

## Periodic Table Breakout

### Lesson Overview

In this culminating activity, students will utilize their chemistry knowledge of the Periodic Table, chemical bonds, and density to solve three problems and acquire three codes for digital locks in a breakout game. The students will be given a set of cards (attached). They must organize the cards into categories. The cards contain metals, nonmetals, and metalloids and are color coded. To solve the first lock code, they must sort them into their correct families. They must then find the two elements with the lowest atomic numbers that could create an ionic bond and use the resulting chemical formula for the second lock. The third lock requires a calculation to determine the density of an element. All lock codes are entered onto a Google Form within the Breakout Google Site (see link below). Answer key provided for teacher in the “elaborate” section below.

### SC Standards Addressed

**7.P.2A.2** Obtain and use information about elements to describe the organization of the Periodic Table.

**7.P.2A.4** Construct explanations for how compounds are classified as ionic or covalent using chemical formulas.

**7.P.2B.2** Use mathematical and computational thinking to describe the relationship between the mass, volume, and density of a given substance. (*Students use storyboards about finding density created in an earlier lesson, to find the density of an element.*)

### Disciplinary Literacy Strategies

Facts First Questioning (*adapted*)

### Computational Thinking

Tools:

Breakout (*Digital*)

Cornerstone(s) Addressed:

- **Decomposition:** Students will determine how to organize the cards into periodic table groups, that lead to the correct lock code. The cards contain a variety of elements--some metals, some nonmetals, some metalloids--and are color coded. Each card contains the atomic number and weight.
- **Pattern Recognition:** Students must recognize the pattern that is created by the cards to enter the correct lock code. For the first lock, they must have the elements grouped into their correct families. For the second lock, students must know the patterns that are found in covalent and ionic bonds. They will need a metal and a nonmetal to create an ionic bond. For the third lock, they must use the correct formula for density.
- **Abstraction:** Some information on the cards is not needed. Some cards are not needed. The colors of the cards are not relevant. Students must determine what information is important for each lock code.

### Lesson Plan

Time required: 45 minutes

Focus Question(s): How can the information in the Periodic Table be used to understand the properties of matter?

Disciplinary Vocabulary: atomic number, atomic weight, Periodic Table, family, metal, nonmetal, metalloid, ionic bond, covalent bond, mass, volume, density

**Materials needed:**

- Device with Internet access to the Digital Breakout site (see Resources)
- Set of element cards
- Calculator (optional)

**Engage** Before the unit begins, students will explore how chemistry impacts their everyday lives. They will research elements and find 10 different ways that elements are used in their daily lives. They will then build a 3-D model of a home/neighborhood with all the uses depicted.

**Explore** Students will be given an Alien Periodic Table template from Pearson Interactive Science and must organize it in a similar way to the Periodic Table of the Elements. They will learn that the table is intentionally organized into families and periods and that it increases in atomic number and weight.

**Explain** Students used a variety of sources to explain the content. This digital breakout is one of the culminating activities for a middle school chemistry unit. Students learned about the Periodic Table, bonding, and density, through guided notes, online labs & simulations (<https://phet.colorado.edu/>), hands-on labs, and using storyboards (used to describe their process for finding density).

**Elaborate** Students are grouped in pairs or trios to complete the Mini-Chemistry Breakout game (see the link in Resources). Students must find the unlock codes for three digital locks on the Google form within the Mini-Chemistry Breakout Google site. They are given a time limit of 30 minutes. They are also given element cards (see attached) that match the diagram on the Google site. Also, on the Google site is an interactive periodic table should they need assistance.

*Included below are the locks, should you wish to make a physical breakout:*

**Lock 1:** Students must correctly sort the element cards into three groups. There are several ways to do this, but the correct way is to sort them by the family number. They must then determine how to use the smallest family to find the code to the number lock. The code is all of the atomic numbers in order from lowest to highest. ANSWER: 715335183115

**Lock 2:** The students must find the two elements with the lowest atomic numbers that could create an ionic bond. To do this, they must understand that they need a metal and a nonmetal. The lowest nonmetal available is H, and the lowest metal available is Li. They must then correctly input the chemical formula of the compound it would create. ANSWER: LiH

**Lock 3:** Students are given the following density problem: Find the density of antimony. The mass is 122 g. A graduated cylinder is filled with 10 mL and when antimony is added, it increases to 28.25 mL. They must remember to calculate the volume by subtracting volume of the graduated cylinder without the object from the volume with the object, which would be 18.25 mL. They can then use the  $D=m/v$  formula to find the code (will need to round to nearest thousandths place). ANSWER: 6.685

**Evaluate** Groups who do not successfully complete the breakout game will be paired with groups who did, and they will follow an adapted facts-first-questioning strategy (see *Disciplinary Literacy Strategies*).

Adaptation: Students question each other about the process they used, i.e. successful groups explain what worked for them and unsuccessful groups ask questions (*if your students are not practiced in this type of peer discussion you may want to prepare the questions in advance*). At the end of strategy have students provide feedback about the breakout game, making suggestions for improvements or things that can be added for groups in the future.

**Assessment Notes:** This is a formative assessment strategy that can be used to identify areas where students are struggling. It is also a great tool for teachers to use to help students strengthen their problem-solving skills and explore different options when a solution is not working. (*For increased rigor remove the link to the Interactive Periodic Table.*)

**Resources**

Periodic Table Breakout Google Sites Page:

<https://sites.google.com/view/periodictablebreakoutkb/home>

SCETV/PBS Interactive Periodic Table:

<https://scetv.pbslearningmedia.org/resource/phy03.sci.phys.matter.ptable/periodic-table-of-the-elements/#.XUnlauhJFRY>

Element Sorting Cards: *Attached*

**Teacher Biographical Information**

Lesson Author: *Include teaching experience, qualifications and certifications.*

- Kelly Bearden
- B. S. Marine Biology
- M.A.T. Elementary Education
- Certification: Elementary Education, Middle School Science
  - 17 years teaching middle school science
  - 12 years teaching 7th grade science
  - 5 years teaching 6th grade science

Element Sorting Cards (PDF file)

7 <b>N</b> 14.01	15 <b>P</b> 30.97	33 <b>As</b> 74.92	51 <b>Sb</b> 121.76	83 <b>Bi</b> 208.98
115 <b>Mc</b> (290)	1 <b>H</b> 1.01	3 <b>Li</b> 6.94	11 <b>Na</b> 22.99	
37 <b>Rb</b> 85.47	55 <b>Cs</b> 132.91	87 <b>Fr</b> (223)	19 <b>K</b> 39.10	