

# WHAT'S UP WITH ATOMS?

(MODIFIED FOR ADEED)

## INSTRUCTIONS

### Science Concept:

The number of protons, neutrons, and electrons in an atom can be determined by the atomic number and atomic weight of an element. (NOTE: This lesson assumes students are familiar with the structure of an atom.)

### Objectives:

The student will:

- use the periodic table to locate information;
- create a data chart of information found in the periodic table; and
- explain the relationship between the atomic number and the atomic mass of an element.

### GLEs Addressed:

#### Science

- [9] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.
- [9] SB1.1 The student demonstrates an understanding of the structure and properties of matter by describing atoms and their base components (i.e., protons, neutrons, electrons).
- [10] SB1.1 The student demonstrates an understanding of the structure and properties of matter by using the periodic tables to describe atoms in terms of their base components (i.e., protons, neutrons, electrons).

### Vocabulary:

**proton** – an atomic particle that occurs in the nucleus of every atom and carries a positive charge equal in size to the negative charge of an electron

**neutron** – an uncharged atomic particle that has a mass nearly equal to that of the proton and is present in all known atomic nuclei except the hydrogen nucleus

**electron** – an elementary particle that has a negative charge of electricity and travels around the nucleus of an atom

**consensus** – general agreement <the consensus of opinion>

**atomic number** – a number that is characteristic of a chemical element and represents the number of protons in the nucleus

**atomic mass** – the mass of any kind of atom usually expressed in atomic mass units

### Materials:

- 2 Balloons
- Helium
- String
- OVERHEAD: "Atomic Notation"
- STUDENT INFORMATION SHEET: "Periodic Table of Elements"

**Activity Preparation:**

Fill two balloons of equal size, one with air and one with helium. Tie a string to each balloon.

**Activity Procedure:****Gear Up****Process Skills: *observing, inferring, and communicating***

1. Display the two balloons tied with string. Release the balloons and ask students to write their observations and an explanation of those observations.
2. Break students into small groups and ask them to share their explanations and observations and then come to a consensus on the explanation. Ask groups to share their conclusions with the class. If groups do not conclude that the observation is a result of the different mass of the two gases, this should be pointed out.
3. Explain that helium is lighter in weight than the combined gases that make up our atmosphere. Ask students what determines the atomic weight of an element. Explain that the atomic weight is the combined weight of the neutrons, electrons, and protons in an atom. Knowing the atomic weight or atomic mass of an element, and its atomic number enables one to determine the number of protons, neutrons, and electrons in an atom of that element.
4. Show OVERHEAD: "Atomic Notation" and ask students to find the number of protons, neutrons, and electrons in a Krypton atom.

**Explore****Process Skills: *observing and communicating***

5. Distribute the STUDENT INFORMATION SHEET: "Periodic Table of Elements." Write the following list of elements on the board: carbon, argon, mercury, radium, lithium, krypton, silver, silicon, cobalt, and calcium.
6. Instruct groups to construct a data table that shows the atomic weight, atomic number, and number of protons, number of neutrons, and number of electrons for each element. Explain that students should work together and will have about 20 minutes to complete the task.

**Generalize****Process Skills: *interpreting data and observing***

7. Compare and discuss each group's data table completed during the Explore Section.
8. Ask students if they discovered any trends in their data.
9. Ask students if there is a relationship between the number of neutrons and the mass of an element. (The number of neutrons equals the atomic mass minus the number of protons or atomic number. The more neutrons, the higher the atomic mass.)

**Apply/Assess****Process Skills: *communicating***

10. Tell students they will now apply what they have learned.
11. Divide the class into four or five groups. Refer students to the STUDENT INFORMATION SHEET and explain that they will be playing a game that has two rounds.
12. Explain that in Round One, the teacher will call out a group number and then an element name. Students should call out the proton number of the element. The first student in that group to answer correctly earns 5 points. Groups should not answer unless their group number has been called.
13. Assign a student to keep score and begin round one. Play for approximately five minutes or as time allows.

14. Explain that in Round Two, the teacher will call out an element name. Students should call out the number of neutrons in the element. The first student to answer correctly earns five points. These questions are open to the entire class.
15. Assign another student to keep score and begin round two. Play for approximately 15 minutes or as time and student interest allows.

**Extension Ideas:**

***Process Skills: communicating and interpreting data***

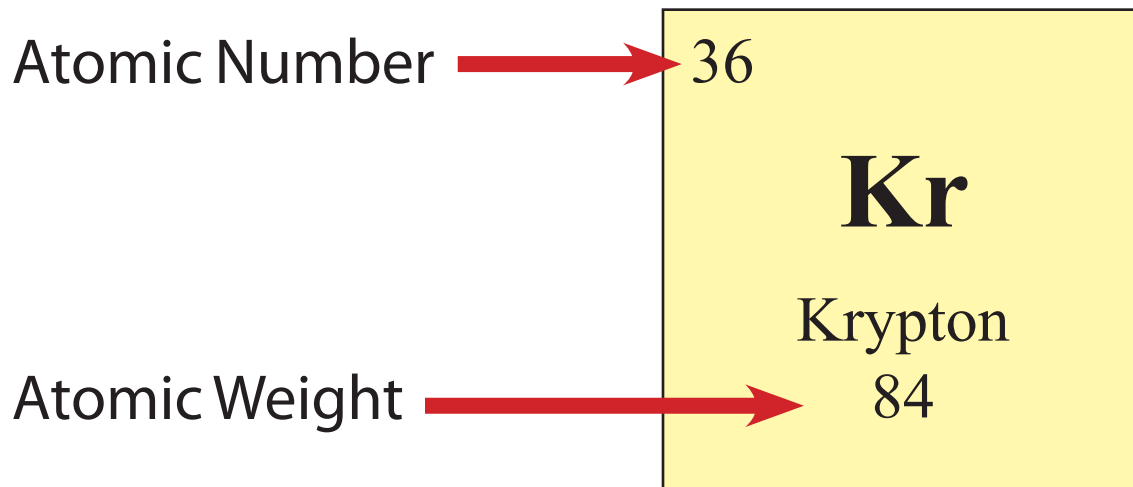
Ask students to research isotopes and their importance.

Ask students to research and then describe the importance of radioactive isotopes in the field of medicine.

## WHAT'S UP WITH ATOMS?

## RUBRIC

<b>Objective</b>	<b>GLE</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
The student uses the periodic table to locate information.	[9-10] SA1.1	The student does not locate the correct information.	The student locates the correct information, but not for all 10 elements.	The student locates the correct information for all 10 elements.	The student locates the correct information for all 10 elements and can explain how the information was located.
The student creates a data chart of information found in the periodic table.	[9] SA1.1	The data table is not structured correctly, with one column for each required element, and is not complete.	The data table is structured properly, but is not clearly labeled and/or is not complete.	The data table is structured properly, labeled properly and complete.	The data table is structured properly, labeled correctly and clearly and is complete. Additionally, the student can explain the data chart to his or her classmates.
The student explains the relationship between the atomic number and atomic mass of an element.	[10] SB1.1	The student does not explain the relationships, or does not do so correctly.	The student explains the relationship, but uses incorrect terminology.	The student explains the relationship correctly and uses correct terminology.	The student explains the relationship correctly, uses the correct terminology, and provides an example.



Atomic Number = Number of Electrons = Number of Protons

Atomic Weight is the same as relative atomic mass. The relative atomic mass rounded to the nearest whole number can be used as the mass number.

Mass Number = Number of Protons + Number of Neutrons

Number of Neutrons = Mass Number – Number of Protons

# The Periodic Table of Elements

$\text{Atomic Number} = \text{Number of Protons} = \text{Number of Electrons}$ $\text{Chemical Symbol}$ $\text{Chemical Name}$ $\text{Atomic Weight} = \text{Number of Protons} + \text{Number of Neutrons}^*$		<b>NON-METALS</b>																					
1	2																	10	18	36	54	86	118
H Hydrogen 1	He Helium 4																	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon 222	Uuo Ununoctium 294
3	4																	9	17	35	53	85	117
Li Lithium 7	Be Beryllium 9																	F Fluorine 19	Cl Chlorine 35	Br Bromine 80	I Iodine 127	At Astatine 210	Uus Ununseptium not yet observed
11	12																	8	16	32	52	84	116
Na Sodium 23	Mg Magnesium 24																	O Oxygen 16	S Sulfur 32	Se Selenium 79	Te Tellurium 128	Po Polonium 209	Uuh Ununhexium 291
19	20																	7	15	31	51	83	115
K Potassium 39	Ca Calcium 40																	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209	Uup Ununpentium 288
37	38																	6	14	28	50	82	114
Rb Rubidium 85	Sr Strontium 88																	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207	Uuq Ununquadium 289
55	56																	5	13	27	49	81	113
Cs Cesium 133	Ba Barium 137																	B Boron 11	Al Aluminum 27	Ga Gallium 70	In Indium 115	Tl Thallium 204	Uut Ununtrium 284
87	88																	13	31	63	81	111	151
Fr Francium 223	Ra Radium 226																	Al Aluminum 27	Ga Gallium 70	In Indium 115	Tl Thallium 204	Uut Ununtrium 284	Uuh Ununhexium 291
<b>METALS</b>																							
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38						
Sc Scandium 45	Ti Titanium 48	V Vanadium 51	Cr Chromium 52	Mn Manganese 55	Fe Iron 56	Co Cobalt 59	Ni Nickel 59	Cu Copper 64	Zn Zinc 65	Ga Gallium 70	Ge Germanium 73	As Arsenic 75	Se Selenium 79	Br Bromine 80	Kr Krypton 84	Xe Xenon 131							
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55							
Y Yttrium 89	Zr Zirconium 91	Nb Niobium 93	Mo Molybdenum 96	Tc Technetium 98	Ru Ruthenium 101	Rh Rhodium 103	Pd Palladium 106	Ag Silver 108	Cd Cadmium 112	In Indium 115	Sn Tin 119	Sb Antimony 122	Te Tellurium 128	I Iodine 127	Xe Xenon 131	Rn Radon 222							
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73							
La Lanthanum 139	Ce Cerium 140	Pr Praseodymium 141	Nd Neodymium 144	Pm Promethium 145	Sm Samarium 150	Eu Europium 152	Gd Gadolinium 157	Tb Terbium 159	Dy Dysprosium 163	Ho Holmium 165	Er Erbium 167	Tm Thulium 169	Yb Ytterbium 173	Lu Lutetium 175	Rn Radon 222	Uuo Ununoctium 294							
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105							
Ac Actinium 227	Th Thorium 232	Pa Protactinium 231	U Uranium 238	Np Neptunium 237	Pu Plutonium 244	Am Americium 243	Cm Curium 247	Bk Berkelium 247	Cf Californium 251	Es Einsteinium 252	Fm Fermium 257	Md Mendelevium 258	No Nobelium 259	Lr Lawrencium 262	Rn Radon 222	Uuo Ununoctium 294							

**KEY**

- = Solid at room temperature
- = Liquid at room temperature
- = Gas at room temperature
- = Radioactive
- = Artificially Made

\*The atomic weights listed on this Table of Elements have been rounded to the nearest whole number. As a result, this chart actually displays the mass number of a specific isotope for each element. An element's complete, unrounded atomic weight can be found on the IUPAC's Elemental web site: <http://education.jlab.org/iselemental/index.html>

Modified from: <http://education.jlab.org>