HW2

The problem we started to do in the class.

A student performed the following experiment in the laboratory: she suspended a clean piece of silver metal in an evacuated tube. The empty test tube weighed 42.8973 grams. The silver weighed 1.7838 grams. Next, she introduced a stream of chlorine gas into the test tube and allowed it to react with silver. After a few minutes, a white compound was found to have formed on the silver strip, coating it uniformly. She then opened the apparatus, weighed the coated strip and found it to weigh 1.9342 grams. Finally, she washed the coated strip with distilled water, removing all the white compound from the silver strip and then dried compound and the strip and reweighed. She discovered that the silver strip weighed 1.3258 grams.

Show how she would determine

a. The number of moles of chlorine gas that reacted

b. The number of moles of silver that reacted

Show how she could determine the simplest formula for the silver chloride

Show how her result would have been affected if (on empirical formula)

a. Some of the white compound had been washed down the sink before it was dried and reweighed

b. The silver strip was not thoroughly dried when reweighed.

Solution: First, we find out the mass of silver used in the reaction. Then instead of just writing the reaction, you should determine 1) the mass of the product (silver chloride), 2) the mass of chlorine gas used for the reaction, 3) convert this mass into moles of Cl_2. Finally, you can see the molar ration of Ag and Cl elements in the formula for silver chloride. I wrote it down with correct arithmetic this time.

$m_1 = 1.7838\,g$ $m_2 = 1.3258\,g$

$M = 108$ $0.4580\,g$ of Ag

$\frac{m}{M} = 0.001$

0.00043 moles of Ag

$2Ag + Cl_2 \rightarrow 2AgCl$

2 : 1

0.0043 moles $n(Cl_2) = 0.0021$ moles

↑ for the second part it will be not correct way to answer (though the answer is correct) that the "correct way"

$1.9342 - 1.3258 = 0.6084\,g$ mass of silver chloride

The mass of chloride gas used

$0.6084 - 0.4580 =$

$= 0.15\,g$ (should be more digits)

$n = \frac{m}{M} = \frac{0.15}{71} = 0.0021$ moles of Cl_2

$Ag : Cl_2$

0.0043 0.0021

1 : 2 molar ratio

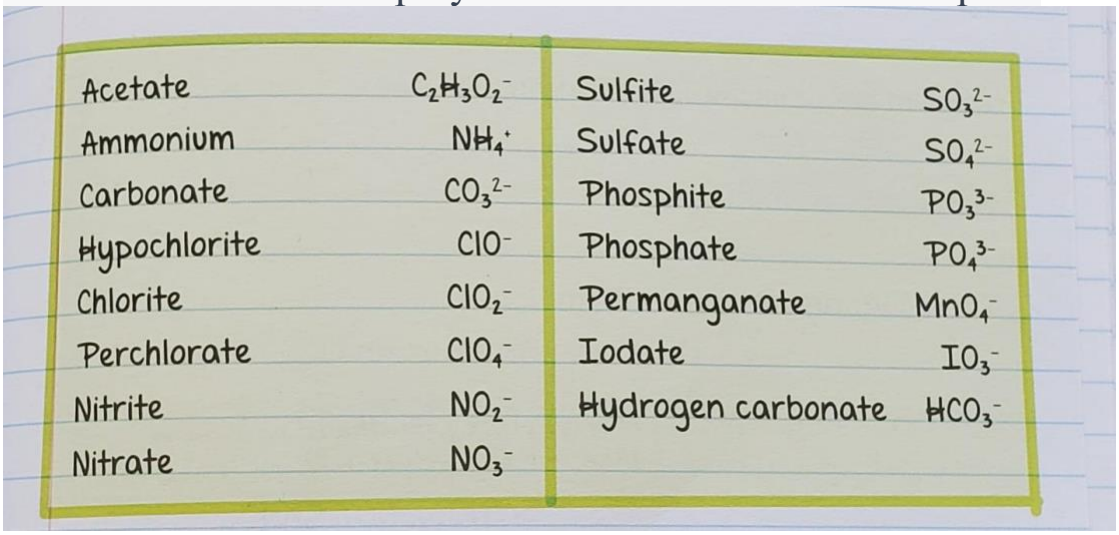
$Ag : Cl$

1 : 1 → AgCl empirical formula

What should we remember from Chemistry 1to do the homework:

- Mass number of an atom (atomic mass) is the number of protons plus the number of neutrons in the nucleus of an atom, it has units AMU. For example, the atomic mass of most helium atoms = 4 AMU (most common isotope of **He** has 2 protons and 2 neutrons)
- The relative atomic mass $\mathbf{A_r}$ of an element is the average of the masses of all natural isotopes of this element relative to the mass of 1/12 of an atom of carbon-12 (we see this atomic weight in the periodic table). For example, atomic weight of iron (Fe) is 55.845. It means the average mass of all isotopes of iron is 55.845 times heavier than the mass of 1/12 of an atom of carbon-12.
- All atomic weights can be found in the periodic table. Knowing these values, we can calculate the molecular weights of all compounds. Some compounds are called ionic (atoms are bound by ionic bonds); examples include NaOH and NaCl.

Reminder: ions can be polyatomic. Here are some examples:



Acetate	$C_2H_3O_2^-$	Sulfite	SO_3^{2-}
Ammonium	NH_4^+	Sulfate	SO_4^{2-}
Carbonate	CO_3^{2-}	Phosphite	PO_3^{3-}
Hypochlorite	ClO^-	Phosphate	PO_4^{3-}
Chlorite	ClO_2^-	Permanganate	MnO_4^-
Perchlorate	ClO_4^-	Iodate	IO_3^-
Nitrite	NO_2^-	Hydrogen carbonate	HCO_3^-
Nitrate	NO_3^-		

Question:

We have a substance, X, with an ionic bond. The mass of the positive ion in the substance is approximately 1 AMU greater than the mass of the negative ion. One of the elements in the positive and negative ions is the same. This substance is capable of reacting with acids. Can you provide the name of this substance?