Answer on the question #56740 - Chemistry - Physical Chemistry

Question:

The enthalpy of hydrogenation of cyclohexene is -119.5 KJ/mol.If Resonance energy of benzene is -150.4 KJ/mol,its enthalpy of hydrogenation would be

options are-
(a) -358.5 KJ/mol
(b) -508.9 KJ/mol
(c) -208.1 KJ/mol
(d) -269.9 KJ/mol

Solution:

Due to the aromaticity, the stabilization of benzene ring occurs. This means that the energy released with the hydrogenation of benzene is lower than it is expected.

The enthalpy of hydrogenation of cyclohexene is representing the enthalpy of hydrogenation of one double bond in the ring. Then, if we take 3 times enthalpy of hydrogenation of cyclohexene, we will have the estimate of enthalpy of hydrogenation of benzene without taking into consideration aromaticity:

$$\Delta H = 3 \cdot \Delta H(cyclohexene) = 3 \cdot (-119.5) = -358.5 \, kJ/mol$$

Then, taking into account the stabilization of benzene molecule due to the resonance, we have:

$$\Delta H(arom) = \Delta H - E_{res} = -358.5 + 150.4 = -208.1 \, kJ/mol$$

Answer: (c)