CP/Honors Chemistry

Unit 2: Atomic Theory

Sections 4.1, 4.2, 4.3

Subatomic Particles

WARM-UP QUIZ

- 1. What are the three subatomic particles?
- 2. Where are the particles located in the atom?
- 3. What are the charges of the particles?
- 4. What does amu stand for?
- 5. What is the mass (in amu) of each particle?
- 6. Which of the subatomic particles is the lightest?
- 7. What is the charge of the nucleus?
- 8. Where is virtually all of the mass of the atom located?
- 9. What effect do protons have on each other?
- 10. What effect do electrons have on each other?
- 11. What keeps the electrons in the atom?
- 12. What is the symbol for each particle?
- 13. What is the charge of an atom?
- 14. What does the charge of an atom tell us about the number of protons and electrons?
- 15. How is the nucleus of a hydrogen atom different from the nuclei of other elements?

Writing Activity #1	Due Date:	
three subatomic particles. Label ✓ In a well-developed writing, contable that you created as a support	npare and contrast the three subatomic particles. Use the orting document and refer to it in your writing.	
***************************************	• • • • • • • • • • • • • • • • • • • •	•
Atomic Structure		
Atoms make up	, which are	_
■ Discovery of elements ha	ive been reported.	-•
■ These elements are organized in	the modern	
■ The in an element an	re to each other and from	
those of all other elements.		

Carbon is an element. What does this fact indicate about the atoms of carbon? _	
Magnesium, oxygen, and hydrogen are also elements. What can be said about the magnesium, oxygen, and hydrogen?	
Atomic Number	******
■ The Periodic Table (PT) provides information about each element and organ	
in order of on the	
■ The atomic number appears on the Equal to	_
☐ Protons are responsible for the of the elem	
are responsible for the chemical and	
number = number of = number of	
■ In the PT, the is given underneath its name and	
followed by its	Helium element
☑ Concept Check	2atomic numb
1. What determines the identity of an atom?	He symbol
2. What is the atomic number of aluminum?	4.003 atomic mass
3. How many protons are in one atom of aluminum?	
4. How many electrons are in one atom of aluminum?	
5. What is the symbol for fluorine? What is its atomic number?	_
6. What is the symbol for sulfur? How many protons does sulfur have?	?
7. What is the symbol for sodium? How many electrons does sodium h	nave?
8. What is the element with atomic number 7? What is its s	ymbol?
How many protons and electrons does this element have?	
9. What is the name of the 30 th element? How many protons an	d electrons does
this element have? What is the charge of an atom of #30?	
10. What element is symbolized by K? What is its atomic nu	mber?

☑ Concept Check

Isotopes The _ in an atom of a particular element is not always the same. Tritium Protium Deuterium Atomic mass = 2 ■ Definition: Same _____; different _____ Same number of ______; different number of _____ Neutrons are _ ■ Isotopes can be identified by writing the ______ after the element name or symbol. **Examples**: • What element is shown in the diagram to the right? Isotopes • How many protons and electrons are in each isotope? *Note: Not all* electrons are shown. • What determines the identity of the element? Its behavior? • How many neutrons are present in each isotope? • What is the mass in amu for each isotope? • Write the name for each isotope under its diagram. Mass Number, Atomic Mass, and Average Atomic Mass ① The mass of an atom is made up of ______; the mass of . ② Therefore, mass number = Mass number is always a _____ number and can be used with ____ to calculate the number of ______. mass number = _____ + _____ 3 Mass number does not indicate the ______ of an atom. The mass of atoms measured in is extremely small. Carbon - 12 4 More useful to work with ______ atomic mass:

1 amu = _____ (nearly equal to mass of proton or neutron)

The average atomic mass is the	e			
	. Isotopes exi	sting in greater	ha	ve a greater
⑤ Due to weighted nature, atomic				·
The average atomic mass appear	ars	the element sy	mbol on the Perio	odic Table.
© Rounding the average atomic m	ass to the		giv	ves the
	for the		isotope of	the element.
⑦ The average atomic mass can b	e calculated v	vhen given		and
		of an element's i	naturally occurrin	g isotopes.
Average Atomic Mass =			·	
				etc.
Example : Find the weighted a	verage mass o	of a football team if	92.0% of the play	ers weigh
200. lbs. and 8.00% weigh 180	•		r = , r · · · · · · · · · · · · · · · · · ·	
Average mass = () + ()()
Average mass =	/\		/	/
Average mass —				
Practice . Calculate the average at copper-63 and copper-65. The perc 62.9 amu. The percent abundance of	cent abundanc	e for copper-63 is 6	9.2%, and its ator	mic mass is
Isotope Names				
• All carbon atoms contain	-			
☐ One isotope of carbon contain	•			
(# protons + # neutrons). The	e isotope nam	e for this isotope of	carbon is written	as
or _				
The carbon isotope containin	g seven neutr	ons is	or	·
☑ Concept Check	*****	• • • • • • • • • • • • • • • • • • • •	•) * * * * * * * * * * *
1. What is the isotope name for	or potassium	with 21 neutrons?		
2. What is the isotope name for	or oxygen wit	h 9 neutrons?		
3. What does nitrogen-13 (or	,			
**********************	• • • • • • • • • • • •	* * * * * * * * * * * * * * * * * * *	• • • • • • • • • • • • • • • •	*********

Isotopic Notation

■ Isotopic notation or isotope symbol: uses the element ______, _____, and

mass	number	v
atomic	number	X

14 C

[Carbon-14]

Practice

- 1. For the carbon isotope above, find the
 - a. Atomic number: _____
 - b. Number of protons: _____
 - c. Number of electrons: _____
 - d. Number of neutrons:
- 2. Write the isotopic notation for neon-22.
- 3. Write the isotope symbol for calcium with 26 neutrons.
- 4. Write the name of the isotope having 8 protons and 9 neutrons. Write its isotopic notation.

Charged Particles: Ions

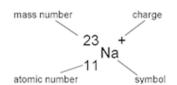
- The nucleus of an atom has a _____ charge. Why?
- Electrons are _____ charged. Why is the atom electrically neutral?
- Definition of *ion*:
- Definition of *anion*:

Example: F Atomic # = # of $e^ F^-$ one electron

■ Definition of *cation*:

Example: Mg Atomic # = # of e^- Mg²⁺ _____ two electrons

 Isotopic notations for ions show the _____ in addition to the symbol, _____ number and _____ number.



Practice

1.
$$Mg^{2+}$$

$$\# p^+ = _$$

$$\#n^0 =$$

2.
$$Al^{3+}$$

$$\# p^+ = \underline{\hspace{1cm}}$$

$$\#\mathbf{n}^0 = \underline{\hspace{1cm}}$$

3.
$$O^{2-}$$

$$\# p^+ = \underline{\hspace{1cm}}$$

$$\#n^0 =$$

$$\# p^+ = \underline{\hspace{1cm}}$$

$$\#e^{-} =$$

$$\#n^0 =$$

$$\# p^+ = \underline{\hspace{1cm}}$$

$$\#n^0 = ___$$

$$\# p^+ = \underline{\hspace{1cm}}$$

6.
$$Cl^-$$
 # $p^+ = ___$ # $e^- = ___$ # $n^0 = ___$

$$#n^0 =$$

Identifying Characteristics of Atoms

Using the square for silicon from the Periodic Table, identify the following:

- 1. Element Symbol
- 2. Atomic Number
- 3. Number of Protons
- 4. Number of Electrons
- 5. (Average) Atomic Mass
- 6. Mass Number (round atomic mass to the nearest whole number)
- 7. Number of Neutrons
- 8. Write the isotopic notation for the most common isotope of silicon.

Using the square for manganese from the Periodic Table, identify the following:

- 1. Element Symbol
- 2. Atomic Number
- 3. Number of Protons
- 4. Number of Electrons
- 5. (Average) Atomic Mass
- 6. Mass Number (round atomic mass to the nearest whole number)
- 7. Number of Neutrons
- 8. Write the isotopic notation for the most common isotope of manganese.

Atomic Structure Practice

Element Name	Element Symbol	Atomic Number	Mass Number	Number of Protons	Number of Electrons	Number of Neutrons
Bromine						
	Ni					
		86				138
					10	12
	Zn		64			
		55				
				92		148
			42		19	
lodine						75



Manganese

25

Mn 54.938



Calculating Average Atomic Mass

Using the isotope data in the table below, calculate the average atomic mass and determine the identity of the element.

Mass (amu)	Percent Abundance
49.946	4.3%
51.941	83.8%
52.941	9.5%
53.939	2.4%

Practi What i	ice is the atomic number for thallium?	What is the element symbol?			
How n	many protons are in an atom of radium?	How many electrons?			
How n	many protons are in an atom of cerium?	How many neutrons?			
	in (using complete sentences) how to determine ss number and atomic number are known.	ne the number of neutrons an atom contains if			
	is the mass number of potassium-39?				
	, , , , , , , , , , , , , , , , , , ,	•••••			
	Icept Check Lithium, which has an atomic mass of 6.9400 Li-6 and Li-7. Which isotope occurs in great	• •			
2.	Chlorine has two naturally occurring isotope of chlorine is 35.453 amu. Which isotope occ				
3.	3. How do you determine which isotope is in greater abundance (<i>when not given percent abundance</i>)?				
	ing Activity #2	Due Date:			
✓ You	ur assigned element:				
nun	a well-developed writing piece, explain the termber. Use your assigned element as a specific to include the number many protons, neutron ment would have	example to support your explanation. Be as, and electrons an atom of your assigned			

Electrons

✓ Compare the following isotopes:

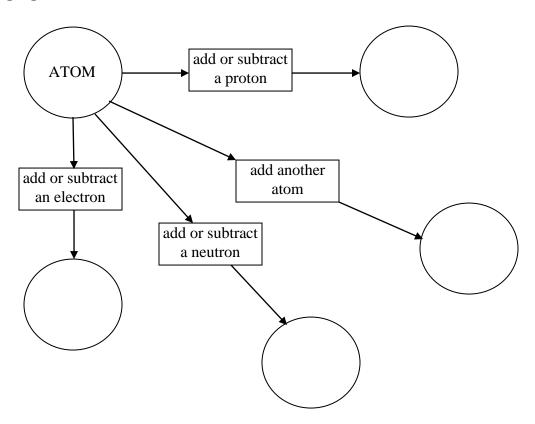
Electrons _____

${}^{12}_{6}$ C	13 C	${\overset{14}{\mathrm{C}}}$	
Atomic #	 Atomic #	 Atomic #	
Mass #	 Mass #	 Mass #	
# Protons	 # Protons	 # Protons	
# Neutrons	 # Neutrons	 # Neutrons	

✓ In a well-developed paragraph, thoroughly explain how these isotopes are similar and how they are different. Use specific details from the carbon examples to support your explanation.

Electrons _____

Changing an Atom



ESSENTIAL VOCABULARY

ANION ATOMIC NUMBER ION NEUTRON
ATOM CATION ISOTOPES NUCLEUS
ATOMIC MASS ELECTRON MASS NUMBER PROTON

ATOMIC MASS UNIT