Student's Name _____ Date _____ Class _____

## Student Sheet: Self-Assessment

**Directions:** Use the space provided to prepare a KWL chart. In the first column, write things you already know about matter. In the second column, write things you want to know. Leave the last column blank. You will fill in things you learned at the end of the unit.

| K | W | L |
|---|---|---|
| **What I Know** | **What I Want to Know** | **What I Learned** |
| | | |

## Student Sheet 1.R: Ideas About Matter Investigations (1 of 4)

**Directions:** You have a few minutes to discuss your ideas about each investigation with your group. Record at least one of the following: an observation; a possible cause-and-effect relationship; or an explanation for why something happened. When you finish, wait for instructions from your teacher before discussing the next investigation.

Students' Names _____ Date _____ Class _____

| **Table 1.1. Describing Matter** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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Students' Names _____ Date _____ Class _____

| **Table 1.2. The Bottle and the Balloon** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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## Student Sheet 1.R: Ideas About Matter Investigations (2 of 4)

Students' Names _____ Date _____ Class _____

| **Table 1.3. The Burning Candle** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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Students' Names _____ Date _____ Class _____

| **Table 1.4. Comparing Three Mixtures** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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## Student Sheet 1.R: Ideas About Matter Investigations (3 of 4)

Students' Names _____ Date _____ Class _____

| **Table 1.5. Dissolving a Tablet** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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Students' Names _____ Date _____ Class _____

| **Table 1.6. Beads in a Bottle** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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## Student Sheet 1.R: Ideas About Matter Investigations (4 of 4)

Students' Names _____ Date _____ Class _____

| **Table 1.7. Floating and Sinking** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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Students' Names _____ Date _____ Class _____

| **Table 1.8. Filtering a Mixture** |
|---|
| Observation: |
| Cause-and-Effect Relationship: |
| Explanation: |

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Student's Name _____ Date _____ Class _____

## Student Sheet 2.4: Using Properties to Identify a Mystery Substance

| | Baking Soda | Baking Powder | Borax | Citric Acid | Cornstarch |
|---|---|---|---|---|---|
| **Appearance** | | | | | |
| **Water** | | | | | |
| **Vinegar** | | | | | |
| **Iodine** | | | | | |
| **Indicator Paper** | | | | | |

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Student's Name _____ Date _____ Class _____

## Student Sheet 3.1: Measuring the Mass, Volume, and Density of Liquids

**Directions:** Use the table below to record data during your investigation.

**Table 1.**

| Volume of Water (mL) | Mass of Graduated Cylinder (g) | Mass of Graduated Cylinder and Water (g) | Mass of Water (g) | Volume of Water (mL) | Density of 1 mL of Water (density in g/mL) |
|---|---|---|---|---|---|
| 00.0 | | | 0.0 | 0.0 | –– |
| 25.0 | | | | | |
| 50.0 | | | | | |

**Directions:** Use the grid below to create a graph of the relationship between mass and volume of water.

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Student's Name _____ Date _____ Class _____

## Student Sheet 3.2: Comparing the Densities of Different Substances

**Directions:** Use the table below to record data during your investigation.

**Table 1.**

| Substance | Length, $l$ (cm) | Width, $w$ (cm) | Height, $h$ (cm) | Volume $V = l \times w \times h$ ($cm^3$) | Mass, $m$ (g) | Density $d = m \div V$ ($g/cm^3$) |
|---|---|---|---|---|---|---|
| **Aluminum** | | | | | | |
| **Transparent Plastic** | | | | | | |
| **Wax** | | | | | | |
| **White Plastic** | | | | | | |

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Student's Name _____ Date _____ Class _____

## Student Sheet 3.4: Building a Density Column

| Table 1. Calculating Density | | | | |
|---|---|---|---|---|
| **Liquid** | **Mass (g)** | **Volume ($cm^3$)** | **Calculation** | **Density ($g/cm^3$)** |
| **Corn Syrup** | | | | |
| **Isopropyl Alcohol** | | | | |
| **Vegetable Oil** | | | | |
| **Water** | | | | |

| Table 2. Calculating Density | | | | |
|---|---|---|---|---|
| **Irregular Object** | **Mass (g)** | **Volume ($cm^3$)** | **Calculation** | **Density ($g/cm^3$)** |
| **Copper Shot** | | | | |
| **Nylon Spacer** | | | | |
| **Steel Bolt** | | | | |

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Student's Name _____ Date _____ Class _____

## Student Sheet 3.5: Building a Density Bottle

| Table 1. Calculating Density | | | |
|---|---|---|---|
| **Liquid** | **Density ($g/cm^3$)** | **Green Bead (Float or Sink)** | **UV Bead (Float or Sink)** |
| **Corn Syrup** | | | |
| **Isopropyl Alcohol** | | | |
| **Salt Brine** | | | |
| **Vegetable Oil** | | | |
| **Vinegar** | | | |
| **Water** | | | |

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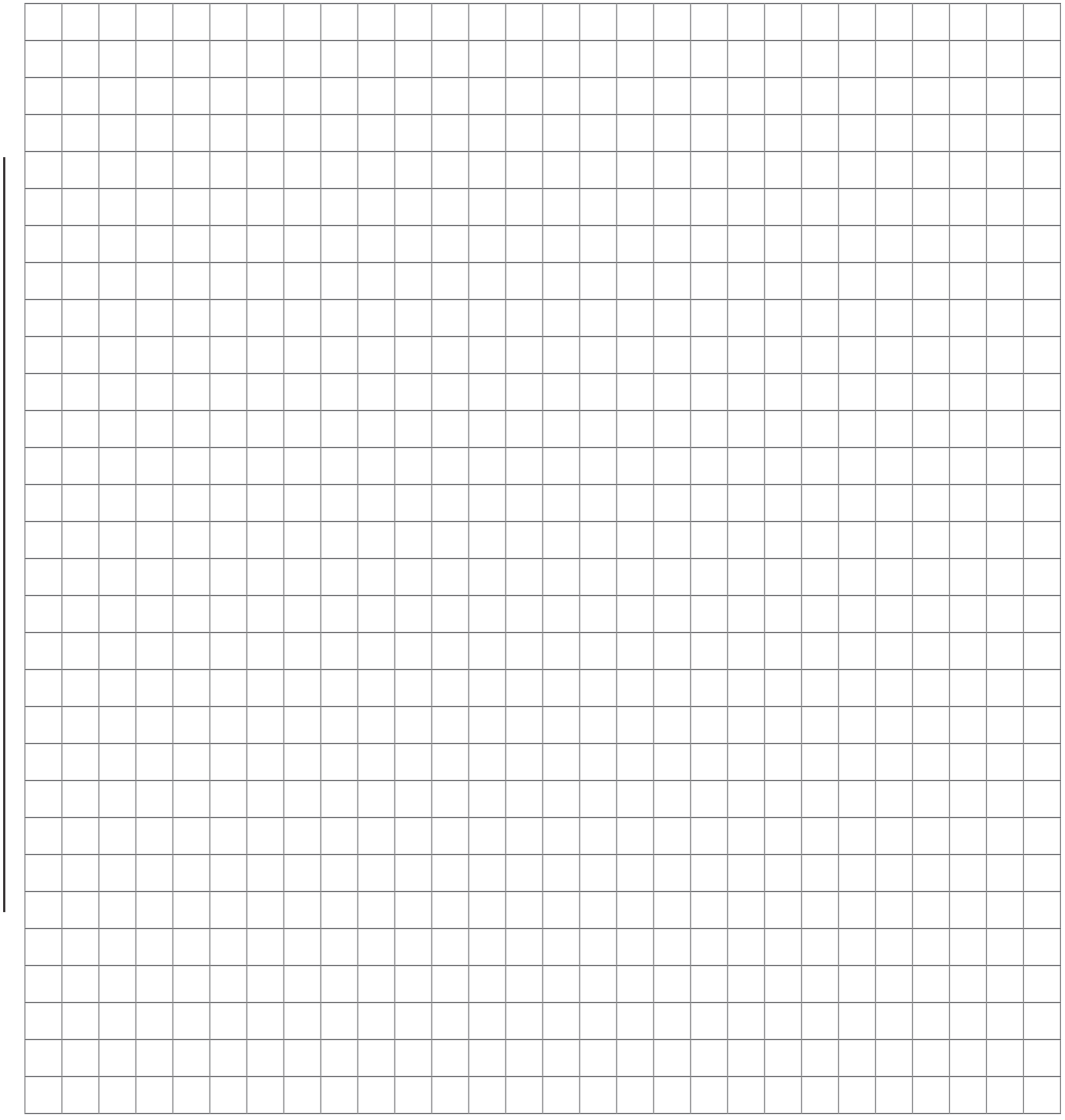
Student's Name _____ Date _____ Class _____

## Student Sheet 4.1: Heating Ice Water

**Directions:** Use the grid below to create a graph of the relationship between the variables you investigated.



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Student's Name _____ Date _____ Class _____

## Student Sheet 4.2: Investigating Mass and Melting

**Directions:** Use the table below to record class data during your investigation.

**Table 1.**

| Pair | Mass of Ice and Bottle (g) | Mass of Water and Bottle (g) | Change in Mass (+, 0, or –) |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |

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Student's Name _____ Date _____ Class _____

## Student Sheet 4.3: States of Matter

**Directions:** Use the table below to draw diagrams and record data during your investigation.

| **Table 1.** | | | |
|---|---|---|---|
| **Particle Diagram** | **Solid** | **Liquid** | **Gas** |
| **Neon** | _____ °C | _____ °C | _____ °C |
| **Argon** | _____ °C | _____ °C | _____ °C |
| **Oxygen** | _____ °C | _____ °C | _____ °C |
| **Water** | _____ °C | _____ °C | _____ °C |
| **Observations** | | | |

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Student's Name _____ Date _____ Class _____

## Student Sheet 5.1: Examining and Grouping Elements (1 of 6)

| **Table 1. Element Descriptions** | | | |
|---|---|---|---|
| **Figure or Card Number** | **Figure 5.1** | **Card 1** | **Card 2** |
| **Name of Element (Symbol)** | Helium (He) | | |
| **State of Matter (at room temperature)** | | | |
| **Appearance** | | | |
| **Other Physical Properties** | | | |
| **Known Chemical Properties** | | | |
| **Additional Information** | | | |

Student's Name _____ Date _____ Class _____

## Student Sheet 5.1: Examining and Grouping Elements (2 of 6)

| Table 1. Element Descriptions | | | |
|---|---|---|---|
| **Figure or Card Number** | **Card 3** | **Card 4** | **Card 5** |
| **Name of Element (Symbol)** | | | |
| **State of Matter (at room temperature)** | | | |
| **Appearance** | | | |
| **Other Physical Properties** | | | |
| **Known Chemical Properties** | | | |
| **Additional Information** | | | |

Student's Name _____ Date _____ Class _____

## Student Sheet 5.1: Examining and Grouping Elements (3 of 6)

| Table 1. Element Descriptions | | | |
|---|---|---|---|
| **Figure or Card Number** | **Card 6** | **Card 7** | **Card 8** |
| **Name of Element (Symbol)** | | | |
| **State of Matter (at room temperature)** | | | |
| **Appearance** | | | |
| **Other Physical Properties** | | | |
| **Known Chemical Properties** | | | |
| **Additional Information** | | | |

Student's Name _____ Date _____ Class _____

## Student Sheet 5.1: Examining and Grouping Elements (4 of 6)

| Table 1. Element Descriptions | | | |
|---|---|---|---|
| **Figure or Card Number** | **Card 9** | **Card 10** | **Card 11** |
| **Name of Element (Symbol)** | | | |
| **State of Matter (at room temperature)** | | | |
| **Appearance** | | | |
| **Other Physical Properties** | | | |
| **Known Chemical Properties** | | | |
| **Additional Information** | | | |

Student's Name _____ Date _____ Class _____

## Student Sheet 5.1: Examining and Grouping Elements (5 of 6)

| Table 1. Element Descriptions | | | |
|---|---|---|---|
| **Figure or Card Number** | **Card 12** | **Card 13** | **Card 14** |
| **Name of Element (Symbol)** | | | |
| **State of Matter (at room temperature)** | | | |
| **Appearance** | | | |
| **Other Physical Properties** | | | |
| **Known Chemical Properties** | | | |
| **Additional Information** | | | |

Student's Name _____ Date _____ Class _____

## Student Sheet 5.1: Examining and Grouping Elements (6 of 6)

| Table 1. Element Descriptions | | |
|---|---|---|
| **Figure or Card Number** | **Card 15** | **Card 16** |
| **Name of Element (Symbol)** | | |
| **State of Matter (at room temperature)** | | |
| **Appearance** | | |
| **Other Physical Properties** | | |
| **Known Chemical Properties** | | |
| **Additional Information** | | |

Student's Name _____ Date _____ Class _____

## Student Sheet 5.2: Making Molecular Models

**Directions:** Use the table below to sketch the molecules of elements you build during your investigation.

| **Table 1.** | |
|---|---|
| Nitrogen ($N_2$) | Chlorine ($Cl_2$) |
| Hydrogen ($H_2$) | Iodine ($I_2$) |
| Oxygen ($O_2$) | Bromine ($Br_2$) |

**Directions:** Use the table below to sketch the molecules of compounds you build during your investigation.

| **Table 2.** | |
|---|---|
| Water ($H_2O$) | Ammonia ($NH_3$) |
| Carbon dioxide ($CO_2$) | Methane ($CH_4$) |
| Silicon dioxide ($SiO_2$) | Hydrogen sulfide ($H_2S$) |

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Student's Name _____ Date _____ Class _____

## Student Sheet 5.3: Build a Molecule (1 of 6)

**Directions:** Use the table below to record data about Collection 1 during your investigation.

**Table 1. Collection 1**

| Substance | Formula | Element(s) | Symbol | Number of Atoms |
|---|---|---|---|---|
| Water | $H_2O$ | Hydrogen | | |
| | | Oxygen | | |
| Oxygen | $O_2$ | Oxygen | | |
| | | | | |
| Hydrogen | $H_2$ | Hydrogen | | |
| | | | | |
| Carbon Dioxide | $CO_2$ | Carbon | | |
| | | Oxygen | | |
| Nitrogen | $N_2$ | Nitrogen | | |
| | | | | |

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Student's Name _____ Date _____ Class _____

## Student Sheet 5.3: Build a Molecule (2 of 6)

**Directions:** Use the table below to record data about Collection 2 during your investigation.

| Table 2. Collection 2 | | | | |
|---|---|---|---|---|
| **Substance** | **Formula** | **Element(s)** | **Symbol** | **Number of Atoms** |
| | | | | |
| | | | | |
| | | | | |
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Student's Name _____ Date _____ Class _____

## Student Sheet 5.3: Build a Molecule (3 of 6)

**Directions:** Use the table below to record data about Collection 3 during your investigation.

| Table 3. Collection 3 | | | | |
|---|---|---|---|---|
| **Substance** | **Formula** | **Element(s)** | **Symbol** | **Number of Atoms** |
| | | | | |
| | | | | |
| | | | | |
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Student's Name _____ Date _____ Class _____

## Student Sheet 5.3: Build a Molecule (4 of 6)

**Directions:** Use the table below to record data about Collection 4 during your investigation.

| Table 4. Collection 4 | | | | |
|---|---|---|---|---|
| **Substance** | **Formula** | **Element(s)** | **Symbol** | **Number of Atoms** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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## Student Sheet 5.3: Build a Molecule (5 of 6)

**Directions:** Use the table below to record data about Collection 5 during your investigation.

| Table 5. Collection 5 | | | | |
|---|---|---|---|---|
| **Substance** | **Formula** | **Element(s)** | **Symbol** | **Number of Atoms** |
| | | | | |
| | | | | |
| | | | | |
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Student's Name _____ Date _____ Class _____

## Student Sheet 5.3: Build a Molecule (6 of 6)

**Directions:** Use the table below to record data about Larger Molecules during your investigation.

**Table 6. Larger Molecules**

| Substance | Formula | Element(s) | Symbol | Number of Atoms |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

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# Periodic Table

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | H | | | | | | | | | | | | | | | | | He |
| 2 | Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| 3 | Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| 4 | K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| 5 | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| 6 | Cs | Ba | La-Lu | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| 7 | Fr | Ra | Ar-Lr | Rf | Db | Sg | Bh | Hs | Mt | Ds | Rg | Cn | Nh | Fl | Mc | Lv | Ts | Og |
| 6 | | | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | |
| 7 | | | Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | |

Student's Name _____ Date _____ Class _____

## Student Sheet 6.4: Separating a Mixture by Distillation

**Directions:** Use the table below to record data during your investigation.

**Table 1**. Comparing Liquids Before and After Distillation

| | Liquid Before Distillation | Liquid After Distillation (Small Beaker) | Liquid After Distillation (Large Beaker) |
|---|---|---|---|
| Observations | | | |
| Conductivity | | | |
| Indicator Paper | | | |

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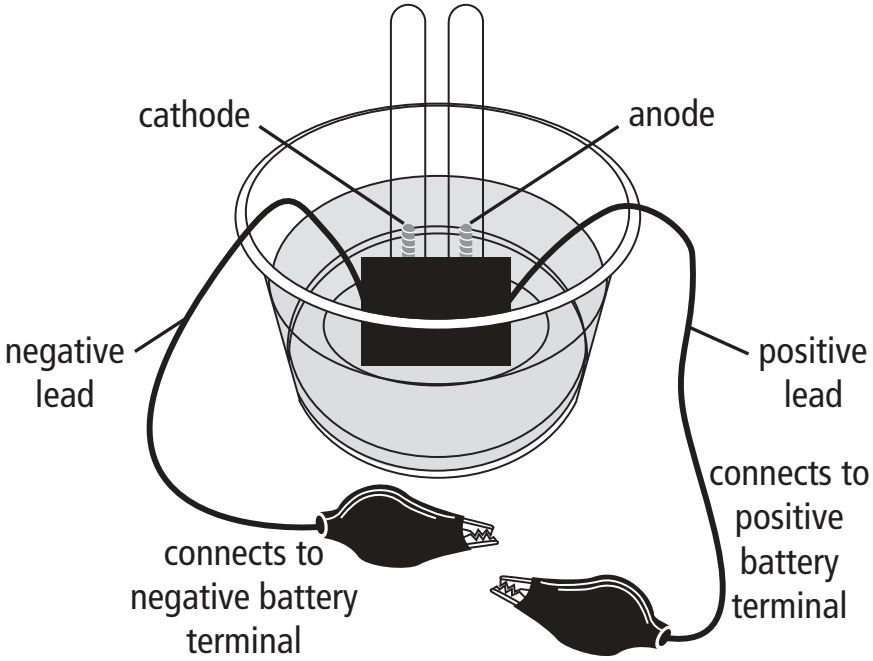
Student's Name _____ Date _____ Class _____

## Student Sheet 7.1: Electrolysis of Water

**1.** Add a line to each test tube in the diagram, showing the amount of substance in the tubes.




**2.** Use the table below to record data during your investigation.

| **Table 1. Burning Splint and Glowing Splint Tests** | | |
|---|---|---|
| | **Gas Collected from the Negative Electrode** | **Gas Collected from the Positive Electrode** |
| **Test with a burning splint** | Tube 1 | Tube 2 |
| **Test with a glowing splint** | Tube 3 | Tube 4 |

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Student's Name _____ Date _____ Class _____

## Student Sheet 7.2: Formation of a Precipitate

**Directions:** Use the table below to record data during your investigation.

**Table 1. Observing the Formation of a Precipitate**

| Test Tubes and Contents | Observations | New Substance? | Chemical Reaction? |
|---|---|---|---|
| **Tube A** copper(II) sulfate + magnesium sulfate | | | |
| **Tube B** copper(II) sulfate + sodium carbonate | | | |
| **Tube C** magnesium sulfate + sodium carbonate | | | |

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Student's Name _____ Date _____ Class _____

## Student Sheet 8.1: Measuring Thermal Energy Release

Use the grid below to create a graph of the relationship between the variables you investigated.

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Student's Name _____ Date _____ Class _____

## Student Sheet 11.PA: Making a Cold Pack

Use the grid below to graph the data you collected.

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Student's Name _____ Date _____ Class _____

## Student Sheet 11.WA: *Matter and Its Interactions* Written Assessment Answer Sheet (page 1 of 3)

### Multiple Choice

**Directions:** Circle the letter of your answer choice, and then clearly explain your reason for choosing it.

**1. A B C D**

_____

_____

_____

_____

**2. A B C D**

_____

_____

_____

_____

**3. A B C D**

_____

_____

_____

**4. A B C D**

_____

_____

_____

_____

**5. A B C D**

_____

_____

_____

_____

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Student's Name _____ Date _____ Class _____

## Student Sheet 11.WA: *Matter and Its Interactions* Written Assessment Answer Sheet (page 2 of 3)

### Constructed Response

**6. (a)** _____

_____

_____

_____

_____

_____

**(b)** _____

_____

_____

_____

_____

_____

_____

**(c)** _____

_____

_____

_____

_____

_____

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Student's Name _____ Date _____ Class _____

## Student Sheet 11.WA: *Matter and Its Interactions* Written Assessment Answer Sheet (page 3 of 3)

**7.** _____

_____

_____

_____

_____

_____

**8.** _____

_____

_____

_____

_____

_____

**9.** _____

_____

_____

_____

_____

_____

**10.** _____

_____

_____

_____

_____

_____

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## Lesson Master 2.4: Testing Known Substances

| | Baking Soda | Baking Powder | Borax | Citric Acid | Cornstarch |
|---|---|---|---|---|---|
| **Vinegar** | **Place Tray Here** | | | | |
| **Iodine** | | | | | |
| **Water** | | | | | |
| **Indicator Paper** | | | | | |

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## Lesson Master 3.1: Suggestions for Making a Graph of the Relationship Between Mass and Volume of Water

1. Give the graph a title that describes the data being displayed.
2. Cover as much space on the graph as possible with plotted data.
3. Label the horizontal x axis "Mass (g)" and label the vertical y axis "Volume (mL)."
4. Set the scale for each axis with even divisions, letting the highest measured value in the data fit on the axis.
5. Make sure all spaces on the x and y axis scales are equal, even if they are not marked in the same intervals.
6. Make scaling of the axes start from zero at the intersection of the axes (called the origin) and increase in value, moving right on the x axis and upward on the y axis.
7. Plot the location of each data point on the graph with a small dot.
8. Instead of connecting each data point, use the overall spread of points to construct a line. Follow the trend in data, or the general direction of your data points to draw a line. Notice that some or all of the plotted points may not fall on the line.

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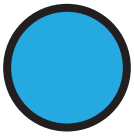
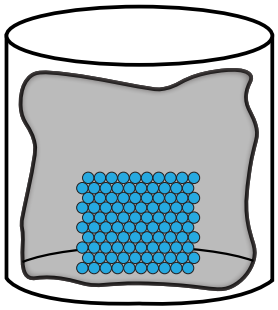
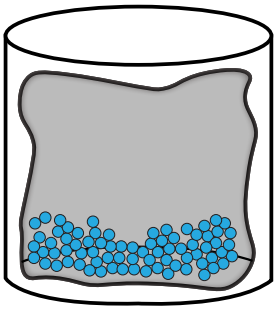
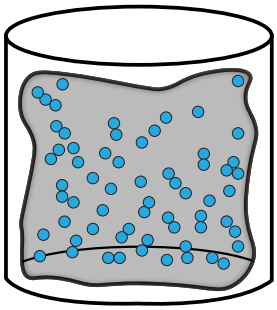
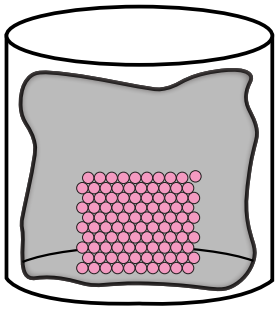
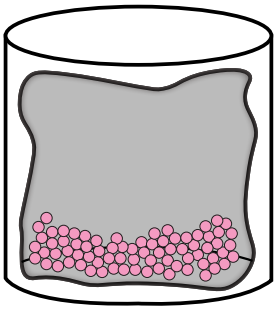
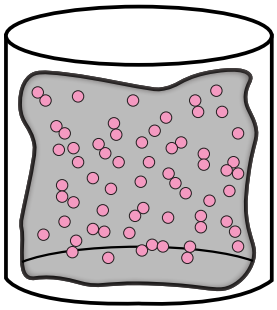
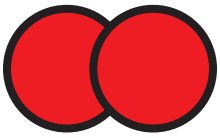
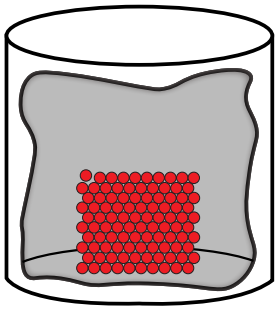
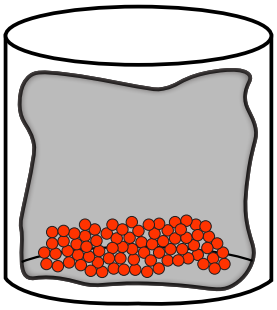
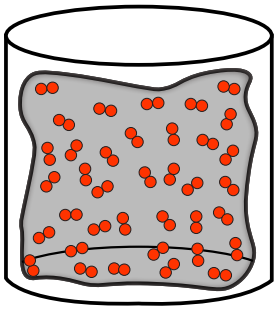
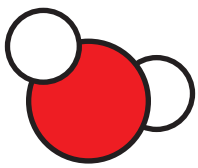
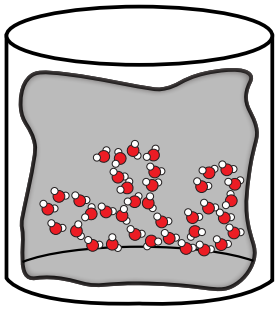
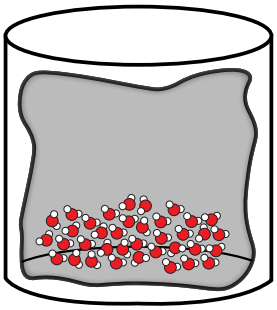
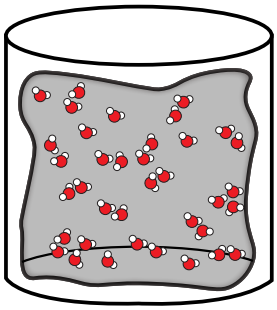
## Lesson Master 4.3: States of Matter Sample Student Data

**Directions:** Use the table below to draw diagrams and record data during your investigation.

**Table 1.**

| Particle Diagram | Solid | Liquid | Gas |
|---|---|---|---|
| **Neon**  | –260 °C  | –247 °C  | –218 °C  |
| **Argon**  | –230 °C  | –187 °C  | –84 °C  |
| **Oxygen**  | –242 °C  | –204 °C  | –79 °C  |
| **Water**  | –116 °C  | 55 °C  | 536 °C  |

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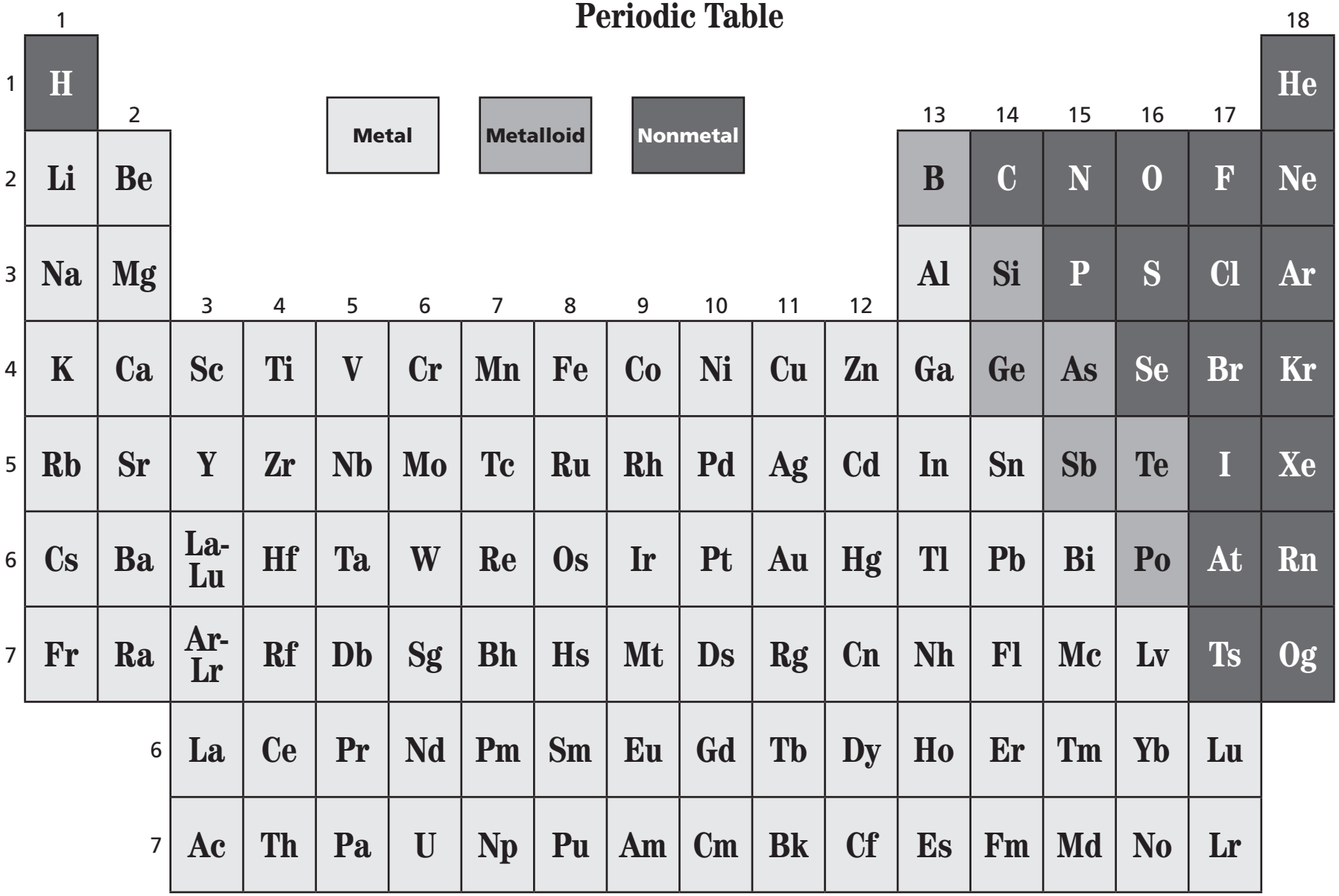
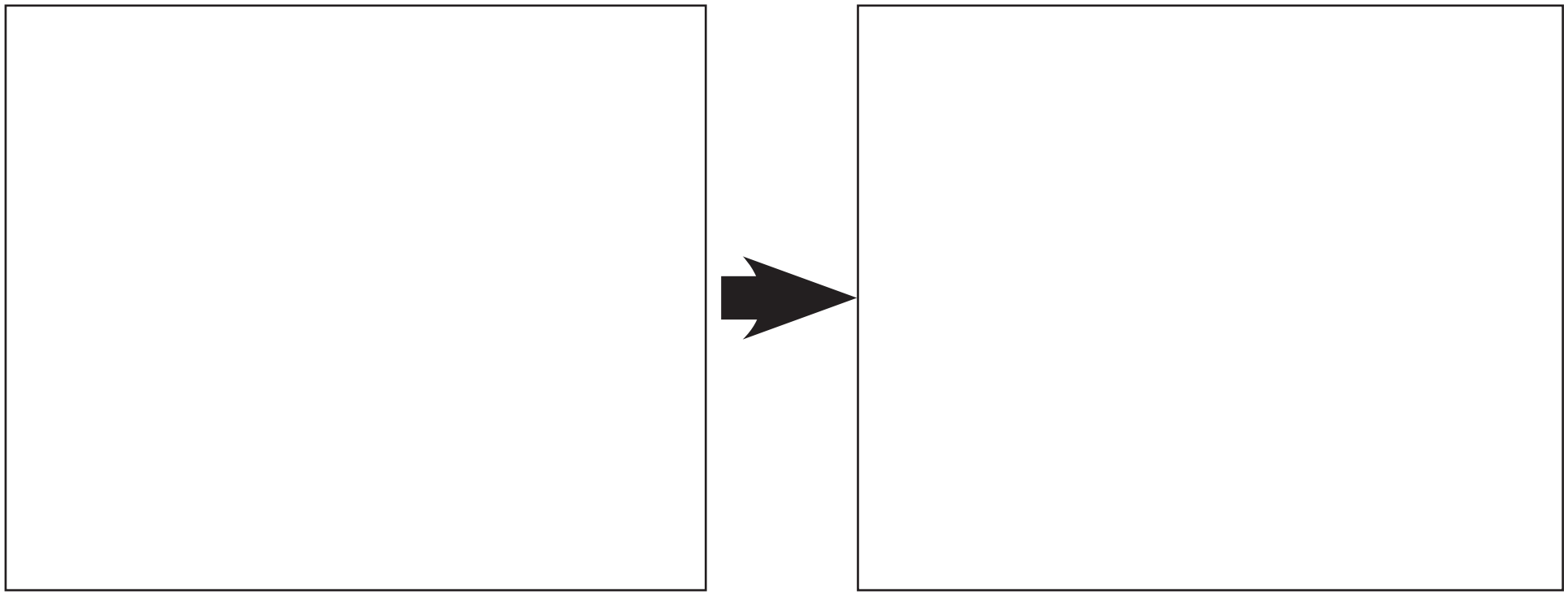

Periodic Table
Metal
Metalloid
Nonmetal
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
1 H He
2 Li Be B C N O F Ne
3 Na Mg Al Si P S Cl Ar
4 K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
5 Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
6 Cs Ba La-Lu Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
7 Fr Ra Ar-Lr Rf Db Sg Bh Hs Mt Ds Rg Cn Nh Fl Mc Lv Ts Og
6 La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
7 Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr

## Lesson Master 7.1: Electrolysis of Water



**Before Electrolysis** **After Electrolysis**

## Lesson Master 8.2a: Design Challenge Scoring Rubric

| Hot Pack Design | | | | |
|---|---|---|---|---|
| **Criterion** | **1. Beginning** | **2. Developing** | **3. Proficient** | **4. Exemplary** |
| **Design for the Outer Bag** | Group designed an outer bag without a warning label. | Group designed an outer bag with a warning label, but it does not describe relevant concerns. | Group designed an outer bag with a warning label that accurately includes a potential hazard, ecological concern, or storage instruction. | Group designed an outer bag with a warning label that accurately includes potential hazards, ecological concerns, and storage instructions. |
| **Temperature Reduction** | Group designed a hot pack with contents that reached a temperature between 20°C and 30°C or over 55°C. | Group designed a hot pack with contents that reached a temperature between 30°C and 40°C. | Group designed a hot pack with contents that reached a temperature between 40°C and 50°C. | Group designed a hot pack with contents that reached a temperature between 50°C and 55°C. |
| **Cost** | Group designed a hot pack with an amount of solid chemical that costs less than $1.00. | Group designed a hot pack with an amount of solid chemical that costs less than $0.70. | Group designed a hot pack with an amount of solid chemical that costs less than $0.50. | Group designed a hot pack with an amount of solid chemical that costs less than $0.25. |

| Grading Rubric | | | | |
|---|---|---|---|---|
| **Criterion** | **1. Beginning** | **2. Developing** | **3. Proficient** | **4. Exemplary** |
| **Written Instructions and Schematics** | Group did not present written instructions or schematics pertaining to the design challenge. | Group presented either written instructions or schematics that were unclear or incomplete but pertained to the design challenge. | Group presented either written instructions or schematics that were clear and pertained to the design challenge. | Group presented written instructions and schematics that were clear, detailed, and pertained to the design challenge. |
| **Design Implementation** | Group constructed a design that did not pertain to the design challenge. | Group constructed a design that somewhat pertained to the design challenge. | Group constructed a design that met the criteria of the design challenge. | Group constructed a design that exceeded the criteria of the design challenge. |
| **Testing and Data Collection** | Group did not test their design. | Group did not use appropriate procedures to test their design and did not collect relevant data. | Group used appropriate procedures to test their design but did not collect relevant data. | Group used appropriate procedures to test their design and collected relevant data. |
| **Reflection and Presentation** | Group presented methods and results in an incomplete and unclear manner and did not reflect on choices. | Group presented methods or results in an unclear manner or did not reflect on choices based on scientific principles. | Group presented methods or results adequately. Group reflected on choices based on scientific principles most of the time. | Group presented methods or results clearly and accurately. Group always reflected on choices based on scientific principles. |

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## Lesson Master 8.2b: Chemical Information Cards

| | |
|---|---|
| **Chemical Name** | Calcium chloride |
| **Chemical Formula** | $CaCl_2$ |
| **Synonyms** | (Intentionally blank) |
| **Melting Point** | 772°C |
| **Boiling Point** | 1935°C |
| **Density** | 2.2 g/cm$^3$ |
| **Appearance** | Colorless to pale yellow solid |
| **Solubility in Water** | 74.5 g in 100 mL |
| **Chemical Properties** | Stable under normal conditions. |
| **Hazards** | Harmful if swallowed; causes serious eye irritation. |
| **Transport** | Not regulated for ground or air transport. |
| **Handling** | Wash thoroughly after handling. Do not eat, drink, or smoke when using this compound. Wear protective gloves/protective clothing/eye protection/face protection. Keep away from oxidizing compounds and strong acids. Avoid contact with skin and eyes. After contact with skin, immediately take off all contaminated clothing and wash immediately with plenty of water. |
| **Ecological Concerns** | Slight ecological hazard. In high concentrations, this compound may be dangerous to plants and/or wildlife. |
| **Storage** | Keep container tightly closed in a cool, well-ventilated place. Store in a dry area. Compound is hygroscopic (absorbs moisture). |
| **Cost** | $0.0141 per g |

| | |
|---|---|
| **Chemical Name** | Magnesium sulfate |
| **Chemical Formula** | $MgSO_4$ |
| **Synonyms** | Magnesium sulphate |
| **Melting Point** | (Intentionally blank) |
| **Boiling Point** | (Intentionally blank) |
| **Density** | 2.65 g/cm$^3$ |
| **Appearance** | White to off-white solid |
| **Solubility in Water** | 35.1 g in 100 mL |
| **Chemical Properties** | Stable under normal conditions. |
| **Hazards** | Not a dangerous substance according to GHS classification criteria; no known OSHA hazards. |
| **Transport** | Not regulated for ground or air transport. |
| **Handling** | Avoid creating and inhaling dust. |
| **Ecological Concerns** | This compound is not expected to be harmful to the ecology. |
| **Storage** | Keep container tightly closed in a cool, well-ventilated place. Store in a dry area. Compound is hygroscopic (absorbs moisture). |
| **Cost** | $0.0443 per g |

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# Periodic Table

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | H | | | | | | | | | | | | | | | | | He |
| 2 | Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| 3 | Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| 4 | K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| 5 | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| 6 | Cs | Ba | La-Lu | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| 7 | Fr | Ra | Ar-Lr | Rf | Db | Sg | Bh | Hs | Mt | Ds | Rg | Cn | Nh | Fl | Mc | Lv | Ts | Og |
| 6 | | | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | |
| 7 | | | Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | |

## Materials

For you

- 1 Science notebook
- Lesson Master 10.Rb: *Synthetic Compound Research Scoring Rubric*

For the class

- Access to resources about synthetic compounds
- Presentation materials

## Procedure

1. You have learned a lot about synthetic compounds. Your group will have an opportunity to gather additional information about your chosen compound and share your findings with your classmates. Your work will be evaluated using Lesson Master 10.Rb: *Synthetic Compound Research Scoring Rubric*. Discuss the rubric as a class, and ask any questions you may have during the discussion.

2. Use the rubric to identify the requirements for this assignment. Prepare a list of requirements in your science notebook.

3. Before you start your research, discuss the following questions with your class:
   - **a.** What is bias?
   - **b.** What types of resources are more likely to be biased?
   - **c.** Should biased resources be used in your research? Why or why not?
   - **d.** What printed or online sources would be considered reliable?
   - **e.** What is an example of a reliable resource?
   - **f.** How many reliable sources would constitute a good amount of research?
   - **g.** Why is it important to use multiple sources when researching?

4. Your teacher will explain how to cite the resources you use in this assignment. Ask questions about anything that is unclear to you.

## Part A: Conducting the Research

5. Begin conducting your research. You should use a variety of printed and online resources, including magazines, newspapers, books, videos, and reliable websites. Reliable websites could include government websites (e.g., .gov), educational institution websites (e.g., .edu), or organizations (e.g., .org). Use your judgment when using online sources. Make sure the website and information seem unbiased and are from a reputable source. Use a minimum of five resources. If you are not sure where to begin, ask your teacher or media specialist for help.

6. Record the information you learn during your research in your science notebook. As you record information, cite what resource it came from.

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## Part B: Presenting Research to the Class

**7.** Work with your group to outline a five-minute presentation about your chosen compound. As you work, be sure to address all of the requirements for this assignment (as described on the lesson master).

**8.** Decide which member of your group will be responsible for creating each part of the presentation. Next, record talking points to guide what each member of the group will say.

**9.** Pictures related to the compound you researched will enhance your presentation. You might make a computer-generated presentation or a poster or use a transparency. Develop any visual aids your group would like to incorporate into your presentation. Write captions for any images you use that explain what they are and where they came from.

**10.** Your teacher will provide an opportunity for your group to present your research and visual aids to the class. During your presentation, you may use notes if you need to, but be sure to speak clearly. Be sure all group members share in the delivery of the presentation and that you use your visual aid(s). Remember, you will have approximately five minutes to deliver your presentation.

**11.** After your presentation, your group will hand in the resources you cited and the visual materials you used.

**12.** As other groups give their presentations, make notes in your science notebook about things you find interesting about the synthetic compounds they describe.

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## Lesson Master 10.Rb: Synthetic Compound Research Scoring Rubric (page 1 of 2)

| | Beginning | Developing | Proficient | Exemplary |
|---|---|---|---|---|
| **Obtaining Information** | Student has not gathered information on a synthetic material that comes from a natural resource. | Student has partially gathered information on a synthetic material that comes from a natural resource. | Student has gathered information on a synthetic material that comes from a natural resource. | Student has thoroughly gathered information on a synthetic material that comes from a natural resource. |
| **Formation** | Student has not explained how the synthetic material is formed. | Student has partially explained how the synthetic material is formed. | Student has explained how the synthetic material is formed, describing either the natural resources or chemical processes used. | Student has thoroughly explained how the synthetic material is formed, including both the natural resources and chemical processes used. |
| **Properties** | Student has not described the properties of the synthetic material that make it different from the natural resource(s) from which it was derived. | Student has partially described the properties of the synthetic material that make it different from the natural resource(s) from which it was derived. | Student has described the properties of the synthetic material that make it different from the natural resource(s) from which it was derived. | Student has thoroughly described the properties of the synthetic material that make it different from the natural resource(s) from which it was derived. |
| **Function** | Student has not explained how the physical and chemical properties of the synthetic material contribute to the function of the synthetic material. | Student has partially explained how the physical and chemical properties of the synthetic material contribute to the function of the synthetic material. | Student has explained how the physical and chemical properties of the synthetic material contribute to the function of the synthetic material. | Student has thoroughly explained how the physical and chemical properties of the synthetic material contribute to the function of the synthetic material. |
| **Societal Need** | Student has not explained how the synthetic material satisfies a social need or desire. | Student has partially explained how the synthetic material satisfies a social need or desire. | Student has explained how the synthetic material satisfies a social need or desire through either its structure or function. | Student has thoroughly explained how the synthetic material satisfies a social need or desire through both its structure and function. |
| **Effects** | Student has not explained the effects of making and using the synthetic material. | Student has partially explained the effects of making and using the synthetic material. | Student has explained the effects of making and using the synthetic material (related to natural resources or society). | Student has thoroughly explained the effects of making and using the synthetic material (related to both natural resources and society). |

*continued*

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## Lesson Master 10.Rb: Synthetic Compound Research Scoring Rubric (page 2 of 2)

| | Beginning | Developing | Proficient | Exemplary |
|---|---|---|---|---|
| **Sources** | Student has not used three or more sources of information for investigating their technology. | Student has used three or more sources of information for investigating their technology, but they are not credible. | Student has used three or more sources of information for investigating their technology, but only some are credible.<br>OR<br>Student has used fewer than three resources and all resources were credible. | Student has used three or more credible sources of information for investigating their technology. |
| **Presentation** | Presentation was not informative. | Presentation was disorganized but informative. | Presentation was fairly organized and informative. | Presentation was well organized and informative. |
| **Visual Aids** | There were no visual aids, or visual aids were not relevant. | Visual aids were relevant for the presentation of information. | Visual aids were relevant and partially effective for the presentation of information. | Visual aids were relevant and effective for the presentation of information. |

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## Lesson Master 11.PAa: Design Challenge Scoring Rubrics (page 1 of 2)

| Cold Pack Design | | | | |
|---|---|---|---|---|
| **Criterion** | **1. Beginning** | **2. Developing** | **3. Proficient** | **4. Exemplary** |
| **Design for the Outer Bag** | Group designed an outer bag without a warning label. | Group designed an outer bag with a warning label, but it does not describe relevant concerns. | Group designed an outer bag with a warning label that accurately includes a potential hazard, ecological concern, or storage instruction. | Group designed an outer bag with a warning label that accurately includes potential hazards, ecological concerns, and storage instructions. |
| **Temperature Reduction** | Group designed a cold pack with contents that reached a temperature less than 20°C. | Group designed a cold pack with contents that reached a temperature less than 15°C. | Group designed a cold pack with contents that reached a temperature less than 10°C. | Group designed a cold pack with contents that reached a temperature between 5°C and 0°C. |
| **Cost** | Group designed a cold pack with an amount of solid chemical that costs less than $1.00. | Group designed a cold pack with an amount of solid chemical that costs less than $0.70. | Group designed a cold pack with an amount of solid chemical that costs less than $0.50. | Group designed a cold pack with an amount of solid chemical that costs less than $0.25. |
| **Ecological Concerns** | Group designed a cold pack with a compound that is expected to be harmful to the ecology. | | | Group designed a cold pack with a compound that is not expected to be harmful to the ecology. |
| **Transportation Regulations** | Group designed a cold pack with a compound that is regulated for transport by ground or air. | | | Group designed a cold pack with a compound that is not regulated for transport by ground or air. |

*continued*

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| Grading Rubric | | | | |
|---|---|---|---|---|
| **Criterion** | **1. Beginning** | **2. Developing** | **3. Proficient** | **4. Exemplary** |
| **Written Instructions and Schematics** | Group did not present written instructions or schematics pertaining to the design challenge. | Group presented either written instructions or schematics that were unclear or incomplete but pertained to the design challenge. | Group presented either written instructions or schematics that were clear and pertained to the design challenge. | Group presented written instructions and schematics that were clear, detailed, and pertained to the design challenge. |
| **Design Implementation** | Group constructed a design that did not pertain to the design challenge. | Group constructed a design that somewhat pertained to the design challenge. | Group constructed a design that met the criteria of the design challenge. | Group constructed a design that exceeded the criteria of the design challenge. |
| **Testing and Data Collection** | Group did not test their design. | Group did not use appropriate procedures to test their design and did not collect relevant data. | Group used appropriate procedures to test their design but did not collect relevant data. | Group used appropriate procedures to test their design and collected relevant data. |
| **Reflection and Presentation** | Group presented methods and results in an incomplete and unclear manner and did not reflect on choices. | Group presented methods or results in an unclear manner or did not reflect on choices based on scientific principles. | Group presented methods or results adequately. Group reflected on choices based on scientific principles most of the time. | Group presented methods or results clearly and accurately. Group always reflected on choices based on scientific principles. |

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## Lesson Master 11.PAb: Chemical Information Cards (page 1 of 3)

| | |
|---|---|
| **Chemical Name** | Ammonium chloride |
| **Chemical Formula** | $NH_4Cl$ |
| **Synonyms** | Sal ammoniac |
| **Melting Point** | 338°C |
| **Boiling Point** | 520°C |
| **Density** | 1.53 g/cm$^3$ |
| **Appearance** | White crystalline solid |
| **Solubility in Water** | 38.3 g in 100 mL |
| **Chemical Properties** | Stable under normal conditions. |
| **Hazards** | Harmful if swallowed. Causes serious eye irritation. Toxic to aquatic life. |
| **Transport** | Regulated for ground transport. Not regulated for air transport. |
| **Handling** | Wash thoroughly after handling. Do not eat, or drink when using this compound. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. Avoid contact with compound. Avoid creating and inhaling dust. After contact with skin, wash immediately with plenty of water. |
| **Ecological Concerns** | Severe ecological hazard. This compound may be toxic to plants and/or wildlife. |
| **Storage** | Keep container tightly closed in a cool, well-ventilated place. Store in a dry area. Compound is hygroscopic (absorbs moisture). |
| **Cost** | $0.0153 per g |

| | |
|---|---|
| **Chemical Name** | Potassium chloride |
| **Chemical Formula** | KCl |
| **Synonyms** | Potassium muriate; Chloride of potash |
| **Melting Point** | 771°C |
| **Boiling Point** | 1413°C |
| **Density** | 1.98 g/cm$^3$ |
| **Appearance** | White crystalline solid |
| **Solubility in Water** | 34.4 g in 100 mL |
| **Chemical Properties** | Not generally reactive under normal conditions. Stable under normal conditions. |
| **Hazards** | Causes eye irritation. Harmful to aquatic life. |
| **Transport** | Not regulated for ground or air transport. |
| **Handling** | Wash thoroughly after handling. Avoid release to the environment. |
| **Ecological Concerns** | Moderate ecological hazard. This compound may be dangerous to plants and/or wildlife. |
| **Storage** | Keep container tightly closed in a cool, well-ventilated place. |
| **Cost** | $0.0205 per g |

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| | |
|---|---|
| **Chemical Name** | Sodium bicarbonate |
| **Chemical Formula** | $NaHCO_3$ |
| **Synonyms** | Baking soda; Sodium hydrogen carbonate; Sodium acid carbonate; Carbonic acid |
| **Melting Point** | 50°C |
| **Boiling Point** | (Intentionally blank) |
| **Density** | 2.20 g/cm$^3$ |
| **Appearance** | White powder |
| **Solubility in Water** | 9.6 g in 100 mL |
| **Chemical Properties** | Not generally reactive under normal conditions. Stable under normal conditions. |
| **Hazards** | Not a dangerous substance according to GHS classification criteria. No known OSHA hazards. |
| **Transport** | Not regulated for ground or air transport. |
| **Handling** | Avoid creating and inhaling dust. |
| **Ecological Concerns** | This compound is not expected to be harmful to the ecology. |
| **Storage** | Keep container tightly closed in a cool, well-ventilated place. |
| **Cost** | $0.0157 per g |

| | |
|---|---|
| **Chemical Name** | Sodium chloride |
| **Chemical Formula** | NaCl |
| **Synonyms** | Table salt; Common salt; Halite; Rock salt |
| **Melting Point** | 801°C |
| **Boiling Point** | 1461°C |
| **Density** | 2.16 g/cm$^3$ |
| **Appearance** | Colorless to white crystalline solid |
| **Solubility in Water** | 35.9 g in 100 mL |
| **Chemical Properties** | Not generally reactive under normal conditions. Stable under normal conditions. |
| **Hazards** | Not a dangerous substance according to GHS classification criteria. No known OSHA hazards. |
| **Transport** | Not regulated for ground or air transport. |
| **Handling** | Avoid creating and inhaling dust. |
| **Ecological Concerns** | This compound is not expected to be harmful to the ecology. |
| **Storage** | Keep container tightly closed in a cool, well-ventilated place. |
| **Cost** | $0.0136 per g |

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## Lesson Master 11.PAb: Chemical Information Cards (page 3 of 3)

| | |
|---|---|
| **Chemical Name** | Urea |
| **Chemical Formula** | $CO(NH_2)^2$ |
| **Synonyms** | Carbamide |
| **Melting Point** | 133°C |
| **Boiling Point** | (Intentionally blank) |
| **Density** | 1.32 $g/cm^3$ |
| **Appearance** | White crystalline solid |
| **Solubility in Water** | 107.9 g in 100 mL |
| **Chemical Properties** | Stable under normal conditions. |
| **Hazards** | May cause eye irritation. May cause gastrointestinal discomfort. May cause irritation to respiratory tract. May cause irritation to skin. |
| **Transport** | Not regulated for ground or air transport. |
| **Handling** | Readily absorbs moisture from air. |
| **Ecological Concerns** | This compound is not expected to be harmful to the ecology. |
| **Storage** | Keep container tightly closed in a cool, well-ventilated place. |
| **Cost** | $0.0167 per g |

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