**Table 1.** Reaction and standard changes in free energies[a] for methanogenesis[b]

| Reaction | $\Delta G^{\circ\prime}$ (KJ/mol $CH_4$) |
|---|---|
| $4\ H_2+CO_2 \rightarrow CH_4+2H_2O$ | −135.6 |
| $4\ Formate \rightarrow CH_4+3CO_2+2H_2O$ | −130.1 |
| $2\ Ethanol+CO_2 \rightarrow CH_4+2\ Acetate$ | −116.3 |
| $Methanol+H_2 \rightarrow CH_4+H_2O$ | −112.5 |
| $4\ Methanol \rightarrow 3CH_4+CO_2+2H_2O$ | −104.9 |
| $4\ Methylamine+2H_2O \rightarrow 3CH_4+CO_2+4NH_4^+$ | −75.0 |
| $4\ Trimethylamine+6H_2O \rightarrow 9CH_4+3CO_2+4NH_4^+$ | −74.3 |
| $2\ Dimethylsulfide+2H_2O \rightarrow 3CH_4+CO_2+H_2S$ | −73.8 |
| $2\ Dimethylamine+2H_2O \rightarrow 3CH_4+CO_2+2NH_4^+$ | −73.2 |
| $4\ 2\text{-}Propanol+CO_2 \rightarrow CH_4+4\ Acetone+2H_2O$ | −36.5 |
| $Acetate \rightarrow CH_4+CO_2$ | −31.0 |

[a]: calculated from the free energy of formation of the most abundant ionic species at neutral pH. Thus, $CO_2$ is $HCO_3^-+H^+$ and formate is $HCOO^-+H^+$.

[b]: from Whitman *et al.* [7].