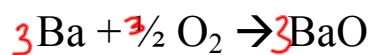
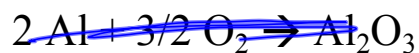


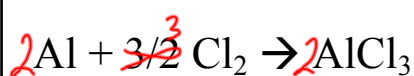
$$3 (-1) \Delta H_1$$



$$(3) \Delta H_2$$



$$(-1) \Delta H_3$$



$$(2) \Delta H_4$$

↑ formation
rxns

$$\Delta H_{\text{rxn}} = -3 \Delta H_1 + 3 \Delta H_2 - \Delta H_3 + 2 \Delta H_4$$

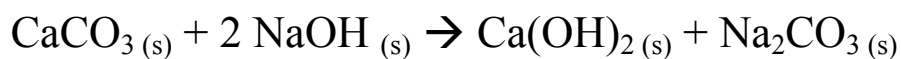
$$3 \Delta H_2 + 2 \Delta H_4 - [3 \Delta H_1 + \Delta H_3]$$

What you did... a general rule

react (-1)

everything x coefficient

$$\Delta H_{\text{rxn}} = \sum \Delta H_f \text{ prod} - \sum \Delta H_f \text{ react}$$



$$\Delta H_{\text{rxn}} = ?$$

$$\Delta H_{\text{rxn}} = \sum \Delta H_f \text{ prod} - \sum \Delta H_f \text{ react}$$

$$= [\text{Ca(OH)}_2 + \text{Na}_2\text{CO}_3] - [\text{CaCO}_3 + 2(\text{NaOH})]$$

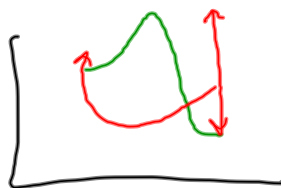
$$= [-986.09 + -1130.77] - [-1207.6 + 2(-425.93)]$$

$$= -57.4 \text{ kJ/mol}$$

Spontaneity and the driving forces of nature

↳ keeps going once started

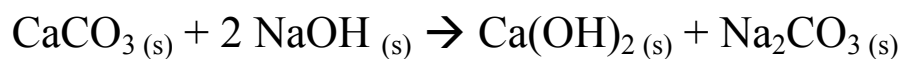
1. heat (enthalpy)



exotherm
tend to be
spont b/c
feed selves
Act. NRH

2. entropy (S) - disorder, chaos, messiness

$$\Delta S = \sum S_{\text{prod}} - \sum S_{\text{react}}$$

Calculating ΔS 

$$\left[\text{Ca(OH)}_2 + \text{Na}_2\text{CO}_3 \right] - \left[\text{CaCO}_3 + 2(\text{NaOH}) \right]$$

$$-2.44 \frac{\text{J}}{\text{K}\cdot\text{mol}}$$

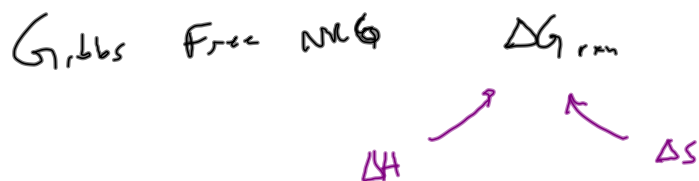
 ΔH and ΔS – signs and spontaneity

ΔH - exothermic ☺

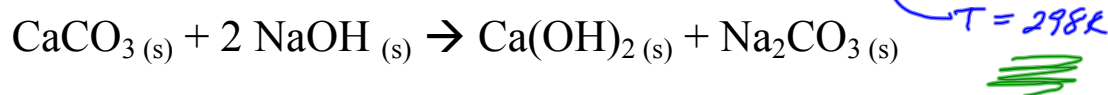
 + endothermic ☹

ΔS + messier ☺

 - neater ☹

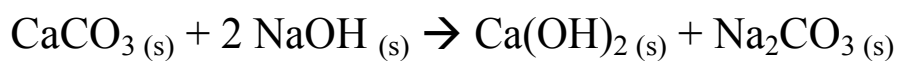


Calculating ΔG – the easy way (when you're lucky)



$$\Delta G = \sum \Delta G_{f, \text{prod}} - \sum \Delta G_{f, \text{react}}$$

Calculating ΔG – the hard way (when you're unlucky)



$$\Delta G = \Delta H - T \Delta S$$

\uparrow \uparrow
 $\frac{\text{kJ}}{\text{mol}}$ $\frac{\text{J}}{\text{K}\cdot\text{mol}}$

