Answer on Question #57013 - Chemistry - Other
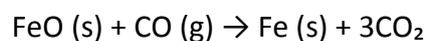
Question:

Using Hess's law, calculate the delta H value for the following reaction:

FeO (s) + CO (g) → Fe (s) + $3CO_2$

Use these three reactions:

1. Fe_2O_3 (s) + $3CO$ (g) → $2Fe$ (s) + $3CO_2$ (g) ΔH = -25 kJ

2. $3Fe_2O_3$ (s) + CO (g) → $2Fe_3O_4$ (s) + CO_2 (g) ΔH = -47.0 kJ

3. Fe_3O_4 (s) + CO (g) → $3FeO$ (s) + CO_2 (g) ΔH = +38.0 kJ

Solution:

To get the reaction we need, we have to make some operations with the equations given :

1. Invert the second and third equation:

   (-II) $2Fe_3O_4$ (s) + CO_2 (g) → $3Fe_2O_3$ (s) + CO (g) ΔH = +47.0 kJ

   (-III) $3FeO$ (s) + CO_2 (g) → Fe_3O_4 (s) + CO (g) ΔH = -38.0 kJ

2. Multiply the second result by two and sum with the (-2):

   (-III*2-II) $6FeO$ (s) + $3CO_2$ (g) → $3CO$ (g) + $3Fe_2O_3$ (s) ΔH = -38.0*2+47=-29 kJ

3. Divide the obtained reaction by 3 and add the (I):

   [(-III*2-II)/3 + I] $2FeO$ (s) + $2CO$ (g) → $2Fe$ (s) + $2CO_2$ (g) ΔH = -29/3 -25 = -34.67 kJ

4. Divide the reaction obtained by 2:

   [(-III*2-II)/3 + I]/2 FeO (s) + CO (g) → Fe (s) + CO_2 (g) ΔH = -54/2=-17.33 kJ

Answer: -17.33 kJ