## Answer on Question #56248 - Chemistry - General chemistry

## Question:

what amount of water would be needed to be added to 10g of ammonium nitrate to change the temperature of an instant cold pack form 20 degrees to 5 degrees?

## Solution:

Dissolution of ammonium nitrate is highly endothermic with  $\Delta H^{\circ} = +25.69 \text{ kJ mol}^{-1}$ .

 $n_{NH4NO3} = m_{NH4NO3}/MW_{NH4NO3} = 10 \text{ g}/80.052 \text{ g mol}^{-1} = 0.1249 \text{ mol}^{-1}$ 

 $Q = -n \Delta H^{\circ} = -0.1249 \text{ mol } 25.69 \text{ kJ mol}^{-1} = -3.209 \text{ kJ};$ 

Specific heat capacity of water at these temperatures is 4.192 kJ kg $^{-1}$  K $^{-1}$ 

If we assume that specific heat capacity of solution will be equal to heat capacity of pure water.

Then:

Q = Cm $\Delta$ T; m = Q/(C $\Delta$ T) = -3.209 kJ/(4.192 kJ kg<sup>-1</sup> K<sup>-1</sup> (-15 K)) = 0.051 kg = 51 g;

 $m = m_{H20} + m_{NH4NO3}$ ;  $m_{H20} = m - m_{NH4NO3} = 51 \text{ g} - 10 \text{ g} = 41 \text{ g}$ .

## Answer: 41 g of water