

# Ch. 4 Worksheet: What Is an Atom?

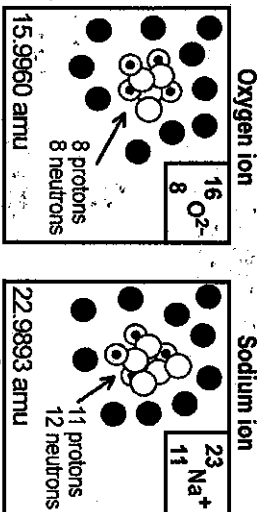
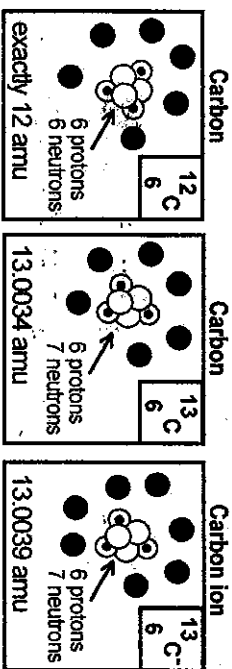
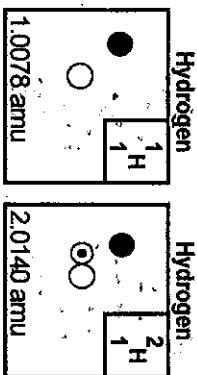
Data collected from selected atoms:

|  |                   |
|--|-------------------|
|  | Electron (-)      |
|  | Proton (+)        |
|  | Neutron (neutral) |

|     |     |       |     |
|-----|-----|-------|-----|
| $A$ | $X$ | $1-2$ | $C$ |
| $Z$ |     | $6$   |     |

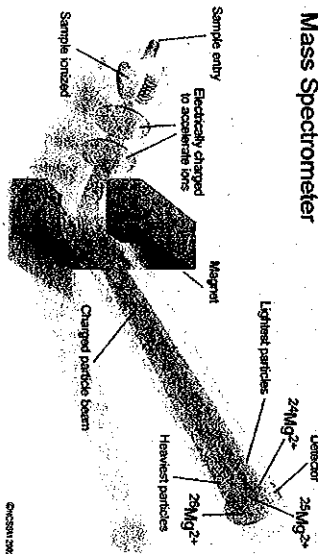
A is the mass number  
Z is the atomic number

Name: Key  
Date: \_\_\_\_\_ Period: \_\_\_\_\_



The nucleus of an atom contains the protons and the neutrons.  
 ${}^1_1\text{H}$  and  ${}^2_1\text{H}$  are isotopes of hydrogen.  
 ${}^{12}_6\text{C}$  and  ${}^{13}_6\text{C}$  are isotopes of carbon.  
An ion is a charged particle.  $\text{O}^{2-}$  and  $\text{Na}^+$  are ions.  
You can't see all the neutron and protons in the nucleus in the diagrams.

Chemists identify isotopes by using a mass spectrometer. The separation is possible because each isotope has a different mass. Lighter masses will bend more as they pass through the magnet field.



### Critical Thinking Questions

- How many protons are found in  ${}^{12}_6\text{C}$ ? 6  ${}^{13}_6\text{C}$ ? 6
- How many neutrons are found in  ${}^{12}_6\text{C}$ ? 6  ${}^{13}_6\text{C}$ ? 7  ${}^{13}_6\text{C}^-$ ? 8
- How many electrons are found in  ${}^{12}_6\text{C}$ ? 6  ${}^{13}_6\text{C}$ ? 6  ${}^{13}_6\text{C}^-$ ? 6
- Based on the data presented above.
  - What do all carbon atoms (and ions) have in common?  
**same # of protons**
  - What do all hydrogen atoms (and ions) have in common?  
**same # of protons**
- What is the significance of the atomic number, Z? Where will you find it on the periodic table?  
**Z is the same as the # of protons above symbol**
- Look at a periodic table, what do all nickel (Ni) atoms have in common?  
**all have 28 protons**
- How is the mass number, A, determined?  
 **$A = p^+ + n^0$**
- What structural feature is different in isotopes of a particular element?  
**different #  $n^0$**
- What feature distinguishes a neutral atom from an ion?  
**neutral atom has an equal # of  $p^+$  and  $e^-$**

10. Where is most of the mass of an atom, within the nucleus or outside of the nucleus? Explain your reasoning.

within the nucleus where the  $p^+$  and  $n^0$  are

11. Complete the chart below:

| Isotope             | Atomic Number<br>Z | Mass Number<br>A | Number of Electrons |
|---------------------|--------------------|------------------|---------------------|
| $31P$               | 15                 | 31               | 31                  |
| $^{180}_{39}Y^{+1}$ | 39                 | 180              | 38                  |
| $^{58}_{19}K^{+1}$  | 19                 | 39               | 18                  |
| $^{58}_{28}Ni^{2+}$ | 28                 | 58               | 26                  |

12. What is the mass (in amu) of

a. one  $^1H$  atom? 1 amu

b. one  $^{12}C$  atom? 12 amu

13. Define mass number

$$\text{mass \#} = p^+ + n^0$$

14. Define atomic number.

$$Z = \# p^+$$

15. How many electrons, protons, and neutrons are found in each of the following?

| Atom or ion    | Electrons | Protons | neutrons |
|----------------|-----------|---------|----------|
| $^{24}Mg$      | 12        | 12      | 12       |
| $^{23}Na$      | 11        | 11      | 12       |
| $^{35}Cl$      | 17        | 17      | 18       |
| $^{39}K^{+1}$  | 38        | 39      | 40       |
| $^{56}Fe^{3+}$ | 23        | 26      | 30       |
| $^{16}O^{2-}$  | 18        | 8       | 8        |
| $^{27}Al^{3+}$ | 10        | 13      | 14       |

16. Summary of Activity: Describe an atom

An atom contains a nucleus in the center made up of protons and neutrons. The electrons orbit the nucleus in the orbitals of the electron cloud.