Lesson 2.3: Physical Science – Chemical Properties

Weekly Focus: Compare & Contrast
Weekly Skill: Comprehension

Lesson Summary: This lesson will have students deepen their understanding of atoms and molecules and how they fit into the periodic table of elements.

Materials Needed:

- Chemistry: Atoms and Molecules (compare and contrast) reading **Unit 2.3 Handout 1**
- Matter and the Periodic Table Worksheets **Unit 2.3 Handout 2**
- Symbolic Atoms (Challenge Activity/Homework) **Unit 2.3 Handout 3**

Objectives: Students will be able to…

- Understand the fundamentals of chemical properties with relationship to the periodic table.
- Read passages with vocabulary related to chemical properties

College and Career Readiness Standards: RI, RST, WHST, SL

ACES Skills Addressed: EC, LS, ALS, CT, SM, DFP, N

Notes: Please review and be familiar with classroom routine notes for: reading for fluency strategies (**Routine 2**), summarizing techniques (**Routine 4**), and self-management skills (**Routine 4)**. The notes will help with making a smooth transition to each activity. **If at all possible, try to use computers for Unit 2.3 Handout 2 (see online resources for the link) for students to navigate websites that will help their digital literacy skills and content knowledge for GED 2014.**

GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be a short answer portion (suggested 10 minutes) where students may have to summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.

Lesson 2.3: Physical Science – Chemical Properties

Activities:

Warm-Up: KWL Chart	Time: 10 - 15 minutes

- As students enter the class, have the following written on the board or overhead **"The periodic table is a list of known elements arranged by their chemical properties."** Have students create a **"KWL"** chart on a piece of notebook paper (below). This helps to activate students' prior knowledge by asking them what they already **K**now (column 1); students (collaborating as a classroom unit or within small groups) set goals specifying what they **W**ant to learn (column 2); and after reading students discuss what they have **L**earned (column 3).
- Students apply higher-order thinking strategies which help them construct meaning from what they read and help them monitor their progress toward their goals.

KWL Chart:

K - What (else) do I KNOW?	W - What do I WANT to know?	L - What did I LEARN?

Activity 1: Reading Comprehension Unit 2.3 Handout 1	Time: 35 - 45 minutes

1) Hand out **Unit 2.3 Handout 1** to students.
2) Discuss with students that when reading, they should pay close attention to what all of the passage is about. Inform students the passage will go more in depth on atoms and molecules by comparing and contrasting them. This is a continuation of material covered in the last two lessons.
3) Ask students to read the passage and answer the questions that follow. Circulate the class while students are working independently to help as needed.
4) When students are finished, review answers as a whole class. Ask for students to share their answers if they would like. If there is time, you may have students practice reading for fluency and read the passage to each other in pairs. (see **Classroom Routine 2 - Reading for Fluency)**
5) Students who finish early can be challenged and encouraged to summarize the reading in 3 to 5 sentences. They can do this on the back of their paper or in a notebook. Explain to students that this is an excellent method for them to self-assess if they understand the material. It is also something they may encounter on the GED 2014 Science Module. **(Classroom Routine 4 – Summarizing Techniques)**

Break: 10 minutes

Activity 3: Elements & the Periodic Table Unit 2.3 Handout 2	Time: 35 - 45 minutes

1) Hand out **Unit 2.3 Handout 2** to students.
2) Discuss with students that when reading, they should pay close attention to what all of the passage is about. Remind students that they should pay close attention to the title and guide words to predict what they will read next. (If there are some students who find the font too small on the Periodic Table, ask them to work in groups)
3) Ask students to read the passage and answer the questions that follow. Remind them to pay

attention to the key while using the periodic table. You may wish to have a whole class discussion on the periodic table and how it is read. (Please see the last page of this document.) Circulate the class while students are working independently (or in groups) to help as needed.

4) When students are finished, review answers as a whole class. Ask for students to share their answers if they would like.

5) Students who finish early can be challenged and encouraged to summarize the reading in 3 to 5 sentences. They can do this on the back of their paper or in a notebook. Explain to students that this is an excellent method for them to self-assess if they understand the material. It is also something they may encounter on the GED 2014 Science Module. **(Classroom Routine 4 – Summarizing Techniques)**

6) You can challenge all students to think of the kinds of jobs or careers where it would be important to know the symbols in the periodic table.

Wrap-Up: Summarize	**Time: 5 - 10 minutes**
Have students turn to a partner (or write in their journals) about what they have learned today about the periodic table of elements. Ask them to tell a partner what is one thing new they learned from today's lesson, or what is one wondering they have for the next class. *Note: Use Classroom Routine 4 Handout for summarizing techniques.*	

Extra Work/Homework: Unit 2.3 Handout 3	**Time: 20+ minutes outside of class**
Students can read and answer questions from worksheet on Symbolic Atoms. This is an advanced activity that may be challenging for some students, but it is an excellent example of some math requirements for GED 2014 within the Science Module.	

Differentiated Instruction/ELL Accommodation Suggestions	**Activity**
The periodic table may be new for some students and a review for others. It could be helpful to show students the color copy with an overhead projector (see last page of this document). Point out the key (which is a strategy they should incorporate in GED 2014). You can orally ask students about different elements they already know. "What is the symbol for Oxygen (O), or Silver (Ag)?"	**Unit 2.3 Handout 2**
The periodic table may be too small and frustrating for some students with vision difficulties to use alone, you can guide these students into working groups.	**Unit 2.3 Handout 2**

Lesson 2.3: Physical Science – Chemical Properties

Online Resources:

This is an **excellent** site for students to practice with elements. If at all possible, have the entire class navigate to the link and practice. If not, try to assign as outside work. There are digital literacy skills involved that will help students for GED 2014.

http://education.jlab.org/elementmath/

This link is a way for students to get more information about each element in the periodic table.

http://education.jlab.org/itselemental/

Suggested Teacher Readings:

- GED Testing Service – GED Science Item Sample (to get an idea of what the test *may* be like)

  http://www.gedtestingservice.com/itemsamplerscience/

- Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:

  http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf

- Minnesota is getting ready for the 2014 GED test! – The website with updated information on the professional development in Minnesota regarding the 2014 GED.

  http://abe.mpls.k12.mn.us/ged_2014_2

- Essential Education's 2014 GED Test Curriculum Blueprint (PDF)

  http://www.passged.com/media/pdf/educators/curriculum-blueprint.pdf

Unit 2.3 Handout 1 (total of 3 pages)

Chemistry: Atoms and Molecules

What is the difference between atoms and molecules? It is actually pretty simple. Molecules are made up of atoms. Each element on the periodic table of elements is made up of one single type of atom. Molecules are formed when atoms bond. Different types of atoms can form together to make a molecule. Two or more of the same type of atom can also be bonded to make a molecule.

For example, H is the symbol for hydrogen and O is the symbol for oxygen. Water is made up of both hydrogen and oxygen. H_2O is the symbol for water. Two hydrogen atoms and one oxygen atom are bonded together to create a water molecule. Oxygen gas is made up of two oxygen atoms bonded together. O_2 is the symbol for an oxygen molecule.

With so many elements, imagine all the combinations of atoms that have been researched and have yet to be researched. Chemistry is very complicated because there are so many different combinations.

Use the information in the reading passage to answer the following questions.

1. Water molecules are made up of

   a. any two atoms bonded together.
   b. two hydrogen atoms and one oxygen atom.
   c. atoms of only one type of element bonded together.
   d. two oxygen atoms.

2. Why does the author describe the atoms that make up water?

   a. to give an example of a specific molecule
   b. to show how liquids are different from solids
   c. to explain why water is so abundant
   d. to illustrate how simple chemistry is

3. Can a single atom be considered a molecule?

   a. only if the atom is found in water
   b. no, it takes two or more atoms bonded to create a molecule
   c. only if it is an oxygen atom floating in the air
   d. yes, all atoms are made up of many different molecules

Lesson 2.3: Physical Science – Chemical Properties

4. Read the following sentence: "Chemistry is very complicated because there are so many different combinations." The word **complicated** means

a. simple and basic
b. difficult to understand
c. fun and exciting
d. able to be learned easily

5. What is the main idea of this passage?

a. Bonded atoms make up molecules.
b. Atoms and molecules are unrelated to each other.
c. Water is the most common type of molecule.
d. Oxygen and hydrogen are necessary for molecules.

6. What makes up a molecule of oxygen gas?

_____

_____

_____

7. Explain why understanding bonding is important for understanding molecules.

_____

_____

_____

8. The question below is an incomplete sentence. Choose the answer that best completes the sentence.

Molecules can be made up of two atoms of the same element; _____ , oxygen gas is made up only of oxygen atoms.

a. for example
b. most importantly
c. on the other hand
d. therefore

9. Read the following sentence.

Two hydrogen atoms and one oxygen atom create a water molecule by bonding together.

Answer the questions below based on the information provided in the sentence you just read. One of the questions has already been answered for you.

1. What?

Two hydrogen atoms and one oxygen atom

2. What do hydrogen and oxygen atoms do?

_____

2. How?

_____

10. **Vocabulary Word: symbol:** a written sign used instead of a word to represent something.

Use the vocabulary word in a sentence:

_____

_____

11. Challenge: Paraphrase (use your own words) the main idea of the reading passage below.

_____

_____

_____

Unit 2.3 Handout 1

Chemistry: Atoms and Molecules

TEACHER ANSWER KEY

1. B
2. A
3. B
4. B
5. A
6. **Answers may vary: suggested answer:** *A molecule of oxygen gas is made up of two atoms of oxygen bonded together.*
7. **Answers may vary: suggested answer:** *Understanding bonding is important for understanding molecules because a molecule cannot exist without the bond between atoms.*
8. A
9. 2. Create a water molecule 3. By bonding together
10. Answers may vary. Check to see if students use the word correctly.
11. Answers may vary. Check to see if students paraphrase the main idea *"Bonded atoms make up molecules."*

Lesson reformatted from ReadWorks.org (780-Chemistry Atoms and Molecules)

Unit 2.3 Handout 2 (4 pages total)

Matter

Brief #2: Elements

Focus

Elements are made from a single type of atom.

Elements are physical materials that are made up of a single type of atom. For example, iron is an element that is only made up of iron atoms. Carbon is an element that is only made up of carbon atoms.

So let's say, for example, that you could see the individual atoms in a piece of iron. What you would see are trillions of iron atoms, each one having a nucleus containing 26 protons and 26 neutrons, with 26 electrons orbiting that nucleus.

The number of protons in the nucleus of any type of atom is like its fingerprint. It is unique to that atom. If an atom has 6 protons it means that it makes the element called carbon. If an atom has 7 protons it makes the element called nitrogen.

There are only about 100 different types of natural elements present on Earth. Elements are considered pure substances because they are only made up of a single type of atom.

Vocabulary

1. elements
2. periodic table
3. atomic number

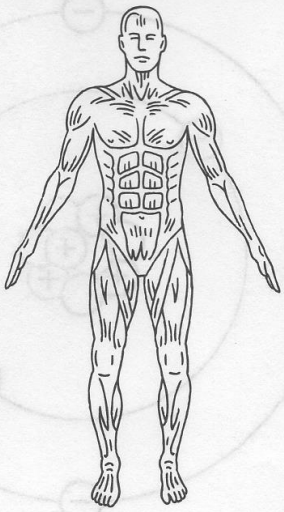
Types of Elements

Each of the elements has a different amount of protons and electrons. And different amounts of protons and electrons produce elements with different physical characteristics. For example, the element called mercury has 80 protons and 80 electrons. Mercury is a metallic liquid. The element of helium has 2 protons and 2 electrons. Helium is a nonmetallic gas. Elements can be metals, nonmetals, or metalloids.

Fast Fact

The human body contains the following elements:

- ✓ oxygen
- ✓ carbon
- ✓ hydrogen
- ✓ nitrogen
- ✓ calcium
- ✓ phosphorus



Metals are elements like copper, iron, and aluminum. They are usually hard, and strong. They are good conductors of electricity. Nonmetals are elements like selenium and helium. Nonmetals are not good conductors of electricity. Metalloids are elements that have characteristics of both metals and nonmetals.

Matter

Brief #2: Elements *(cont.)*

The Periodic Table *(cont.)*

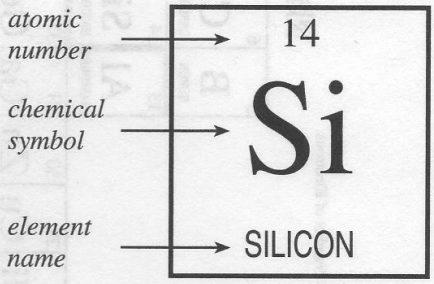
The periodic table is arranged in 7 rows and 18 columns. The elements in the columns are called families. They have certain things in common. The elements in the rows are called periods. They have very little in common.

Each element on the period table has an atomic number. **The atomic number tells how many protons are in the nucleus of that particular element.** The atomic number for sulfur is 16. That means that the sulfur atom has 16 protons in its nucleus. The elements are arranged from left to right in number order.

If you look carefully, about thee-quarters of the way across the period table, you will see a zig-zag line. All of the elements to the right of this line are non-metals. And all of the elements to the left of this line are metals. The elements that are along the zigzag line are the metalloids.

These are the metalloids:

- ✓ boron
- ✓ silicon
- ✓ germanium
- ✓ arsenic
- ✓ antimony
- ✓ tellurium
- ✓ polonium



Silicon is a metalloid

Even though aluminum appears along this line, it is a metal.

Lanthanum and Actinide Series

You have probably noticed that there are two rows that appear at the bottom of the periodic table that are separated from the rest. These are called the Lanthanum series and the Actinide series. The Lanthanum series goes from atomic number 57 to atomic number 71. This is really part of row six. It is the elements that come between barium and lutetium. The Actinide series is really part of row seven. It goes from atomic number 89 to atomic number 103. These two rows are pulled to the bottom of the periodic table only so that the periodic table can appear neatly over one page.

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
LANTHANUM	CERIUM	PRASEODYMIUM	NEODYMIUM	PROMETHIUM	SAMARIUM	EUROPIUM	Gadolinium	TERBIUM	DYSPROSIUM	HOLMIUM	ERBIUM	THULIUM	YTTERBIUM	LUTETIUM
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
ACTINIUM	THORIUM	PROTACTINIUM	URANIUM	NEPTUNIUM	PLUTONIUM	AMERICIUM	CURIUM	BERKELIUM	CALIFORNIUM	EINSTEINIUM	FERMIUM	Mendelevium	NOBELIUM	LAWRENCIUM

Periodic Table of the Elements

American Spellings

hydrogen 1 **H** 1.00794																	helium 2 **He** 4.002602
lithium 3 **Li** 6.941	beryllium 4 **Be** 9.012182												boron 5 **B** 10.811	carbon 6 **C** 12.0107	nitrogen 7 **N** 14.00674	oxygen 8 **O** 15.9994	fluorine 9 **F** 18.9984	neon 10 **Ne** 20.1797
sodium 11 **Na** 22.98977	magnesium 12 **Mg** 24.3050												aluminum 13 **Al** 26.981538	silicon 14 **Si** 28.0855	phosphorus 15 **P** 30.97376	sulfur 16 **S** 32.065	chlorine 17 **Cl** 35.453	argon 18 **Ar** 39.984
potassium 19 **K** 39.0983	calcium 20 **Ca** 40.078	scandium 21 **Sc** 44.95591	titanium 22 **Ti** 47.867	vanadium 23 **V** 50.9415	chromium 24 **Cr** 51.9961	manganese 25 **Mn** 54.93805	iron 26 **Fe** 55.845	cobalt 27 **Co** 58.9332	nickel 28 **Ni** 58.6934	copper 29 **Cu** 63.546	zinc 30 **Zn** 65.409	gallium 31 **Ga** 69.723	germanium 32 **Ge** 72.64	arsenic 33 **As** 74.9216	selenium 34 **Se** 78.96	bromine 35 **Br** 79.904	krypton 36 **Kr** 83.798
rubidium 37 **Rb** 85.4678	strontium 38 **Sr** 87.62	yttrium 39 **Y** 88.90585	zirconium 40 **Zr** 91.225	niobium 41 **Nb** 92.90638	molybdenum 42 **Mo** 95.94	technetium 43 **Tc** [98]	ruthenium 44 **Ru** 101.07	rhodium 45 **Rh** 102.9055	palladium 46 **Pd** 106.42	silver 47 **Ag** 107.8682	cadmium 48 **Cd** 112.411	indium 49 **In** 114.818	tin 50 **Sn** 118.710	antimony 51 **Sb** 121.760	tellurium 52 **Te** 127.60	iodine 53 **I** 126.9045	xenon 54 **Xe** 131.293
cesium 55 **Cs** 132.90545	barium 56 **Ba** 137.327	lutetium 71 **Lu** 174.967	hafnium 72 **Hf** 178.49	tantalum 73 **Ta** 180.9479	tungsten 74 **W** 183.84	rhenium 75 **Re** 186.207	osmium 76 **Os** 190.23	iridium 77 **Ir** 192.217	platinum 78 **Pt** 195.078	gold 79 **Au** 196.96655	mercury 80 **Hg** 200.59	thallium 81 **Tl** 204.3833	lead 82 **Pb** 207.2	bismuth 83 **Bi** 208.980	polonium 84 **Po** [209]	astatine 85 **At** [210]	radon 86 **Rn** [222]
francium 87 **Fr** [223]	radium 88 **Ra** [226]	lawrencium 103 **Lr** [262]	rutherfordium 104 **Rf** [261]	dubnium 105 **Db** [262]	seaborgium 106 **Sg** [266]	bohrium 107 **Bh** [264]	hassium 108 **Hs** [269]	meitnerium 109 **Mt** [268]	darmstadtium 110 **Ds** [271]	roentgenium 111 **Rg** [272]	ununbium 112 **Uub** [285]		ununquadium 114 **Uuq** [289]				

Key:

element name
atomic number
symbol
atomic weight

lanthanum 57 **La** 138.9055	cerium 58 **Ce** 140.116	praseodymium 59 **Pr** 140.90765	neodymium 60 **Nd** 144.24	promethium 61 **Pm** [145]	samarium 62 **Sm** 150.36	europium 63 **Eu** 151.964	gadolinium 64 **Gd** 157.25	terbium 65 **Tb** 158.9253	dysprosium 66 **Dy** 162.50	holmium 67 **Ho** 164.930	erbium 68 **Er** 167.259	thulium 69 **Tm** 168.934	ytterbium 70 **Yb** 173.04
actinium 89 **Ac** [227]	thorium 90 **Th** 232.038	protactinium 91 **Pa** 231.0359	uranium 92 **U** 238.0289	neptunium 93 **Np** [237]	plutonium 94 **Pu** [244]	americium 95 **Am** [243]	curium 96 **Cm** [247]	berkelium 97 **Bk** [247]	californium 98 **Cf** [251]	einsteinium 99 **Es** [252]	fermium 100 **Fm** [257]	mendelevium 101 **Md** [258]	nobelium 102 **No** [259]

Notes: Elements with atomic weights in square brackets have no stable isotopes. Different sources list different atomic weights for elements. The difference arises from the differing atomic weights of various isotopes. We have tried to list the most stable isotope. For example, some sources list the atomic weight of seaborgium as 263 and others 266. The most stable isotope appears have an atomic weight of 266 so we list that weight here. Roentgenium is still the unofficial name of element 111 but it is the one recommended by the IUPAC so we list it here instead of the generic 'unununium'. Aluminum, cesium, and sulfur are the American spellings for aluminium, caesium, and sulphur. This table was downloaded from http://www.science-teachers.com/printable_periodic_tables.htm

PERIODIC TABLE WORKSHEET

Use the periodic table to find the information asked for below. Look carefully at the key in the table.

1. What is the **atomic number** of:

   Calcium _____

   Iron _____

   Gold _____

   Uranium _____

2. What is the **atomic mass** of:

   Calcium _____

   Iron _____

   Uranium _____

   Copper _____

3. How many **protons** do the following have?

   Calcium _____

   Gold _____

   Copper _____

   Iron _____

4. How many **electrons** do the following have?

   Gold _____

   Iron _____

   Copper _____

   Uranium _____

5. Does mercury have more protons and electrons than tin? _____yes _____no

6. Is mercury a heavier element than tin? _____yes _____no

7. Does potassium have more electrons than neon? _____yes _____no

8. Does hydrogen have more electrons than Uranium? _____yes _____no

9. Which has more protons, sulfur or iodine? (circle answer)

10. Which has more protons, iodine or silver? (circle answer)

11. Write the symbols or the names for each of these elements:

    Chlorine _____ _____ Zn

    Copper _____ Helium _____

    Potassium _____ Iron _____

    Silver _____ _____ P

    _____ Na _____ Ne

    _____ Sn Mercury _____

Lesson 2.3: Physical Science – Chemical Properties

PERIODIC TABLE WORKSHEET TEACHER ANSWER KEY

Use a periodic table to find the information asked for below:

1. What is the **atomic number** of:

   Calcium _**20**_

   Iron __**26**_

   Gold _**79**__

   Uranium _**92**__

2. What is the **atomic mass** of:

   Calcium _**40.078**__

   Iron _**55.845**__

   Uranium **238.0289**_

   Copper _**63.546**_

3. How many **protons** do the following have? (same # as the atomic number)

   Calcium _**20**__

   Gold _**79**__

   Copper _**29**__

   Iron _**26**_

4. How many **electrons** do the following have? (same # as the atomic number)

   Gold _**79**__

   Iron __**26**__

   Copper __**29**_

   Uranium __**92**_

5. Does mercury (**80**) have more protons and electrons than tin (**50**)? _**XX**_yes _____no

6. Is mercury (**200.59**) a heavier element than tin (**118.710**)? __**XX**_yes _____no

7. Does potassium (**19**) have more electrons than neon (**10**)? __**XX**__yes _____no

8. Does hydrogen (**1**) have more electrons than Uranium (**92**)? _____yes __ **XX** ___no

9. Which has more protons, sulfur (**16**) or iodine (**53**)? (circle answer) **(iodine)**

10. Which has more protons, iodine (**53**) or silver (**47**)? (circle answer) **(iodine)**

11. Write the symbols or the names for each of these elements:

    Chlorine __**Cl**_____

    Copper ____**Cu**_____

    Potassium ____**K**_____

    Silver ____**Ag**_____

    ____**Sodium**_____ Na

    ____**tin**_____ Sn

    _____**zinc**_____ Zn

    Helium ___**He**_____

    Iron ____**Fe**_____

    _____**phosphorus**_____ P

    _____**neon**_____ Ne

    Mercury ____**Hg**____

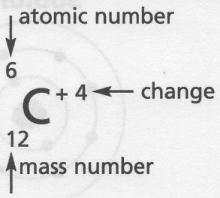
Unit 2.3 Handout 3 (1 page total)

Name _____ Date _____

Symbolic Atoms

A chemical symbol can show information about an atom more easily than a diagram can. The example below shows how to write a symbol for an atom. The atomic number tells how many protons there are. In a neutral atom the electrons equal the number of protons. The mass number equals the sum of the protons and neutrons. If the atom is positively charged, it has lost electrons. If it is negatively charged, it has gained electrons. Use the diagram and the periodic table on page 20 to complete the chart. If there is no charge, assume the atom is neutral.

	Formula	Example with Carbon
# protons	atomic #	6
# neutrons	atomic mass − atomic number	12 − 6 = 6
# electrons	atomic number − number charge	6 − (+4) = 2



Use what you have learned from the diagram to complete the chart.

	Element/Ion	Atomic Number	Mass Number	Charge	Protons	Neutrons	Electrons
1	$^{12}_{24}Mg$						
2	$^{9}_{19}F^{-1}$						
3	$^{16}_{32}S^{-2}$						
4	$^{1}_{1}H$						
5	$^{4}_{9}Be^{+2}$						
6	$^{11}_{23}Na^{+1}$						
7	$^{19}_{39}K$						

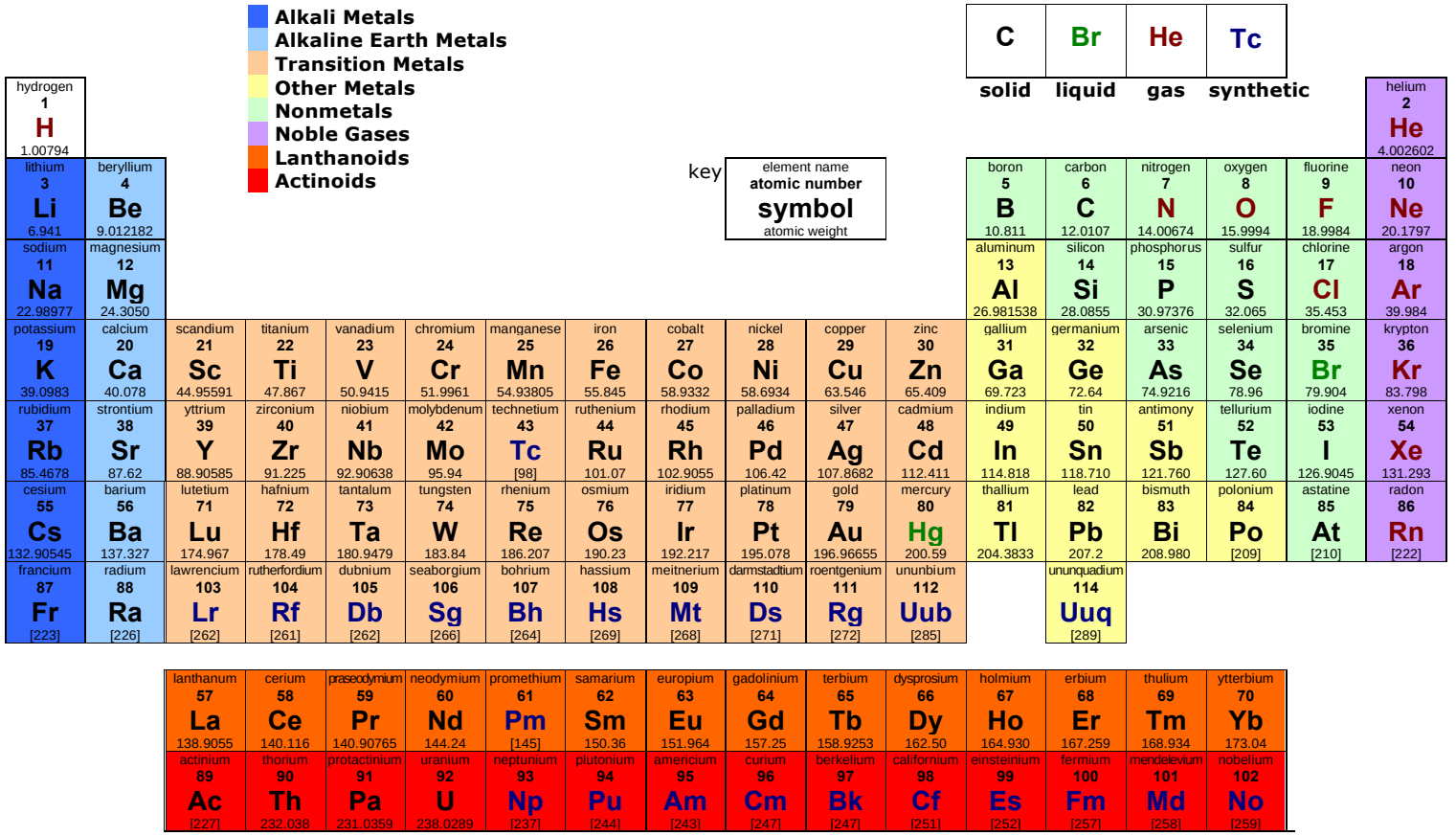
Unit 2.3 Handout 3 (1 page total)

TEACHER ANSWER KEY

	Element/ion	Atomic number	Mass number	Charge	Protons	Neutrons	electrons
1	**Mg**	**12**	**24**	**0**	**12**	**12**	**12**
2	**F**	**9**	**19**	**-1**	**9**	**10**	**10**
3	**S**	**16**	**32**	**-2**	**16**	**16**	**18**
4	**H**	**1**	**1**	**0**	**1**	**0**	**1**
5	**Be**	**4**	**9**	**+2**	**4**	**5**	**2**
6	**Na**	**11**	**23**	**=1**	**11**	**12**	**10**
7	**K**	**19**	**39**	**0**	**19**	**20**	**19**

Lesson 2.3: Physical Science – Chemical Properties

Periodic Table of the Elements



Lesson 2.3: Physical Science – Chemical Properties