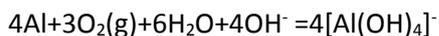


## Answer on Question #55709 - Chemistry - Physical chemistry

### Question:

For the reaction  $4\text{Al} + 3\text{O}_2(\text{g}) + 6\text{H}_2\text{O} + 4\text{OH}^- = 4[\text{Al}(\text{OH})_4]^-$ ,  $E_0$  cell 2.73V. If  $\Delta G^0_{\text{formation}}[\text{OH}^-] = -157\text{KJ/mol}$  and  $\Delta G^0_{\text{formation}}[\text{H}_2\text{O}] = -237.2\text{KJ/mol}$ . determine  $\Delta G^0_{\text{formation}}$  of  $[\text{Al}(\text{OH})_4]^-$ .

### Solution



$$\Delta G^0(\text{OH}^-) = -157\text{KJ/mol}$$

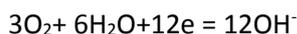
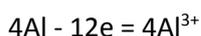
$$\Delta G^0(\text{H}_2\text{O}) = -237.2\text{KJ/mol}$$

$\Delta G^0(\text{O}_2) = \Delta G^0(\text{Al}) = 0$  – by definition of the Gibbs free energy for simple substances.

$$\Delta G^0(\text{rxn}) = 4\Delta G^0([\text{Al}(\text{OH})_4]^-) - 4\Delta G^0(\text{OH}^-) - 6\Delta G^0(\text{H}_2\text{O}) - 3\Delta G^0(\text{O}_2) - 4\Delta G^0(\text{Al});$$

$$\Delta G^0([\text{Al}(\text{OH})_4]^-) = (\Delta G^0(\text{rxn}) + 4\Delta G^0(\text{OH}^-) + 6\Delta G^0(\text{H}_2\text{O}) + 3\Delta G^0(\text{O}_2) + 4\Delta G^0(\text{Al}))/4$$

$$\Delta G^0(\text{rxn}) = -nFE^0$$



The number of electrons ( $n$ ) is 12.

$$\Delta G^0([\text{Al}(\text{OH})_4]^-) = ((-12 \times 96500 \times 2.73) + 4 \times (-157000) + 6 \times (-237200))/4 = -1.303 \times 10^6 \text{ J/mol}$$

**Answer:  $-1.303 \times 10^6 \text{ J/mol}$**