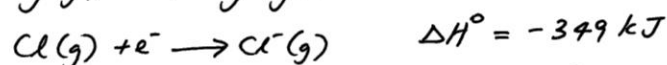
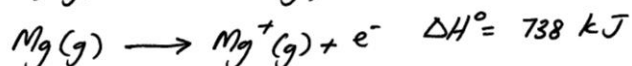
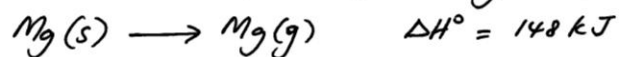


Problem-solving Example 3

The alkaline earth metals form halides with general formula MX_2 rather than MX .

a) Calculate the ΔH_f° of MgCl using the following data:



$$\Delta H_{\text{lattice}}^{\circ} \text{ of } \text{MgCl} = 783.5 \text{ kJ mol}^{-1} .$$

b) Is MgCl favored energetically relative to Mg and Cl_2 ?
Explain .

c) Use Hess's Law to calculate ΔH° for the conversion of MgCl to MgCl_2 and Mg (ΔH_f° of $\text{MgCl}_2 = -641 \text{ kJ mol}^{-1}$)

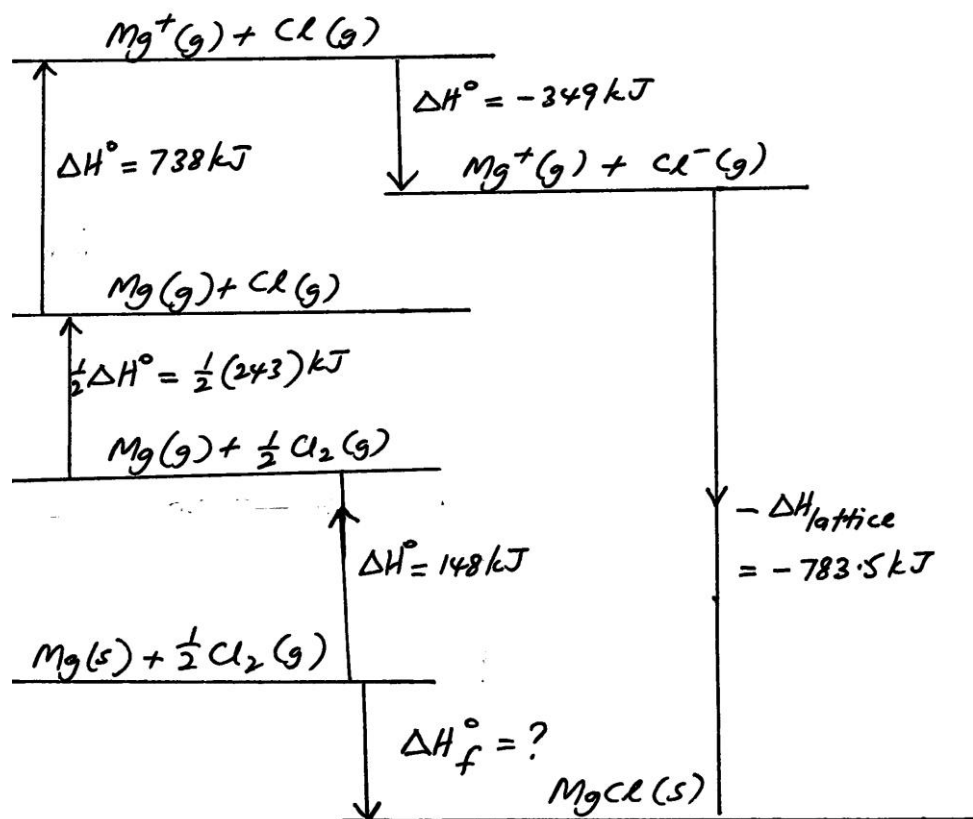
d) Is MgCl favored energetically relative to MgCl_2 ? Explain .

SOLUTION



Solution:

a) Draw Born-Haber cycle.



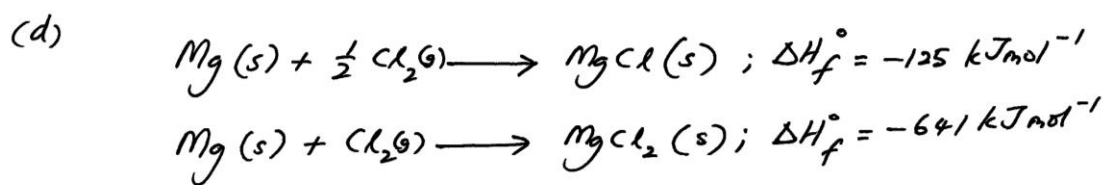
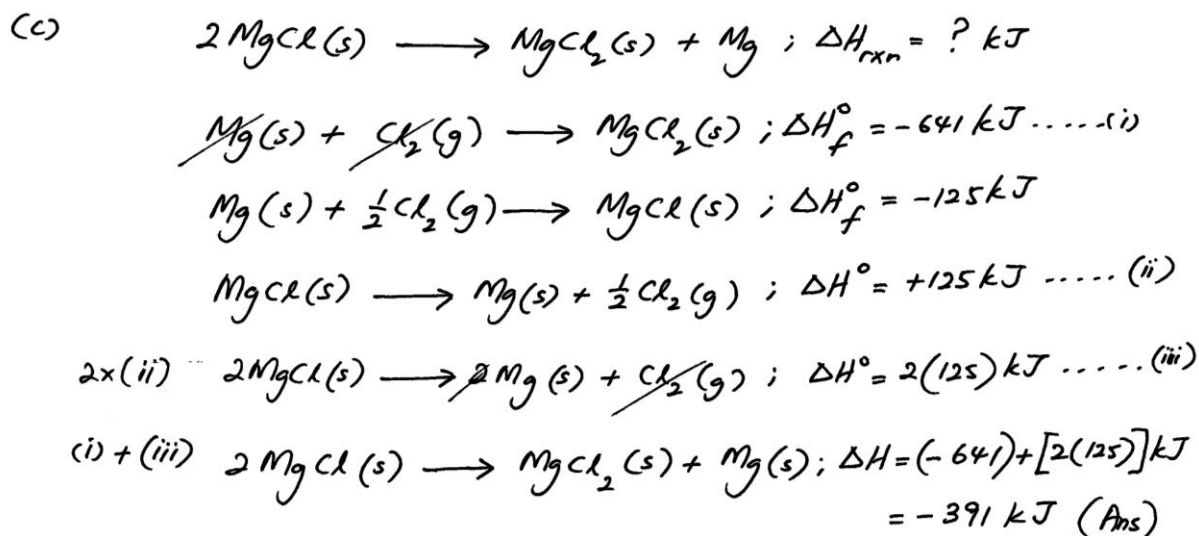
Using Hess's Law:

$$\Delta H_f^\circ = (+148) + \left(\frac{1}{2} \times 243\right) + (+738) + (-349) + (-783.5)$$

$$\Delta H_f^\circ = -125 \text{ kJ}$$

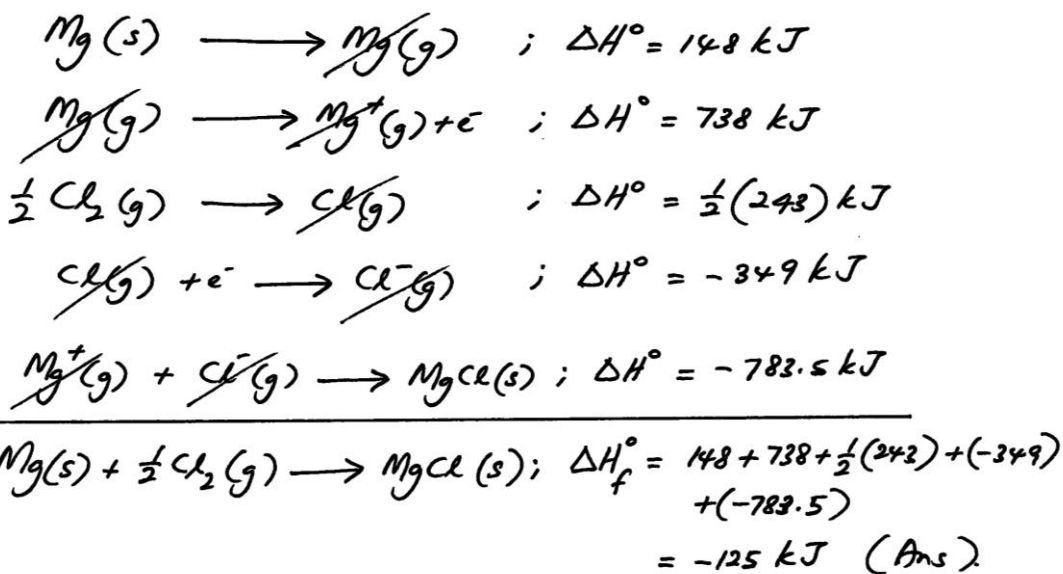


(b) MgCl_2 is favored energetically relative to Mg and Cl_2 since ΔH_f° is negative.



MgCl is not favored energetically relative to MgCl_2 because ΔH_f° for MgCl_2 is much more negative than that for MgCl .

ALTERNATIVE METHOD



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