

Atoms, Molecules and Ions Practice Problems

Name: Key

Date: _____ Period: _____

1. How many protons, neutrons, and electrons are present in $^{90}_{38}\text{Sr}$?

$p = 38 \quad n = 52 \quad e = 38$

2. Recalling that the mass of an element listed on the periodic table is a weighted average, in nature, boron occurs as two isotopes B-10 (mass = 10.013u) and B-11 (mass = 11.009u). Which of these two isotopes occurs in the greater abundance and why?

B (listed) = 10.81 B-11 is in greater abundance b/c the weighted average is closer to 11 than 10

3. A sample of an oxide of tin with the formula SnO consists of 0.742g of tin and 0.100g of oxygen. A sample of a second oxide of tin consists of 0.555g of tin and 0.150g of oxygen. What is the formula of this second oxide? What law does this example illustrate? Who came up with this law?

$\text{SnO} \quad \frac{0.742\text{g}}{0.100\text{g}} = 7.42/1$
 $\frac{0.555\text{g}}{0.150\text{g}} = 3.70/1$
 $\frac{7.42}{3.70} = 2$
 SnO_2 Dalton Law of Multiple prop.

4. Explain the difference between an element with $Z = 31$ and $A = 68.926\text{u}$ and one with $Z = 31$ and $A = 70.925$? Write the full symbology for these two atoms.

$^{69}_{31}\text{Ga}$ $^{71}_{31}\text{Ga}$ Gallium-71 has 2 more neutrons than Ga-69. They are isotopes.

5. What is the element that contains 15 protons, 16 neutrons and 18 electrons? Is it an ion? If so, is it a cation (positive charge) or an anion (negative charge)? What is its charge?

$^{31}_{15}\text{P}^{3-}$ It is an ion = anion with a charge of $3-$

6. Which subatomic particle has a charge of 0 and an atomic mass of +1u?

neutron ^1_0n

7. In a reaction between nitrogen and oxygen, it is determined that 5.00g of nitrogen reacts exactly with 11.42g of oxygen to produce 16.42g of the compound.

a) What will happen if 5.00g of nitrogen is reacted with 15.00g of oxygen?

Only 11.42g of O is used. 3.58g O is leftover

b) What will happen if 2.00g of nitrogen is reacted with 11.42g of oxygen?

$2.00\text{g N} \left(\frac{11.42}{5.00} \right) = 4.568$
 4.57g of O is used
 6.85g O is leftover

c) How much nitrogen will react with 20.00g of oxygen?

$20.00\text{g O} \left(\frac{5.00}{11.42} \right) = 8.75657$
 8.76g N

d) What if it is found that under certain conditions 10.00g of nitrogen will react exactly with 11.42g of oxygen? What can you conclude from this?

This ratio is $\frac{11.42}{10.00} = 1.142$ vs.

$\frac{11.42}{5.00} = 2.284$ Nitrogen combines with oxygen in more than one combination

8. A blue solid called azulene is thought to be a pure compound. Analyses of three samples of the material yield the following results:

	Mass of Sample	Mass of Carbon	Mass of Hydrogen	C/H ratio
1.	1.000g	0.937g	0.0629g	14.90
2.	0.244g	0.229g	0.0153g	14.97
3.	0.100g	0.094g	0.0063g	14.92

Could the material be a pure compound? Explain.

Yes, to within the limits of precision, the ratios are the same, consistent with a pure compound.

9. Write the atomic symbol for the element a) that has 36 protons, neutrons and electrons with equal numbers of all three.

$^{24}_{12}\text{Mg}$

b) whose ion has the following properties: a 2-charge, 12.5% more electrons than protons, 16 neutrons.

$\frac{(x+2)}{x} = 1.125 \quad x = 16 \leftarrow \text{protons}$
 $\frac{32}{16} = 2-$

c) whose mass number is 115 and has 30% more neutrons than protons.

$\frac{115-x}{x} = 1.30$
 $115 = 2.3x$
 $x = 50 \text{ protons}$
 $115 - 50 = 65 \text{ neutrons}$
 $^{115}_{50}\text{Sn}$

10. Determine which experiment was used to find the following:

- The nucleus of the atom. *Rutherford's gold foil*
- The charge to mass ratio of the electron. *J.J. Thomson/Cathode Ray Tube*
- The charge on the electron. *Millikan's Oil drop*

11. List the order in which subatomic particles (protons, neutrons and electrons) were discovered. *electron, proton, neutron*

12. On the periodic table, cobalt has a mass of 58.93u and nickel (which comes after cobalt), has a mass of only 58.69u. Are these elements misplaced given that values should increase as you work your way across and down the periodic table? *No. The periodic Table is arranged by atomic number, not mass*

13. A given element has a mass 5.81 times that of C-12. Give the atomic mass, the name, and the symbol of the element.

$$12(5.81) = 69.72$$

69.72 Ga gallium
31

14. Give the group, period and classification (metal, nonmetal, metalloid) for the following elements:

- Al *3A, 3, metal*
- Br *7A, 4, nonmetal*
- Sc *3B, 4, transition metal*
- Cs *1A, 6, alkali metal*

15. Define the term molecule and decide whether Li₂O (lithium oxide) fits this description. *molecule: Compound formed from the sharing of two or more electrons, usually between two nonmetals.*

Li₂O is not a molecule. It is ionic (electron transfer)

16. For which type(s) of compounds do you need to use prefixes such as mono, di, tri, etc.? *Covalent compounds (molecules)*

17. What is the difference between SO₃²⁻ and SO₃? *SO₃²⁻ is the polyatomic ion sulfite (part of a compound) and SO₃ is the molecule sulfur trioxide*

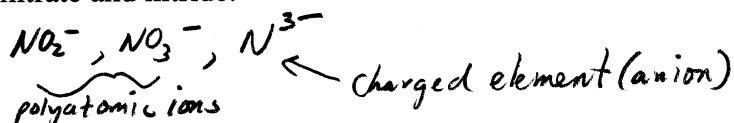
18. Name the following compounds:

- Mg₃N₂ *magnesium nitride*
- HNO₃ *nitric acid*
- Cu₂SO₄ *Copper(I) Sulfate (cuprous)*
- Br₂O₃ *dibromine trioxide*
- Mg(OH)₂ *magnesium hydroxide*
- LiHCO₃ *lithium bicarbonate*

19. Write formulas for the following compounds:

- Carbonic acid *H₂CO₃ (aq)*
- Potassium perchlorate *KClO₄*
- Sulfur tetrachloride *SCl₄*
- Tin(IV)nitrate *Sn(NO₃)₄*
- Cuprous oxide *Cu₂O*
- Phosphoric acid *H₃PO₄ (aq)*

20. Explain the difference between nitrite, nitrate and nitride.

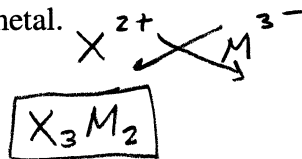


21. How many total protons, neutrons and electrons are there in the compound Sr(ClO₃)₂?

	p	n	e
Sr	38	50	38
Cl	17	18	17 x 2
O	8	8	8 x 6

<i>p = 120</i>
<i>n = 134</i>
<i>e = 120</i>

22. Using X and M to represent a cation and anion respectively, write the general formula for an ionic compound formed from the combination of an alkaline earth metal and a group VA nonmetal.



23. Who was the first person credited with producing a workable periodic table. Cite a strength and a weakness of that first table.

Dmitri Mendeleev (1869)
Strength: Able to predict the properties of (at the time) undiscovered elements

Weakness: Arranged by mass instead of atomic number. Some elements were out of place.

Chemistry

Nomenclature Practice

Name: KEY Date: _____ Period

Instructions: Correct nomenclature errors in the middle column with respect to the compounds in the left hand column. Place corrections in the right hand column. If no correction is needed write "No change".

$\text{Ca}(\text{ClO}_4)_2$	calcium chlorate	calcium perchlorate
calcium nitrate	$\text{Ca}(\text{N}_2\text{O}_6)$	$\text{Ca}(\text{NO}_3)_2$
BaI_2	barium(II)iodide	barium iodide
cupric oxide	CuO	No Change
KF	potassium fluorate	potassium fluoride
magnesium carbonate	$\text{Mg}(\text{CO}_3)$	MgCO_3
SnF_2	tin fluoride	tin(II)fluoride / stannous fluoride
chromium(III)phosphate	CrPO_4	No Change
dinitrogen tetroxide	N_2O_6	N_2O_4
PbS	lead sulfide	lead(II)sulfide / plumbous sulfide
cobalt(III)hydroxide	Co_3OH	$\text{Co}(\text{OH})_3$
SF_6	sulfur fluoride	sulfur hexafluoride
potassium sulfate	K_2SO_4	No Change
Sr_3N_2	strontium nitrate	strontium nitride
NO_2	mononitrogen dioxide	nitrogen dioxide
PCl_5	phosphorus pentachlorite	phosphorus pentachloride
barium sulfide	Ba_2S_2	BaS

