



**Reading Supports**

**Teacher’s Guide:**

**“The Periodic Table Turns 150: Is the Best Yet to Come?”**

*February/March 2019*

<http://www.acs.org/chemmatters>



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# Reading Supports

The pages that follow include reading supports in the form of an Anticipation Guide, a Graphic Organizer, and Student Reading Comprehension Questions. These resources are designed to help students prepare to read the article and then locate and analyze information from the article.

* **Anticipation Guide (p. 5):** The Anticipation Guide helps to engage students by activating prior knowledge and stimulating student interest before reading. If class time permits, discuss students’ responses to each statement before reading each article. As they read, students should look for evidence supporting or refuting their initial responses.

**Or** consider the following ideas to engage your students in reading:

**The Periodic Table Turns 150: Is the Best Yet to Come?**

* Before reading, ask students why the Periodic Table is organized the way it is.
* As they read, students can find information to confirm or refute their original ideas.
* **Graphic Organizer (p. 6):** The Graphic Organizer is provided to help students locate and analyze information from the article. Student understanding will be enhanced when they explore and evaluate the information themselves, with input from the teacher, if students are struggling. Encourage students to use their own words and avoid copying entire sentences from the article. The use of bullets helps them do this.

If you use the aforementioned organizers to evaluate student performance, you may want to develop a grading rubric such as the one below.

|  |  |  |
| --- | --- | --- |
| **Score** | **Description** | **Evidence** |
| 4 | Excellent | Complete; details provided; demonstrates deep understanding. |
| 3 | Good | Complete; few details provided; demonstrates some understanding. |
| 2 | Fair | Incomplete; few details provided; some misconceptions evident. |
| 1 | Poor | Very incomplete; no details provided; many misconceptions evident. |
| 0 | Not acceptable | So incomplete that no judgment can be made about student understanding |

* **Student Reading Comprehension Questions (p. 7):** The Student Reading Comprehension Questions are designed to encourage students to read the article (and graphics) for comprehension and attention to detail, to provide the teacher with a mechanism for assessing how well students understand the article and/or whether they have read the assignment, and, possibly, to help direct follow-up, in-class discussion, or additional, deeper assignments.

Some of the articles in this issue provide opportunities, references, and suggestions for students to do further research on their own about topics that interest them.

To help students engage with the text, ask students which article **engaged** them most and why, or what **questions** they still have about the articles. The “Web Resources for More Information” section of the Teacher’s Guide: Tools and Resources provides sources for additional information that might help you answer these questions.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Anticipation Guide

**Directions: *Before reading the article*,** in the first column, write “A” or “D,” indicating your agreement or disagreement with each statement. As you read, compare your opinions with information from the article. In the space under each statement, cite information from the article that supports or refutes your original ideas.

|  |  |  |
| --- | --- | --- |
| **Me** | **Text** | **Statement** |
|  |  | 1. Mendeleev was the first person to categorize elements based on their physical and chemical characteristics. |
|  |  | 1. At the time when Mendeleev published his periodic table, there were 92 known elements. |
|  |  | 1. Mendeleev knew about protons. |
|  |  | 1. Mendeleev predicted the existence of elements that had not yet been discovered, along with their properties. |
|  |  | 1. Organizing the periodic table according to atomic number validated Mendeleev’s approach. |
|  |  | 1. Hydrogen is found at the top of Group 1 because it is a metal. |
|  |  | 1. Mendeleev put the lanthanides and actinides below the main part of the periodic table. |
|  |  | 1. Period 7 in the periodic table is complete. |
|  |  | 1. The periodic table keeps changing. |
|  |  | 1. Nobel laureate Glenn Seaborg hypothesized the existence of a superactinide series of stable elements. |

## Graphic Organizer

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: As you read the article, complete the graphic organizer below to summarize what you learned about the periodic table from your reading.

|  |  |  |
| --- | --- | --- |
| 3 | **New things you learned about the periodic table** |  |
| 2 | **Ideas from the article that will help you in chemistry class** |  |
| 1 | **Question you have about the periodic table** |  |
| Contact! | **How do you think the periodic table might change in your lifetime, and why do you think so?** |  |

## Student Reading Comprehension Questions

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: Use the article to answer the questions below.

* 1. What was Dmitri Mendeleev’s dream that reportedly was the start of his periodic table?
  2. What is periodicity?
  3. How did (a) Antoine Lavoisier, (b) Johann Döbereiner, and (c) John Newlands attempt to organize the elements?
  4. (a) What is a hydride, and (b) how did Mendeleev use hydrides in developing his table?
  5. (a) What was Mendeleev’s most insightful decision in organizing his early periodic table, and (b) why?
  6. What revision to Mendeleev’s original periodic table did he make in 1871?

**Student Reading Comprehension Questions, cont.**

* 1. How did Henry Moseley change the periodic table in 1913 to its modern form?
  2. Why is the placement of hydrogen on the periodic table a debate for some scientists?
  3. Although the elements in the lanthanide and actinide series sit below the main table, where do they really belong?
  4. Explain (a) Seaborg’s “island of stability” concept, and (b) how it involves the nucleus of the atom.

**Critical-Thinking Questions**

***Write your answers on another piece of paper, if needed.***

* 1. Compare electron energy levels and nuclear rings, both physically and chemically.
  2. Use the Internet to research other periodic table arrangements and select one; then explain why you chose it and discuss its advantages and disadvantages over the commonly-used table.

## Answers to Reading Comprehension Questions

1. **What was Dmitri Mendeleev’s dream that reportedly was the start of his periodic table?**

Dmitri Mendeleev was reported to have had a dream where the chemical elements lined up in their order of increasing atomic mass, and a pattern emerged.

1. **What is periodicity?**

Periodicity is a repetition of behavior (in this case, chemical properties) at regular intervals.

1. **How did (a) Antoine Lavoisier, (b) Johann Döbereiner, and (c) John Newlands attempt to organize the elements?**

a. Lavoisier categorized the elements into metals, non-metals, earths, and gases based on their characteristics.

b. Döbereiner noticed some patterns among triplets of elements.

c. Newlands noticed chemical periodicity and compared the phenomenon to musical octaves where repeats occurred in groups of eight.

1. **(a) What is a hydride, and (b) how did Mendeleev use hydrides in developing his table?**

a. A hydride is a compound of hydrogen with another element.

b. Mendeleev studied the chemical formulas of different hydrides and noticed a pattern that helped him develop his table.

1. **(a) What was Mendeleev’s most insightful decision in organizing his early periodic table, and (b) why was it so important?**

Mendeleev’s insightful decision in organizing his periodic table was to let properties trump atomic weight when placing the elements.

This process allowed Mendeleev to skip slots in his table where the elements’ properties did not match known elements and to predict undiscovered elements.

1. **What revision to Mendeleev’s original periodic table did he make in 1871?**

In 1871, Mendeleev reversed his original arrangement so that the new table lined up elements with similar properties vertically, and periods were in horizontal rows so that the table looks similar the one today.

1. **How did Henry Moseley change the periodic table in 1913 to its modern form?**

In 1913, Henry Moseley developed the first modern periodic table by basing the element sequence on atomic number (number of protons) rather than on atomic mass.

1. **Why is the placement of hydrogen on the periodic table a debate for some scientists?**

Hydrogen’s placement is debatable because, in some ways, its chemical behavior is like group 17 (7A) elements, yet in other ways, it is like group 1 elements.

1. **Although the lanthanide and actinide series elements sit below the main table, where do they really belong?**

The lanthanide and actinide series elements really belong in the periodic table in periods 6 and 7, respectively, and between groups 2 and 3.

1. **Explain (a) Seaborg’s “island of stability” concept, and (b) how it involves the nucleus.**

a. Seaborg’s island of stability concept is when super-heavy elements become more stable and, therefore, have longer lives.

b. In the island of stability idea, the nucleus has rings composed of a particular number of protons and neutrons and that when full, the super-heavy element with filled nuclear rings would become stable for longer periods of time.

**Critical-Thinking Questions**

1. **Compare electron energy levels and nuclear rings, both physically and chemically**

Both electron energy levels and nuclear rings are ways to organize subatomic particles. For electron energy levels, the electrons fill in until the energy level is full, which produces chemical stability. For the nuclear rings, protons and neutrons are physically filled in until the ring is full, which produces nuclear stability.

1. **Use the Internet to research other periodic table arrangements and select one; then explain why you chose it and discuss its advantages and disadvantages over the commonly-used table.**

Student answers will vary depending upon which periodic table they select for comparison. Possible advantages might include that the selected table

1. is easier to comprehend,
2. has better continuity,
3. provides a better visualization of electron arrangements, and
4. includes the lanthanide and actinide elements into the main table.

Possible disadvantages might include that the selected table

1. has smaller print and is, therefore, harder to read because it includes the lanthanide and actinide elements in the main table,
2. is larger and more unwieldy because it includes the lanthanide and actinide elements in the main table,
3. has a less traditional format and is therefore unfamiliar and harder to understand, and
4. is less clear in showing relationships among periods or groups.