Chemistry lab report

Business

Aim- to test Hess’ law by converting NaOH to NaCl by using two different routes and measuring the enthalpy change for each oneTheory- the Hess’ law states that the total enthalpy change on converting a given set of reactants to a particular set of products is always constant irrespective of the pathway it takes.

Method-Route 1-Reaction1-NaOH(s) + HCL(aq) NaCl + H2O(l)1. take 50 cm3 of HCl in an insulated calorimeter using a pipette. The initial temperature should be recorded. 2. 1 gram of NaOH was grinded in a crucible and added to it3. The apparatus was stirred.

The final temperature was found using a cooling curve. 4. The heat given out by the reaction was recorded using the formulaHeat given out by the reaction= heat absorbed by water5. The enthalpy change is calculated using the formulaH1=(Heat absorbed by water/no. of moles of the limiting reactantRoute2-Reaction2-NaOH(s) + H2O(l) NaOH(aq)1.

25- cm3 cube of water was taken in an insulated calorimeter using a pipette. The initial temperature was recorded2. 1 gram of solid NaOH was added to it. The apparatus was stirred3. The final temperature was recorded. Since the reaction is slow the final temperature was found by plotting a cooling curve.

4. The heat given out by the reaction was noted using the formulaHeat given out by the reaction= heat absorbed by water5. The enthalpy change is noted using the formulaH2= heat absorbed by water/ no. of moles of the limiting reactantReaction 3- NaOH(aq) +HCl(aq) NaCl +H2O(l)1. The 25 cm3 aqueous NaOH is taken in an insulated calorimeter .

The initial temperature is noted. 2. Aqueous 25 cm3 HCl in added to it. The apparatus is stirred and the final temperature is noted. 3. The heat evolved ion the experiment in noted by the formulaHeat given out by the reaction= heat absorbed by water4.

The enthalpy change is calculated using the formulaH3= heat absorbed by water/no . of moles of the limiting reactantAfter the following enthalpies have been calculated the Hess' law is proven ifH1 = H2 + H3Data collection and data processingEnthalpy change=(heat absorbed by water)/no. of moles of the limiting reactantFor reaction 1-Mass of NaOH(+/- 0. 01 g)No. of Moles of NaOHVol.

of HCl(+/-0. 04 cm3)Initial temp.(+/-0. 5 oC)1. 040. 0255028.

0Heat evolved by the reaction = heat absorbed by waterHeat absorbed by water- mass of water x sp. heat capacity of water x change in temperatureTime (seconds)Temperature (+/- 0. 5 degree Celsius)3028. 06028. 09028.

012028. 0 (add NaOH(s))15029. 018030. 021031. 524032.

027032. 530032. 533033. 036034. 039035. 542035.

045035. 048034. 551034. 554034. 557034.

560034. 063034. 0the maximum temperature reached as seen in the graph= 36oCthereforeheat absorbed by water= mass x sp. heat capacity x change in temperature= 50 x 4. 18 x (36-28)= 1672 joules= 1.

672 KJno . of moles of NaOH= 0. 025therefore the enthalpy change per mole = 1. 672/0. 025= 66.

88 KJ/molreaction 2-Mass of NaOH(+/- 0. 01 g)No. of moles of NaOHInitial temperature(+/-0. 5oC)Volume of water(+/-0. 04 cm3)Molarity of NaOH(aq) (mol/dm3)1. 000.

02527. 5251Heat evolved by the reaction = heat absorbed by waterHeat absorbed by water= mass of water x sp. heat capacity of water x change in temperatureTime(+/- 0. 01 seconds)Temperature(+/- 0. 5 degree celcius)3027.

56027. 59027. 512027. 5 (add NaOH(s))15030. 018031. 521033.

524033. 527033. 530033. 533033. 536033.

039033. 042033. 045033. 048032. 551032.

554032. 557032. 560032. 063032. 0final temperature as is seen from the graph= 34oCheat absorbed by water= 25 x 4. 18 x (34-27.

5)= 679. 25 Joules= 0. 67925 KiloJoulesenthalpy change=-27. 17 KJ/molreaction 3-Vol. of NaOH(+/-0.

04 cm3)Vol. of HCl(+/-0. 04 cm3)Molarity of NaOH (mol/dm3)Molarity of HCl (mol/dm3)Initial temperature(0. 5oC)25251130. 0Final temperature= 35. 5oCThe heat absorbed by water = 25 x 4.

18 x (35. 5-30)= 574. 75 joules= 0. 5745 KJThe enthalpy change = – 22. 99KJ/molH1= -66. 88 KJ/molH2+H3=-50.

16 Kj/molTotal error possible= 1. 56All the three reactions were exothermic, i. e., heat was given out in all the three reactions therefore the values will be negative. Conclusion and evaluation- the following factors would have caused a shift from the actual values-1.

All the heat would not be transferred to the water. Some heat would be lost to the surroundings, which would cause a decrease in the value. 2. Also it is assumed in reaction 1 and 3 that HCL(aq) would have the same sp. Heat capacity as that of water which is not true. 3.

The stirring was not adequate. A cooling curve was plotted when the reaction was slow. This would give us the value of the final temperature which would be obtained had the reaction been fast. The difference between both the enthalpies is significantly large. This could be due to the above stated reasons. It was expected that enthalpy value reaction 1 would be equal to that of reaction 2 + reaction3 (since Hess’ law states that the total enthalpy change on converting a given set of reactants to a particular set of products is always constant irrespective of the pathway it takes).