

Periodic Table Battleship

Grade Levels: 5-8

Duration: 50 min

Students identify elements of the periodic table by their atomic symbol and their position in the table in this fun activity based on the classic game of *Battleship*.

The periodic table shows the following elements marked with red 'X's: Na, Mg, Al, Ga, Ag, Cd, In, Sn, Pb, Bi, Po, At, Rn, Fr, Ra, and Pa. Battleship ships are placed on the table, with some labeled with element symbols: O (Oxygen), S (Sulfur), I (Iodine), and Br (Bromine). A compass rose is in the top left, and clouds are scattered in the background.

Outline

Frame the Activity	15 min total
Activate Prior Knowledge	10 min
Playing the Game	35 min total
Introduce the Rules of the game	5 min
Game Play	25 min
Debrief	5 min



Lab Connection:

Chemicals of Innovation

Grade Levels: 5-8

Duration: 50 min

Concepts/Skills

Atomic mass, atomic symbol, atomic number, elements, periodic table organization.

Objectives

Students will:

- Identify elements of the periodic table based on their atomic number and symbol.
- Define the difference between a period and group on the periodic table.



Periodic Table Battleship

Materials and Preparation

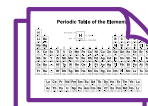
For the classroom:

- Tape or staplers
- Large periodic table poster or projected digital version.



Each student will need:

- 1 copy of [Rules for Periodic Table Battleship](#)
- 1 manilla folder
- 2 [Periodic Table Game Boards](#)



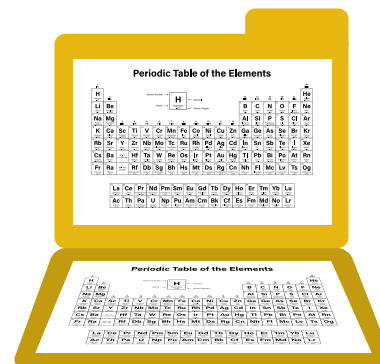
If planning to play the game more than once, we recommend laminating the worksheets prior to game assembly.

- 2 different colored markers



Preparation:

- Build the game boards for game play. If time permits, students can build their own boards in class or for homework.
 - Tape or staple one worksheet to the inside of each flap of the manilla folder. Both worksheets should be facing upright when the folder is open horizontally.



Background Information

Used across many science disciplines all around the world, the periodic table of elements is a graphical representation of all known chemical elements. Elements are arranged by increasing **atomic number**, or number of protons within the nucleus of one atom of each element.

Atomic Number →

1
H
Hydrogen
1.008

← Symbol

Name →

← Atomic Weight

In addition to being organized by atomic number, the periodic table is also organized into rows and columns. Rows on the periodic table are called **periods**. Elements in the same period have the same number of **atomic orbitals**. Columns on the periodic table are called **groups**. Elements in the same group have the same number of **valence electrons**.

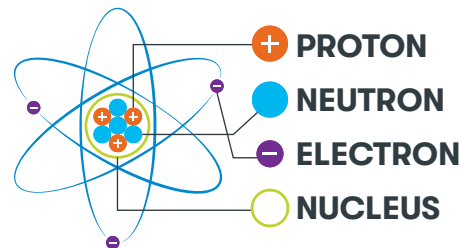
PERIOD **GROUP**

Periodic Table of the Elements

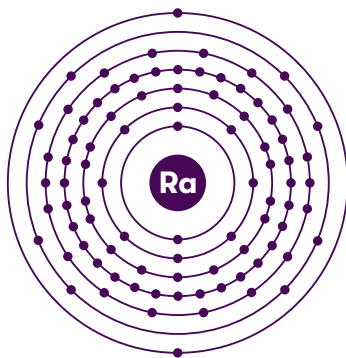
Atomic Orbitals

Each atom contains protons and neutrons, found in the nucleus of the atom. Surrounding the nucleus are electrons, which can be found within different energy levels or atomic orbitals.

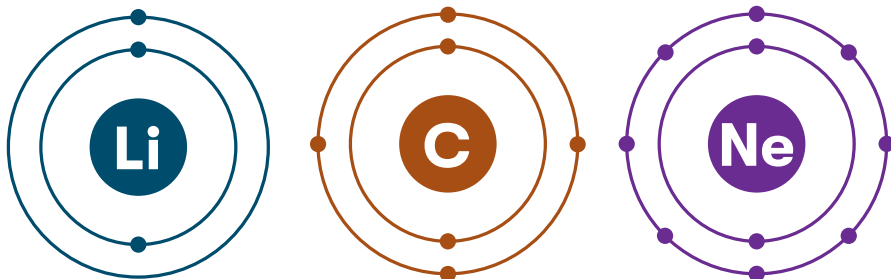
The number of atomic orbitals is dependent on the number of electrons in an atom. Each orbital can also only hold a certain number of electrons.



Orbital	Electron Capacity
1	2
2	8
3	18
4	32
5	50
6	72
7	98

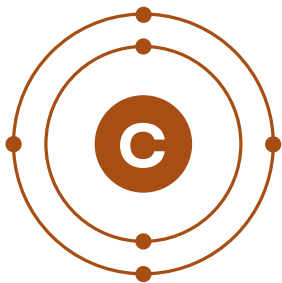


Periods: Elements in the same period or row all have the same number of atomic orbitals. The elements below are all in Period 2 as they all have two atomic orbitals.



Valence Electrons

For many atoms, their outermost orbital will not be completely full. When orbitals are left unfilled, the remaining electrons in the orbital are available to either share with or bond to other atoms. These remaining electrons are called valence electrons. Let's look at Carbon for example:

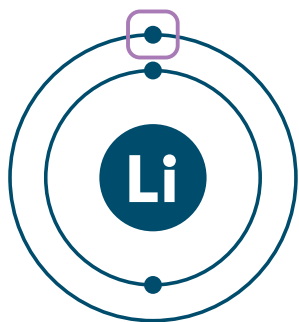


Carbon's atomic number is 6 — it has 6 protons in its nucleus and 6 electrons in the outer orbitals.

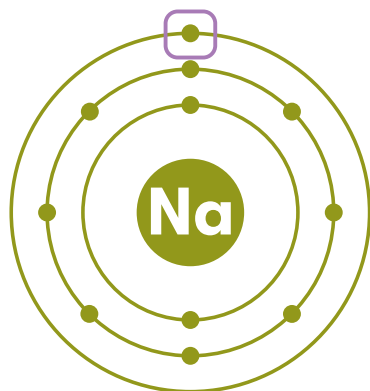
The first orbital holds 2 electrons.

The remaining 4 electrons are in the second orbital. These are the valence electrons and are available to bond with other atoms.

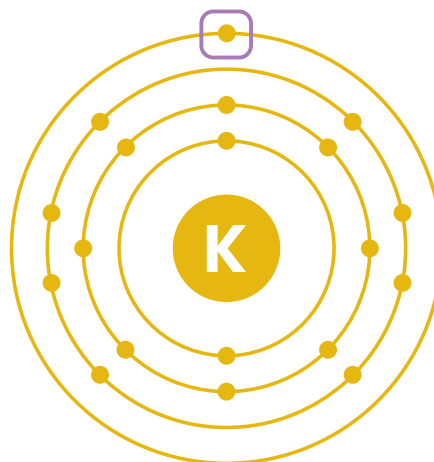
Groups: Elements in the same group or column have the same number of valence electrons. This gives elements in the same group similar chemical reactivity properties. The elements below are all in Group I as they each have one valence electron.



Lithium: Group I;
1 valence electron



Sodium: Group I;
1 valence electron



Potassium: Group I;
1 valence electron

Knowing how the periodic table is organized has been and continues to be essential to understanding how elements interact and react with one another and has even led to the discovery of previously unknown elements. In this lesson, students will become more familiar with this organization through a twist on a classic game.

Frame the Activity

Activate Prior Knowledge (10 min)

1. Lead a discussion to help students activate prior knowledge about the periodic table.
 - *What can you tell me about how the periodic table is organized?*
 - *What information does the periodic table give us about each element?*
2. As students share their knowledge of the periodic table, highlight their points using a large periodic table. Use the information from the [Background Information](#) to fill in the gaps of your students' knowledge.
For example:
 - Elements are arranged in order of increasing size (atomic number).
 - Elements have an atomic symbol, atomic number, and atomic mass.
 - Rows on the periodic table are called periods; columns are called groups.
3. Introduce the game:

"Today we will be putting our periodic table knowledge to the test with a friendly game of Periodic Table Battleship! You will be creating a fleet of ships from the elements on your periodic table and see if you can sink your opponent's ships first!"



Lab Connection

If you took the Chemicals of Innovation lab at The Tech, this is a great time to have students recall their experience in the lab!

thetech.org/sciencelabs



Playing the Game

Introduce the Rules of the Game (5 min)

1. Review the [Rules for Periodic Table Battleship](#) with students. Remind them that it is similar to the classic game of Battleship.
2. Once students understand the rules, place them in pairs and pass out the [Periodic Table Gameboards](#) and markers.

Game Play (25 min)

1. Have students play for approximately 20-25 minutes or until everyone has completed at least one game round.
2. While playing, remind students to use their new periodic table vocabulary to ask their opponent questions about their ships' positions.



Try incorporating other periodic table vocabulary during game play! Students can ask for a specific atomic symbol, atomic number, or even atomic mass.

Debrief (5 min)

1. Bring the class back together and have pairs discuss how their game went.
 - *Were there any strategies used to correctly guess ship placements?*
 - *What did elements in horizontally placed ships have in common?*
 - *What did elements in vertically placed ships have in common?*

Next Generation Science Standards

Grades	Framework Element	Description
Grade 5	DCI - PS1.A	Structure and Properties of Matter Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gasses are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.
Grades 6-8	DCI PS1.A	Structure and Properties of Matter Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.

Vocabulary

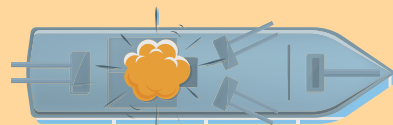
- **Atomic symbol:** A one or two -letter abbreviation for an element. The same atomic symbol is used in all languages.
- **Atomic mass:** The average mass of an element; the amount of protons plus neutrons
- **Atomic orbital:** Also called a shell or energy level. The area surrounding the center of an atom where electrons are found. Each orbital can hold a certain number of electrons.
- **Group:** Columns on the periodic table. Elements in the same group have the same number of valence electrons and have similar chemical properties.
- **Period:** Rows on the periodic table. Elements in the same row have the same number of atomic orbitals.
- **Valence electron:** Electrons in an atom's outermost orbital that are available to bond with other atoms.

Periodic Table Battleship

Rules of the Game

We suggest the following numbers and sizes of ships for gameplay:

- One ship 2 elements in length
- One ship 3 elements in length
- Two ships 4 elements in length
- One ship 5 elements in length



- Pick where you want to put your "ships" using the lower periodic table board. Then circle or outline your ships using one color of marker or pen.

 - Ships can only be positioned vertically or horizontally on the board - no diagonal ships.

Periodic Table of the Elements

- Once ships are selected, you and your opponent take turns asking possible positions for their ships.

 - You should ask in the form of Period #, Group # or by asking for an atomic symbol or number.

Is there a ship in Period 4, Group 5?

Does your ship include the symbol Au?

Does your ship include the atomic number 12?

- Mark off when you hit or miss your opponent's ships on the top periodic table.

 - You can choose your own marks for hit or miss.

Periodic Table of the Elements

Hit!

Miss!

- If your ship is hit, you should write an X over the element that your opponent has called.

Periodic Table of the Elements

X

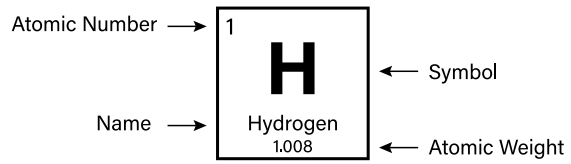
- Continue until one partner has sunk all of the elemental ships.

Periodic Table of the Elements

You sunk my Nitrogen!

Periodic Table of the Elements

1 IA											18 VIIIA						
1 H Hydrogen 1.008											2 He Helium 4.002602						
3 Li Lithium 6.94	4 Be Beryllium 9.0121831											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998403163	10 Ne Neon 20.1797
11 Na Sodium 22.98976928	12 Mg Magnesium 24.305											13 Al Aluminium 26.9815385	14 Si Silicon 28.085	15 P Phosphorus 30.973761998	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955908	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938044	26 Fe Iron 55.845	27 Co Cobalt 58.933194	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.630	33 As Arsenic 74.921595	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.798
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90584	40 Zr Zirconium 91.224	41 Nb Niobium 92.90637	42 Mo Molybdenum 95.95	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.293
55 Cs Caesium 132.90545196	56 Ba Barium 137.327	57 - 71 Lanthanoids	72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.592	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98040	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 - 103 Actinoids	104 Rf Rutherfordium (267)	105 Db Dubnium (268)	106 Sg Seaborgium (269)	107 Bh Bohrium (270)	108 Hs Hassium (269)	109 Mt Meitnerium (278)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (282)	112 Cn Copernicium (285)	113 Nh Nihonium (286)	114 Fl Flerovium (289)	115 Mc Moscovium (289)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)



57 La Lanthanum 138.90547	58 Ce Cerium 140.116	59 Pr Praseodymium 140.90766	60 Nd Neodymium 144.242	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92535	66 Dy Dysprosium 162.500	67 Ho Holmium 164.93033	68 Er Erbium 167.259	69 Tm Thulium 168.93422	70 Yb Ytterbium 173.045	71 Lu Lutetium 174.9668
89 Ac Actinium (227)	90 Th Thorium 232.0377	91 Pa Protactinium 231.03588	92 U Uranium 238.02891	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (266)