010 hand warmer lab guide

Section	*+/-*	*Reason*
10pts) introduction		
10pts) materials methods		
10pts) results		
10pts) conclusion		
10pts) table		

Name:

Observing the Heats of Solutions of Endothermic and Exothermic Ionic Compounds in Water

INTRODUCTION

Paragraph 1 - Enthalpy, Exothermic, Endothermic,

Paragraph 2 - Figure 1, Figure 2, Figure 3

Paragraph 3 - In this study we determined _____. We hypothesized that _____ would be the best handwarmer. However it was determined that _____ is the best choice producing _____ joules of energy at the cheapest cost. This data (confirms or rejects) our hypothesis.

MATERIALS AND METHODS

Determining the C_{cal} To determine the constant of the calorimeter,

Determining the enthalpy of the salt solution To determine the enthalpy of the salt solution MgCl2 will be described in detailed, the remaining salts enthalpies were determined in the same manner.

RESULTS

Trial 1: Heats of solution and costs for the ionic compounds tested.

Trial 1	Class	mandy givas leo	charlotte megan	jack jamison	heesoo daniel	mandy givas leo	charlotte megan
Compound	MgSO4	NH4NO3	CaCl2	NaCH3CO2	NaCl	LiCl	Na2CO3
H2O Volume (mL)	45	45	45	45	45	45	45
Mass (g)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Tempintial (°C)	22.8	22.1	21.9	22.2	22.5	21.8	22.0
Tempfinal (°C)	38.8	14.2	34.9	26.5	21.2	40.0	27.9
ΔT (°C)	16.0	-7.9	13.0	4.3	-1.3	18.2	5.9
q-aqueous (J)							
q-calorimeter (J)							
q-solution (J)							
FW	120.37	80.04	110.98	82.03	58.44	42.39	105.99
moles							
joules/moles							
Cost ($/kg)							
Cost per mole							
cost per joule per mole							

*__BOLD__ = endothermic

Trial 2: Heats of solution and costs for the ionic compounds tested.

Trial 2	Class	mandy givas leo	charlotte megan	jack jamison	heesoo daniel	mandy givas leo	charlotte megan
Compound	MgSO4	NH4NO3	CaCl2	NaCH3CO2	NaCl	LiCl	Na2CO3
H2O Volume (mL)	45	45	45	45	45	45	45
Mass (g)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Tempintial (°C)	22.8	22.1	21.9	22.2	22.5	21.8	22.0
Tempfinal (°C)	38.8	14.2	34.9	26.5	21.2	40.0	27.9
ΔT (°C)	16.0	-7.9	13.0	4.3	-1.3	18.2	5.9
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moles							
joules/moles							
Cost ($/kg)							
Cost per mole							
cost per joule per mole							

*__BOLD__ = endothermic

CONCLUSION

$$\Delta E = q + w$$

Figure 1. The equation for the change in energy of a system

$$\Delta H_{soln} = \Delta H_{bond} + \Delta H_{lattice} + \Delta H_{dipole}$$

Figure 2. The formula for the change in enthalpy for a reaction involving H_2O and an ionic compound

$$M_aX_b(s) \rightarrow aM^{+b}(aq) + bX^{-a}(aq)$$

Figure 3. The general reaction for the disassociation of a salt into its cation and anion

$$T_{Avg} = (T_{Hot} + T_{Cold}) / 2$$

Figure 4. The equation for determining the average temperature (predicted mix temperature)

$$q_{water} = m \times c \times (T_{mix} - T_{Avg})$$

Figure 5. The formula for heat of the water surrounding, assuming that 1 mL H_2O is equivalent to 1 gram H_2O and the specific heat of water, c, is 4.184 J/g-°C.

$$q_{aqueous} = m \times c \times (T_{Final} - T_{Initial})$$

Figure 6. The formula for heat of the water surrounding, assuming that 1 mL H_2O is equivalent to 1 gram H_2O and the specific heat of water, c, is 4.184 J/g-°C.

$$q_{calorimeter} = C_{calorimeter} \times (T_{Final} - T_{Initial})$$

Figure 7. The formula for heat lost to the calorimeter in a reaction resulting in a certain change in temperature.

$$q_{solution} = -(q_{aqueous} + q_{calorimeter})$$

Figure 8. The formula for the heat of a solution of water and an salt contained in a calorimeter.