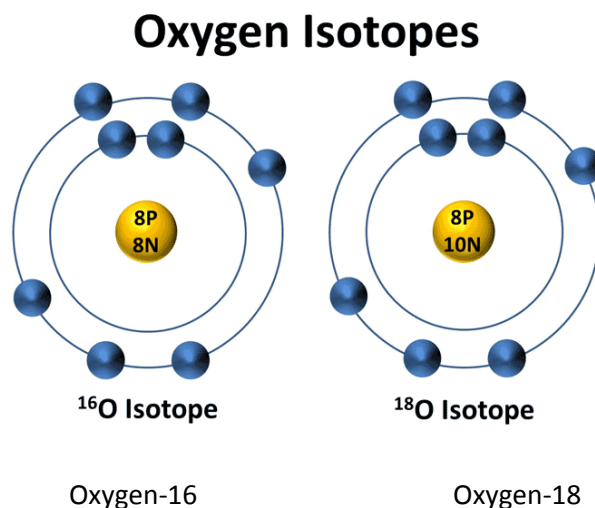


Isotopes

Isotopes are atoms of the same element that have different masses due to different numbers of neutrons. See the example below for two isotopes of oxygen. One has 8 neutrons while the other has 10 neutrons. Therefore, the masses are 16 amu and 18 amu respectively.



Isotopes are written with the name followed by a hyphen and the mass number. Symbol notation is when we write it like this: $^{16}_8\text{O}$ and $^{18}_8\text{O}$

Practice:

1. Lithium has two isotopes: lithium-6 and lithium-7. Draw a diagram like those above for each lithium isotope. Label the protons, electrons, neutrons. *Note that only two electrons can go in the first energy level.*

2. Write the symbol notation for each of the following isotopes.
 - a. Potassium-39
 - b. Potassium-40
 - c. Potassium-41

3. Write an equation showing the relationship between an atom's atomic number and its mass number. (Hint: it should be in your notes.)

Isotopes

4. Which subatomic particles identifies an atom as that of a particular element?
5. What do all isotopes of an element have in common?
6. What do the superscript and the subscript in the notation $^{200}_{80}\text{Hg}$ represent?
7. An isotope of xenon has an atomic number of 54 and contains 77 neutrons. What is the mass of this isotope?
8. What is the mass number of uranium-234?
9. How many neutrons are in uranium 234?
10. Silicon is very important to the semiconductor industry. The three naturally occurring isotopes of silicon are silicon-28, silicon-29 and silicon-30.
 - a. Write the symbol for each.
 - b. How many protons does each one have?
 - c. How many neutrons does each isotope of silicon have?
11. Determine the number of protons, electrons, and neutrons for isotopes a. through e. in the table. Name each isotope, and write its symbol.

Element	Atomic Number	Mass Number	Protons	Neutrons	Electrons	Symbol
a. O^{-2}	8	16				
b. O	8	17				
c. O	8	18				
d. Zn^{+2}	30	64				
e. Zn	30	64				

1. Who was the first to arrange elements in a table? How were they arranged?
2. Who arranged the elements by atomic number?
3. What are the three main types of elements?
4. Where are metals located?
5. Where are nonmetals located?
6. Which element touches the staircase but is not a metalloid? What type of element is it?
7. What type of element is sodium?
8. What type of element is sulfur?
9. What type of element is silicon?
10. Why do elements in the same group have similar chemical properties?
11. What does the period number indicate?
12. What is the group number and name of the most active metals?
13. What is the group number and name of the most active nonmetals?
14. What is the name of group 18? What state of matter are the elements in that group in?
15. How many valence electrons does calcium have?

16. How many valence electrons does oxygen have?
17. How many valence electrons does helium have?
18. What is the name of group 2?
19. What group number are the halogens in?
20. What can we use to predict the properties of an element?
21. Who developed the basis for modern atomic theories?
22. Who discovered the electron? How?
23. Who discovered the nucleus? How?
24. Who proposed the idea that electrons are in fixed orbits?
25. What model is believed to be the most accurate?
26. An atom has 17 protons, 17 electrons, and 19 neutrons. What is the mass number of that atom?
27. Find the number of protons, neutrons, and electrons for the following elements.
 - A. Arsenic-75
 - B. Gold-197
 - C. Fluorine-19

28. Find the number of protons and electrons for the following ions.

A. Silver ion (Ag^{1+})

B. Carbon ion (C^{4-})

C. Strontium ion (Sr^{2+})

29. Isotopes have the same number of _____, and different number of _____ or _____.

30. I have an isotope that has 84 protons and 125 neutrons. Write the complete hyphen and symbolic notations for this isotope.

31. Write the number of protons, neutrons, and electrons for the isotope: $^{65}_{29}\text{Cu}$

P = _____ E = _____ N = _____

32. Write the number of protons, neutrons, and electrons for the isotope-ion: $^{44}_{20}\text{Ca}^{+2}$

P = _____ E = _____ N = _____

33.

Element	Atomic Number	Number of Protons	Number of Neutrons	Mass Number	Isotope Symbol
Calcium (Ca)		20	20		
Nickel (Ni)		28		59	
Gold (Au)	79		118		
	6			14	

1. Who was the first to arrange elements in a table? How were they arranged?

Mendeleev. He arranged the periodic table by the atomic mass. Atomic number was not discovered yet...

2. Who arranged the elements by atomic number?

Mosley. He provided the basis of ordering elements on the periodic table today.

3. What are the three main types of elements?

Metals, metalloids, nonmetals

4. Where are metals located?

On the LEFT side of the metalloids

5. Where are nonmetals located?

On the RIGHT side of metalloids

6. Which element touches the staircase but is not a metalloid? What type of element is it?

Aluminum. It is a metal

7. What type of element is sodium?

Metal

8. What type of element is sulfur?

Nonmetal

9. What type of element is silicon?

Metalloids

10. Why do elements in the same group have similar chemical properties?

Because they have the same numbers of valence electrons.

11. What does the period number indicate?

The energy levels

12. What is the group number and name of the most active metals?

Alkali metals

13. What is the group number and name of the most active nonmetals?

Halogens

14. What is the name of group 18? What state of matter are the elements in that group in?

Noble Gases. They are all gas at room temperature.

15. How many valence electrons does calcium have?

2 valence electrons

16. How many valence electrons does oxygen have?

6 valence electrons

17. How many valence electrons does helium have?

2 valence electrons

18. What is the name of group 2?

Alkaline Earth Metals

19. What group number are the halogens in?

17 or 7A

20. What can we use to predict the properties of an element?

The position of the element on the periodic table. Example: group, period, family, etc.

21. Who developed the basis for modern atomic theories?

Dalton

22. Who discovered the electron? How?

Thomson. By doing the Cathode Ray Tube Experiment.

23. Who discovered the nucleus? How?

Rutherford. By doing the Gold Foil Experiment

24. Who proposed the idea that electrons are in fixed orbits?

Bohr

25. What model is believed to be the most accurate?

The Electron Cloud Model

26. An atom has 17 protons, 17 electrons, and 19 neutrons. What is the mass number of that atom?

$P^+ + n^0 = \text{mass}$ $17 + 19 = 36$

27. Find the number of protons, neutrons, and electrons for the following elements.

A. Arsenic-75 33 protons 42 neutrons 33 electrons

B. Gold-197 79 protons 118 neutrons 79 electrons

C. Fluorine-19 9 protons 10 neutrons 9 electrons

28. Find the number of protons and electrons for the following ions.

A. Silver ion (Ag^{1+}) 47 protons 46 electrons

B. Carbon ion (C^{4-}) 6 protons 10 electrons

C. Strontium ion (Sr^{2+}) 38 protons 36 electrons

29. Isotopes have the same number of protons, and different number of mass number or neutrons.

30. I have an isotope that has 84 protons and 125 neutrons. Write the complete hyphen and symbolic notations for this isotope.

Polonium – 209 $^{209}_{84}\text{Po}$

31. Write the number of protons, neutrons, and electrons for the isotope: $^{65}_{29}\text{Cu}$

P = 29 E = 29 N = 36

32. Write the number of protons, neutrons, and electrons for the isotope-ion: $^{44}_{20}\text{Ca}^{+2}$

P = 20 E = 18 N = 24

33.

Element	Atomic Number	Number of Protons	Number of Neutrons	Mass Number	Isotope Symbol
Calcium (Ca)	20	20	20	40	$^{40}_{20}\text{Ca}$
Nickel (Ni)	28	28	31	59	$^{59}_{28}\text{Ni}$
Gold (Au)	79	79	118	197	$^{197}_{79}\text{Au}$
Carbon (C)	6	6	8	14	$^{14}_6\text{C}$