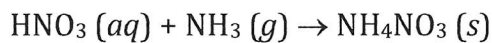


x 3/3

Name: Ciara Ostrander

Ammonium nitrate, the main component of fertilizers, is produced from the reaction of nitric acid and ammonia. The chemical equation for this synthesis is given below.



Using the following table of standard enthalpies of formations at 25 °C:

1. Calculate the change in enthalpy for this process.
2. Indicate if this an exothermic or an endothermic process.

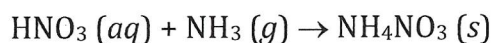
| Substance | ΔH_f° (kJ/mol) |
|------------------------------|-----------------------------|
| $\text{HNO}_3 (aq)$ | -206.6 |
| $\text{NH}_3 (g)$ | -46.1 |
| $\text{NH}_4\text{NO}_3 (s)$ | -365.6 |

$$\textcircled{1} \quad \frac{1 \text{ mol} (-365.6 \text{ kJ})}{1 \text{ mol}} - \left[\frac{1 \text{ mol} (-46.1 \text{ kJ})}{1 \text{ mol}} + \frac{1 \text{ mol} (-206.6 \text{ kJ})}{1 \text{ mol}} \right] = -112.9 \text{ kJ}$$

- $\textcircled{2}$ This is an exothermic process because the $\Delta H < 0$.

x $\frac{3}{3}$ Name: Natalia Reyes Becerra

Ammonium nitrate, the main component of fertilizers, is produced from the reaction of nitric acid and ammonia. The chemical equation for this synthesis is given below.



Using the following table of standard enthalpies of formations at 25 °C:

1. Calculate the change in enthalpy for this process.
2. Indicate if this an exothermic or an endothermic process.

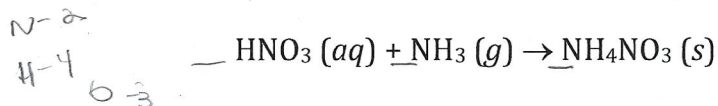
| Substance | ΔH_f° (kJ/mol) |
|------------------------------|-----------------------------|
| $\text{HNO}_3 (aq)$ | -206.6 |
| $\text{NH}_3 (g)$ | -46.1 |
| $\text{NH}_4\text{NO}_3 (s)$ | -365.6 |

$$\begin{aligned} \Delta H_{\text{rxn}} &= (1 \text{ mol}) \left(-365.6 \frac{\text{kJ}}{\text{mol}} \right) \\ &\quad - (1 \text{ mol}) \left(-46.1 \frac{\text{kJ}}{\text{mol}} \right) \\ &\quad - (1 \text{ mol}) \left(-206.6 \frac{\text{kJ}}{\text{mol}} \right) \\ \hline \Delta H_{\text{rxn}} &= \boxed{-112.9 \text{ kJ}} \end{aligned}$$

2. Exothermic

Name: Jonara Jiménez

Ammonium nitrate, the main component of fertilizers, is produced from the reaction of nitric acid and ammonia. The chemical equation for this synthesis is given below.



Using the following table of standard enthalpies of formations at 25 °C:

1. Calculate the change in enthalpy for this process.
2. Indicate if this an exothermic or an endothermic process.

| Substance | ΔH_f° (kJ/mol) |
|-------------------------------------|-----------------------------|
| HNO ₃ (aq) | -206.6 |
| NH ₃ (g) | -46.1 |
| NH ₄ NO ₃ (s) | -365.6 |

1.) $\Delta H =$

Reactants

$$1(-206.6 \text{ kJ/mol}) + 1(-46.1 \text{ kJ/mol}) = -252.7 \text{ kJ}$$

Products

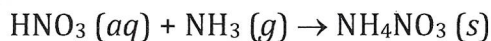
$$1 \text{ mol}(-365.6 \text{ kJ/mol}) = -365.6 \text{ kJ}$$

$$\Delta H_{\text{rxn}}^\circ = -365.6 \text{ kJ} + (+252.7 \text{ kJ}) = \boxed{-112.9 \text{ kJ}}$$

2.) This is an exothermic process.

x $\frac{3}{3}$ Name: Afia Kuragu

Ammonium nitrate, the main component of fertilizers, is produced from the reaction of nitric acid and ammonia. The chemical equation for this synthesis is given below.



Using the following table of standard enthalpies of formations at 25 °C:

1. Calculate the change in enthalpy for this process.
2. Indicate if this an exothermic or an endothermic process.

| Substance | ΔH_f° (kJ/mol) |
|-------------------------------------|-----------------------------|
| HNO ₃ (aq) | -206.6 |
| NH ₃ (g) | -46.1 |
| NH ₄ NO ₃ (s) | -365.6 |

$$\Delta H_{\text{rxn}}^\circ = \sum n_{\text{products}} \Delta H_f^\circ \text{ products} - \sum n_{\text{reactants}} \Delta H_f^\circ \text{ reactants}$$

$$= \cancel{(1 \text{ mol HNO}_3)(-206 \frac{\text{kJ}}{\text{mol}})} + \cancel{(1 \text{ mol NH}_3)(-46.1 \frac{\text{kJ}}{\text{mol}})}$$

$$= (1 \text{ mol NH}_4\text{NO}_3)(-365.6 \frac{\text{kJ}}{\text{mol}}) - [(1 \text{ mol HNO}_3)(-206.6 \frac{\text{kJ}}{\text{mol}}) + (1 \text{ mol NH}_3)(-46.1 \frac{\text{kJ}}{\text{mol}})]$$

$$\Delta H_{\text{rxn}}^\circ = -365.6 \text{ kJ} - (-252.7 \text{ kJ})$$

$$\Delta H_{\text{rxn}}^\circ = -112.9 \text{ kJ}$$

This is an exothermic process because $\Delta H_{\text{rxn}}^\circ$ is negative.