Castle Mendeleev- Answer Sheet

For each room, list clues as you read that will help you determine the composition of the room. Examples of clues that will help are: the number of protons, number of neutrons, number of electrons, number of valence electrons, oxidation number, period, family, state of the element, and the name of the family the element belongs to.

ROOM	CLUES	ELEMENT
1	1. 2. 3.	
2	1. 2. 3.	
3	1. 2. 3.	
4	1. 2. 3.	
5	1. 2. 3.	
6	1. 2. 3.	
7	1. 2. 3.	
8	1. 2. 3.	
9	1. 2. 3.	

ROOM	CLUES	ELEMENT
10	1.	
	2.	
	3.	
11	1.	
	2.	
	3.	
12	1.	
	2.	
	3.	
13	1.	
	2.	
	3.	
14	1.	
	2.	
	3.	
15	1.	
	2.	
	3.	
16	1.	
	2.	
	3.	
17	1.	
	2.	
	3.	
18	1.	
	2.	
	3.	

Castle Mendeleev

You and your friends have been magically transported inside an 18-room castle built by the famous chemist Dmitri Mendeleev. Each room is entirely made from one of the elements of the first three rows of the periodic table. No element is repeated. Each element will appear in the state (solid, liquid, or gas) in which it is found at room temperature.

You do not know where in the castle you have been transported. A holographic image of Mendeleev will accompany you on your journey, giving you clues to help you determine which room you are in. Each time you identify the element a room is made from, you will be transported to another room. Once you travel through all the rooms, you will find your way out of the Castle Mendeleev.

Helpful Hints:

- "2nd floor" = 2nd row of the periodic table
- you are in an 18-room castle and you are only using the 1st 3-rows of the periodic table (18 elements)
- valence electrons = electrons on the outside energy level
- diatomic = contains 2 atoms ("di" means 2)
- halogen = Family 7A or 17
- oxidation number: what the charge of the atom will be after it has either gained or lost electrons. Ex: oxidation number of +3 = atom lost 3 electrons and has +3 charge
- alkali metal = Family 1A or 1

1. You and your friends have suddenly materialized into a room made entirely of a shiny metallic solid. A wooden door is set into one wall. A shimmering holograph appears before you. It is an old man with long brown hair and a full beard streaked with gray hairs. Wearing a full-length 19th century topcoat is Dmitri Mendeleev himself. In a crisp, intelligent voice the scientist says, "This room has been constructed of a strong, lightweight, corrosion resistant metal composed of atoms containing 3 valence electrons and 13 protons. It is the 3rd most abundant metal in the Earth's crust. What element is this room made of? Carve its symbol into the wooden door to escape to the next room.

2. The next room you find yourselves in is made of a clear gas. Suddenly, Mendeleev appears saying, "This element is a non-metal, diatomic gas. It is necessary for all living things. It combines with most other elements to form oxides and it gets thinner as you go up in the atmosphere." What symbol will you carve into the door of this room?

3. Next, you and your friends are transported to a room made from a green-yellow gas that immediately begins to burn your nostrils and your throat. You reach into your packs for gas masks to protect yourselves from these noxious (poisonous) fumes. You realize that this gas, when combined with sodium makes a good flavoring for meat and french fries. For the third time a holograph of Mendeleev speaks to you and through the shifting gas says, "This diatomic gas is a halogen." What element surrounds you?

4. In the next room, you find yourselves surrounded by bright yellow crystals. As you remove the gas masks, you smell rotten eggs. The old chemist, tinted yellow by the light reflecting off of the crystals, appears yet again. "The atoms of this element have 6 valence electrons and an atomic mass number of 32g/mol." Carve the symbol of the correct element in the room's door.

5. You are now in a room made of a clear gas, located in one of the towers of Castle Mendeleev. The atoms of this gas have an oxidation number of 0. Trying to talk to your

friends, your voice sounds high-pitched and squeaky, like Mickey Mouse. The holograph tells you, "The atoms of this element are not only extremely stable, they are also molecules." What element is this room made up of?

6. The sixth room you are transported to is on the second floor of the castle and it is composed of a silver-gray metallic solid. Taking a knife out of your backpack, you are able to cut a piece of it off because the substance is very soft. A portion of the element touches your hand, burning your skin. Filling a small glass beaker with water from your canteen, you drop the substance in to observe its reaction with water. It momentarily floats on the water before causing a small explosion. This element has 5 neutrons and an oxidation number of +2. What element is this?

7. Next, you are transported to a room with bright white, waxy walls. When you turn off the lights, the entire room glows in the dark! The holograph tells you, "This element is an important nutrient in plants. It is also used in some water softeners and detergents. This element has an oxidation number of –3 and it has 16 neutrons. What element is this room made of?

8. You are now in a room made of shiny, silver metal. The image of Mendeleev reappears to say, "This element appears here in its pure form. If combined with traces of other elements, it becomes a semiconductor that is used in circuits of electronic devices such as calculators. It and oxygen are the two elements that make sand but not diamonds. The neutrons and protons of this element add up to about 28." What element is he speaking of?

9. The ninth room is composed of a gas that has no color, taste, or odor. A transparent image of the chemist tells you, "An atom of this element has 2 electrons in its first shell and 5 electrons in its second shell. This element makes up approximately 80% of normal air and can be used to make laughing gas." What element is it?

10. The next room you are transported to is made of a soft white material. The 19th century chemist states, "This element will have an intense reaction in water and you could have an explosion. This room is on the second floor of my castle and is made of an alkali metal." Which element is it?

11. Next, you are transported to another room in Castle Mendeleev. The room is made of a thick, inert (stable) Noble gas. Mendeleev flickers into view to tell you, "This element is used to fill light bulbs. The atoms of this element have 2 electrons in the first shell, 8 electrons in the second shell, and 8 electrons in their third shell." Carve the correct symbol into the door.

12. After escaping from room eleven, you materialize into a room made of a solid substance. Mendeleev's image appears in front of you and says, "This element is the basic unit for all living things. Without out, jewelers would go broke, gas stations would go out of business, plants would die, and every breath you exhale would be incomplete. This element can become coal or diamonds under extreme pressure. What element is this room constructed from?

13. The next room you enter is filled with an inert gas. Mendeleev appears telling you, "This atoms of this gas contain 10 neutrons and they emit a brilliant orange-red light when

contained in a light bulb. Las Vegas wouldn't be the same without this element." What is this element?

14. This room is made of a light gray metal. Again, the image of Mendeleev speaks. "This element is so reactive with water that it must be stored in oil and it has an oxidation number of +1." You and your friends remember seeing your science teacher explode some of this in a demonstration. What element is this room made of?

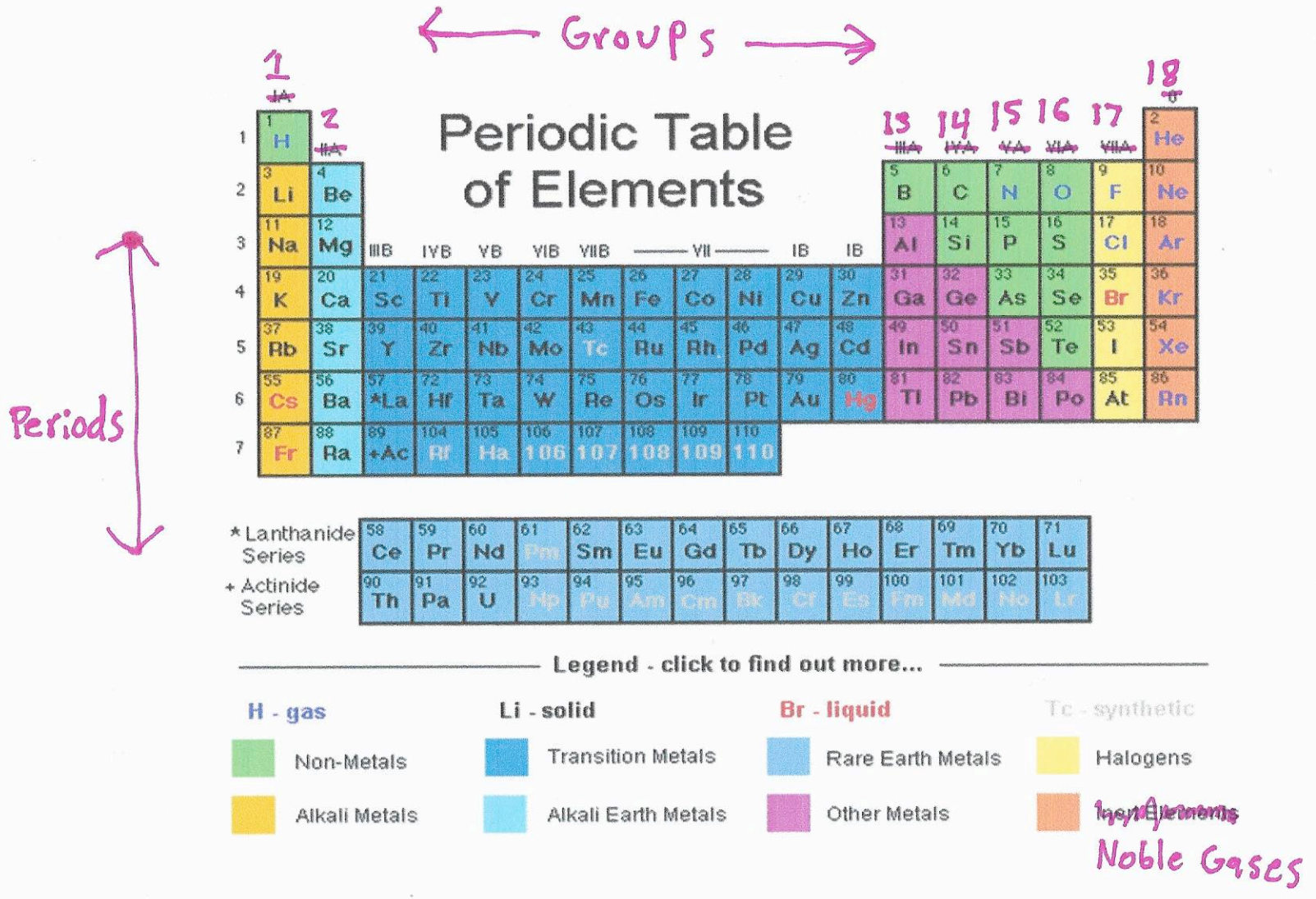
15. The next room you find yourselves in is made of a metal-like material. This element was once mined in Death Valley, California. Dr. Mendeleev says, "Many people use this element to get rid of fleas on their pets. It is in Period 2 and Family 3A or 13 (depending on your periodic table)." What element is this room made of?

16. The sixteenth room you enter is made of a greenish-yellow gas. The image tells you, "The atoms of this element have a high electron affinity. When one combines it with sodium, it can help reduce tooth decay. This is why manufacturers put in toothpaste and why some people have their teeth treated with it. It has 10 neutrons." What element is Mendeleev speaking of?

17. Next, you have been transported to a room on the third floor of Castle Mendeleev that is made of a white solid. The holograph of Dmitri Mendeleev reappears, shifting before you like a milky ghost. "This element is used by many people who have an infection. When combined with sulfur and oxygen it becomes $MgSO_4$ better known as Epsom salt." What element is this room made of?

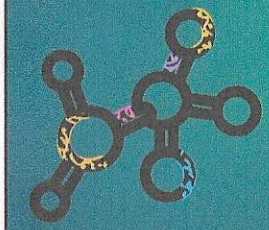
18. You finally find yourself in the first tower of Castle Mendeleev. The room is made of a transparent gas. Mendeleev tells you, "This is the simplest and lightest of all the elements as well as being the most abundant in the universe." What element do you carve on the last door of the castle?

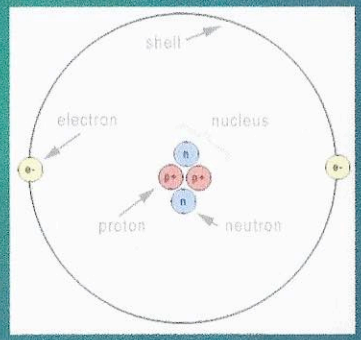
Upon carving the correct symbol into the final door, you and your friends are transported to a large dining hall. The holographic image of Dmitri Mendeleev, who has accompanied you throughout your journey, stands at the end of a long table set for dinner. Speaking to your group for the last time, he says, "Congratulations adventurers! Come, have a seat and drink to your victory with a toast of complex carbon, hydrogen, and oxygen compounds dissolved into a liquid compound of hydrogen and oxygen." Don't worry it's just lemonade.


Groups
Periods
1
2
13
14
15
16
17
18
Periodic Table of Elements
* Lanthanide Series
+ Actinide Series
Legend - click to find out more...
H - gas
Li - solid
Br - liquid
Tc - synthetic
Non-Metals
Transition Metals
Rare Earth Metals
Halogens
Alkali Metals
Alkali Earth Metals
Other Metals
Noble Gases

Matter & the Periodic Table

Ch. 2 - Sec. 1





1

An Introduction to Matter

Neon Gas

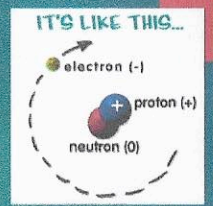

Sulfur


Gold

- **Matter is anything that has mass and takes up space!**
  - All matter is made of elements
  - 112 elements are listed on the Periodic Table
  - Samples of the elements are made up of tiny parts called atoms

2

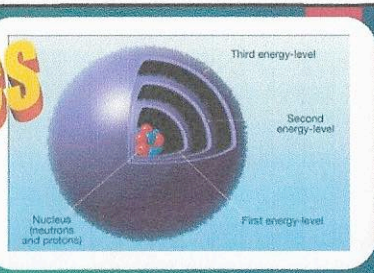
ATOM BASICS



- **ATOM**: the smallest particle that has the properties of an element.
  - Nucleus (99% of atom's mass): uncharged neutrons and positively charged protons. Net charge of the nucleus is **POSITIVE**
  - Electrons in constant motion creating a "cloud" like a fan around the nucleus. Charge of an electron is **NEGATIVE**

3

ATOM BASICS



- Electrons organize in **energy levels**, or shells, that surround the nucleus

The electrons in the outer most energy level are called **Valence Electrons**

- Valence Electrons are the only electrons able to form chemical bonds with other atoms

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ISOTOPES

- **Isotopes** are atoms that have the same # of protons, but a different # of neutrons.
- The difference in the number of neutrons cause isotopes to have a different mass numbers
- **Mass Number = protons + neutrons**
- **Number of Neutrons= Mass - # of protons**
- Isotopes are unstable and fall apart releasing atomic particles – they are radioactive, release energy

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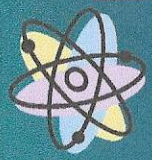
Example of an Isotope



- Example:

  Carbon-12 vs. Carbon-14

  ^{12}C

  Mass # = 12; Atomic # = 6

  (6P, 6E, 6N)

  How did we determine there were 6 neutrons?

  ^{14}C

  Mass # = 14; Atomic # = 6

  (6P, 6E, 8N)

  How did we determine there were 8 neutrons?

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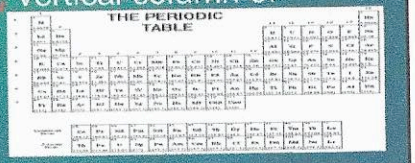
Organization of the Periodic Table

- **PERIODIC LAW**: when elements are arranged in order of increasing atomic number, similarities in their properties will occur in a regular pattern.

  (Periodic means "repeating" pattern.)
- **PERIOD:** horizontal row of elements
- **GROUP (FAMILY):** vertical column of elements.



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- **Alkali Metals**: soft, shiny metals, usually highly reactive with water, ex. Na, Li, K

  Contain one valence electron – GROUP #1
- **Alkaline Earth Metals**: less reactive than other alkali metals, ex. Be, Mg, Ca

  Two valence electrons – GROUP #2

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- **Transition Metal**: complex arrangements of electrons result in many cations
- Ex. Iron (Fe) can be +2, +3, or +4

  Can hold 18 electrons in their valence shell

- **Halogens**: very reactive, form anions, have a negative net charge, all need 1 extra electron

  GROUP #17 Ex. F, Br, I

- **Noble Gases**: non-reactive because of a full valence shell, do not form compounds

  GROUP #18 Ex. Ne, Ar, Kr

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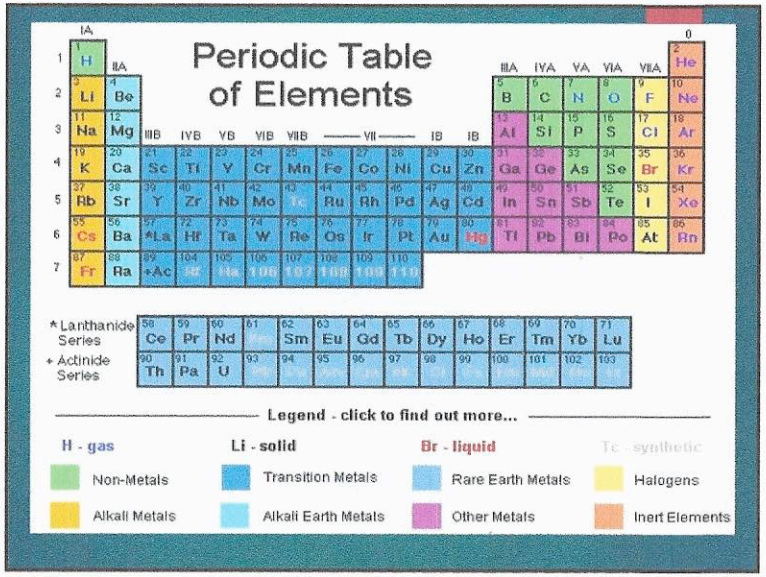

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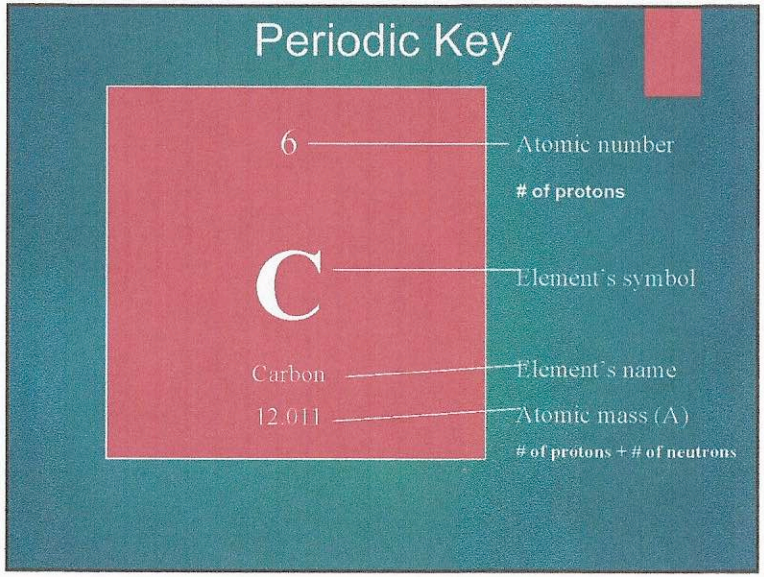

11

Determining the Number of Protons, Neutrons, Electrons

- # of protons = Atomic Number on PT
- # of electrons = # of protons (in a neutral atom)
- # of neutrons = Atomic mass – atomic number

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