



Periodic Shuffle

Introduction to Periodicity and Electron Configuration



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Grade Level	9th – 12th Grade	Time Frame	2-3 class period(s)
Course	Chemistry, Physical Science	Duration	135 minutes

Essential Question

How do patterns allow for making predictions? How can the periodic table be used to make predictions about the properties of elements?

Summary

In this lesson, students will learn how to predict electron configuration and valence electrons by exploring patterns within the periodic table. Students will discover that elements are arranged in increasing order of their atomic number in the periodic table, and then the elements repeat their properties after a definite interval. As a prerequisite to this lesson, students should be able to read electron configurations.

Snapshot

Engage

Students predict missing portions of a ROYGBIV visual table.

Explore

Students investigate the electron configuration patterns of the periodic table.

Explain

Students color in a periodic table to reflect the patterns they found.

Extend

Students investigate the valence electrons patterns of the periodic table.

Evaluate

Students write a Word Splash about what they have learned.

Standards

ACT College and Career Readiness Standards - Science (6-12)

- IOD202:** Identify basic features of a table, graph, or diagram (e.g., units of measurement)
- IOD302:** Understand basic scientific terminology
- IOD304:** Determine how the values of variables change as the value of another variable changes in a simple data presentation
- IOD403:** Translate information into a table, graph, or diagram
- EMI201:** Find basic information in a model (conceptual)
- EMI301:** Identify implications in a model
- EMI603:** Use new information to make a prediction based on a model

Next Generation Science Standards (Grades 9, 10, 11, 12)

- HS-PS1-1:** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

Oklahoma Academic Standards (Physical Science)

- CH.PS1.1 :** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

Oklahoma Academic Standards (Physical Science)

- PS.PS2:** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- PS.PS1.1.1:** Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.
- PS.PS1.1.2:** The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.

Attachments

- [Electron Configuration Cards—Periodic Shuffle - Spanish.docx](#)
- [Electron Configuration Cards—Periodic Shuffle - Spanish.pdf](#)
- [Electron Configuration Cards—Periodic Shuffle.docx](#)
- [Electron Configuration Cards—Periodic Shuffle.pdf](#)
- [Explore—Periodic Shuffle - Spanish.docx](#)
- [Explore—Periodic Shuffle - Spanish.pdf](#)
- [Explore—Periodic Shuffle.docx](#)
- [Explore—Periodic Shuffle.pdf](#)
- [Lesson Slides—Periodic Shuffle.pptx](#)
- [Periodic Table—Periodic Shuffle - Spanish.docx](#)
- [Periodic Table—Periodic Shuffle - Spanish.pdf](#)
- [Periodic Table—Periodic Shuffle.docx](#)
- [Periodic Table—Periodic Shuffle.pdf](#)
- [Valence Electrons—Periodic Shuffle - Spanish.docx](#)
- [Valence Electrons—Periodic Shuffle - Spanish.pdf](#)
- [Valence Electrons—Periodic Shuffle.docx](#)
- [Valence Electrons—Periodic Shuffle.pdf](#)

Materials

- Lesson Slides (attached)
- Explore handout (attached; 1 per student)
- Electron Configuration Cards (attached; 1 card per group of three students)
- Valence Electrons handout (attached; 1 per student)

- Periodic Table handout (attached; 1 per student)
- Class periodic table (large enough that a sticky note should fit inside each square)
- Colored pencils or markers
- Sticky notes (1 stack per group of three students)

10 minutes

Engage

Use the attached **Lesson Slides** to guide the instruction. Display **slide 2** and provide an introduction to the lesson. Point out the word "periodicity," and share the following definition with students: *Periodicity is the repetition of something after a certain interval.* Consider asking students if they can think of some things that occur at regular intervals. Possible responses might include a full moon occurring about every 29 days, a year occurring every 365 days, or a day occurring every 24 hours. In chemistry, periodicity refers to the recurring trends that are seen in the properties of elements.

Teacher's Note

Consider reviewing electron configuration if it has been some time since students have used that information.

Share the essential questions with students on **slide 3**. Go to **slide 4** and go over the learning objectives. Go to **slide 5**, and give students a few minutes to consider how they would fill in the missing parts of the grid and why. Have some students share what they are thinking and how they came to that conclusion.

Teacher's Note

As students engage with the ROYGBIV table, they should begin constructing knowledge about how to identify and analyze patterns.

Go to **slide 6**. The correct answer is the image on the right. Point out the patterns.

The patterns in the ROYGBIV table are similar to the periodic table which will be explored throughout the lesson. The horizontal pattern in the ROYGBIV table is analogous to the electron configuration in the periodic table, while the vertical pattern is analogous to the valence electrons.

45 minutes

Explore

Lesson Preparation

Print out the attached **Electron Configuration Cards**. Cut out each card and prepare to distribute one card to each student group. Consider printing the cards on card stock or laminating them to reuse them for other classes.

Additionally, be sure to display a large periodic table in an easily accessible spot for students to interact with.

Go to **slide 7**. Put students into groups of about three, and pass out one of the attached **Explore** handouts to each student. Next, give each group one Electron Configuration Card and a pad of sticky notes.

Teacher's Note

If you have more than eight groups, make additional copies of the Electron Configuration Cards document, and assign the same cards to more than one group.

Have students work on the Explore handout, including having students putt sticky notes on the classroom-size periodic table.

15 minutes

Explain

Go to **slide 8**. Pass out one of the attached **Periodic Table** handouts to each student. Let students pick four colors of markers or colored pencils. Based on what they learned in the Explore activity, have the students color the s, p, d, and f blocks four unique colors in their handouts. Remind them to add a legend indicating which color represents which block.

Periodic Table of the Elements

s
p
d
f

1 IA 1A												13 IIIA 3A		14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A														
1 H Hydrogen 1.008												5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180															
3 Li Lithium 6.941	4 Be Beryllium 9.012											11 Na Sodium 22.990	12 Mg Magnesium 24.305												13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948		
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.972	35 Br Bromine 79.904	36 Kr Krypton 83.798															
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.757	52 Te Tellurium 127.6	53 I Iodine 126.905	54 Xe Xenon 131.29															
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.084	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.384	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium 209	85 At Astatine 210	86 Rn Radon 222.018															
87 Fr Francium 223.018	88 Ra Radium 226.025	89-103 Actinide Series	104 Rf Rutherfordium 261	105 Db Dubnium 262	106 Sg Seaborgium 263	107 Bh Bohrium 264	108 Hs Hassium 265	109 Mt Meitnerium 266	110 Ds Darmstadtium 267	111 Rg Roentgenium 268	112 Cn Copernicium 269	113 Uut Ununtrium 270	114 Fl Flerovium 271	115 Uup Ununpentium 272	116 Lv Livermorium 273	117 Uus Ununseptium 274	118 Uuo Ununoctium 276															
																		57 La Lanthanum 138.905	58 Ce Cerium 140.12	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.255	69 Tm Thulium 168.934	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.967
																		89 Ac Actinium 227.033	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.08	99 Es Einsteinium 252.083	100 Fm Fermium 257.095	101 Md Mendelevium 258.10	102 No Nobelium 259.108	103 Lr Lawrencium 260.105

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This is an example of what is meant about coloring in the periodic table using the orbital predictions of a guide based on what part of the periodic table corresponds to which orbital type.

30 minutes

Extend

Go to **slide 9**. Pass out one of the attached **Valence Electrons** handouts to each student. Have students return to their groups from the Explore activity and ask them to complete the handout. This time, students should work with their group to write the number of valence electrons they determined for each group on the sticky notes. Have students place their sticky notes over each group.

10 minutes

Evaluate

Go to **slide 10**. Have students participate in a [Word Splash](#) activity, using all of the words listed to write synthesis statements connecting all the words.

- Electron configuration
- Periodic table
- Valence electrons
- Electron orbitals
- s, p, d, and f orbitals

Sample Student Response

The periodic table predicts electron configuration and number of valence electrons and can be grouped by s, p, d, and f orbitals.

Resources

- K20 Center. (n.d.). Word splash. Strategies. <https://learn.k20center.ou.edu/strategy/199>