**MOLAR HEAT OF FORMATION**

These are molar heats of formation for anions and cations in aqueous solution.

In all cases, the heats of formation are given in kJ/mol at 25°C for 1 mole of the ion.

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| --- | --- | --- | --- | --- |
| **Cations** | **ΔHf (kJ/mol)** |  | **Anions** | **ΔHf (kJ/mol)** |
| Ag+ (aq) | +105.9 |  | Br- (aq) | -120.9 |
| Al3+ (aq) | -524.7 |  | Cl- (aq) | -167.4 |
| Ba2+ (aq) | -538.4 |  | ClO3- (aq) | -98.3 |
| Ca2+ (aq) | -543.0 |  | ClO4- (aq) | -131.4 |
| Cd2+ (aq) | -72.4 |  | CO32- (aq) | -676.3 |
| Cu2+ (aq) | +64.4 |  | CrO42- (aq) | -863.2 |
| Fe2+ (aq) | -87.9 |  | F- (aq) | -329.1 |
| Fe3+ (aq) | -47.7 |  | HCO3- (aq) | -691.1 |
| H+ (aq) | 0.0 |  | H2PO4- (aq) | -1302.5 |
| K+ (aq) | -251.2 |  | HPO42- (aq) | -1298.7 |
| Li+ (aq) | -278.5 |  | I- (aq) | -55.9 |
| Mg2+ (aq) | -462.0 |  | MnO4- (aq) | -518.4 |
| Mn2+ (aq) | -218.8 |  | NO3- (aq) | -206.6 |
| Na+ (aq) | -239.7 |  | OH- (aq) | -229.9 |
| NH4+ (aq) | -132.8 |  | PO43- (aq) | -1284.1 |
| Ni2+ (aq) | -64.0 |  | S2- (aq) | +41.8 |
| Pb2+ (aq) | +1.6 |  | SO42- (aq) | -907.5 |
| Sn2+ (aq) | -10.0 |  |  |  |
| Zn2+ (aq) | -152.4 |  |  |  |
| Reference: Masterton, Slowinski, Stanitski, *Chemical Principles*, CBS College Publishing, 1983. | | | | |