

Name _____

Block 1A

Date 10/18



Atomic Structure

Where are protons, neutrons and electrons found in an atom?

Protons & Neutrons = Nucleus

Electrons = Electron cloud

Atomic # = # Protons = # Electrons

Elements are electrically neutral, so they must have equal positive and negative charges
(positive + negative = 0)

Ex. He atomic #2 has 2 positive protons and therefore must have 2 negative electrons in order to be neutral.

We already know that the protons and neutrons contain the mass of an atom. (remember electrons are 1836 x's smaller in mass or electrons mass is 1/1836 of proton or neutron)

Atomic Mass Unit (AMU) = $1/12^{\text{th}}$ the mass of a Carbon-12 atom

And, Mass Number is the Whole Number

Mass # = # protons + # neutrons

So, Mass # - Atomic # = # Neutrons

(protons+neutrons) - (protons) = # neutrons

Ex. Lithium, ${}^7_3\text{Li}$, Atomic # 3, Mass # 7, has 3 protons and a total of 7 protons and neutrons.

Mass # - Atomic # = # Neutrons

7 - 3 = 4 neutrons

How many electrons in Lithium? 3

There are different ways to represent the same Isotope...what's an isotope?

Isotope-atoms with the same # of protons, but different #'s of neutrons.

Two isotopes of the element Carbon.

Carbon-12

C-12

${}^{12}_6\text{C}$

Atomic # 6

#protons=6

#electrons=6

Mass # = 12

12 - 6 = 6 neutrons

Carbon-14

C-14

${}^{14}_6\text{C}$

Atomic #6

#protons=6

#electrons=6

Mass # = 14

14 - 6 = 8 neutrons

mass number

100

CHEMISTRY

ATOMIC STRUCTURE PRACTICE I

X = element symbol

A = mass number [# of protons (p) + # neutrons (n)]

Z = atomic number [# of protons]

N = # of neutrons

A - Z = N

A typical isotopic symbol takes this form:



ex. The isotopic symbol for Fluorine would be



Mass #
must be a whole #
not from P.T.!

Fill in the missing items in the table below.

Name	Symbol	<i>Atomic #</i> Z	<i>Mass #</i> A	#p	#e	#n	Isotopic Symbol
Sodium	$^{23}_{11}\text{Na}$	11	23	11	11	12	$^{23}_{11}\text{Na}$
Chlorine	Cl	17	35	17	17	18	$^{35}_{17}\text{Cl}$
Potassium	K	19	39	19	19	20	$^{39}_{19}\text{K}$

Fill in the missing items in the table below.

Name	Symbol	<i>Atomic #</i> Z	<i>Mass #</i> A	#p	#e	#n	Isotopic Symbol
Phosphorus	$^{31}_{15}\text{P}$	15	31	15	15	16	$^{31}_{15}\text{P}$
Iron	Fe	26	56	26	26	30	$^{56}_{26}\text{Fe}$
Iodine	I	53	127	53	53	74	$^{127}_{53}\text{I}$

Fill in the missing items in the table below.

Name	Symbol	<i>Atomic #</i> Z	<i>Mass #</i> A	#p	#e	#n	Isotopic Symbol
Silver	Ag	47	108	47	47	61	$^{108}_{47}\text{Ag}$
Krypton	Kr	36	84	36	36	48	$^{84}_{36}\text{Kr}$
Tungsten	$^{184}_{74}\text{W}$	74	184	74	74	110	$^{184}_{74}\text{W}$

Name: _____
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Atomic Structure Worksheet

1. The 3 particles of the atom are:

- a. proton
- b. neutron
- c. electron

Their respective charges are:

- a. positive
- b. neutral
- c. negative

2. The number of protons in one atom of an element determines the atom's atomic number, and the number of electrons determines charge of an element.

3. The atomic number tells you the number of protons in one atom of an element. It also tells you the number of electrons in a ~~neutral~~ atom of that element. The atomic number gives the "identity" of an element as well as its location on the Periodic Table. No two different elements will have the same atomic number.

4. The Atomic mass of an element is the average mass of an element's naturally occurring atom, or isotopes, taking into account the isotopes of each isotope. relative mass (g)

5. The mass number of an element is the total number of protons and neutrons in the nucleus of the atom.

6. The mass number is used to calculate the number of neutrons in one atom of an element. In order to calculate the number of neutrons you must subtract the atomic # from the mass #.

7. Give the symbol and number of protons in one atom of:

Lithium Li 3p⁺
 Iron Fe 26p⁺
 Oxygen O 8p⁺
 Krypton Kr 36p⁺

Bromine Br 35p⁺
 Copper Cu 29p⁺
 Mercury Hg 80p⁺
 Helium He 2p⁺

8. Give the symbol and number of electrons in a neutral atom of:

Uranium U 92e⁻
 Boron B 5e⁻
 Antimony Sb 51e⁻

Chlorine Cl 17e⁻
 Iodine I 53e⁻
 Xenon Xe 54e⁻

9. Give the symbol and number of neutrons in one atom of:

Show your calculations.

Barium -127 127 - 56 = 71 Ba

Carbon -14 14 - 6 = 8 C

Fluorine -18 18 - 9 = 9 F

Europium -153 153 - 63 = 90 Eu

Bismuth -207 207 - 83 = 124 Bi

Hydrogen -3 3 - 1 = 2 H

Magnesium -30 30 - 12 = 18 Mg

Mercury -177 177 - 80 = 97 Hg

10. Name the element which has the following numbers of particles:

a. 26 electrons, 29 neutrons, 26 protons Titanium Ti

b. 53 protons, 74 neutrons Iodine I

c. 2 electrons (neutral atoms) Helium He

d. 20 protons Calcium Ca

e. 86 electrons, 125 neutrons, 82 protons (charged atom) Lead Pb

f. 0 neutrons Hydrogen H

11. If you know only the following information can you always determine what the element is?
 (Yes/No).

a. number of protons yes

b. number of neutrons no

c. number of electrons in a neutral atom yes

d. number of electrons no

I Properties of subatomic particles—mass and charge

A system for expressing the masses of atoms and subatomic particles has been developed based upon the atomic mass unit.

- One atomic mass unit (u) is defined as exactly $\frac{1}{12}$ of a carbon 12 atom.
- The mass of one proton is equal to about 1 amu
- The mass of one neutron is slightly greater than that of the proton but still approximately 1 amu
- The mass of the electron is approximately $1/1837$ of the mass of a(n) proton. Its mass is often regarded as negligibly nothing.
- Complete the following table of properties of the subatomic particles.

Particle	Charge	Mass	Location
proton	+	1 amu	nucleus
neutron	0	1 amu	nucleus
electron	-	almost nothing	electron cloud

II Determining # of PROTONS, NEUTRONS & ELECTRONS...

1. Determine the number of **protons** in each of the following:

- An atom with atomic number 14 14
- An atom of sodium (Na) 11
- An atom with a mass number of 37 and an atomic number of 17 17
- An atom of U-238 92
- An atom of ^{235}U 92

2. Determine the number of **neutrons** in each of the following:

- An atom of carbon with mass number 14 8
- An atom with an atomic number of 27 and a mass number of 60 33
- An atom of Tc-99 56
- An atom of ^{226}Ra 138
- An atom of H-1 0
- An isotope of hydrogen, ^2H , known as deuterium 1
- An isotope of hydrogen, ^3H , known as tritium 2

3. Determine the number of **electrons** in each of the following:

- A neutral atom of potassium (K) 19
- A neutral atom of Pb-206 82
- A neutral atom with 15 protons and 16 neutrons 15
- A neutral atom of ^{86}Kr 36

4. Why is the "17" in $^{35}_{17}\text{Cl}$ not needed to describe chlorine? (1 point)

17 is the only atomic # Cl can have.

A True-False

Classify each of the following statements as always true, AT; sometimes true, ST; or never true, NT.

NT

1 According to Dalton's atomic theory, atoms are composed of protons, electrons, and neutrons.

AT

2 Atoms of elements are electrically neutral.

NT

3 The mass of an electron is equal to the mass of a neutron.

AT

4 The charge on all protons is the same.

NT

5 The atomic number of an element is the sum of the protons and electrons in the atom.

NT

6 The atomic number of an element is the whole number that decreases as you read across each row of the periodic table from left to right.

ST

7 An atom of nitrogen has 7 protons and 7 neutrons.

ST

8 Relative atomic masses are measured in amus.

AT

9 The number of neutrons in the nucleus can be calculated by subtracting the atomic number from the mass number.

Questions and Problems

Answer the following questions or solve the following problems in the space provided. Show your work.

B Complete the following table.

Element	Symbol	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
carbon	<u>C</u>	<u>6</u>	<u>12</u>	<u>6</u>	<u>6</u>	<u>6</u>
<u>potassium</u>	<u>K</u>	<u>19</u>	<u>39</u>	<u>19</u>	<u>19</u>	<u>20</u>
<u>magnesium</u>	<u>Mg</u>	<u>12</u>	<u>24</u>	<u>12</u>	<u>12</u>	<u>12</u>
helium	<u>He</u>	<u>2</u>	<u>4</u>	<u>2</u>	<u>2</u>	<u>2</u>
<u>boron</u>	<u>B</u>	<u>5</u>	<u>11</u>	<u>5</u>	<u>5</u>	<u>6</u>

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C Fill in the following table.

Element	Symbol	Atomic number	Mass number	Number of neutrons
nitrogen-15	<u>¹⁵N</u>	<u>7</u>	<u>15</u>	<u>8</u>
<u>neon-22</u>	<u>²²Ne</u>	<u>10</u>	<u>22</u>	<u>12</u>
beryllium-9	<u>⁹Be</u>	<u>4</u>	<u>9</u>	<u>5</u>