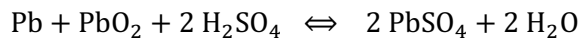


Ex. 1 Standard redox potential — Lead-acid battery

The overall chemical reaction in a lead-acid battery (car) is:



Looking up the thermodynamic data for this reaction (e.g., in CRC Handbook hbcnetbase.com, NIST.gov website, CRM's form, etc.), you would find the standard-state data at 25°C:

Compound	$\Delta_f \tilde{h}_{25^\circ\text{C}}^\ominus$ kJ/mol	$\tilde{s}_{25^\circ\text{C}}^\ominus$ J/(mol·K)
PbSO ₄	-920.00	148.5
Pb	0	64.80
PbO ₂	-274.47	71.78
H ₂ SO ₄ aqueous	-909.00	20.08
H ₂ O(l)	-285.80	70.00
H ⁺ aqueous	0 (definition)	0 (definition)

Derive from these the standard redox potential for a lead-acid battery at 25°C.

Ex. 2 Standard redox potential – Influence of temperature and gases

The table below gives the standard molar enthalpy-change of formation and the standard molar entropy for some compounds, at 1 bar and 25°C.

Compound	$\Delta_f \tilde{h}_{25^\circ\text{C}}^\ominus$	$\tilde{s}_{25^\circ\text{C}}^\ominus$
	kJ/mol	J/(mol·K)
H ₂	0	130.6
O ₂	0	205.0
H ₂ O (<i>l</i>)	-285.8	69.9
H ₂ O (<i>g</i>)	-241.8	188.7
CH ₄	-74.85	186.2
CO ₂	-393.5	213.6

1. Compute the standard redox potential, $E^\ominus$, for the electrochemical oxidation of:
 - a) hydrogen at 25°C;
 - b) methane at 25°C.
2. Write the standard redox potential as a function of temperature, $E^\ominus(T)$.
 - a) Plot $E^\ominus(T)$ in the interval $T = [25, 1000]^\circ\text{C}$, for hydrogen and for methane.
 - b) Draw conclusions regarding the influence of temperature and of gases on $E^\ominus$.