# Lecture 1C: Meet the Elements Chemistry 1010



# Review

What is an atom?

tiny, separate particles that all matter is made of What is an element? different kinds of atoms What is a compound? atoms joined together What is a chemical reaction? rearranging the connections between atoms

How small are atoms? almost unbelievably small!

Can we take pictures of atoms? no, but we can get images of their shape What is a mole?  $6.022 \times 10^{23}$  of something (atoms, molecules, etc) What particles is an atom made of? protons, neutrons, and electrons What does the number of protons tell us about an atom? what kind of atom it is What does the number of protons vs. electrons tell us about an atom? the charge What does the number of protons and neutrons tell us about an atom? the mass

# Introduction

## Match the following pictures with what element they are.

copper, bromine, sulfur, aluminum, lead, mercury, carbon



lead

sulfur

mercury



bromine

copper



aluminum

Today we will be talking about the elements. We will answer the following questions:

- 1. What are the elements?
- 2. Which ones occur naturally, and which are artificial?
- 3. When were they discovered?
- 4. Where do the names of the elements come from?
- 5. What are the symbols we use for the elements?
- 6. Which are the most common elements?
- 7. What do the elements look like in their pure form?
- 8. How are the elements' atoms arranged in their pure form?

1. What are the elements?

There are <u>118</u> known elements.

What makes them different from each other?

each has a different number of protons this is called the atomic number

What are some that are familiar to you?

What are some that you've never heard of?

Why do you think that some are familiar and others not?

some are more common, others are rare some are more useful, others don't have many uses some aren't even found naturally on the earth 2. Which ones occur naturally, and which are artificial?

Naturally occurring elements: 1 – 92 (except 43, 61)

Artificial elements: 43, 61, 93-118

What's different about the ones that don't occur naturally?

they are radioactive – decay into other elements too quickly for us to find them in nature

Imagine that you saw a news report in which a scientist claimed to have found a new element on another planet.

What would you think about this?

No way! All of the stable ones have been found. How many protons does it have? All of the numbers have been taken.

## 3. When were the elements discovered?

#### Some elements were known anciently:



gold, lead, mercury, tin, silver, zinc, copper, iron, sulfur, carbon

Some elements were discovered by the alchemists (before 1700):



arsenic, bismuth, antimony, platinum, phosphorus

**Phosphorus** was first produced by boiling large amounts of urine, heating the resulting paste, and passing the vapors through water to give a white, waxy substance that glowed in the dark. The process was kept secret for some time. The rest of the naturally occurring elements were discovered between 1700 and 1950:

prior to 1700: 15 elements

1700 to 1750: 1 new element (cobalt)



**Cobalt** compounds have been used since ancient times to color glass, glazes, and ceramics. Around 1735 Georg Brandt showed that cobalt was a new element.

## 1750 to 1800: 17 new elements



Nitrogen, hydrogen, chlorine, and oxygen were discovered around 1774, and there was a lively debate about their relationship to each other and to the process of combustion.

## 1800 to 1850: 25 new elements



In 1808, Humphry Davy used the newly discovered electricity to separate molten salts, isolating magnesium, barium, strontium, potassium, sodium, and calcium for the first time.

## 1850 to 1900: 24 new elements



In 1861, Robert Bunsen and Gustav Kirchhoff invented a spectroscope to look at the unique patterns of light given off by different elements. Using it they discovered cesium and rubidium.



In 1898 Lord Rayleigh and William Ramsey discovered argon, krypton, neon, and xenon as gases present in small amounts in the air.

#### 1900 to 1950: 8 new elements



The last element to be found in nature was francium in 1939. There is so little of it present that it was only detected by the radiation it gives off.

Astatine, which can also be found in tiny amounts in nature, was produced artificially in 1940 before it was detected in nature in 1943.

#### **Artificial elements: 28 elements**

The first artificially produced element was technetium. It was found as a product of a nuclear reaction in discarded parts of a cyclotron.

The most recent new element to be made has an atomic number of 117, and is being called ununseptium until a name is announced.