro | 110.6 | 19 |

| | | | | |
|---|---|---|---|---|
| CCCC[Cl] | 1-chlorobutane | Alkane-Monochloro | 130.8 | 23 |
| [Cl]CCC[Cl] | 1,3-dichloropropane | Alkane-Dichloro | 128.6 | 22 |
| CCCCC[Cl] | 1-chloropentane | Alkane-Monochloro | 150.3 | 27 |
| CCCCCCC[Cl] | 1-chloroheptane | Alkane-Monochloro | 190.3 | 35 |
| c1ccc2ccccc2c1 | naphthalene | Polycyclic aromatic | 156.9 | 32 |
| c1ccc2c(c1)ccc3ccccc23 | phenanthrene | Polycyclic aromatic | 198.5 | 44 |
| c1ccc2cc3ccccc3cc2c1 | anthracene | Polycyclic aromatic | 200.7 | 44 |
| c1cc2ccc3cccc4ccc(c1)c2c34 | pyrene | Polycyclic aromatic | 211.7 | 50 |
| c1ccncc1 | pyridine | Pyridine | 107.5 | 20 |
| CC#N | acetonitrile | Nitrile | 73.9 | 15 |
| CCC#N | propionitrile | Nitrile | 94.9 | 19 |
| CCCC#N | 1-cyanopropane | Nitrile | 114.7 | 23 |
| CCCCC#N | 1-cyanobutane | Nitrile | 134.4 | 27 |
| c1ccc(cc1)c1ccccc1 | biphenyl | Benzene-Biphenyl | 187.2 | 38 |
| N | ammonia | Amine-NH3 | 44.3 | 5 |
| CC(C)(C)[Cl] | t-butyl chloride | Alkane-Monochloro | 124.7 | 23 |
| C1CCOCC1 | tetrahydropyran | Ether cyclic | 122.0 | 22 |
| C1CCOC1 | tetrahydrofuran | Ether cyclic | 106.8 | 18 |
| C1CCSC1 | tetrahydrothiophene | Sulfide-cycloalkyl | 117.5 | 20 |
| CCc1ccc(O)cc1 | 4-ethylphenol | Phenol-alkyl substituted | 159.7 | 32 |
| O=C1CCCCN1 | d-valerolactam | Amide | 128.8 | 25 |
| CN1C(=O)CCCC1 | N-methyl-delta-valerolactam | Amide | 146.3 | 30 |
| CN(C)C(C)=O | n,n-dimethylacetamide | Amide | 125.0 | 26 |
| CN1CCCCC1 | n-methylpiperidine | Amine-Tertiary Cyclic | 143.3 | 28 |
| CC1CCCCN1 | 2-methylpiperidine | Amine-Secondary Cyclic | 143.4 | 27 |
| CC1CCCNC1 | 3-methylpiperidine | Amine-Secondary Cyclic | 143.2 | 27 |
| CC1CCNCC1 | 4-methylpiperidine | Amine-Secondary Cyclic | 143.1 | 27 |
| CN1CCCC1=O | n-methyl-2-pyrrolidinone | Amide | 132.2 | 26 |
| CSC | dimethylsulfide | Sulfide-Dialkyl | 96.2 | 16 |
| CCSCC | diethylsulfide | Sulfide-Dialkyl | 136.1 | 24 |
| CCCSCCC | dipropylsulfide | Sulfide-Dialkyl | 175.7 | 32 |
| CC(C)SC(C)C | diisopropylsulfide | Sulfide-Dialkyl | 167.4 | 32 |
| CSCC | methylethylsulfide | Sulfide-Dialkyl | 116.4 | 20 |
| C=C | ethene | Alkene-ethene | 64.8 | 12 |
| CC=C | propene | Alkene-methyl substituted | 86.2 | 16 |
| C=CCC | but-1-ene | Alkene-monoalkyl substituted | 106.1 | 20 |
| CCCC=C | pent-1-ene | Alkene-monoalkyl substituted | 126.0 | 24 |
| CCCCC=C | hex-1-ene | Alkene-monoalkyl substituted | 145.9 | 28 |
| CCCCCC=C | hept-1-ene | Alkene-monoalkyl substituted | 165.9 | 32 |
| CCCCCCC=C | oct-1-ene | Alkene-monoalkyl substituted | 185.3 | 36 |
| CCCCCCCC=C | non-1-ene | Alkene-monoalkyl substituted | 205.4 | 40 |
| CCCCCCCCC=C | dec-1-ene | Alkene-monoalkyl substituted | 224.7 | 44 |
| CCCCCCCCCC=C | undec-1-ene | Alkene-monoalkyl substituted | 244.7 | 48 |
| CCCCCCCCCCC=C | dodec-1-ene | Alkene-monoalkyl substituted | 265.0 | 52 |
| CNC=O | n-methylformamide | Amide | 90.2 | 17 |
| CN(C)C=O | n,n-dimethylformamide | Amide | 108.2 | 22 |
| CCCCN(C=O)CCCC | n,n-dibutylformamide | Amide | 219.2 | 46 |
| CNC(C)=O | n-methylacetamide | Amide | 108.7 | 21 |
| CCNC(C)=O | n-ethylacetamide | Amide | 129.5 | 25 |
| CCCCNC(C)=O | n-butylacetamide | Amide | 168.5 | 33 |
| CCOC | methylethylether | Ether-Dialkyl | 103.8 | 18 |
| COC1CCCCC1 | methylcyclohexylether | Ether-Dialkyl | 157.9 | 30 |
| CCCCCCCCCCCO | undecan-1-ol | Alcohol-Primary | 261.1 | 49 |
| CCCCCCCCCCCCO | dodecan-1-ol | Alcohol-Primary | 277.7 | 53 |
| CCCCCCCCCCCCCO | tridecan-1-ol | Alcohol-Primary | 299.3 | 57 |
| CCCCCCCCCCCCCCO | tetradecan-1-ol | Alcohol-Primary | 318.4 | 61 |
| CCCCCCCCCCCCCCCO | pentadecan-1-ol | Alcohol-Primary | 335.1 | 65 |
| CCCCCCCCCCCCCCCCO | hexadecan-1-ol | Alcohol-Primary | 356.0 | 69 |
| CCCCCCCCCCCCCCCCCO | heptadecan-1-ol | Alcohol-Primary | 373.6 | 73 |
| CCCCCCCCCCCCCCCCCCO | octadecan-1-ol | Alcohol-Primary | 392.5 | 77 |
| CCCCCCCCCCCCCCCCCCCO | nonadecan-1-ol | Alcohol-Primary | 409.8 | 81 |
| CCCCCCCCCCCCCCCCCCCCO | eicosan-1-ol | Alcohol-Primary | 432.0 | 85 |
| OC12CC3CC(C1)CC(C2)C3 | adamantan-1-ol | Alcohol-Tertiary | 170.7 | 33 |
| CC(C)O | propan-2-ol | Alcohol-Secondary | 101.1 | 17 |
| CCC(C)O | butan-2-ol | Alcohol-Secondary | 119.9 | 21 |
| CCCC(C)O | pentan-2-ol | Alcohol-Secondary | 139.2 | 25 |
| CCC(C)(C)O | 2-methylbutan-2-ol | Alcohol-Tertiary | 134.1 | 25 |
| CC(C)(C)O | 2-methylpropan-2-ol | Alcohol-Tertiary | 117.3 | 21 |
| CCCC(C)(C)O | 2-methylpentan-2-ol | Alcohol-Tertiary | 153.5 | 29 |

| | | | | |
|---|---|---|---|---|
| CCCCC(C)(C)O | 2-methylhexan-2-ol | Alcohol-Tertiary | 173.5 | 33 |
| OC1CCCC1 | cyclopentanol | Alcohol-Secondary | 123.7 | 21 |
| OC1CCCCC1 | cyclohexanol | Alcohol-Secondary | 137.8 | 25 |
| OC1CCCCCC1 | cycloheptanol | Alcohol-Secondary | 152.6 | 29 |
| OC1CCCCCCC1 | cyclooctanol | Alcohol-Secondary | 169.9 | 33 |
| C1C2CC3CC1CC(C2)C3 | adamantane | Alkane-Cyclic | 164.1 | 32 |
| CC(=O)C1CCCCC1 | cyclohexylmethylketone | Ketone-Dialkyl | 169.6 | 34 |
| CC1CCCCC1=O | 2-methylcyclohexanone | Ketone-Cycloalkyl | 148.9 | 30 |
| C1CC1 | cyclopropane | Alkane-Cyclic | 81.2 | 12 |
| CCCC1CCCC1 | propylcyclopentane | Alkane-Cyclic Branched | 171.0 | 32 |
| CCCCCC1CCCC1 | pentylcyclopentane | Alkane-Cyclic Branched | 210.7 | 40 |
| CCCC1CCCCC1 | propylcyclohexane | Alkane-Cyclic Branched | 185.3 | 36 |
| CCCCC1CCCCC1 | butylcyclohexane | Alkane-Cyclic Branched | 204.9 | 40 |
| CC(C)(C)C1CCCCC1 | t-butylcyclohexane | Alkane-Cyclic Branched | 191.2 | 40 |
| Cc1ccccn1 | 2-methylpyridine | Pyridine-Methyl substituted | 127.4 | 25 |
| Cc1cccnc1 | 3-methylpyridine | Pyridine-Methyl substituted | 127.2 | 25 |
| Cc1ccncc1 | 4-methylpyridine | Pyridine-Methyl substituted | 127.1 | 25 |
| Cc1cccnc1C | 2,3-dimethylpyridine | Pyridine-Methyl substituted | 143.9 | 30 |
| Cc1ccnc(C)c1 | 2,4-dimethylpyridine | Pyridine-Methyl substituted | 147.0 | 30 |
| Cc1ccc(C)nc1 | 2,5-dimethylpyridine | Pyridine-Methyl substituted | 147.0 | 30 |
| Cc1cccc(C)n1 | 2,6-dimethylpyridine | Pyridine-Methyl substituted | 147.1 | 30 |
| Cc1cnccc1C | 3,4-dimethylpyridine | Pyridine-Methyl substituted | 143.5 | 30 |
| Cc1cncc(C)c1 | 3,5-dimethylpyridine | Pyridine-Methyl substituted | 146.4 | 30 |
| c1ccc2ncccc2c1 | quinoline | Pyridine-Quinoline | 152.3 | 32 |
| c1ccc2cnccc2c1 | isoquinoline | Pyridine-Isoquinoline | 151.7 | 32 |
| CCCc1ccccc1 | propylbenzene | Benzene-Alkyl Substituted | 170.4 | 33 |
| CCCCc1ccccc1 | butylbenzene | Benzene-Alkyl Substituted | 190.5 | 37 |
| CCCCCc1ccccc1 | pentylbenzene | Benzene-Alkyl Substituted | 210.2 | 41 |
| CCCCCCc1ccccc1 | hexylbenzene | Benzene-Alkyl Substituted | 229.8 | 45 |
| CC(C)c1ccccc1 | isopropylbenzene | Benzene-Alkyl Substituted | 166.6 | 33 |
| CC(C)(C)c1ccccc1 | tert-butylbenzene | Benzene-Alkyl Substituted | 178.6 | 37 |
| [Cl]c1cccc([Cl])c1 | 1,3-dichlorobenzene | Benzene-Dichloro | 146.7 | 28 |
| [Cl]c1ccc([Cl])cc1 | 1,4-dichlorobenzene | Benzene-Dichloro | 146.9 | 28 |
| c1ccc2c(c1)c3cccc4cccc2c34 | fluoranthene | Polycyclic aromatic | 217.4 | 48 |
| c1cc2ccc3ccc4ccc5ccc6ccc1c7c2c3c4c5c67 | coronene | Polycyclic aromatic | 278.0 | 74 |
| C1Cc2cccc3cccc1c23 | acenaphthene | Polycyclic aromatic | 179.9 | 38 |
| C1c2ccccc2c2ccccc12 | fluorene | Benzene-Biphenyl | 192.8 | 40 |
| C1Cc2ccccc2C1 | indane | Benzene-indane | 155.0 | 30 |
| CCF | fluoroethane | Alkane-Monofluoro | 77.6 | 12 |
| CCCF | 1-fluoropropane | Alkane-Monofluoro | 97.6 | 16 |
| CC(C)F | 2-fluoropropane | Alkane-Monofluoro | 96.9 | 16 |
| CCCCF | 1-fluorobutane | Alkane-Monofluoro | 117.5 | 20 |
| CCCCCF | 1-fluoropentane | Alkane-Monofluoro | 137.0 | 24 |
| Fc1ccccc1 | fluorobenzene | Benzene-Monofluoro | 116.3 | 21 |
| Fc1ccccc1F | 1,2-difluorobenzene | Benzene-Difluoro | 121.1 | 22 |
| Fc1ccccc1[Cl] | o-fluorochlorobenzene | Benzene-ChloroFluoro | 133.5 | 25 |
| Fc1cccc([Cl])c1 | m-fluorochlorobenzene | Benzene-ChloroFluoro | 134.2 | 25 |
| Fc1ccc([Cl])cc1 | p-fluorochlorobenzene | Benzene-ChloroFluoro | 133.8 | 25 |
| Oc1cccc(F)c1 | 3-fluorophenol | Phenol-Fluoro substituted | 125.3 | 24 |
| Oc1ccc(F)cc1 | 4-fluorophenol | Phenol-Fluoro substituted | 125.3 | 24 |
| CC=CC | cis-but-2-ene | Alkene-methyl substituted | 107.2 | 20 |
| CC=CC | trans-but-2-ene | Alkene-methyl substituted | 107.2 | 20 |
| CC=C(C)C | 2-methylbut-2-ene | Alkene-methyl substituted | 123.2 | 24 |
| CC(C)(C)C | 2,2-dimethylpropane | Alkane Acyclic Branched | 125.8 | 24 |

## Reference for Section 8


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**Section 9:**
**Description of calculation procedure exemplified in workbook Excel 2.xlsx**

The calculation procedure is exemplified for 266 solutes in four worksheets of the workbook Excel 2.xlscx and the fifth worksheet lists the experimental partition data used in the development of the model. In the first two sheets, the calculated free energy contributions for transfer from the reference state to solvent are summed for each compound in the training set and used to compute free energies of transfer from water to organic solvent.

**1 ΔG water->nonpolar**
This sheet contains the parameters for water and a table of non-polar solvents and their associated parameters (blue cells). Entering a solvent ID from the table into the highlighted yellow cell (L4) pulls in data from the other sheets and calculates the free energies of transfer from water into the non-polar solvent selected. Plots are shown of the calculated (x axis) versus the experimental (y axis) free energies of transfer.

**2 ΔG water->polar**
This sheet contains a table of polar organic solvents and their associated parameters (blue cells). Entering a solvent ID from the table into the highlighted yellow cell (L4) pulls in data from the other sheets and calculates the free energies of transfer. Plots are shown of the calculated (x axis) versus the experimental (y axis) free energies of transfer.

**3 Solute Functional Groups**
This sheet contains a table of the functional group fragmentation of the training set of compounds (blue cells). Data are pulled in from the other sheets and used to calculate the solvation energies of each fragment in three different solvents (water, the non-polar solvent selected in cell L4 on the *ΔG water->nonpolar* sheet, and the polar solvent selected in cell L4 on the *ΔG water->nonpolar* sheet).

**4 SSIP ΔGs**
This sheet contains a table of the SSIP description of solute functional groups and the associated parameters (blue cells). Data are pulled in from the other sheets, and the solvation energies of the SSIPs are summed to obtain solvation energies for each functional group in three different solvents (water, the non-polar solvent selected in cell L4 on the *ΔG water->nonpolar* sheet, and the polar solvent selected in cell L4 on the *ΔG water->nonpolar* sheet).

**5 Experimental Data**
This sheet tabulates experimental free energies ($-\Delta G^o$) for solute transfer from water to organic solvents.