

**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?

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**Writing Activity #1** **Due Date:** \_\_\_\_\_

- ✓ Create a table indicating the symbol, location, charge, and relative mass (in amu) of the three subatomic particles. Label the table *Document A*.
- ✓ In a well-developed writing, compare and contrast the three subatomic particles. Use the table that you created as a supporting document and refer to it in your writing.

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**Atomic Structure**

- Atoms make up \_\_\_\_\_, which are \_\_\_\_\_.
- Discovery of \_\_\_\_\_ elements have been reported.
- These elements are organized in the modern \_\_\_\_\_.
- The \_\_\_\_\_ in an element are \_\_\_\_\_ to each other and \_\_\_\_\_ from those of all other elements.

**☑ Concept Check**

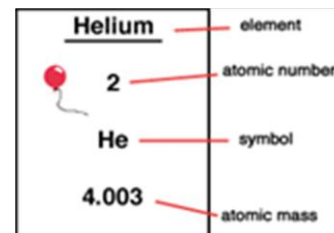
Carbon is an element. What does this fact indicate about the atoms of carbon? \_\_\_\_\_

Magnesium, oxygen, and hydrogen are also elements. What can be said about the atoms of magnesium, oxygen, and hydrogen? \_\_\_\_\_

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**Atomic Number**

- The Periodic Table (PT) provides information about each element and organizes the elements in order of \_\_\_\_\_.
- The atomic number appears \_\_\_\_\_ on the periodic table.
  - ☐ Equal to \_\_\_\_\_
  - ☐ Protons are responsible for the \_\_\_\_\_ of the element. Electrons are responsible for the chemical \_\_\_\_\_ and \_\_\_\_\_ of atoms.
  - ☐ Since atoms are neutral,  
\_\_\_\_\_ number = number of \_\_\_\_\_ = number of \_\_\_\_\_
- In the PT, the \_\_\_\_\_ is given underneath its name and atomic number, followed by its \_\_\_\_\_.



**☑ Concept Check**

1. What determines the identity of an atom? \_\_\_\_\_
2. What is the atomic number of aluminum? \_\_\_\_\_
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 have? \_\_\_\_\_
8. What is the element with atomic number 7? \_\_\_\_\_ What is its symbol? \_\_\_\_\_  
How many protons and electrons does this element have? \_\_\_\_\_
9. What is the name of the 30<sup>th</sup> element? \_\_\_\_\_ How many protons and 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 number? \_\_\_\_\_



- ④ The *average atomic mass* is the \_\_\_\_\_  
 \_\_\_\_\_. Isotopes existing in greater \_\_\_\_\_ have a greater  
 \_\_\_\_\_.
- ⑤ Due to weighted nature, atomic masses are \_\_\_\_\_.  
 The average atomic mass appears \_\_\_\_\_ the element symbol on the Periodic Table.
- ⑥ Rounding the average atomic mass to the \_\_\_\_\_ gives the  
 \_\_\_\_\_ for the \_\_\_\_\_ isotope of the element.
- ⑦ The average atomic mass can be calculated when given \_\_\_\_\_ and  
 \_\_\_\_\_ of an element's naturally occurring isotopes.

Average Atomic Mass =

*etc.*

**Example:** Find the weighted average mass of a football team if 92.0% of the players weigh 200. lbs. and 8.00% weigh 180. lbs.

$$\text{Average mass} = (\text{_____})(\text{_____}) + (\text{_____})(\text{_____})$$

Average mass =

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**Practice.** Calculate the average atomic mass for the two naturally occurring isotopes of copper: copper-63 and copper-65. The percent abundance for copper-63 is 69.2%, and its atomic mass is 62.9 amu. The percent abundance of copper-65 is 30.8%, and its atomic mass is 64.9 amu.

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**Isotope Names**

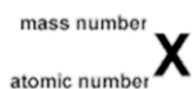
- All carbon atoms contain \_\_\_\_\_ protons because \_\_\_\_\_.
- ✧ One isotope of carbon contains eight neutrons, giving it a mass number of \_\_\_\_\_  
 (# protons + # neutrons). The isotope name for this isotope of carbon is written as  
 \_\_\_\_\_ or \_\_\_\_\_.
- ✧ The carbon isotope containing seven neutrons is \_\_\_\_\_ or \_\_\_\_\_.

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 **Concept Check**

1. What is the isotope name for potassium with 21 neutrons?
2. What is the isotope name for oxygen with 9 neutrons?
3. What does nitrogen-13 (or N-13) mean?

## Isotopic Notation

- Isotopic notation or isotope symbol: uses the element \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.



### Practice

- For the carbon isotope above, find the
  - Atomic number: \_\_\_\_\_
  - Number of protons: \_\_\_\_\_
  - Number of electrons: \_\_\_\_\_
  - Number of neutrons: \_\_\_\_\_
- Write the isotopic notation for neon-22.
- Write the isotope symbol for calcium with 26 neutrons.
- Write the name of the isotope having 8 protons and 9 neutrons. \_\_\_\_\_  
Write its isotopic notation.

## Charged Particles: Ions

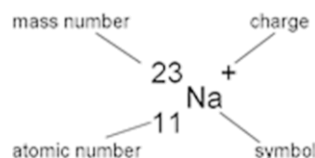
- The nucleus of an atom has a \_\_\_\_\_ charge. Why?
- Electrons are \_\_\_\_\_ charged. Why is the atom electrically neutral?
- Definition of *ion*:

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

- Definition of *cation*:

**Example:** Mg Atomic # \_\_\_\_\_ = # of  $e^-$   $Mg^{2+}$  \_\_\_\_\_ two electrons

- Isotopic notations for ions show the \_\_\_\_\_ in addition to the symbol, \_\_\_\_\_ number and \_\_\_\_\_ number.



### Practice

- $Mg^{2+}$       #  $p^+$  = \_\_\_\_\_      #  $e^-$  = \_\_\_\_\_      #  $n^0$  = \_\_\_\_\_
- $Al^{3+}$       #  $p^+$  = \_\_\_\_\_      #  $e^-$  = \_\_\_\_\_      #  $n^0$  = \_\_\_\_\_
- $O^{2-}$       #  $p^+$  = \_\_\_\_\_      #  $e^-$  = \_\_\_\_\_      #  $n^0$  = \_\_\_\_\_
- $P^{3-}$       #  $p^+$  = \_\_\_\_\_      #  $e^-$  = \_\_\_\_\_      #  $n^0$  = \_\_\_\_\_
- $K^+$       #  $p^+$  = \_\_\_\_\_      #  $e^-$  = \_\_\_\_\_      #  $n^0$  = \_\_\_\_\_
- $Cl^-$       #  $p^+$  = \_\_\_\_\_      #  $e^-$  = \_\_\_\_\_      #  $n^0$  = \_\_\_\_\_

## 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.

<p style="text-align: center;">Silicon</p> <p style="text-align: center;">14</p> <p style="text-align: center;"><b>Si</b></p> <p style="text-align: center;">28.086</p>
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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.

<p style="text-align: center;">Manganese</p> <p style="text-align: center;">25</p> <p style="text-align: center;"><b>Mn</b></p> <p style="text-align: center;">54.938</p>
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## 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	
Iodine						75



✓ Compare the following isotopes:



Atomic # \_\_\_\_\_

Atomic # \_\_\_\_\_

Atomic # \_\_\_\_\_

Mass # \_\_\_\_\_

Mass # \_\_\_\_\_

Mass # \_\_\_\_\_

# Protons \_\_\_\_\_

# Protons \_\_\_\_\_

# Protons \_\_\_\_\_

# Neutrons \_\_\_\_\_

# Neutrons \_\_\_\_\_

# Neutrons \_\_\_\_\_

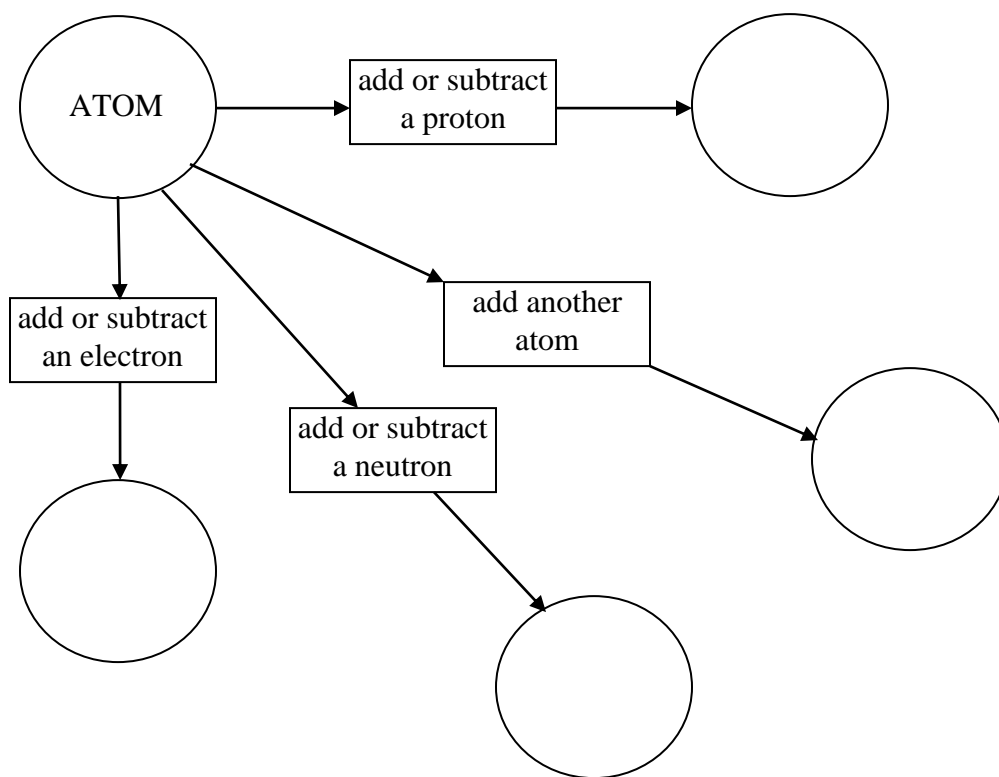
# Electrons \_\_\_\_\_

# Electrons \_\_\_\_\_

# Electrons \_\_\_\_\_

✓ 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.

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**Changing an Atom**



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**ESSENTIAL VOCABULARY**

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

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