ANSWERS

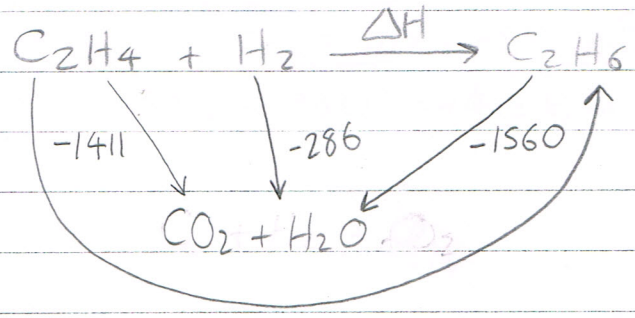
Hess Law

① Calculate the standard enthalpy change for the reaction:

$$C_2H_{4(g)} + H_{2(g)} \rightarrow C_2H_{6(g)}$$

given the following standard enthalpy changes of combustion:

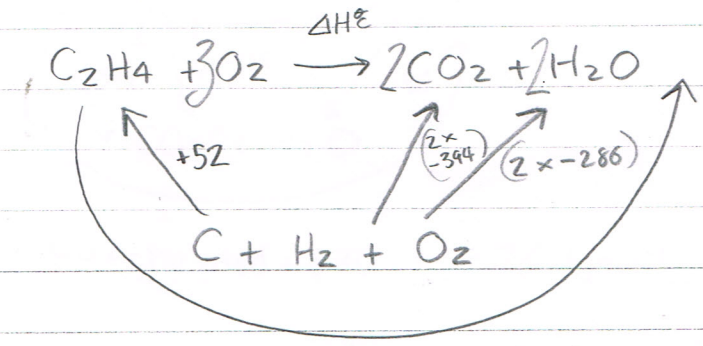
$\Delta H_c^\ominus (C_2H_{4(g)}) = -1411\ kJmol^{-1}$
$\Delta H_c^\ominus (H_{2(g)}) = -286\ kJmol^{-1}$
$\Delta H_c^\ominus (C_2H_{6(g)}) = -1560\ kJmol^{-1}$



$-1411 + -286 = -1697 + 1560 = -137\ kJmol^{-1}$

② Calculate the enthalpy change of combustion of ethene, C_2H_4, given the following enthalpy changes of formation

$\Delta H^{\ominus}_f (C_2H_4(g)) = +52\ kJmol^{-1}$
$\Delta H^{\ominus}_f (CO_2(g)) = -394\ kJmol^{-1}$
$\Delta H^{\ominus}_f (H_2O(l)) = -286\ kJmol^{-1}$



$-788 + -572 = -1360$

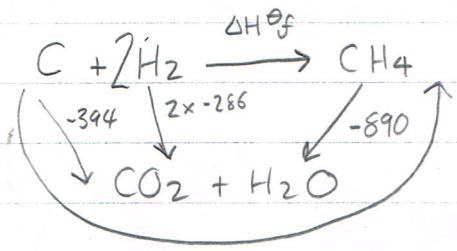
$-52 + -1360 = -1412\ kJmol^{-1}$

③ Calculate the standard enthalpy change of formation of methane from the following enthalpy changes of combustion:

$\Delta H^{\ominus}_c : (CH_4(g)) = -890\ kJmol^{-1}$

$\Delta H^{\ominus}_c : (H_2(g)) = -286\ kJmol^{-1}$

$\Delta H^{\ominus}_c : (C(s)) = -394\ kJmol^{-1}$

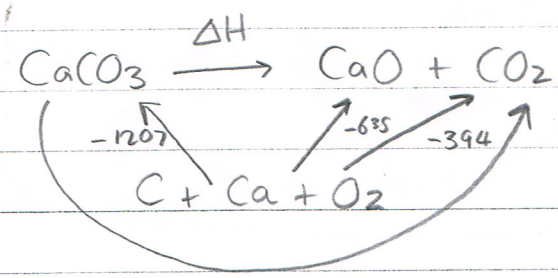


$-394 + -572 = -966 + 890 = -76\ kJmol^{-1}$

④ Calculate the enthalpy change for the reaction:

$$CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$$

$\Delta H^{\ominus}f(CaCO_{3(s)}) = -1207\ kJmol^{-1}$
$\Delta H^{\ominus}f(CaO_{(s)}) = -635\ kJmol^{-1}$
$\Delta H^{\ominus}f(CO_{2(g)}) = -394\ kJmol^{-1}$



$-635 + -394 = -1029$

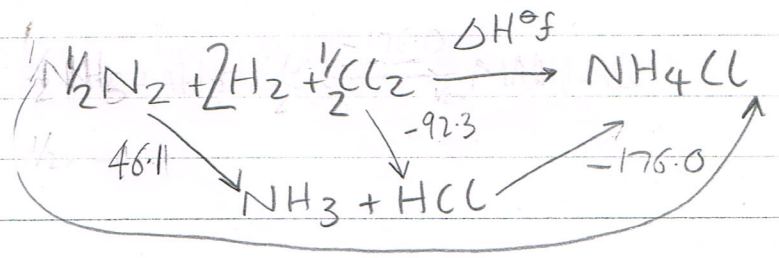
$+1207 + -1029 = +178\ kJmol^{-1}$

(5) Calculate the standard enthalpy change of formation of solid ammonium chloride, NH_4Cl, using the following data:

$\Delta H^{\ominus}_f(NH_3(g)) = -46.1\ kJmol^{-1}$ $\Delta H^{\ominus} = -176.0\ kJmol^{-1}$

$\Delta H^{\ominus}_f(HCl(g)) = -92.3\ kJmol^{-1}$

$$NH_3(g) + HCl(g) \longrightarrow NH_4Cl(s)$$



$-46.1 + -92.3 = -138.4 + -176.0 = -314.4\ kJmol^{-1}$