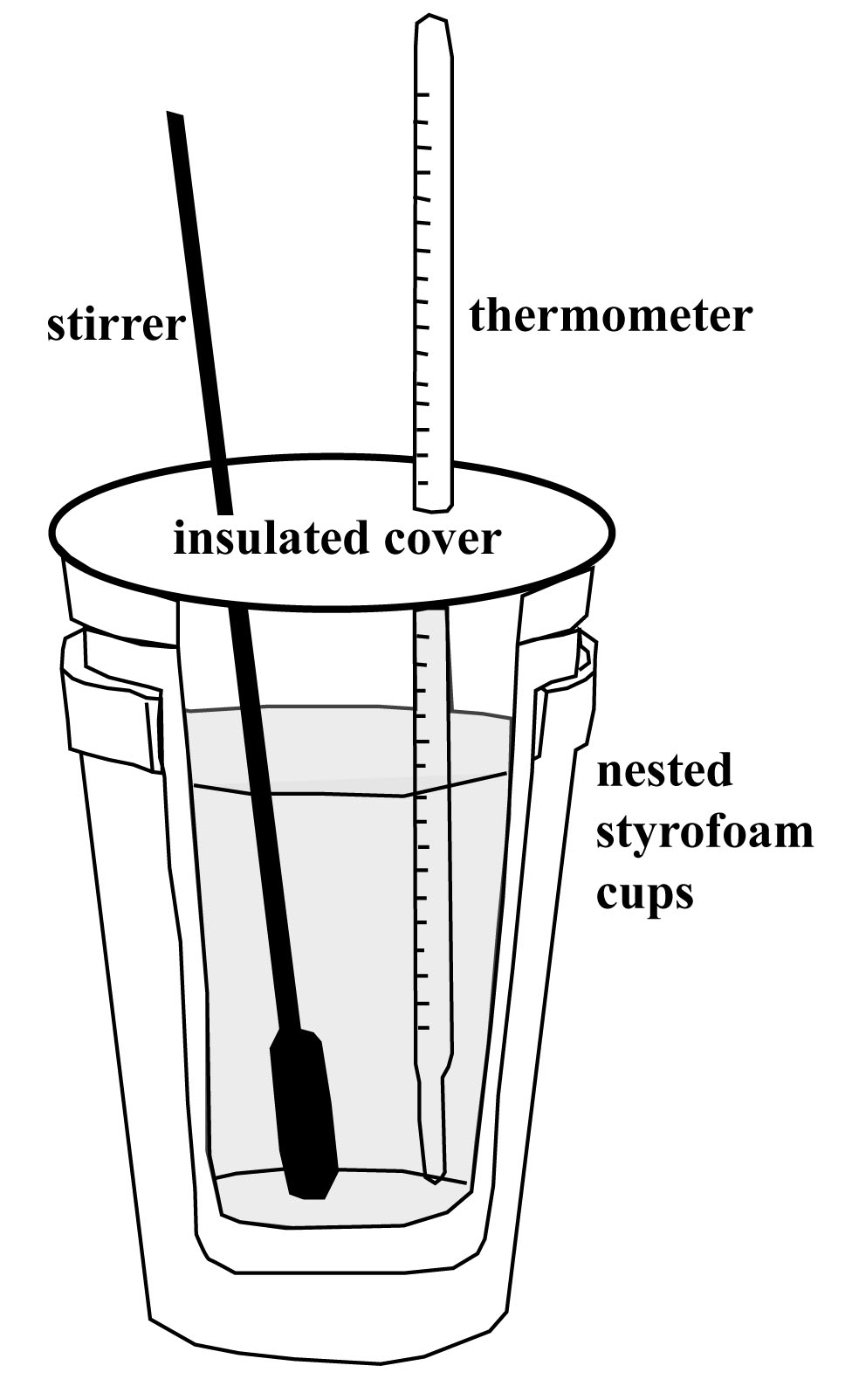
**Attachment 1. Reference Sheet A**

**Table A**

|  |
| --- |
| ammonium nitrate + water |
| calcium chloride anhydrous + water |
| lithium chloride + water |
| sodium acetate + water |
| sodium chloride + water |
| sodium carbonate + water |
| magnesium sulfate anhydrous + water |
| magnesium + 3M hydrochloric acid |
| magnesium oxide + 3M hydrochloric acid |

**Calorimeter Diagram**



*Image above is derived from the following source:* [www.sparknotes.com/testprep/books/sat2/chemistry/chapter11section4.rhtml](http://www.sparknotes.com/testprep/books/sat2/chemistry/chapter11section4.rhtml)

*Last accessed: April 2014*

**Attachment 2. Data Sheet A**

**Molecular Model** [**System Diagram**](http://www.chm.davidson.edu/vce/calorimetry/index.html) Compounds:

|  |  |
| --- | --- |
| Before | After |
| Model features should include:   * The chemical reaction, the system and the surroundings under study * The bonds that are broken during the course of the process * The bonds that are formed during the course of the process * The energy transfer between the system and surroundings | |
| Explanation:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |

**Attachment 2.** (continued) **Data Sheet A**

**Molecular Model** [**System Diagram**](http://www.chm.davidson.edu/vce/calorimetry/index.html) Compounds:

|  |  |
| --- | --- |
| Before | After |
| Model features should include:   * The chemical reaction, the system and the surroundings under study * The bonds that are broken during the course of the process * The bonds that are formed during the course of the process * The energy transfer between the system and surroundings | |
| Explanation:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |

**Attachment 3. Data Sheet B**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 100mL of 100 °C water | + | 100mL of 50 °C water | = | Predicted Final Temperature | Trial 1  Actual Final Temperature | Trial 2  Actual Final Temperature | Trial 3  Actual Final Temperature |

**Describe** your reasoning for your predicted final temperature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Stating **evidence** from your investigation, explain how the data support or do not support the prediction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Attachment 3.**(continued) **Data Sheet B**

|  |
| --- |
| Initial System Diagram        Compound Calorimeter |
| Description |

|  |
| --- |
| Final System Diagram |
| Description |

**Attachment 4. Data Sheet C**

**Data Table C-1**

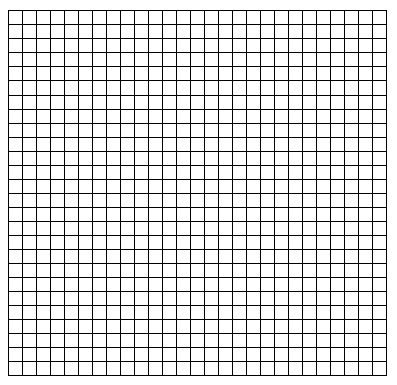
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Compounds** | **Mass of Compound (g)** | **Initial**  **Temperature** | **Final**  **Temperature** | **∆Temperature** | **∆T/mass of Compound (g)** |
| **Trial 1** |  |  |  |  |  |
| **Trial 2** |  |  |  |  |  |
| **Trial 3** |  |  |  |  |  |

**Data Table C-2**

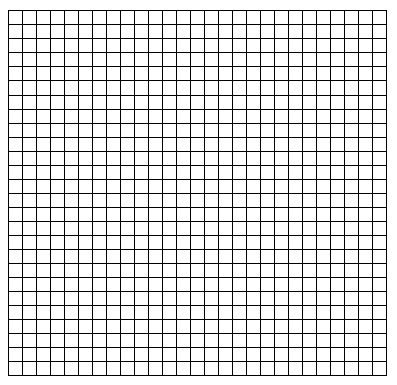
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Compounds** | **Mass of Compound (g)** | **Initial**  **Temperature** | **Final**  **Temperature** | **∆Temperature** | **∆T/mass of compound (g)** |
| **Trial 1** |  |  |  |  |  |
| **Trial 2** |  |  |  |  |  |
| **Trial 3** |  |  |  |  |  |

**Attachment 4.** (continued) **Data Sheet C**

**C-1 Graph**

****

**C-2 Graph**



**Attachment 5. Reference Sheet E: Student Version**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Molar Mass  (g/mol) | H (Kj/mol) | 3 g | 5 g | 10 g |
| Magnesium Sulfate  MgSO4 | 120.366 | -87.4 | .0249 mol  q= - 2.18Kj  Calc. T=5.05 0C | .0415 mol  q= - 3.63 Kj  Calc. T= 7.880C | .0831 mol  q= - 7.26 Kj  Calc. T=15.80C |
| Ammonium Nitrate  NH4NO3 | 80.052 | 25.69 | .0375 mol  q= .963  Calc.T -2.230C | .0625 mol  q= 1.61  Calc.T=-3.660C | .125 mol  q= 3.2  Calc. T=-6.950C |
| Calcium chloride anhydrous  CaCl2 | 110.98 | -70.2 | .0270 mol  q= - 1.90 Kj  CalcT= 4.390C | .0451 mol  q= - 3.17Kj  CalcT= 7.210C | .0901 mol  q= - 6.33Kj  CalcT= 13.70C |
| Lithium chloride  LiCl | 42.394 | -37.0 | .0708 mol  q= - 2.618Kj  Calc. T= 6.070C | .118 mol  q= - 4.37Kj  Calc. T= 9.940C | .236 mol  q= - 8.73 Kj  Calc. T= 19.00C |
| sodium acetate  NaC2H3O2 | 82.0343 | -17.4 | .0366 mol  q= - .637Kj  Calc. T=1.480C | .0610 mol  q= - 1.06Kj  Calc. T=2.410C | .122 mol  q= - 2.12Kj  Calc. T=4.600C |
| sodium chloride  NaCl | 58.44 | +3.87 | .0513 mol  q= .199Kj  Calc. T= -.4600C | .0856 mol  q= .331Kj  Calc. T=-.7530C | .171 mol  q= .662Kj  Calc. T= -1.440C |
| Sodium carbonate | 105.9885 | -29.0 | .0283 mol  q = -.821Kj  Calc. T= 1.900C | .0471 mol  q= -1.37Kj  Calc. T=3.110C | .0946 mol  q= -2.74Kj  Calc. T=5.960C |
| magnesium + 3M hydrochloric acid | 24.305 | -440 | .123 mol  q= - 54.3Kj  Calc. T=100+0C | .206 mol  q= - 90.5Kj  Calc. T=100+0C | .411 mol  q= - 181Kj  Calc. T=100+0C |
| magnesium oxide + 3M hydrochloric acid | 40.3044 | -151 | .0744 mol  q= - 11.72Kj  Calc. T=26.10C | .124 mol  q= - 18.7Kj  Calc. T=42.60C | .248 mol  q= - 37.4Kj  Calc. T=65.60C |
|  | Molar Mass  (g/mol) | H (Kj/mol) | 0.5 g | 1 g | 2 g |
| magnesium + 3M hydrochloric acid | 24.305 | -440 | .026 mol  q= - 9.5Kj  Calc. T=21.40C | .0411 mol  q= - 18.1Kj  Calc. T=42.80C | .0822 mol  q= - 36.2Kj  Calc. T=85.60C |
| magnesium oxide + 3M hydrochloric acid | 40.3044 | -151 | .0124 mol  q= - 1.87Kj  Calc. T=4.430C | .0248 mol  q= - 3.74Kj  Calc. T= 8.860C | .0496 mol  q= - 7.48Kj  Calc. T=17.50C |

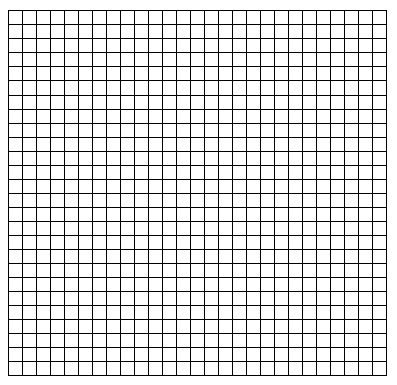
**Attachment 6. Reference Sheet E: Teacher Version**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Molar Mass (g/mol) | H (Kj/mol) | 3 g | 5 g | 10 g |
| Magnesium Sulfate  MgSO4 | 120.366 | -87.4 | .0249 mol  q= - 2.18Kj  Calc. T=5.050C  Exp. T= 5.780C | .0415 mol  q= - 3.63 Kj  Calc. T= 7.880C  Exp. T= 9.80C | .0831 mol  q= - 7.26 Kj  Calc. T=15.80C  Exp. T= 15.430C | |
| Ammonium Nitrate  NH4NO3 | 80.052 | 25.69 | .0375 mol  q= .963  Calc.T -2.230C  Exp. T= -2.30C | .0625 mol  q= 1.61  Calc.T=-3.660C  Exp.T=-3.70C | .125 mol  q= 3.2  Calc. T=-6.950C  Exp. T= -6.60C | |
| Calcium chloride anhydrous  CaCl2 | 110.98 | -70.2 | .0270 mol  q= - 1.90 Kj  CalcT= 4.390C  Exp. T=3.670C | .0451 mol  q= - 3.17Kj  CalcT= 7.210C  Exp. T=6.50C | .0901 mol  q= - 6.33Kj  CalcT= 13.70C  Exp. T=12.670C | |
| Lithium chloride  LiCl | 42.394 | -37.0 | .0708 mol  q= - 2.618Kj  Calc. T= 6.070C  Exp. T=5.70C | .118 mol  q= - 4.37Kj  Calc. T= 9.940C  Exp. T=8.940C | .236 mol  q= - 8.73 Kj  Calc. T= 19.00C  Exp. T=21.70C | |
| sodium acetate  NaC2H3O2 | 82.0343 | -17.4 | .0366 mol  q= - .637Kj  Calc. T=1.480C  Exp. T=1.440C | .0610 mol  q= - 1.06Kj  Calc. T=2.410C  Exp. T=2.70C | .122 mol  q= - 2.12Kj  Calc. T=4.600C  Exp. T=4.30C | |
| sodium chloride  NaCl | 58.44 | +3.87 | .0513 mol  q= .199Kj  Calc. T= -.460C  Exp. T=-.610C | .0856 mol  q= .331Kj  Calc. T=-.7530C  Exp. T=-.940C | .171 mol  q= .662Kj  Calc. T= -1.440C  Exp. T=-1.440C | |
| Sodium carbonate | 105.9885 | -29.0 | .0283 mol  q = -.821Kj  Calc. T= 1.90C  Exp. T=1.60C | .0471 mol  q= -1.37Kj  Calc. T=3.110C  Exp. T=2.980C | .0946 mol  q= -2.74Kj  Calc. T=5.960C  Exp. T=5.830C | |
| magnesium + 3M hydrochloric acid | 24.305 | -440 | .123 mol  q= - 54.3Kj  Calc. T=100+0C  5g & above Mg +HCl | .206 mol  q= - 90.5Kj  Calc. T=100+0C  Generates excessive heat | .411 mol  q= - 181Kj  Calc. T=100+0C  Do not attempt these are Dangerous | |
|  | Molar Mass (g/mol) | H (Kj/mol) | 3 g | 5 g | 10 g |
| magnesium oxide + 3M hydrochloric acid | 40.3044 | -151 | .0744 mol  q= - 11.72Kj  Calc. T=26.10C  Exp. T=26.10C | .124 mol  q= - 18.7Kj  Calc. T=42.60C  Exp. T=41.90C | .248 mol  q= - 37.4Kj  Calc. T=65.60C  Exp. T=63.30C | |
|  | Molar Mass (g/mol) | H (Kj/mol) | 0.5 g | 1 g | 2 g |
| magnesium + 3M hydrochloric acid | 24.305 | -440 | .026 mol  q= - 9.5Kj  Calc. T=21.40C  Exp. T=20.90C | .0411 mol  q= - 18.1Kj  Calc. T=42.80C  Exp. T=39.90C | .0822 mol  q= - 36.2Kj  Calc. T=85.60C  Exp. T=82.30C | |
| magnesium oxide + 3M hydrochloric acid | 40.3044 | -151 | .0124 mol  q= - 1.87Kj  Calc. T=4.430C  Exp. T=4.60C | .0248 mol  q= - 3.74Kj  Calc. T= 8.860C  Exp. T=9.10C | .0496 mol  q= - 7.48Kj  Calc. T=17.50C  Exp. T=18.10C | |

**Attachment 7. Data Sheet E**

**Compound**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Amount | Theoretical Change  (from Reference Sheet E) |  | Amount | Experimental Change |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |



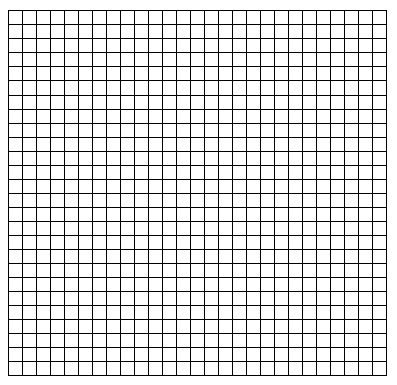
Equation for line of best fit of theoretical change

Equation for line of best fit of experimental change

**Attachment 7.** (continued)**Data Sheet E**

**Compound**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Amount | Theoretical Change  (from Reference Sheet E) |  | Amount | Experimental Change |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |



Equation for line of best fit of theoretical change

Equation for line of best fit of experimental change

Summary Page

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_