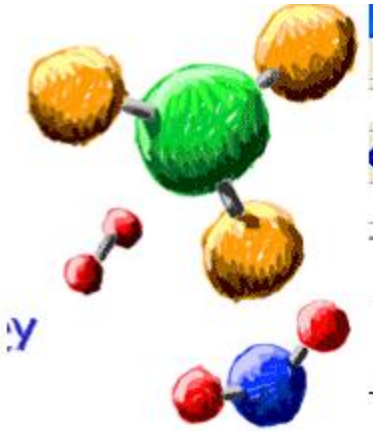
Science 9
Chemistry



Science 9

Unit 2:Chemistry

Topic 1: Laboratory Safety

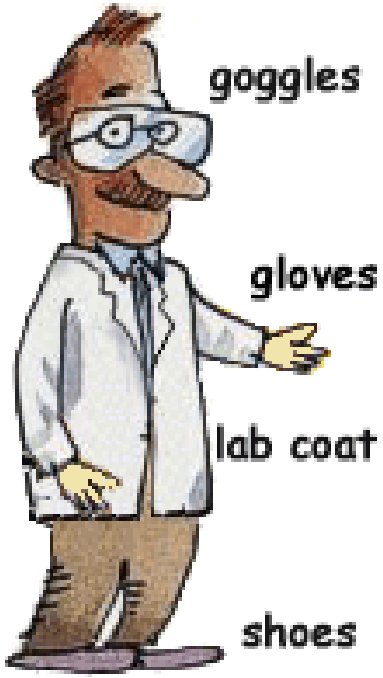
GENERAL SAFETY EQUIPMENT

It is important that specific pieces of safety equipment be available in the room where you are conducting activities.

small fire extinguisher	first aid kit
fire blanket	fume hood
eye wash station	glass disposal container
safety shower	chemical spill kit
chemical resistant gloves	pair of safety tongs
plastic dustpan and brush	sharps container

PERSONAL SAFETY EQUIPMENT

You should also check to see if the following safety equipment is available for your personal use



GENERAL SAFETY 1:

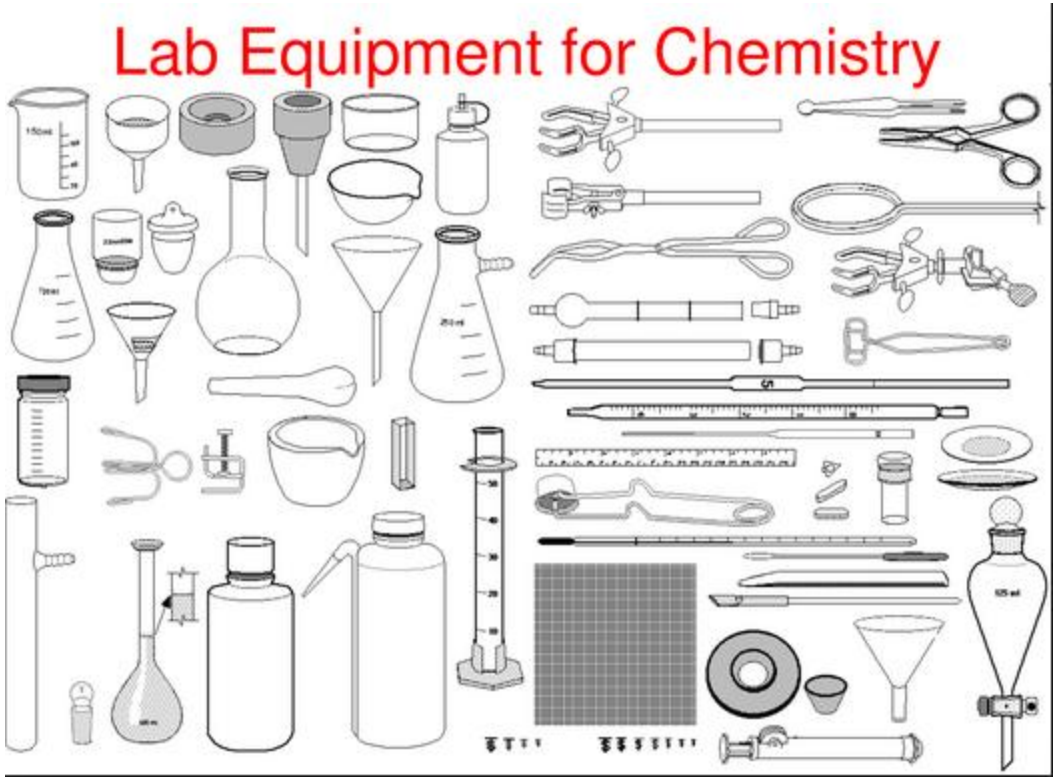
1. Always listen to the teacher and obey his or her instructions. Do not run or horse around in the lab

GENERAL SAFETY 2:

Read the instructions for each activity carefully before coming to the lab. Never try anything other than the written laboratory

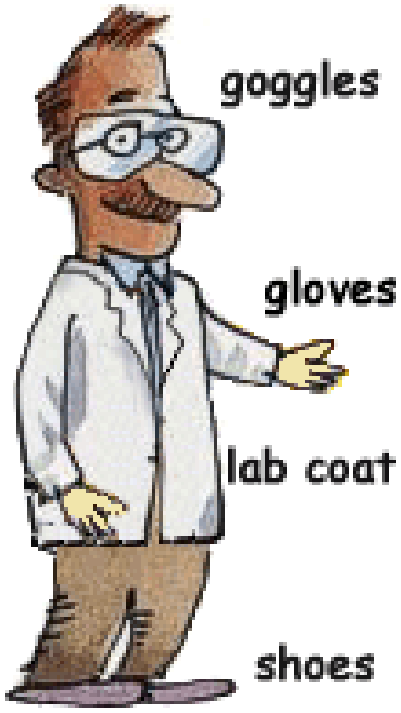
GENERAL SAFETY 3:

Make sure you know how to use your lab equipment properly before you start an activity.



GENERAL SAFETY 4:

Always use appropriate protective equipment, such as a lab coat or protective eye wear. Tell your teacher if you are wearing contact lenses.



GENERAL SAFETY 5:

Tie long hair back out of the way, do not wear loose clothing, sandals, or open-toed shoes.

GENERAL SAFETY 6:

Do not chew gum or eat ordrink anything in the laboratory.

GENERAL SAFETY 7:

Know the location and use of all emergency equipment and emergency exits

GENERAL SAFETY 8:

If you should discover a fire, notify your teacher immediately. Warn other students to keep away from the area and follow your teacher's directions. If the fire is large, evacuate the room, close the door and pull the fire alarm

GENERAL SAFETY 9:

If your clothing or hair should catch fire, drop to the floor and roll to extinguish the flames. Do Not Run - this can make the fire worse. Yell to catch the attention of others so that they can help extinguish the flames with water or a fire blanket. If you see another student whose clothing or hair has ignited, tell the teacher and get clean water or a fire blanket to help them extinguish the flames

GENERAL SAFETY 10:

Always wash your hands with warm water and soap after the lab.

GENERAL SAFETY 11:

Report all accidents to the teacher, no matter how small they may seem

GLASSWARE 12:

Do not use cracked or chipped glassware and be careful with glass pipettes and other pointed glassware.

Dispose of it in a “sharps” bucket or as your teacher directs. Use clean glassware. After using glassware, wash it or put it in an approved place to soak

CHEMICALS 13:

Know the safety precautions and hazards for all chemicals you are using before you start your lab

CHEMICALS 14:

If you come in contact with a solid substance, brush it off immediately. For liquid spills, wash the affected area thoroughly with water. If you get anything in your eyes, do not touch them. Rinse
them immediately and continuously for15 minutes and inform your teacher.

CHEMICALS 15:

Hold containers away from your face when pouring liquids.

CHEMICALS 16:

Read labels on containers. Never use a chemical from a container that does not have a readable label. Inform your teacher if label cannot be read.

CHEMICALS 17:

When in the lab, never put anything in your mouth such as fingers, equipment, hair, pencils, or chemicals that you are working with, even if they are food items.

CHEMICALS 18:

Never return a chemical to its original container. Doing this could contaminate the original stock.

CHEMICALS 19:

Never put any chemical down the sink or into the garbage without permission

CHEMICALS 20:

Clean up any spills according to your teacher's instructions

CHEMICALS 21:

If you are asked to smell a substance, never smell it directly. Hold the container at arm's length and waft fumes toward you

CHEMICALS 22:

When diluting a concentrated acid with water, add the acid to the water, not the water to the acid. This prevents sudden overheating of the water

DO add ACID to WATER instead of the reverse order of addition.

The heat generated will be less, but splattering still may occur.

CHEMICALS 23:

Do not enter the chemical storeroom without permission from your teacher

CHEMICALS 24:

When getting chemicals for use in an experiment, read the label twice to make sure you have the right chemical at the correct concentration. Read any safety information on the label as well.

CHEMICALS 25:

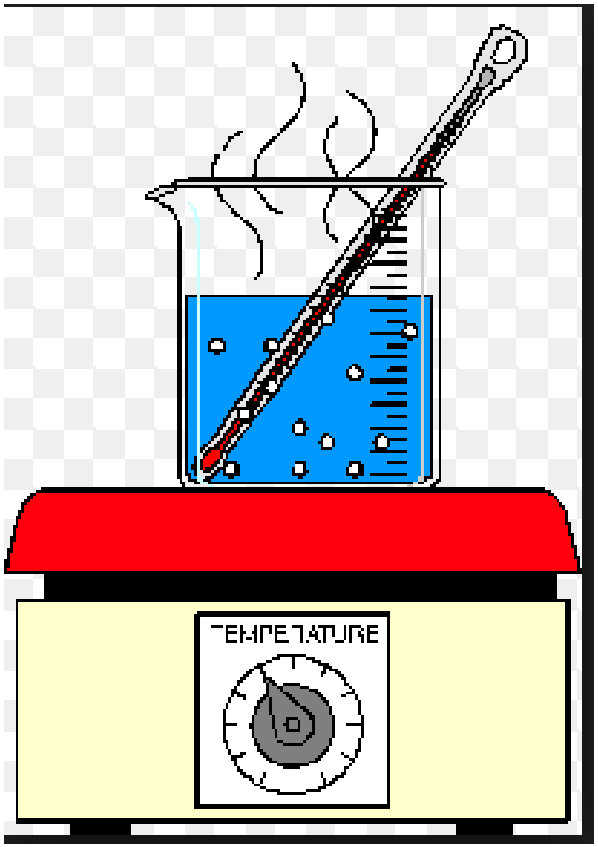
Report any spills of chemicals to the teacher.

HOT PLATES AND OPEN FLAMES 26:

Handle hot objects carefully. Be especially careful with a hot plate even if it looks as though it has cooled down

HOT PLATES AND OPEN FLAMES 27:

Never leave a hot plate or open flame unattended. A person may get a serious burn

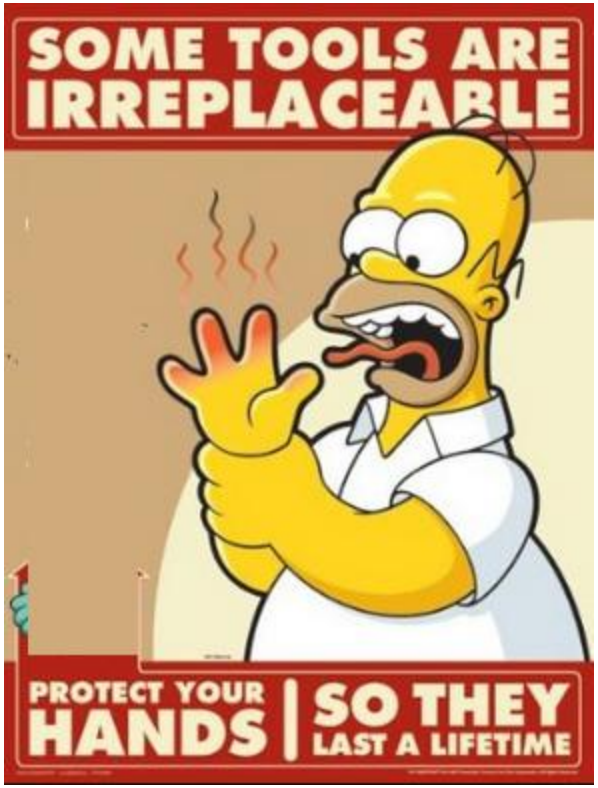


HOT PLATES AND OPEN FLAMES 28:

Tie long hair back out of the way and do not wear loose clothing or hats with protruding brims

HOT PLATES AND OPEN FLAMES 29:

If you are not sure whether a piece of equipment or glassware is hot or cold, approach it with the back of your hand so that you can detect any heat before grasping it.

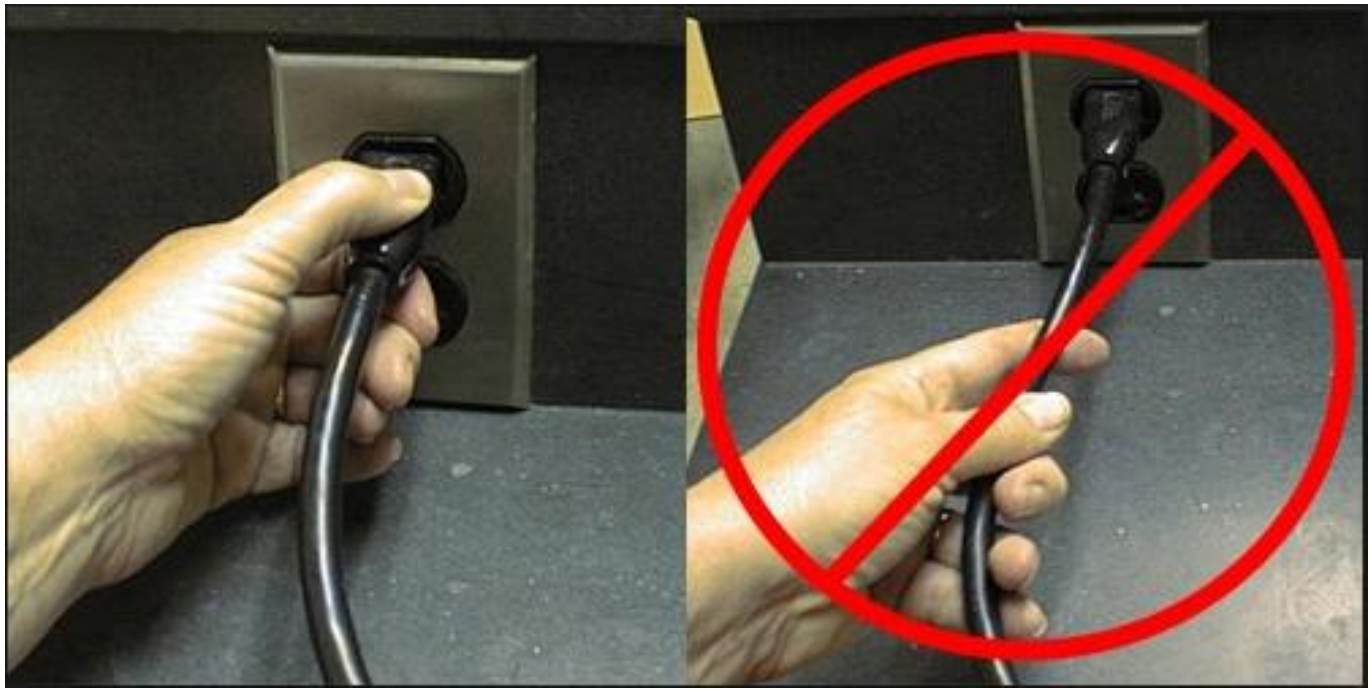


ELECTRICAL EQUIPMENT 30:

Make sure your hands are dry when touching electrical cords, plugs, or sockets.

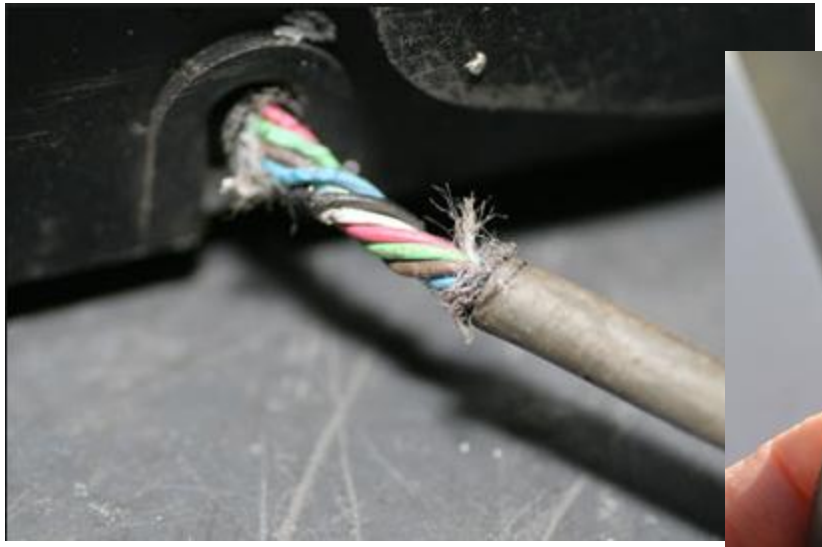
ELECTRICAL EQUIPMENT 31:

Pull the plug, not the cord, when unplugging electrical equipment



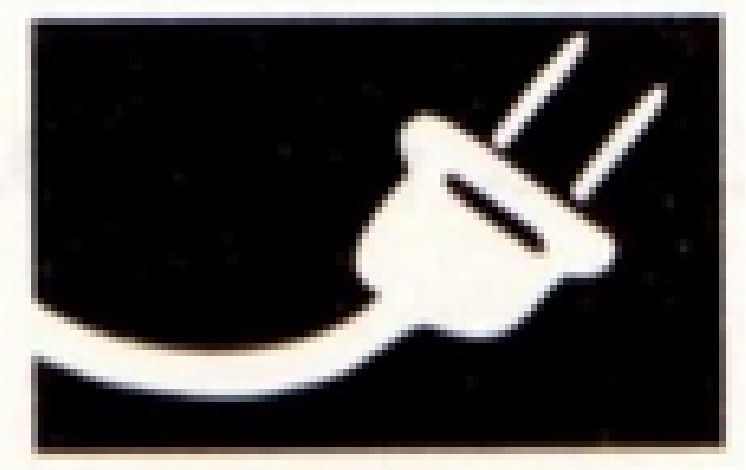
ELECTRICAL EQUIPMENT 33:

Report frayed cords and any other damaged equipment to your teacher.



ELECTRICAL EQUIPMENT 34:

If any electrical component becomes hot during an activity, disconnect the circuit immediately.



Science Lab safety

What laboratory safety rules are being broken in this lab?

Reading Check

- Complete questions 1,2,3,4 and 5 on

Page 11

Science 9

Unit 2:Chemistry

Topic 2: WHMIS

What is WHMIS ?

- The **W**orkplace **H**azardous **M**aterials **I**nformation **S**ystem (**WHMIS**) is Canada's hazard communication standard.

What are the main parts of WHMIS?

- The main components of WHMIS are:
  - hazard identification and product classification,
  - labelling,
  - material safety data sheets, and
  - worker training and education.

Why was WHMIS created?

- It was created in response to the Canadian workers' right to know about the safety and health hazards that may be associated with the materials or chemicals they use at work.

The 6 WHMIS classes:

All controlled products fall into one or more of six WHMIS classes

- Class A: Compressed gas

- Class B: Flammable and Combustible material

- Class C: Oxidizing material

Class D: Poisonous and Infectious materials

- Division 1 (D1) - Materials Causing Immediate and Serious Toxic Effects

- Division 2 (D2) - Materials Causing Other Toxic Effects

- Division 3 (D3) - Biohazardous Infectious Material

- Class E: Corrosive material

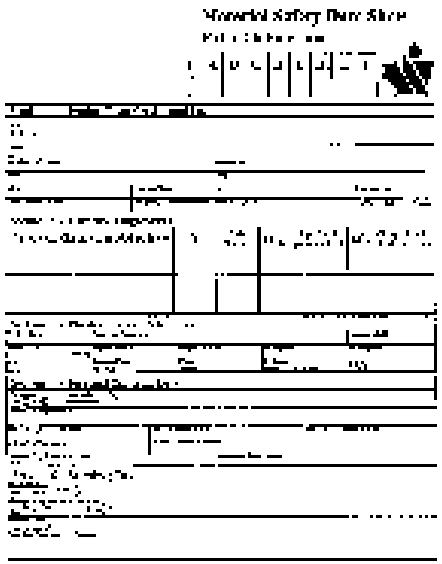
- Class F: Dangerously Reactive material

A chemical container may have one or more of the symbols

Student Work

WHMIS WORKSHEET

Material Safety Data Sheets (MSDSs)



WHMIS MSDSs have **nine categories**

of information:

- Section 1 - **Product Information**: including identif and use
- Section 2 - **Hazardous Ingredients**: listing of ingredients considered hazardous as well as each ingredient's concentration, etc.
- Section 3 - **Physical Information**: form, odor, appearance, pH, etc.
- Section 4 - **Fire or Explosion Hazard**: conditions of flammability, flash point, etc.

- Section 5 - **Reactivity Information**: conditions of instability, reactivity, decomposition, etc.
- Section 6 - **Health Hazard Information**: route of entry, effects of exposure, exposure limits, etc.
- Section 7 - **Preventive Measures**: personal protective equipment, waste disposal, storage, etc.
- Section 8 - **First Aid Measures**
- Section 9 - **Preparation Information and Update**: person who wrote MSDS, date of preparation

Student Activity

- Worksheet on MSDS

Science 9

Unit 2:Chemistry

Topic 3: Chemical and Physics Properties

What is Chemistry

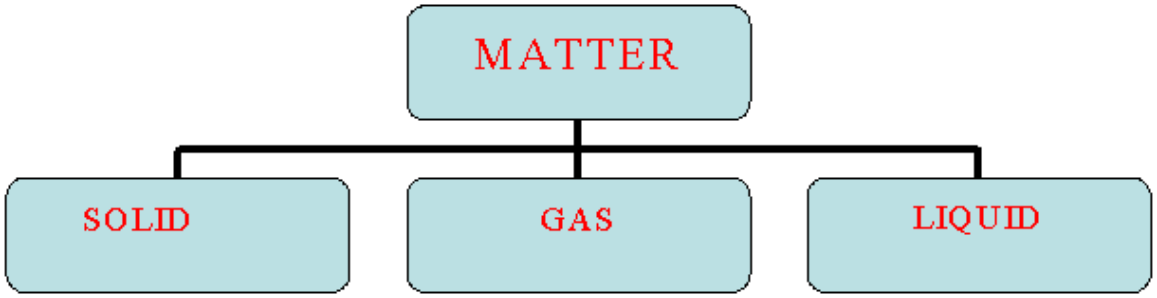
- **Chemistry** is the study of matter, its properties, and the changes or chemical reactions that matter can undergo

Rusting of metal (oxidation of iron) is one example of a relatively slow chemical reaction that unfortunately occurs all around

The alchemists tried to turn base metals into gold

Matter

- **Matter=>** anything that occupies space and has mass.



Things that are not matter Gravity, light, electricity, heat

Describing Matter: Physical Properties

Physical properties are characteristics of matter that are often observed or measured.

Qualitative properties are properties that can be described but not measured.

Quantitative properties are characteristics that can be measured numerically.

Table 1.1 Physical Properties

Physical Property	Description
Qualitative	
State	Solid, liquid, gas
Colour	Colour
Malleability	Ability to be bent or beaten into sheets
Ductility	Ability to be drawn into wires
Texture	Appearance and feel of the surface
Magnetism	Tendency to be attracted to a magnet
Lustre	Degree to which the material reflects light
Quantitative	
Solubility	Ability to dissolve in water
Conductivity	Ability to conduct electricity or heat
Viscosity	Resistance to flow
Density	Ratio of a material's mass to its volume
Melting point	Temperature of melting/freezing
Boiling point	Temperature of boiling/condensing

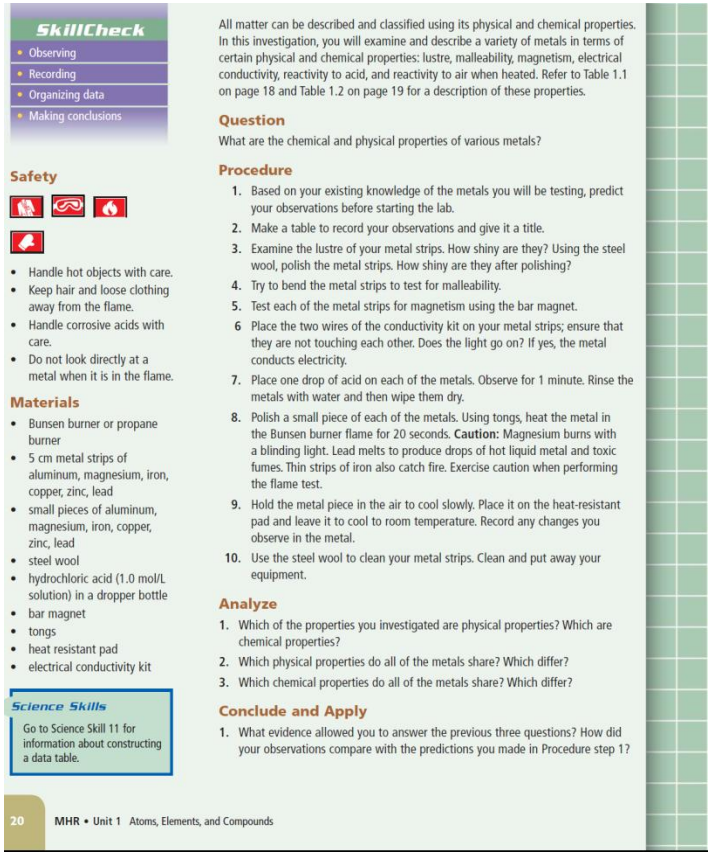
Describing Matter: Chemical Properties

Chemical properties characteristics that describe a substance's ability to react chemically with other substances to form new products (e.g., flammability)

Table 1.2 Chemical Properties

Chemical Property	Description
Reactivity	Degree to which the substance combines chemically with other substances (water, acid, other substances)
Combustibility	Degree to which the substance burns (reacts with air or pure oxygen)
Toxicity	Degree to which the substance reacts in the body to produce harmful substances

PHYSICAL AND CHEMICAL PROPERTIES



SkillCheck

- Observing
- Recording
- Organizing data
- Making conclusions

Safety

- Handle hot objects with care.
- Keep hair and loose clothing away from the flame.
- Handle corrosive acids with care.
- Do not look directly at a metal when it is in the flame.

Materials

- Bunsen burner or propane burner
- 5 cm metal strips of aluminum, magnesium, iron, copper, zinc, lead
- small pieces of aluminum, magnesium, iron, copper, zinc, lead
- steel wool
- hydrochloric acid (1.0 mol/L solution) in a dropper bottle
- bar magnet
- tongs
- heat resistant pad
- electrical conductivity kit

Science Skills

Go to Science Skill 11 for information about constructing a data table.

All matter can be described and classified using its physical and chemical properties. In this investigation, you will examine and describe a variety of metals in terms of certain physical and chemical properties: lustre, malleability, magnetism, electrical conductivity, reactivity to acid, and reactivity to air when heated. Refer to Table 1.1 on page 18 and Table 1.2 on page 19 for a description of these properties.

Question

What are the chemical and physical properties of various metals?

Procedure

1. Based on your existing knowledge of the metals you will be testing, predict your observations before starting the lab.
2. Make a table to record your observations and give it a title.
3. Examine the lustre of your metal strips. How shiny are they? Using the steel wool, polish the metal strips. How shiny are they after polishing?
4. Try to bend the metal strips to test for malleability.
5. Test each of the metal strips for magnetism using the bar magnet.
6. Place the two wires of the conductivity kit on your metal strips; ensure that they are not touching each other. Does the light go on? If yes, the metal conducts electricity.
7. Place one drop of acid on each of the metals. Observe for 1 minute. Rinse the metals with water and then wipe them dry.
8. Polish a small piece of each of the metals. Using tongs, heat the metal in the Bunsen burner flame for 20 seconds. **Caution:** Magnesium burns with a blinding light. Lead melts to produce drops of hot liquid metal and toxic fumes. Thin strips of iron also catch fire. Exercise caution when performing the flame test.
9. Hold the metal piece in the air to cool slowly. Place it on the heat-resistant pad and leave it to cool to room temperature. Record any changes you observe in the metal.
10. Use the steel wool to clean your metal strips. Clean and put away your equipment.

Analyze

1. Which of the properties you investigated are physical properties? Which are chemical properties?
2. Which physical properties do all of the metals share? Which differ?
3. Which chemical properties do all of the metals share? Which differ?

Conclude and Apply

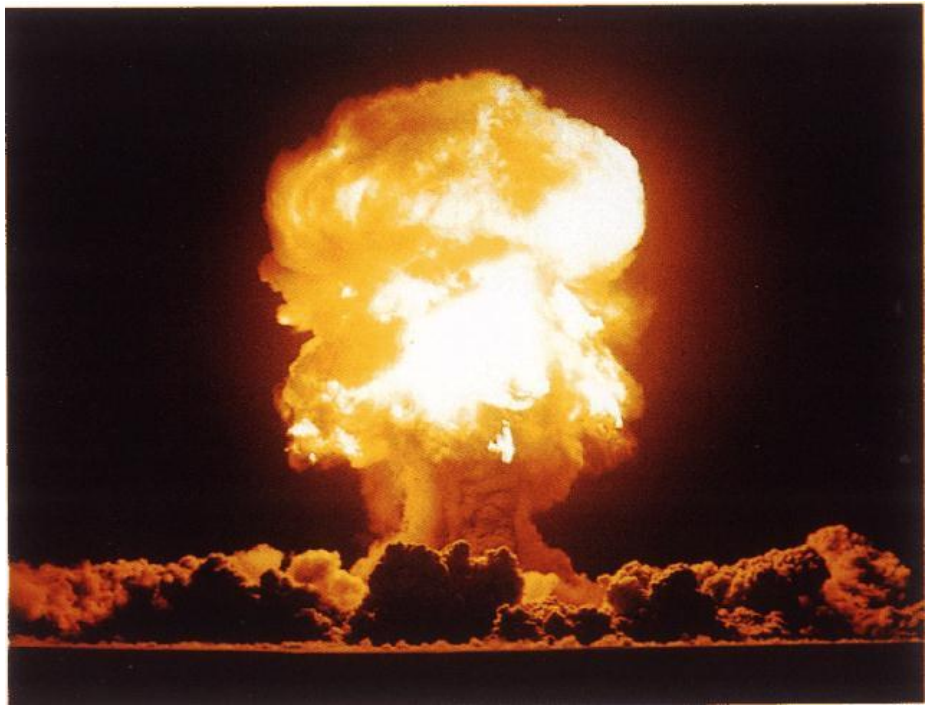
1. What evidence allowed you to answer the previous three questions? How did your observations compare with the predictions you made in Procedure step 1?

SEE PAGE 20

Science 9

Unit 2:Chemistry

Topic 4: Atomic Theory



THEORIES AND LAWS

What is the difference between a theory and a law?

Theory an explanation of an event that has been supported by consistent, repeated experimental results and has therefore been accepted by most scientists

Law a description of events, patterns, or relationships in science that have been observed over and over again

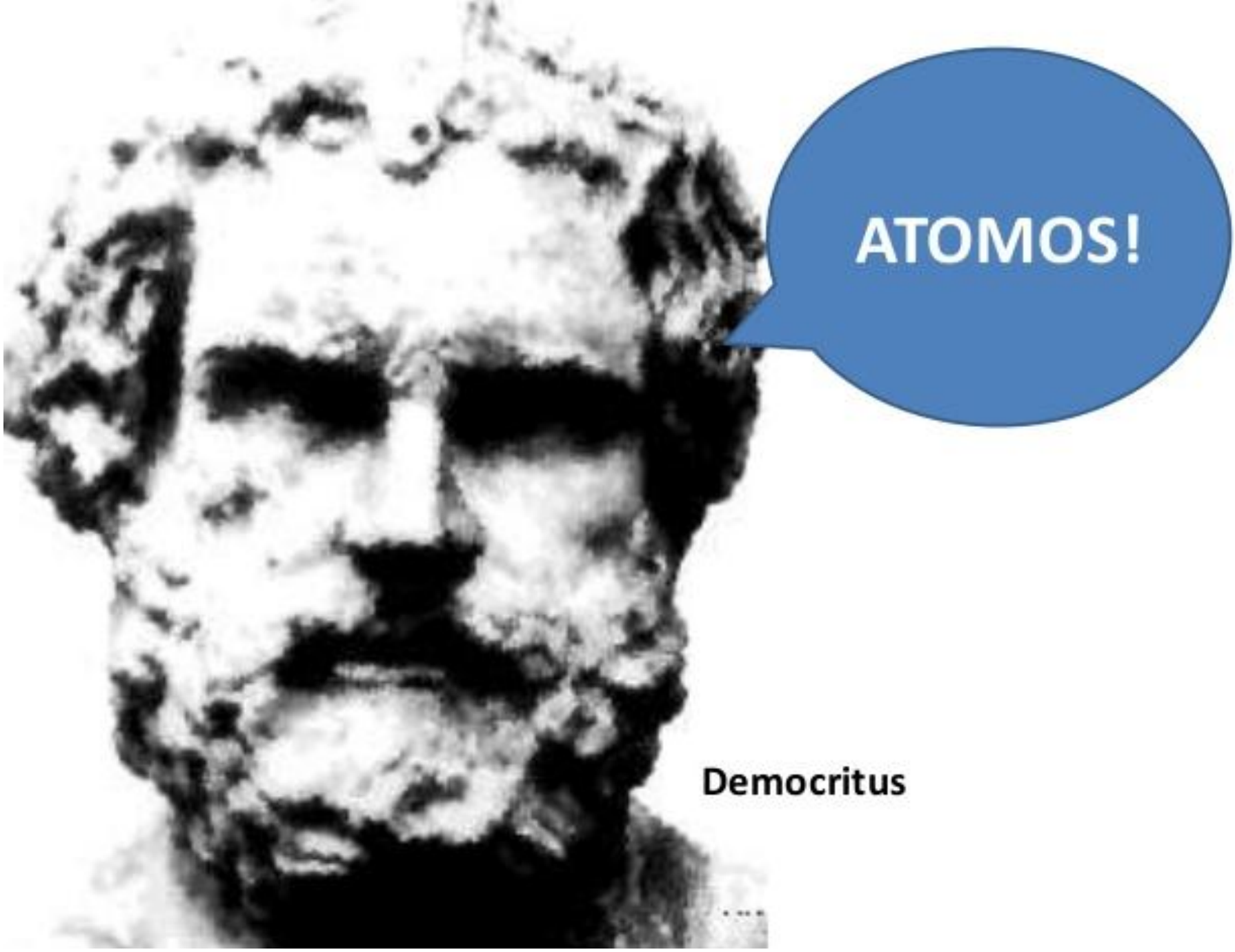
Laws do not provide explanations—
they simply state what happens.

HISTORY OF THE ATOM

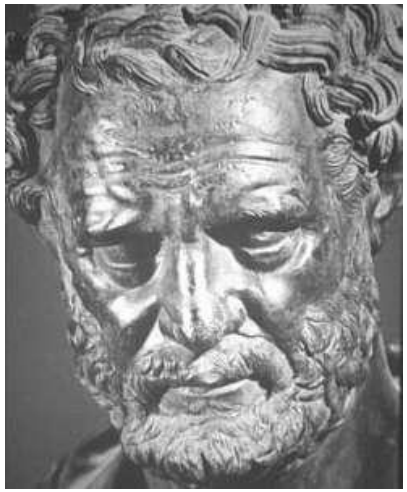
Empedocles

all matter was composed of four “elements” (earth; air; water; and fire) and that this was not based on any scientific data.

This was later supported by Aristotle


ATOMOS!
Democritus

460 BC Democritus develops the idea of atoms

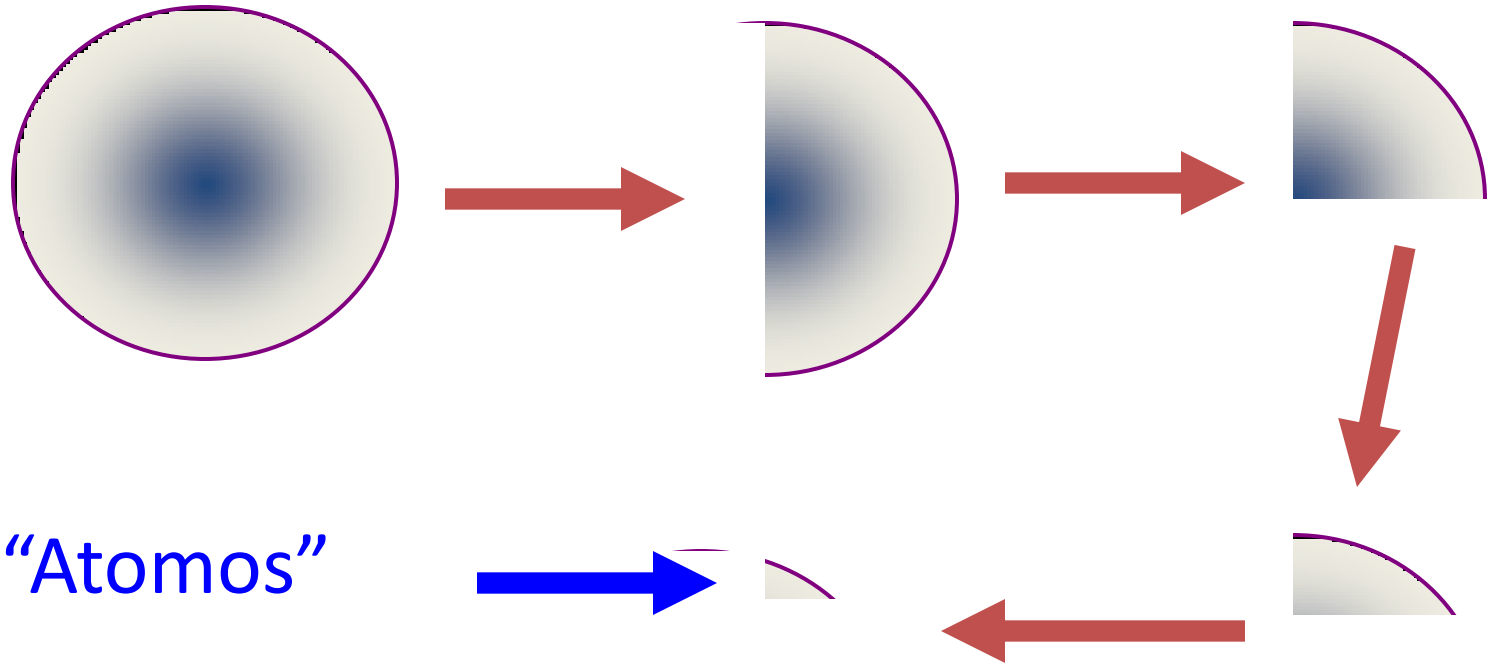


he pounded up materials in his pestle and mortar until he had reduced them to smaller and smaller particles which he called

ATOMA

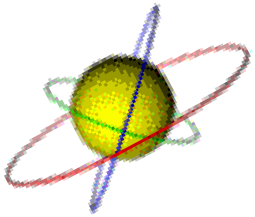
(*greek for indivisible*)

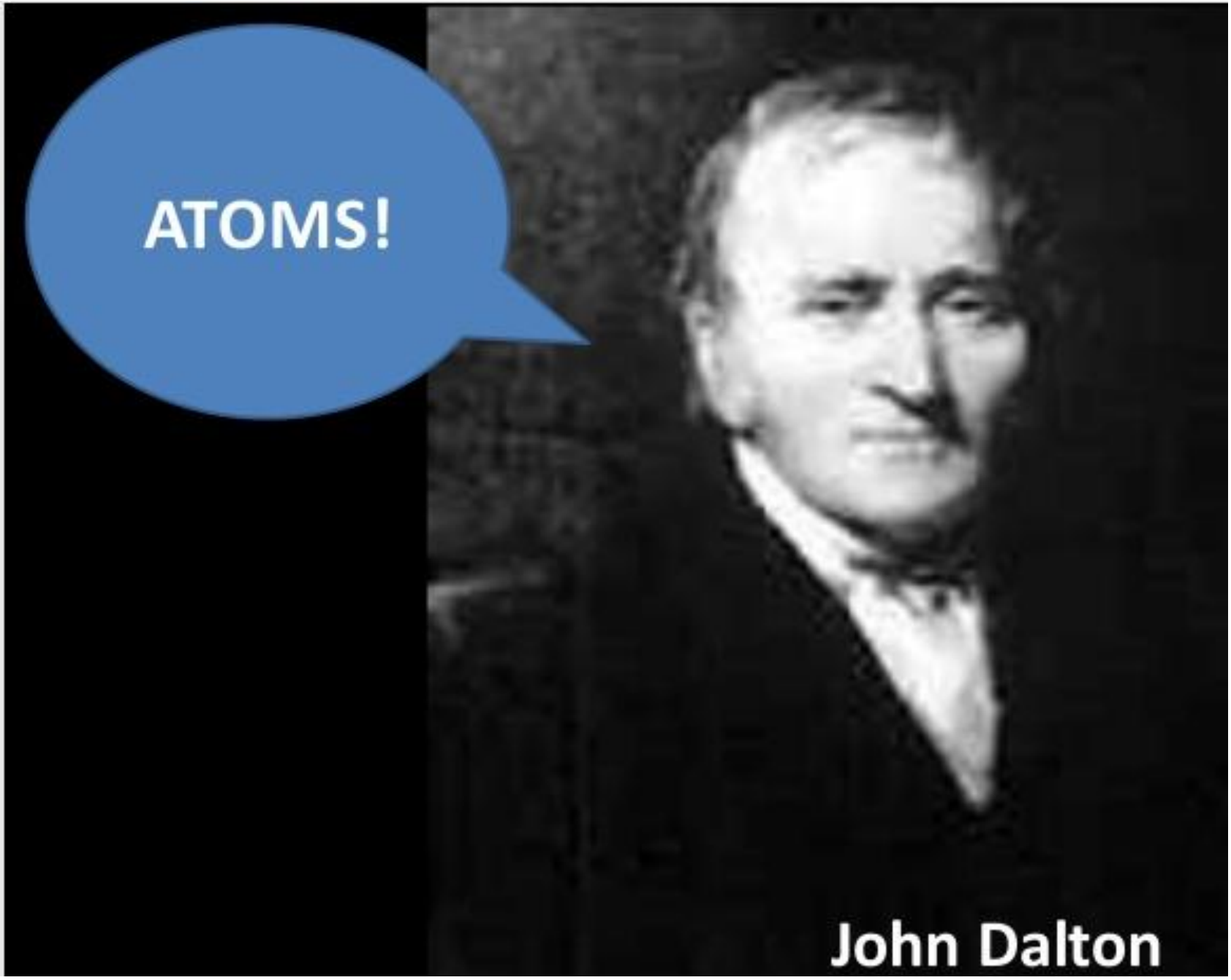
Democritus' Model



"Atomos"

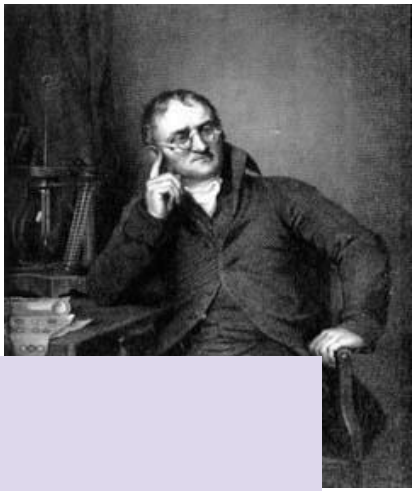
ATOMOS was the word Democritus used the point, or stage where matter cannot be broken down any further. ATOMOS literally means "indivisible"




ATOMS!
John Dalton

HISTORY OF THE ATOM

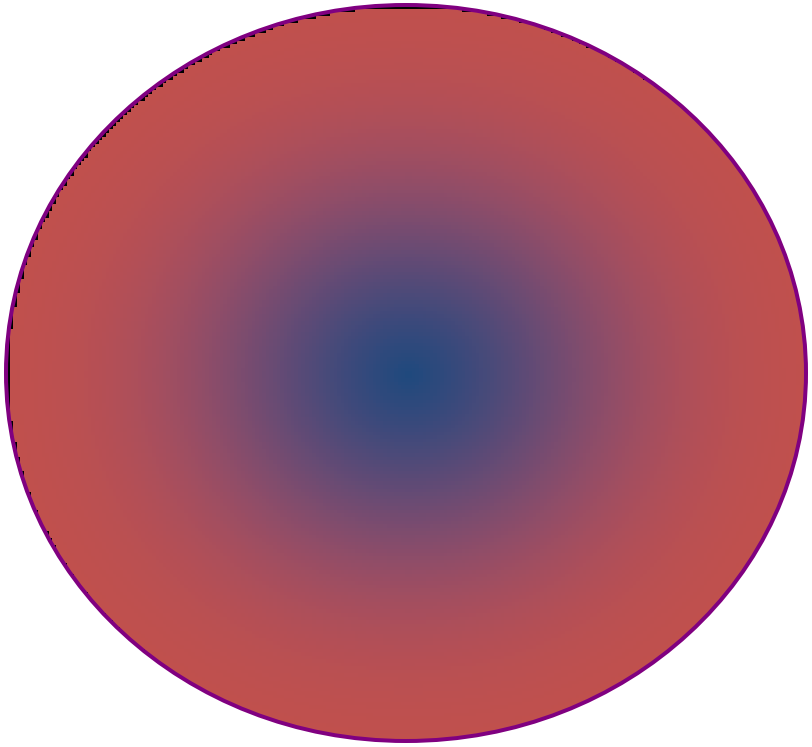
1808 John Dalton



Dalton's Atomic Theory

- All matter is made of small particles called atoms.
- Atoms cannot be created, destroyed, or divided into smaller particles.
- All atoms of the same element are identical in mass and size, but they are different in mass and size from the atoms of other elements.
- Compounds are created when atoms of different elements link together in definite proportions.

Dalton's Model-Billiard Ball Model



The "Indivisible Sphere"

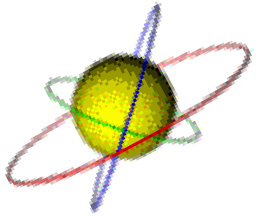
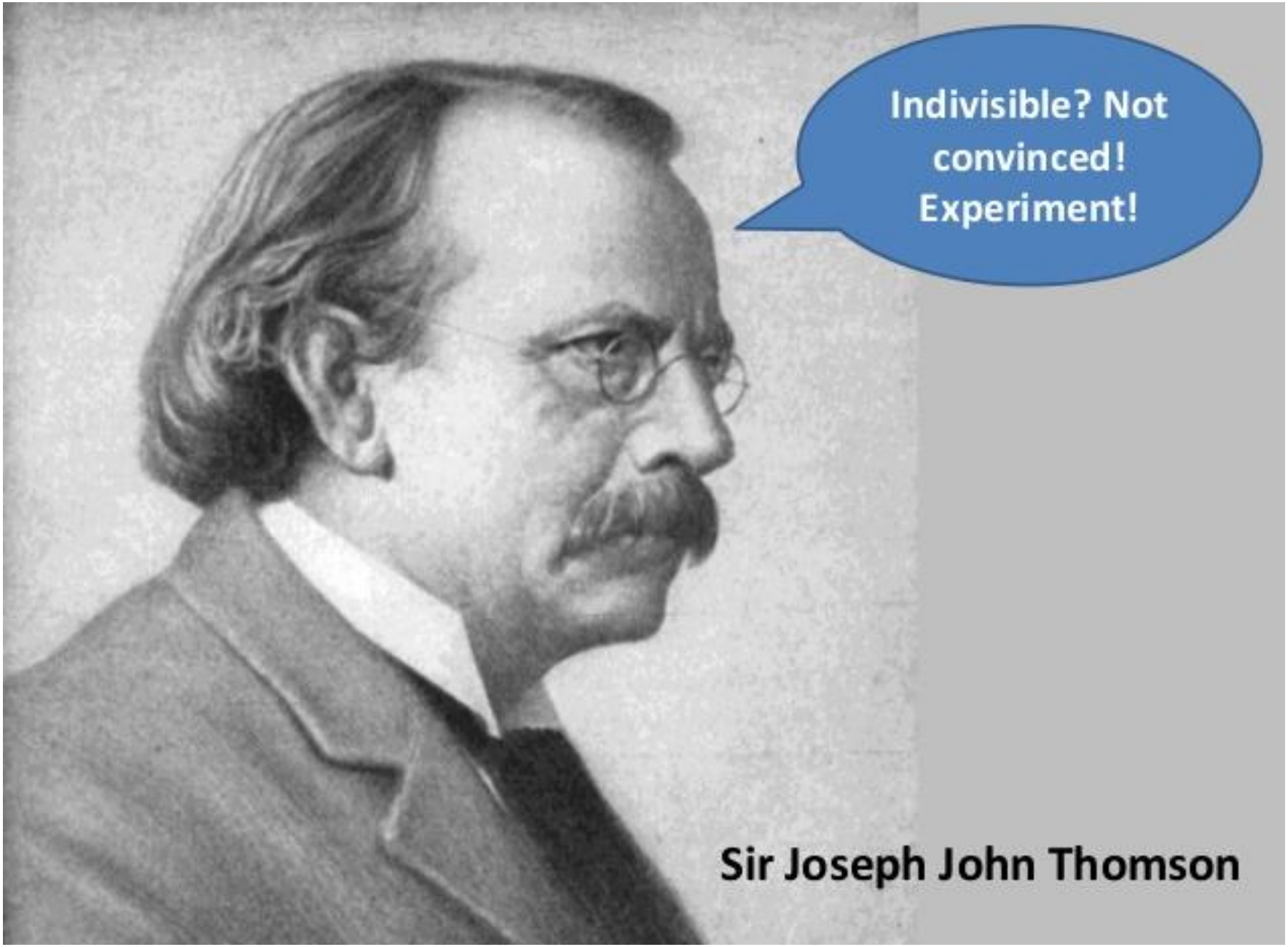


Figure 1.11 Lead (A) cannot be turned into gold (B) because lead atoms cannot change into gold atoms.


Indivisible? Not convinced! Experiment!
Sir Joseph John Thomson

HISTORY OF THE ATOM

1897 Joseph John Thomson

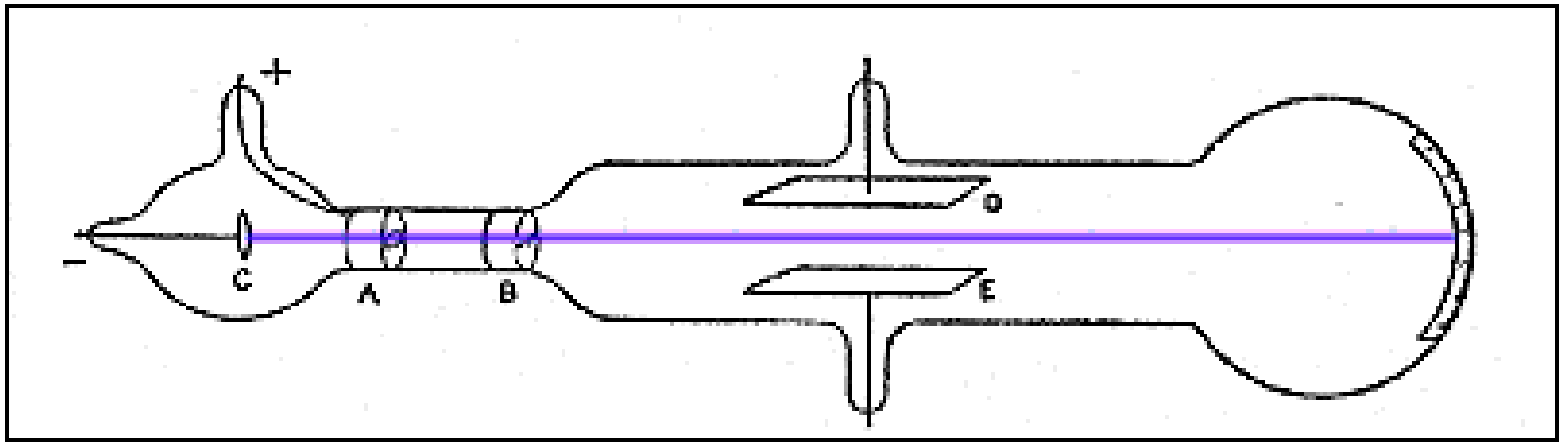
ELECTRON

From his experiments, found that atoms could sometimes eject a far smaller negative particle which he called an **electrons.**

This was a startling proposal, since most scientists at the time thought that atoms were indivisible

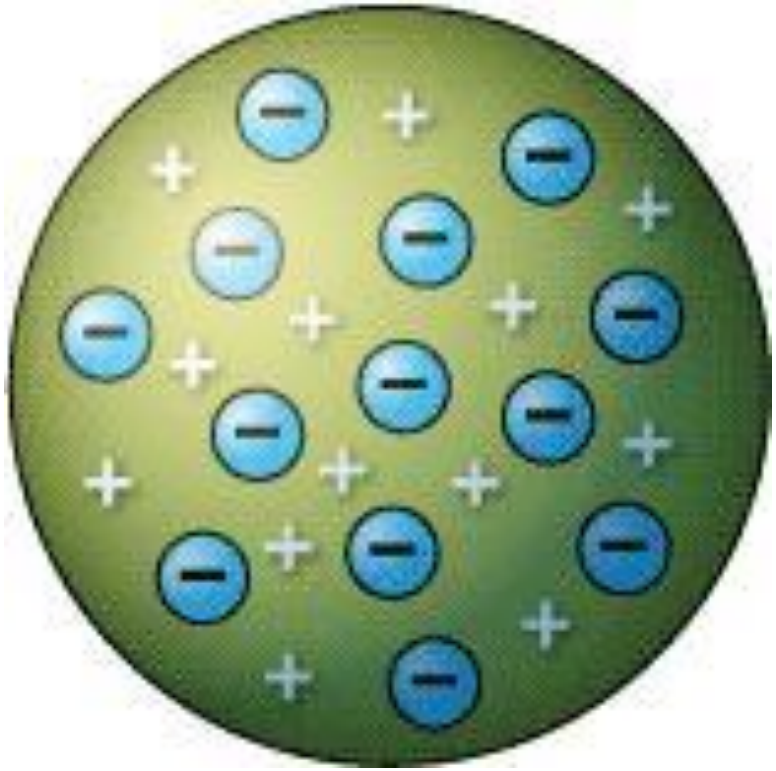
His discovery was the result of doing experiments with "cathode ray tubes

Stream of electrons is attracted to positively charged plate here.



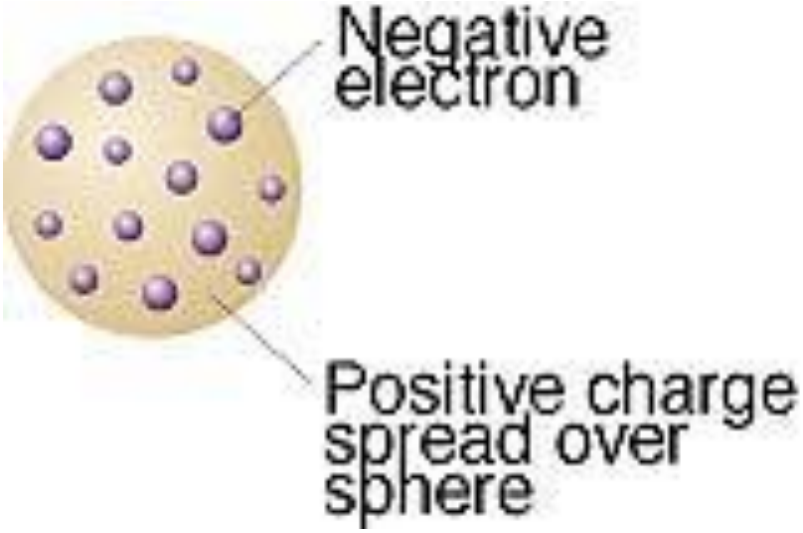
HISTORY OF THE ATOM

Thomson proposed a “raisin bun” or “Plum Pudding” model of the atom. His model pictured a positively charged ball like a bun with negatively charged particles embedded in it like raisins



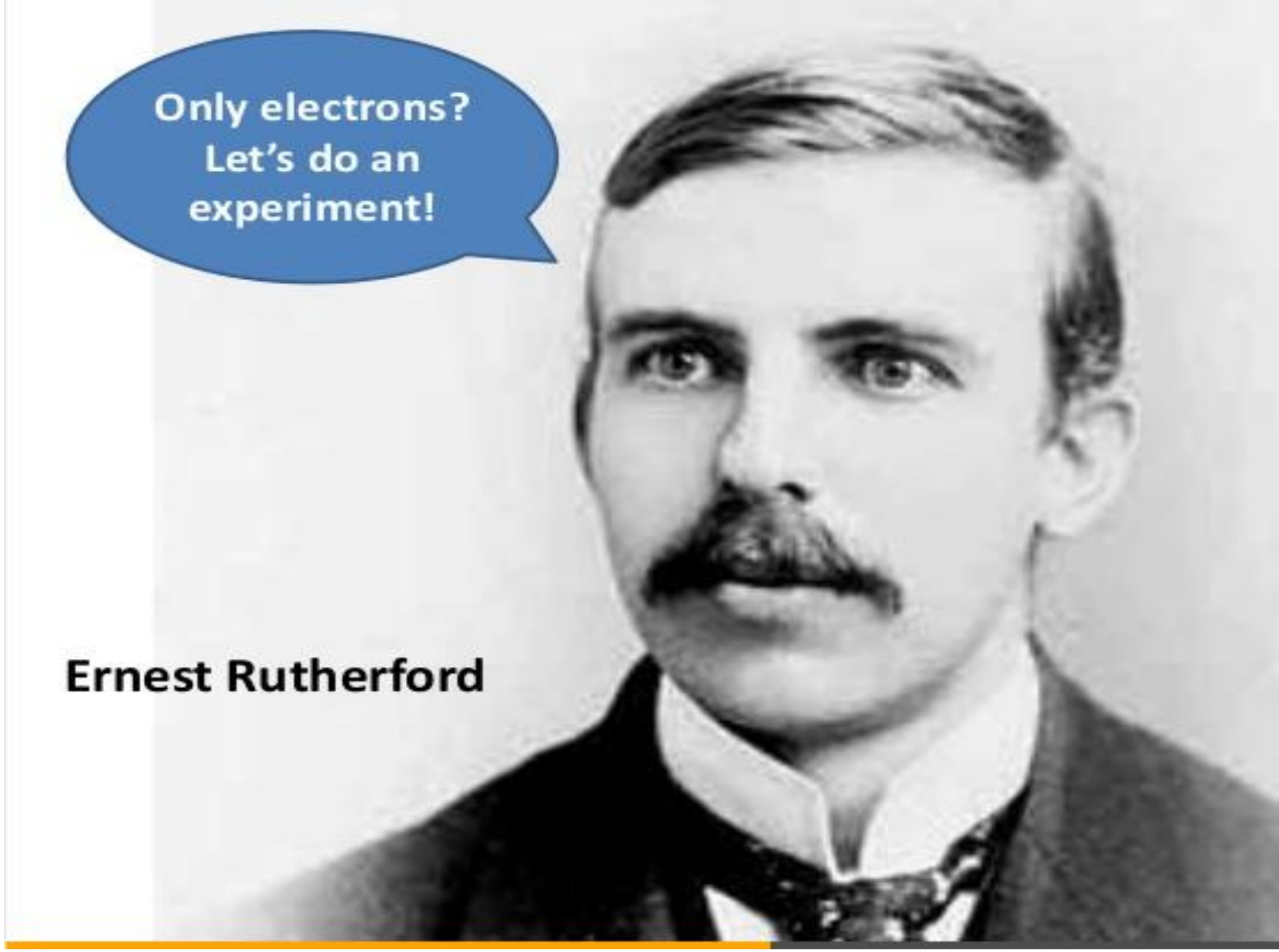
RAISIN BUN MODEL

The Plum Pudding Model



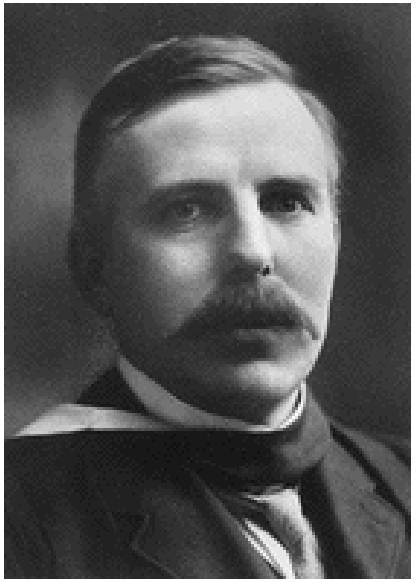
- Thomson did not know how the electrons in an atom were arranged. **He believed they were mixed throughout an atom.**

  He proposed that the atom was a sphere of positively charged material. Spread throughout the atom were the negatively charged electrons similar to plums in a pudding or **chocolate chips in ice cream.**


Only electrons? Let's do an experiment!
Ernest Rutherford

HISTORY OF THE ATOM

1910 **Ernest Rutherford**

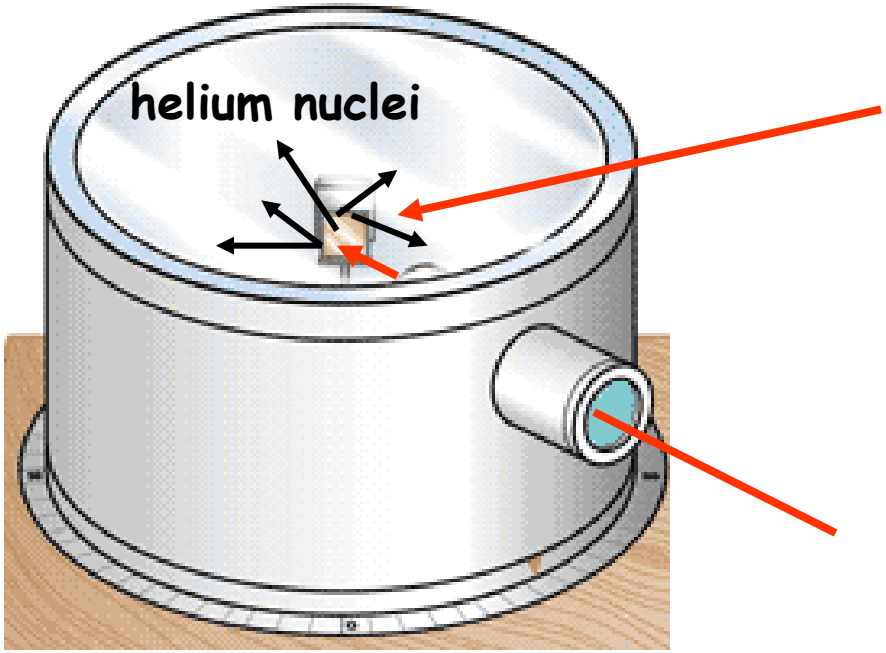


oversaw Geiger and Marsden carrying out his famous experiment.

they fired Helium nuclei at a piece of gold foil which was only a few atoms thick.

they found that although most of them passed through. About 1 in 10,000 hit

HISTORY OF THE ATOM



They found that while most of the helium nuclei passed through the foil, a small number were deflected and, to their surprise, some helium nuclei bounced straight back.

HISTORY OF THE ATOM

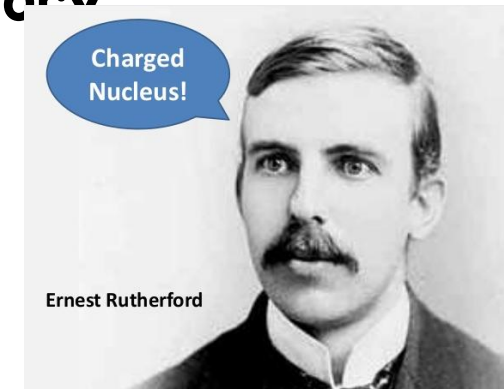
Rutherford's new evidence allowed him to propose a more detailed model with a **central nucleus**

He also established that there must be at least two kinds of particles inside the nucleus

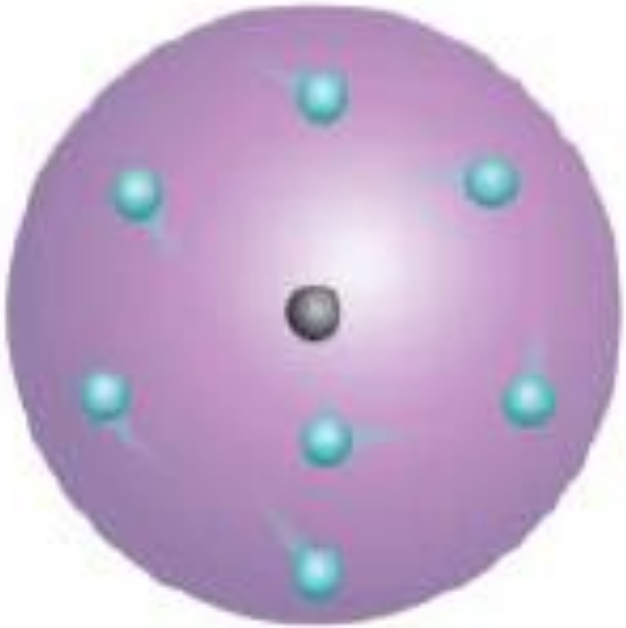
1) Proton: a positive electric charge,

2) Neutron, had no electric charge

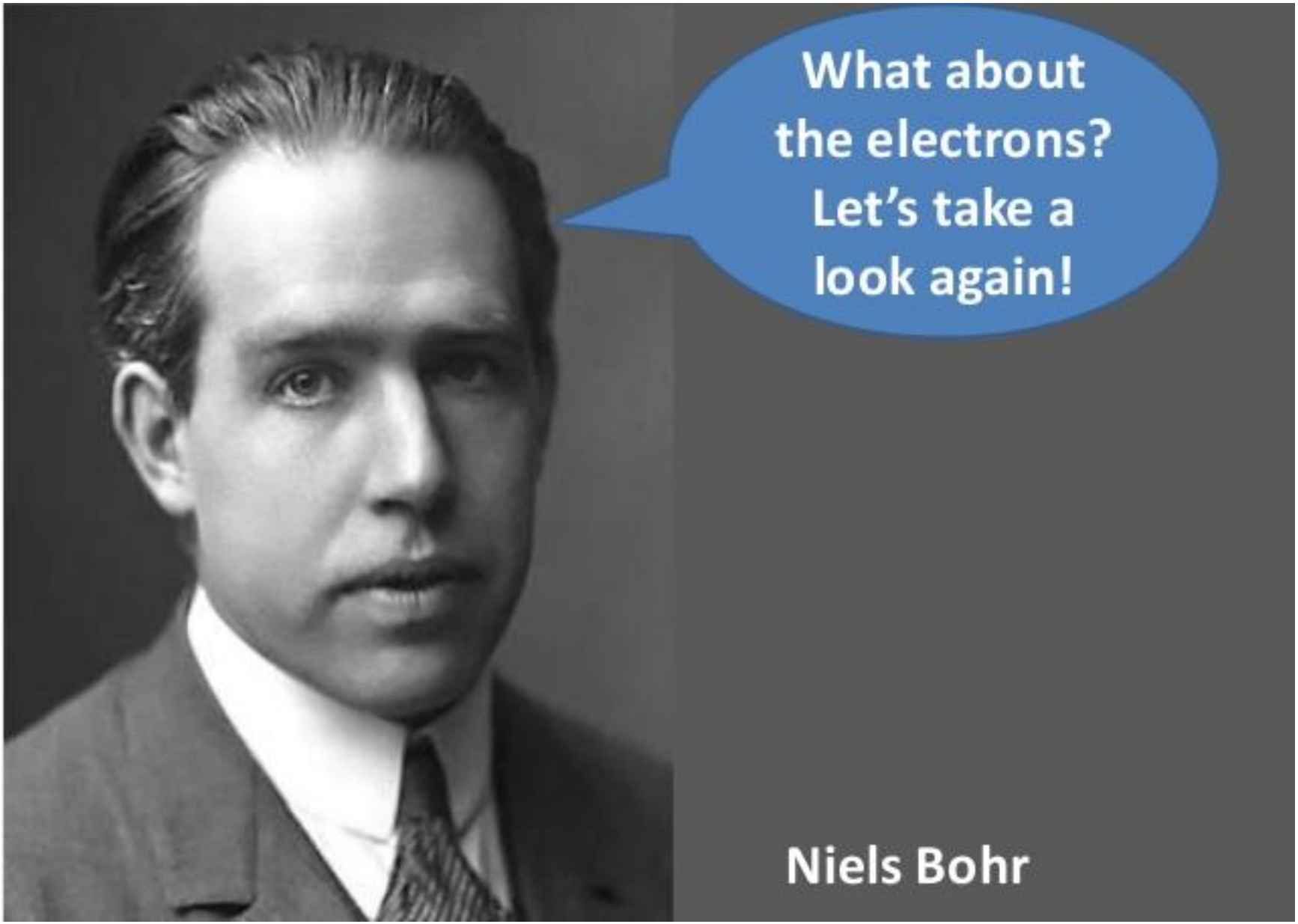
However, this was not the end of the story



Rutherford's –Nuclear Model



Rutherford's model:
Electrons move about a nucleus.


What about the electrons? Let's take a look again!
Niels Bohr

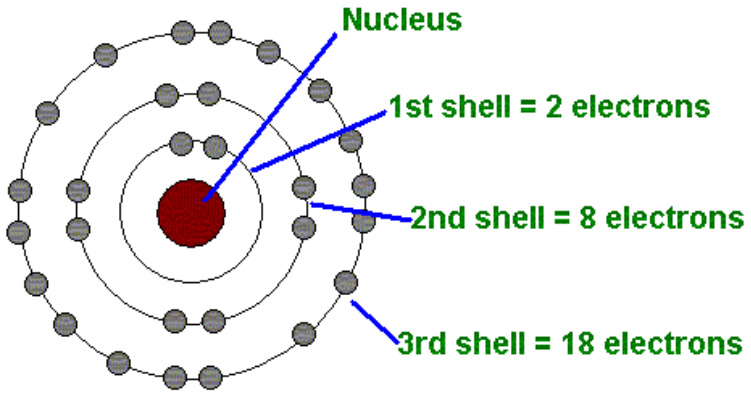
1913

Niels Bohr

Bohr refined Rutherford's idea by adding that the electrons were in orbits like planets orbiting the sun

He proposed that electrons surround the nucleus in specific energy “levels” or “shells.”

With each orbit only able to contain a set number of electrons.

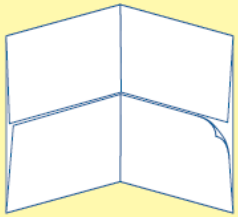


Theory is often called the orbital model.

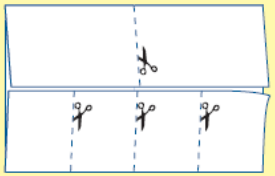
FOLDABLE

STEP 1 **Make** a shutterfold using one sheet of paper.

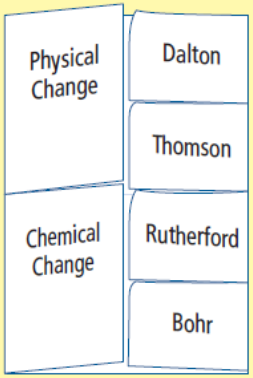
STEP 2 **Fold** the shutterfold in half like a wallet. **Crease** well.



STEP 3 **Open** the Foldable and **cut** the top flap in half along the fold. **Cut** the flap on the bottom into four small tabs.



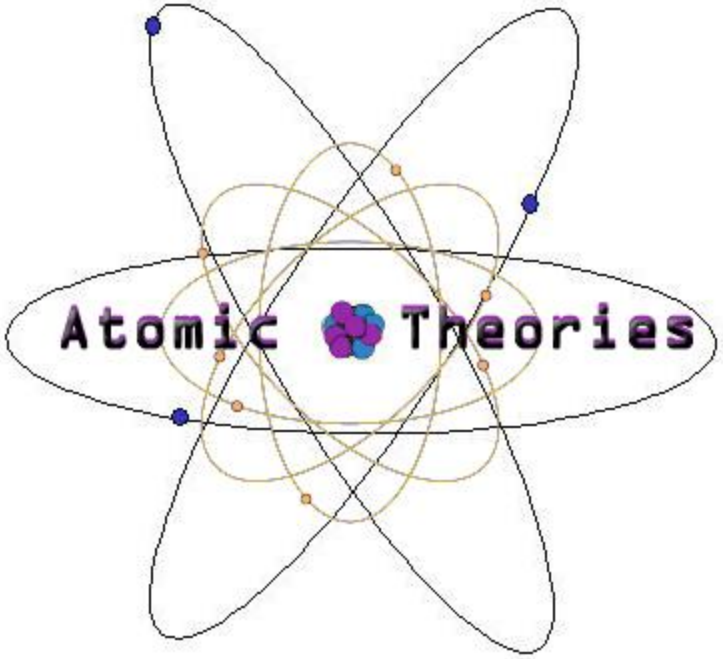
STEP 4 **Label** the Foldable as shown.

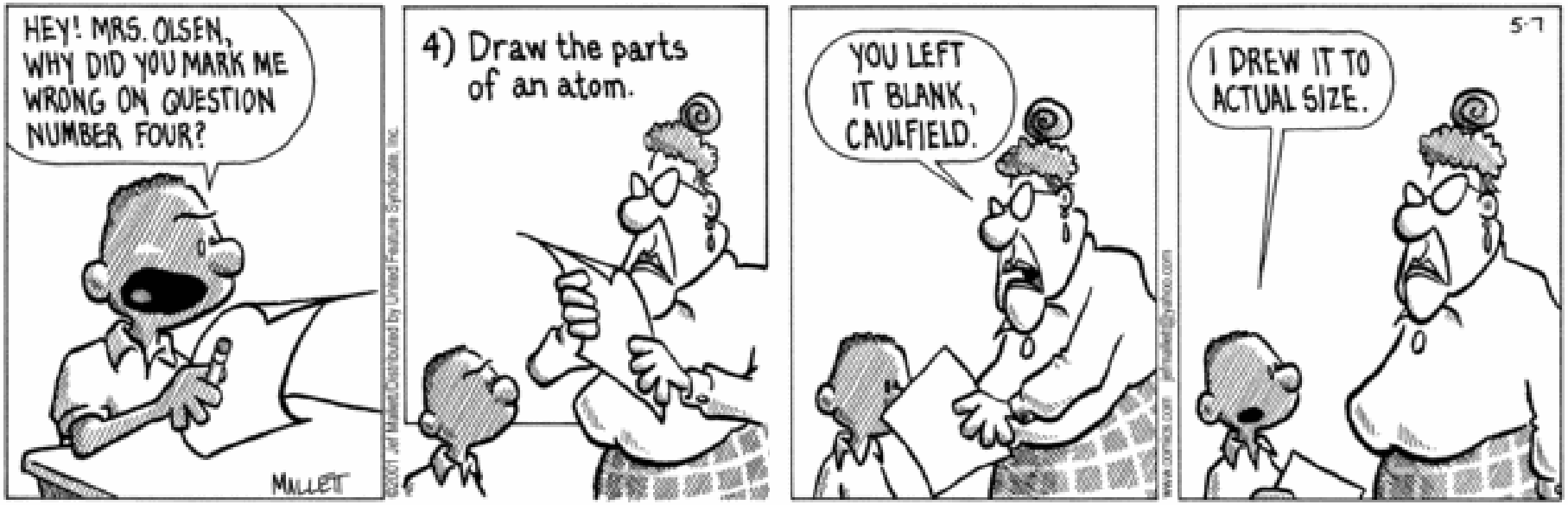


Science 9

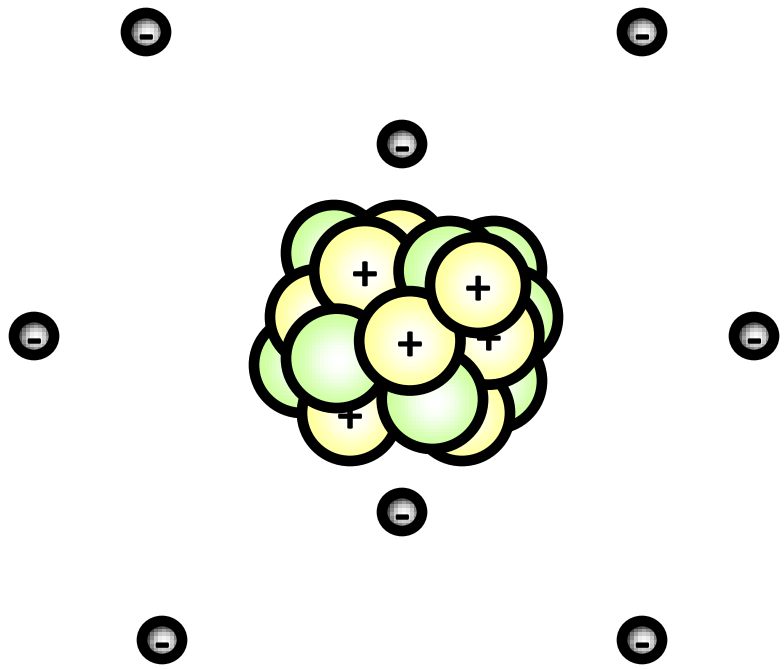
Unit 2:Chemistry

TOPIC 5: ATOMIC STRUCTURE




HEY! MRS. OLSEN, WHY DID YOU MARK ME WRONG ON QUESTION NUMBER FOUR?
MALLETT
4) Draw the parts of an atom.
©2001 Jef Mallett/Distributed by United Feature Syndicate, Inc.
YOU LEFT IT BLANK, CAULFIELD.
www.comics.com
jefmallett@yahoo.com
5-7
I DREW IT TO ACTUAL SIZE.

Atoms: The Building Blocks of Matter:

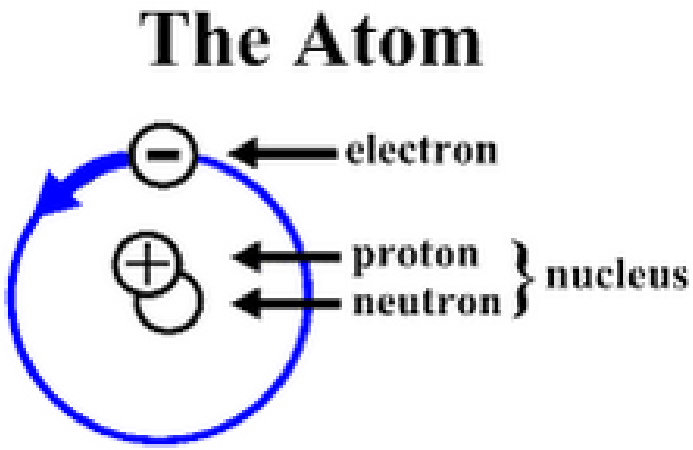


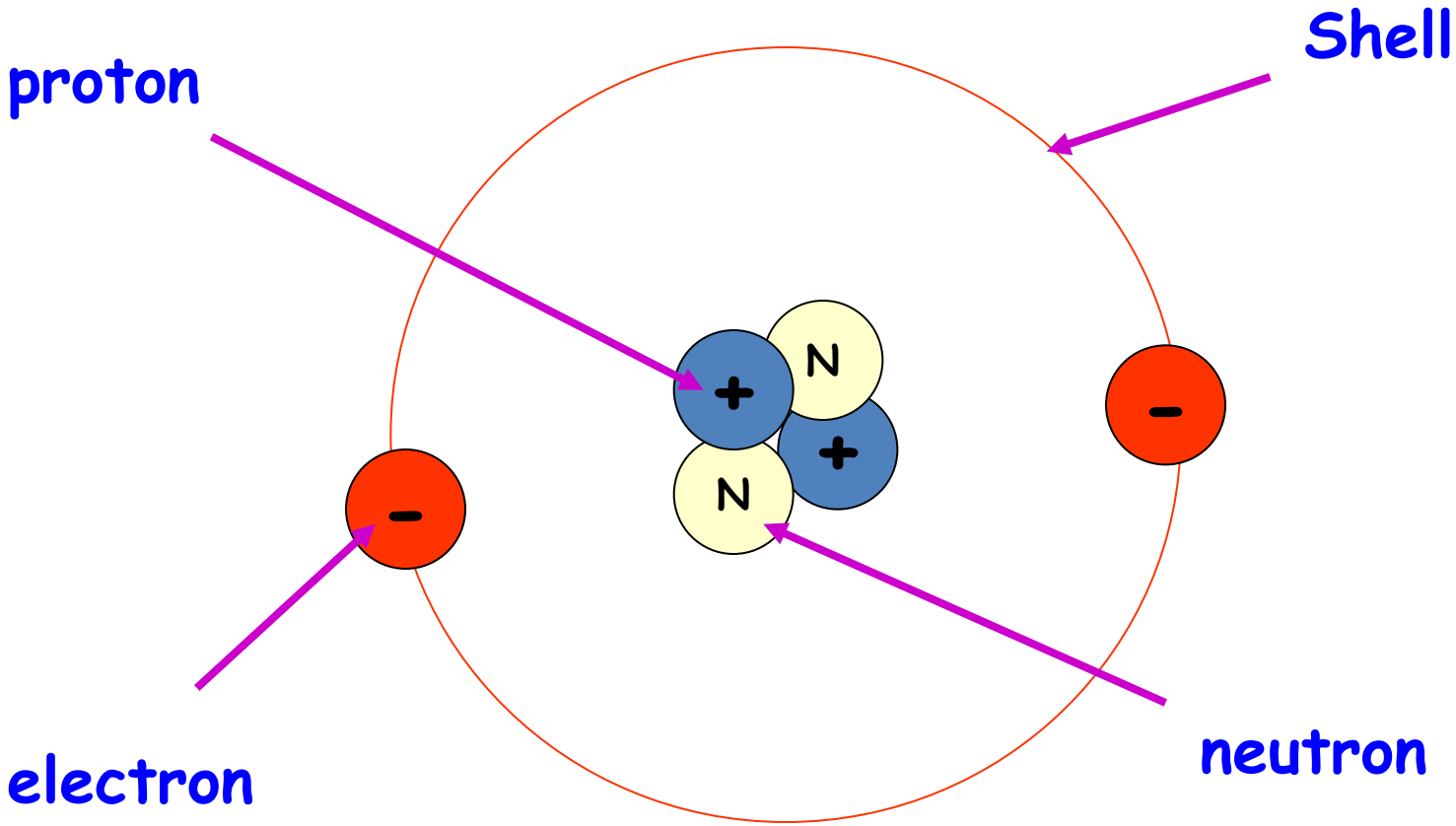
Inside the Atom

- An **atom** is the smallest particle of an element that retains the properties of the element.

Atoms are made up of three kinds of smaller particles called **subatomic particles ("sub-" means below).**

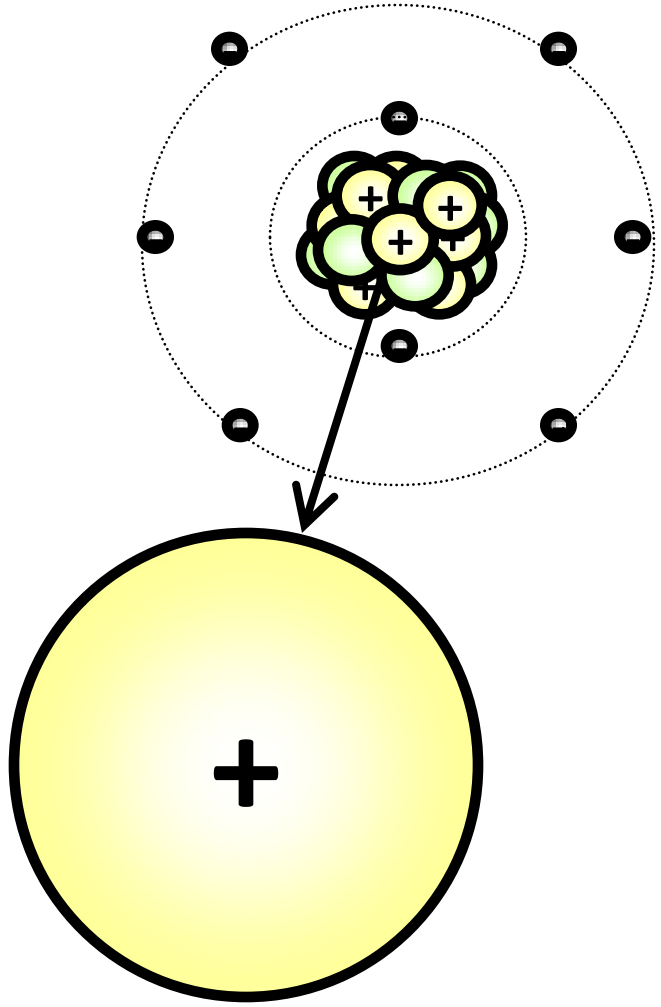
Protons
Electrons
Neutrons




proton
Shell
N
+
+
N
−
−
electron
neutron

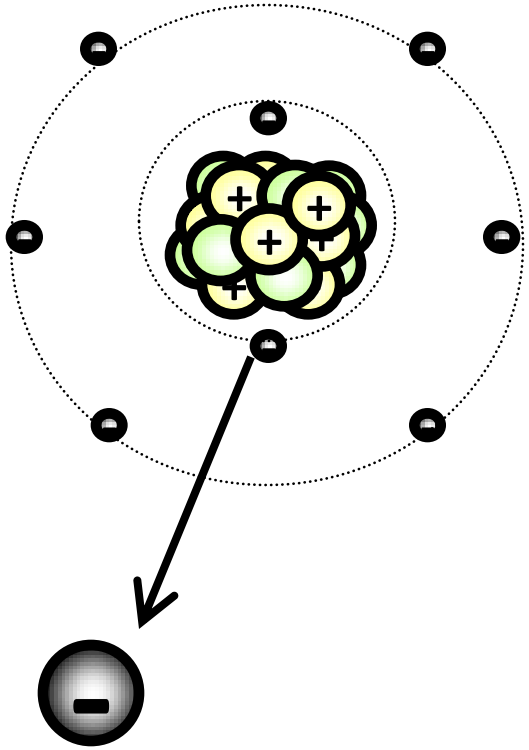
Protons (+)

- Positively charged particles
- Help make up the nucleus of the atom
- Contribute to the atomic mass

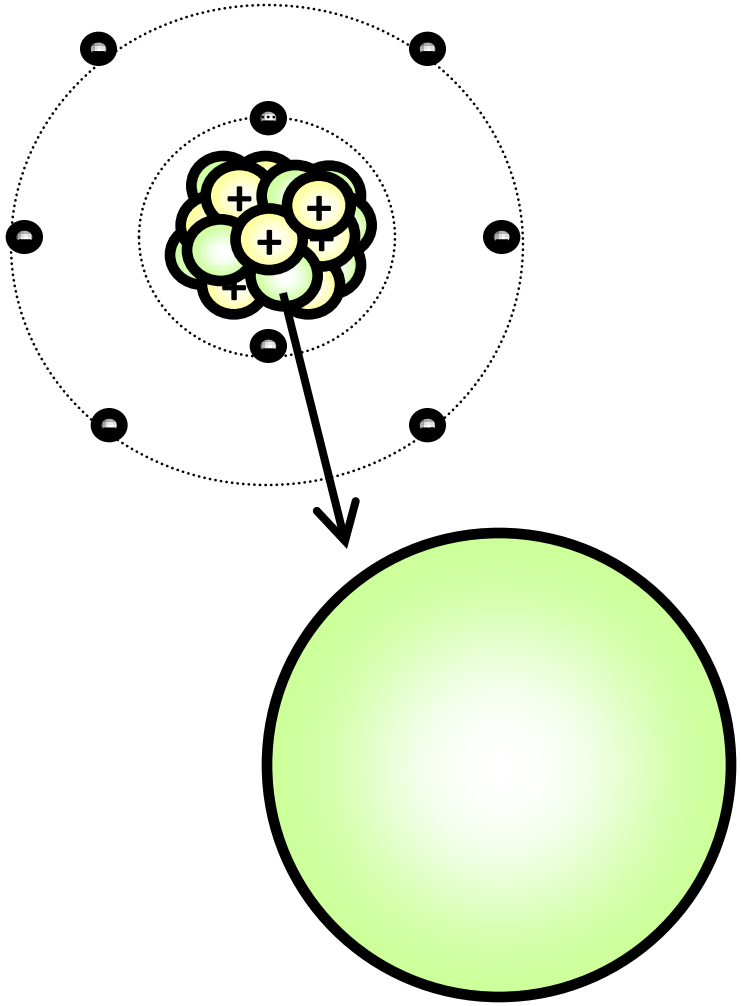


Electrons (-)

- Negatively charged particles
- Electrons occupy special regions called energy levels, or shells, which surround the nucleus.
- Mass is insignificant when compared to protons and neutrons
- Equal to the number of protons
- Involved in the formation of chemical bonds



Neutrons



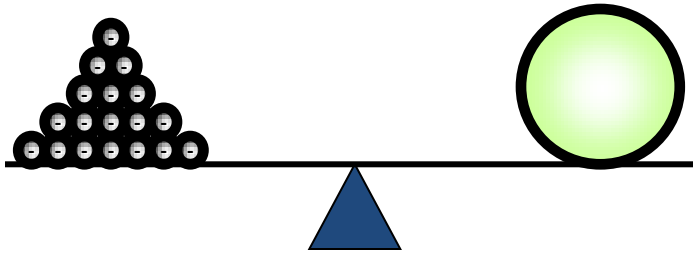
- Neutral particles; have no electric charge
- Help make up the nucleus of the atom
- Contribute to the atomic mass
- Most massive sub-atomic particle

Sub-Atomic Particles

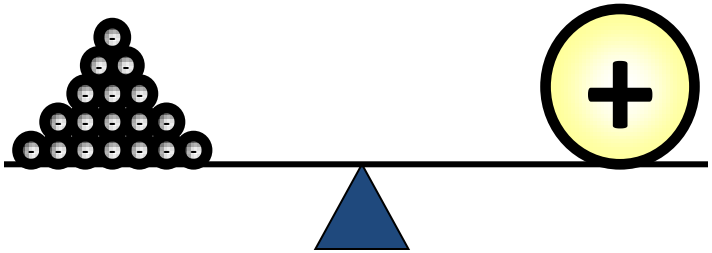
Mass Comparison

(protons, neutrons, electrons)

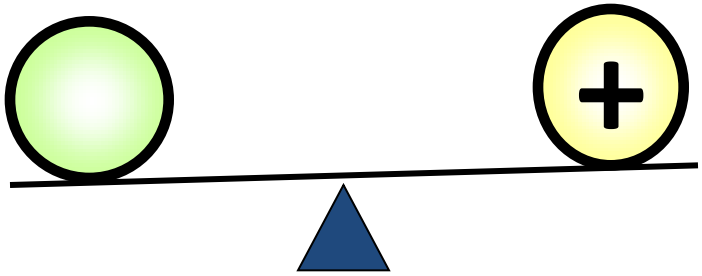
Neutron = 1.6749286 x10^{-27} kg
Proton = 1.6726231 x10^{-27} kg
Electron = 9.1093897 x10^{-31} kg



1839 electrons = 1 neutron



1836 electrons = 1 proton



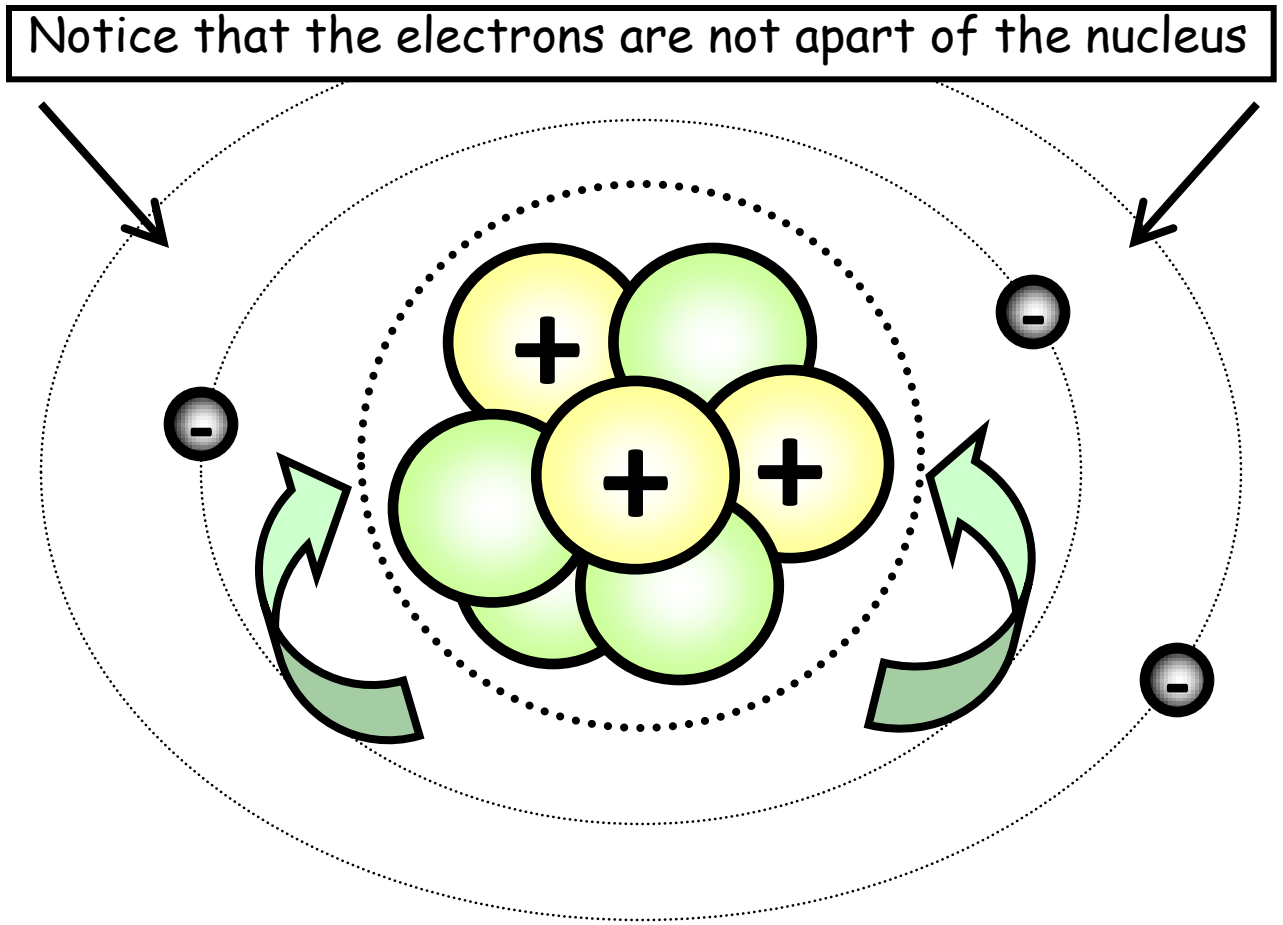
1 neutron ≈ 1 proton

Electric charge

- Electric charge comes in two types: positive and negative.
- Protons have a positive charge, and electrons have a negative charge.
- Each proton counts as +1, and each electron counts as -1.
- All atoms have an equal number of protons and electrons. This means that the charges add up to zero, making the atom uncharged or neutral.

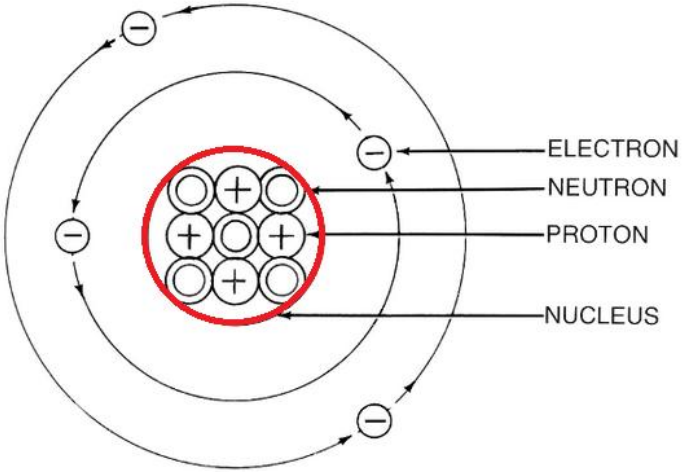
The Atom's "Center"

- Protons and neutrons are grouped together to form the "center" or **nucleus** of an atom.



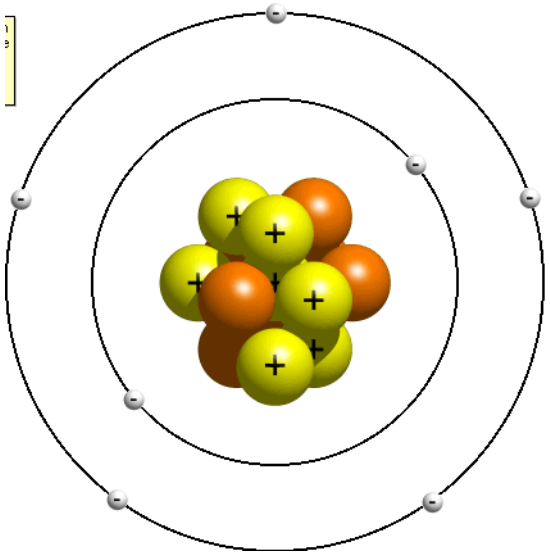
The Nucleus

- The nucleus is a tiny region at the centre of the atom.
- Has a positive charge because of its protons.
- Contains neutrons.
- It contain the protons and
- neutrons, it has the most mass
- Protons and neutrons are held in the nucleus and can not enter or leave it.



SUMMARY OF ATOMIC STRUCTURE

Name	Symbol	Relative Mass	Electric Charge	Location in the Atom
Proton	p	1836	+	Nucleus
Neutron	n	1837	0	Nucleus
Electron	e	1	−	Surrounding the nucleus



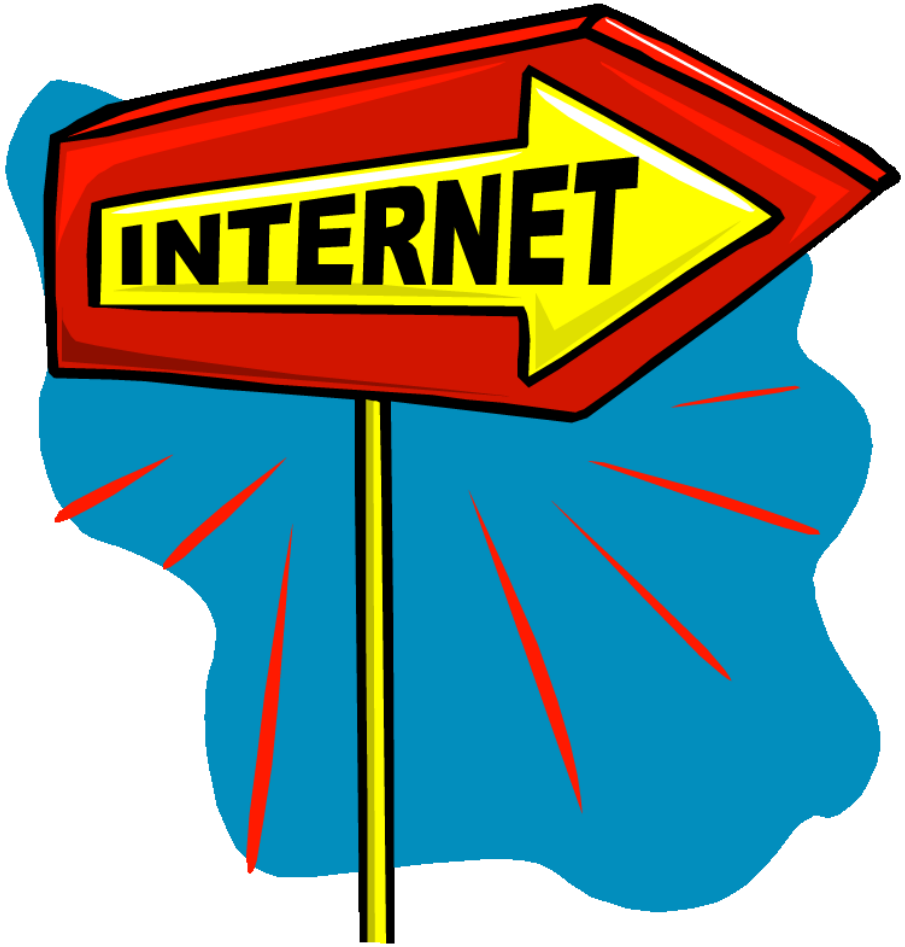
Educational Movie

- Bill nye---atoms

Educational Movie

- **Atoms and Their Electrons**

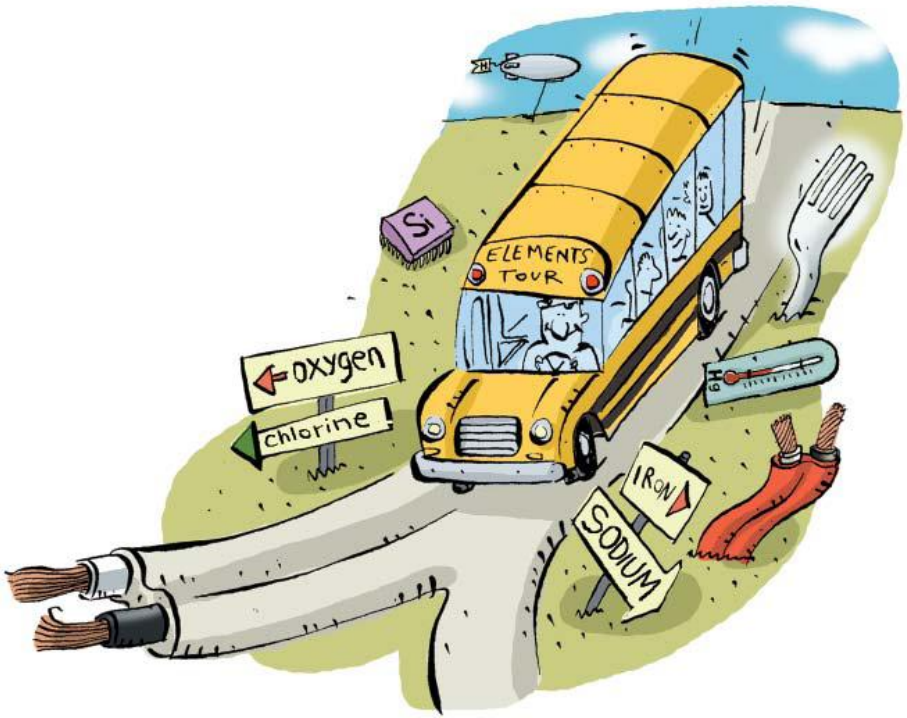
The Atom According to WKRP



Science 9

Unit 2:Chemistry

Topic 6: EXPLORING ELEMENTS



ELEMENT

- **element** a pure substance that cannot be broken down into simpler components.

- There are more than 115 different elements

- Around 92 of these occur in nature, while the remainder are synthetic elements that have been observed in laboratories.

Chemical Symbols

- **Chemical Symbols international symbol for each element consisting of one or two letters,**

  O for oxygen

  Na for sodium;

Note the first letter is always capitalized; second letter is never capitalized

Table 2.1 Thirty-five Common Elements

Name of Element	Symbol	Origin of Element's Symbol
Gases at room temperature		
hydrogen	H	*Hydros genes* = water forming
helium	He	*Helios* = sun
neon	Ne	*Neon* = new
nitrogen	N	*Nitron* = saltpetre (an explosive)
oxygen	O	*Oxys genes* = acid forming
fluorine	F	*Fluere* = Latin for flowing
chlorine	Cl	*Chloros* from *khloros* = pale green
Liquids at room temperature		
bromine	Br	*Bromos* = smelly
mercury	Hg	*Hydrargyrum* = Latin for liquid silver
Solids at room temperature		
lithium	Li	*Lithos* = stone
sodium	Na	*Natrium* = Latin for sodium
potassium	K	*Kalium* = Latin for potash
rubidium	Rb	*Rubidus* = Latin for red
cesium	Cs	*Caesius* = Latin for bluish-grey
beryllium	Be	*Beryllos* = emerald
magnesium	Mg	*Magnesia alba* = a place in Greece
calcium	Ca	*Calx* = Latin for limestone
strontium	Sr	*Strontian* = a village in Scotland
barium	Ba	*Barys* = heavy
titanium	Ti	*Titans* = gods from Greek mythology
chromium	Cr	*Chroma* = colour
manganese	Mn	*Magnesia negra* = Latin for black magnesium
iron	Fe	*Ferrum* = Latin for iron
cobalt	Co	*Cobald* from *kobold* = German for goblin
nickel	Ni	*kupfer Nickel* = German for devil's copper
copper	Cu	*Cuprum* = Latin for Cyprian
zinc	Zn	*Zink* = German for zinc
silver	Ag	*Argentum* = Latin for silver
gold	Au	*Aurum* = Latin for gold
tin	Sn	*Stannum* = Latin for tin
lead	Pb	*Plumbum* = Latin for lead
carbon	C	*Carbo* = Latin for coal
phosphorus	P	*Phosphoros* = bringer of light
sulphur	S	*Sulphurium* = Latin for sulphur
iodine	I	*Iodes* = violet

KNOW THE FOLLOWING CHEMICAL SYMBOLS

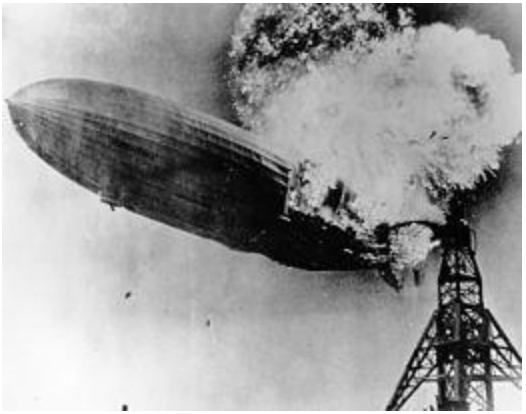
• (i)	Hydrogen		H
• (ii)	Sodium		Na
• (iii)	Potassium		K
• (iv)	Magnesium	Mg	
• (v)	Calcium		Ca
• (vi)	Iron		Fe
• (vii)	Nickel		Ni
• (viii)	Copper		Cu
• (ix)	Zinc		Zn
• (x)	Carbon		C
• (xi)	Nitrogen		N
• (xii)	Oxygen		O
• (xiii)	Neon		Ne
• (xiv)	Helium		He
• (xv)	Chlorine		Cl
• (xvi)	Silicon		Si
• (xvii)	Silver		Ag
• (xviii)	Gold		Au
• (xix)	Mercury		Hg
• (xx)	Lead		Pb

SEE STUDY GUIDE

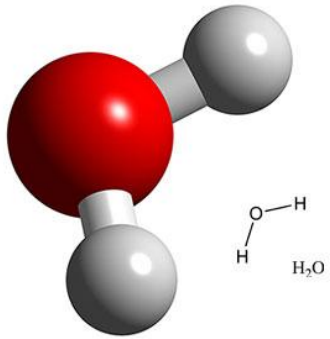
Hydrogen (H)

- Hydrogen is a colourless, odourless, tasteless, and highly flammable gas.

Hydrogen makes up over 90 percent of the atoms in the universe and is highly reactive.



Most hydrogen on Earth is found combined with oxygen as water.



Iron (Fe)

- Iron is a very strong metal, especially when mixed with carbon to make steel.

Large concrete structures such as buildings and swimming pools have long iron bars embedded in the concrete to give it strength

Oxygen (O)

- Oxygen is a non-metal. It is the gaseous element we breathe to stay alive.
- Our cells combine oxygen with sugar to release energy.

- About21 percent of the atmosphere is oxygen, but this is enough to maintain life.

- Plants produce oxygen as a by-product of Photosyn

Figure 2.3 Oxygen is very reactive. Under the right conditions, it can cause steel wool to burn.

Sodium (Na)

- Sodium is a metal, but it is an unusual one.

- Your knife and fork, high tensionpower lines, automobile frames—all are made of metals. Sodium looks metallic, but it cannot be used for any of these purposes because it is too soft.

- In fact, it can be cut with a knife.

Chlorine (Cl)

- Chlorine is a pale yellow-green gas

- Chlorine is added to water in swimming pools and to some water supplies to kill bacteria.

- It is safe in pools, but in high concentrations it is deadly.
-
- Chlorine combines with sodium to form table salt. It is an amazing thing that two highly toxic elements, sodium and chlorine, can combine to make something that is essential to most life forms.

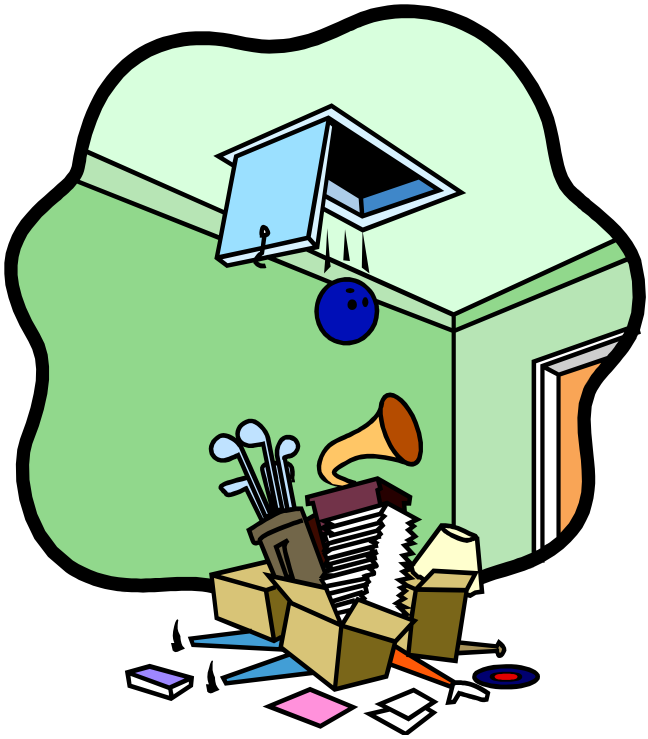
- Chlorine gas released in the battle field

Mercury (Hg)

- Mercury is unique among metals: it is a liquid at room temperature.
- This property makes it an ideal component of “sparkless switches,” needed in places where explosive gases are used, such as welding shops.
- Like all metals, mercury is an excellent conductor of electricity.
- Mercury is a poison. Mercury vapour—a gas that forms over liquid
- mercury—is especially toxic.

How to organize the elements?

- In the early beginnings of chemistry, there was no organization of elements.
- Difficult to find information.
- Chemistry didn’t make sense.
- However, 19th century, chemists began looking for a way to organize their observations of the elements.



The Periodic Table

Periodic Table is a chart that organizes the elements according to their physical and chemical properties.

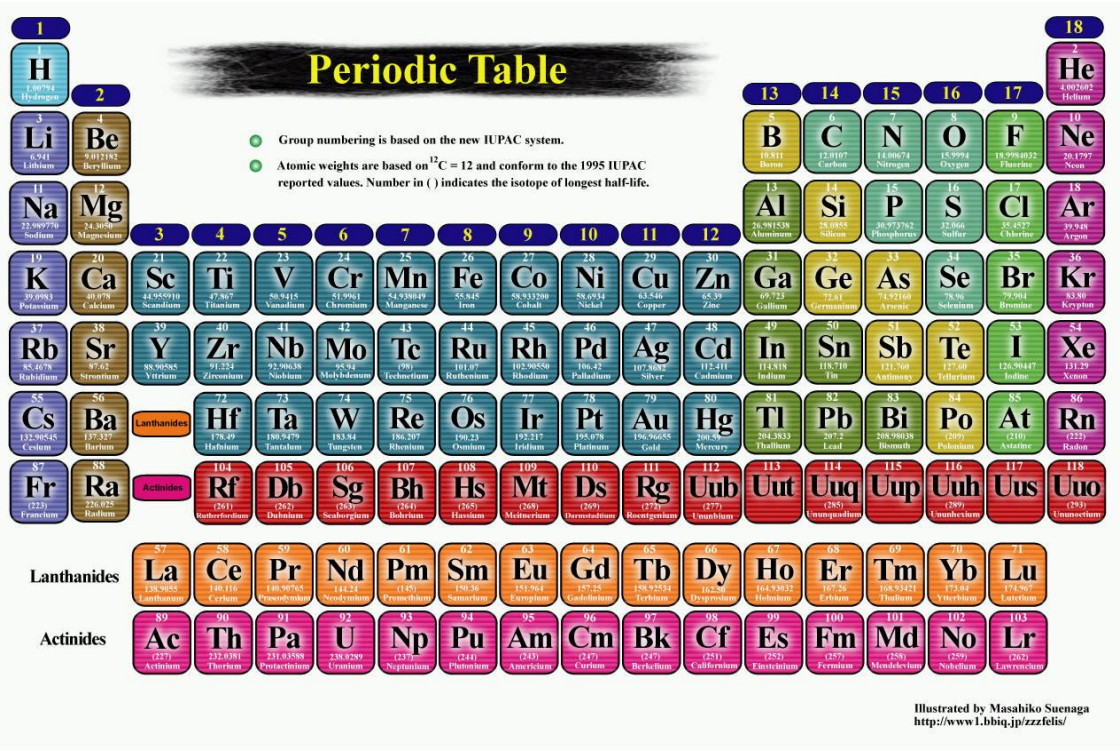
Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period																		
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo

*Lanthanoids	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb
**Actinoids	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No

Why is the Periodic Table important to me?

- The periodic table is the most useful tool to a chemist.
- You get to use it on every test.
- It organizes lots of information about all the known elements.

I am Dmitri Mendeleev!



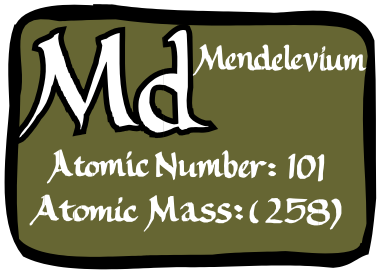
I made the PERIODIC TABLE !

Dmitri Mendeleev: Father of the Table


Library of Congress

HOW HIS WORKED…

- Put elements in rows by increasing atomic weight.
- Put elements in columns by the way they reacted.

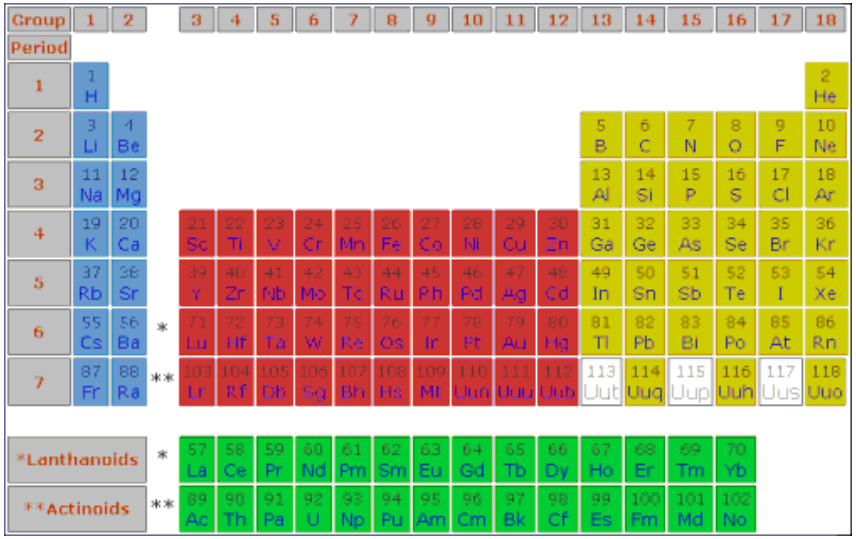


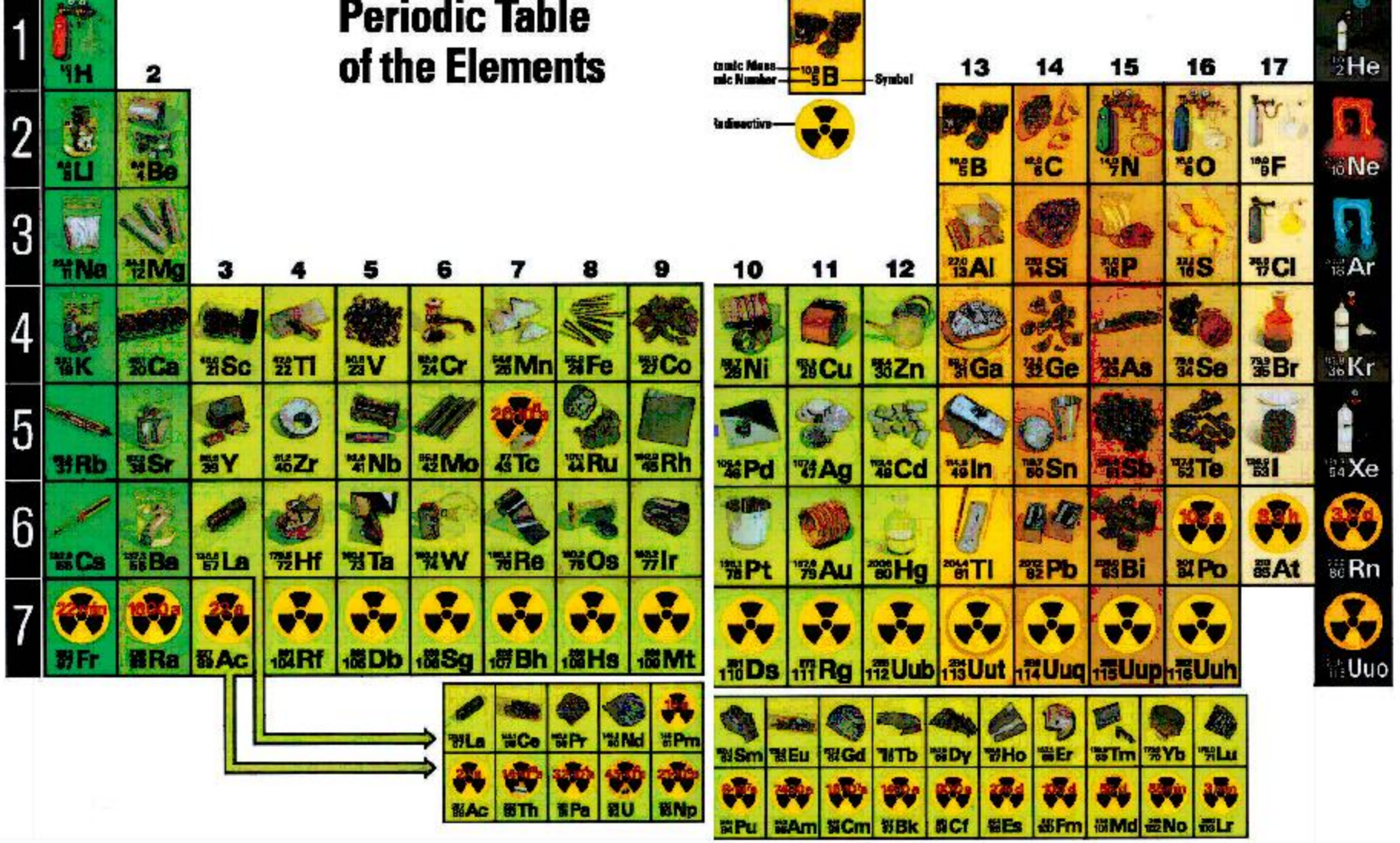
SOME PROBLEMS…

- He left blank spaces for what he said were undiscovered elements. (Turned out he was right!)
- He broke the pattern of increasing atomic weight to keep similar reacting elements together.

The Current Periodic Table

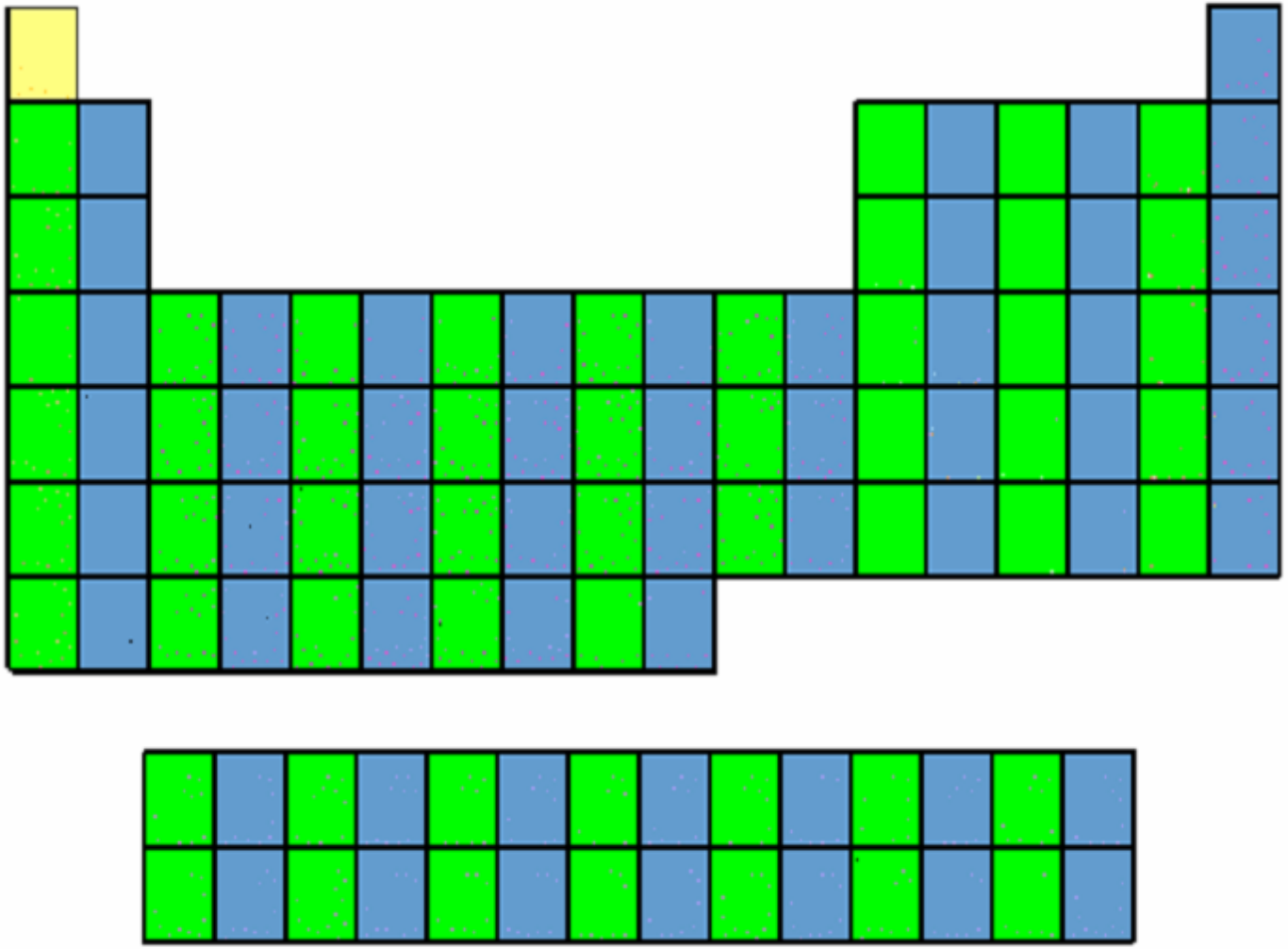
- The horizontal rows are called **periods** and are labeled from 1 to 7.
- The vertical columns are called **groups** are labeled from 1 to 18.



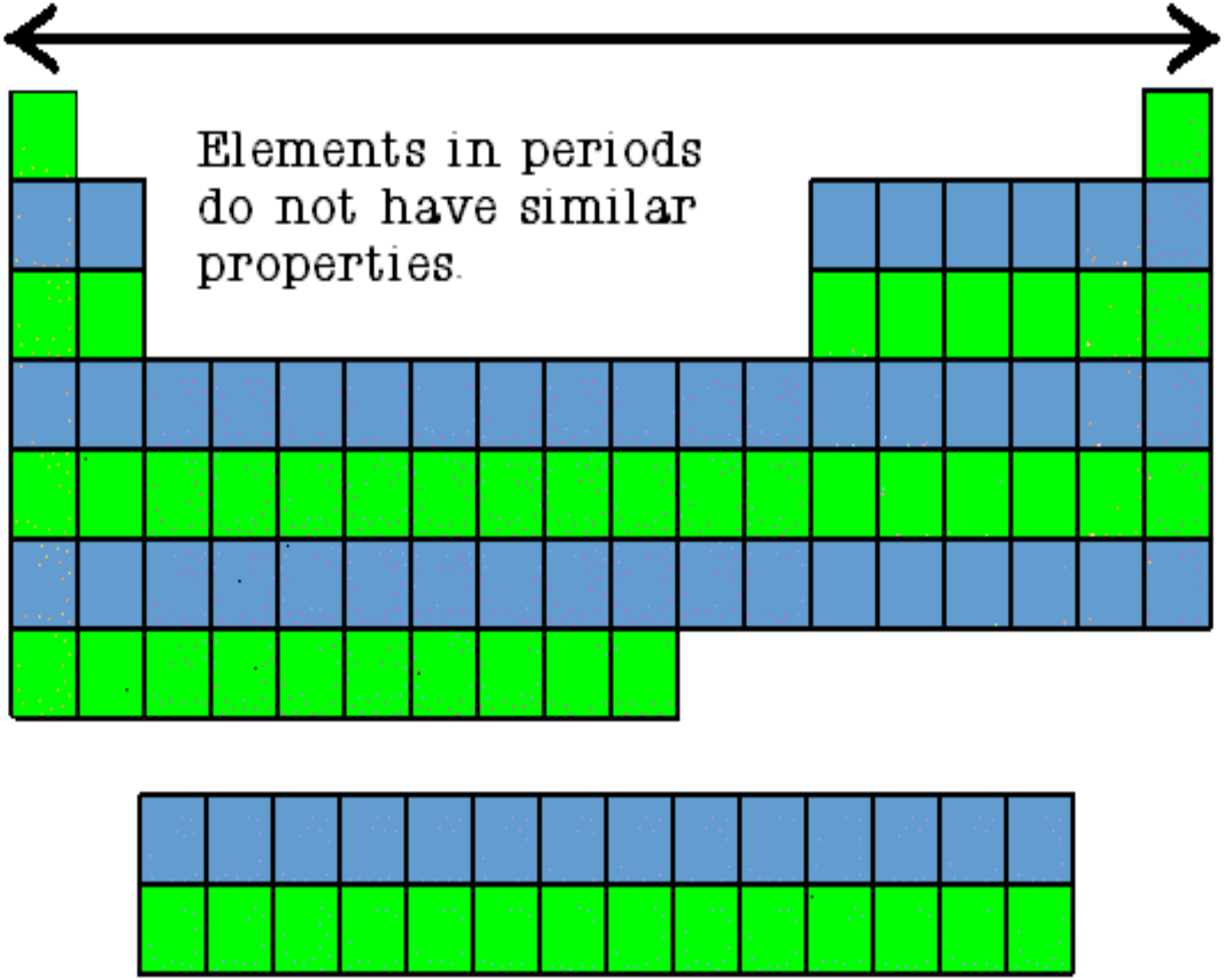


Elements in the same group have similar chemical and physical properties!!

Elements in the periodic table are also grouped into families, which are the columns. Elements in families have similar properties.

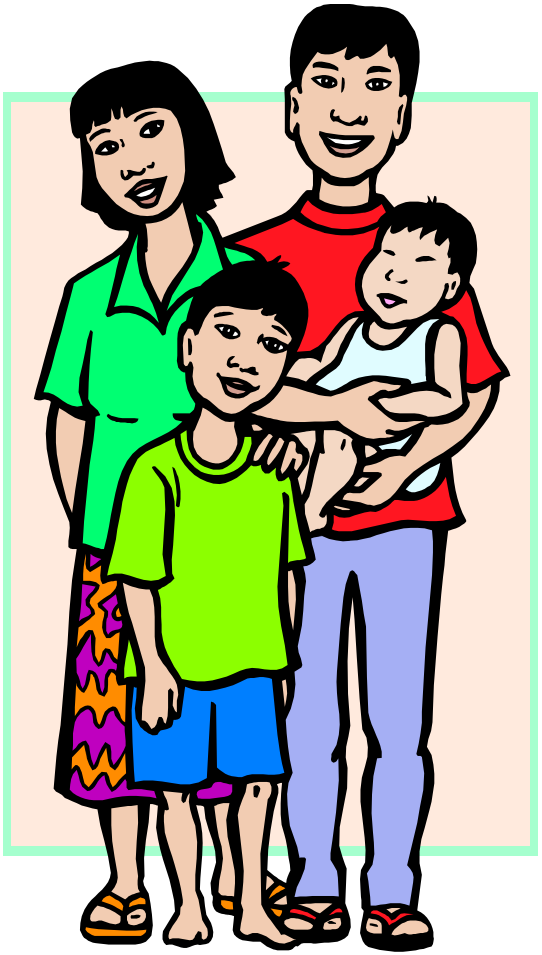


The elements are also categorized into periods, or horizontal rows.



Families on the Periodic Table

- Columns are also grouped into families.
- Families may be one column, or several columns put together.
- Families have names rather than numbers. (Just like your family has a common last name.)



Alkali Metals

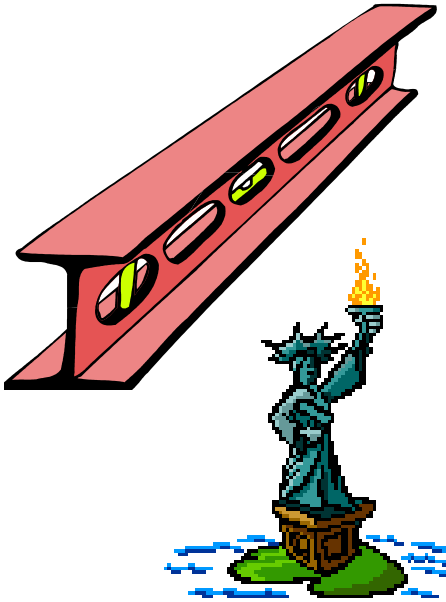
- 1st column on the periodic table (Group 1) not including hydrogen.
- Very reactive metals, always combined with something else in nature (like in salt).
- Soft enough to cut with a butter knife

Alkaline Earth Metals

- Second column on the periodic table. (Group 2)
- Reactive metals that are always combined with nonmetals in nature.
- Several of these elements are important mineral nutrients (such as Mg and Ca

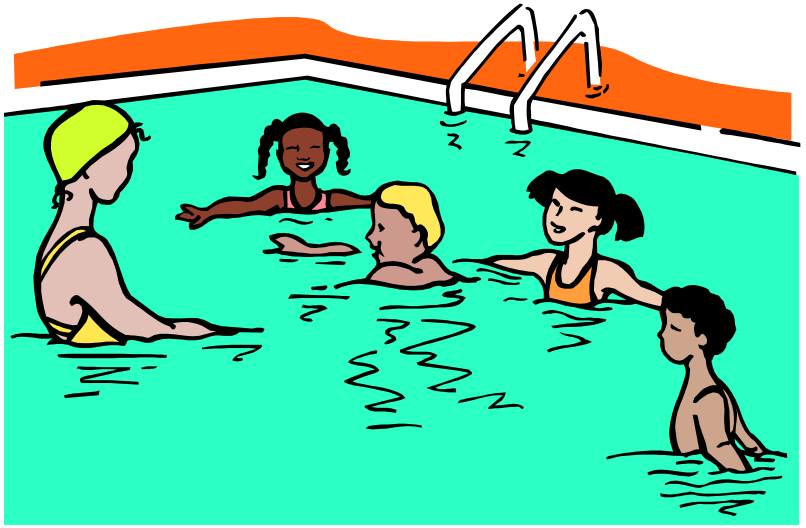
Transition Metals

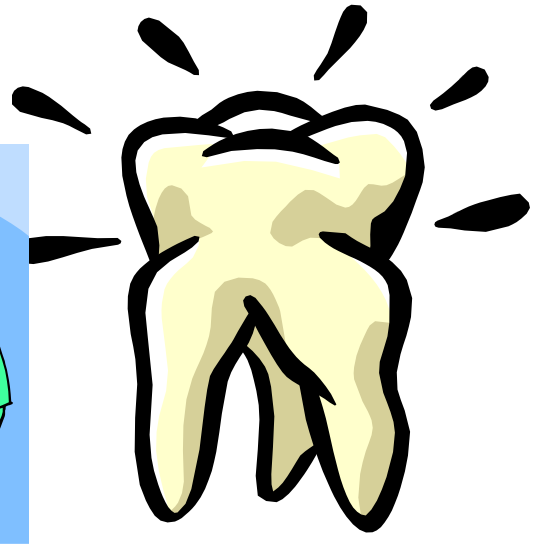
- Elements in groups 3-12
- Less reactive harder metals
- Includes metals used in jewelry and construction.
- Metals used “as metal.”



Halogens

- Elements in group 17
- Very reactive, volatile, diatomic, nonmetals
- Always found combined with other element in nature .
- Used as disinfectants and to strengthen teeth.

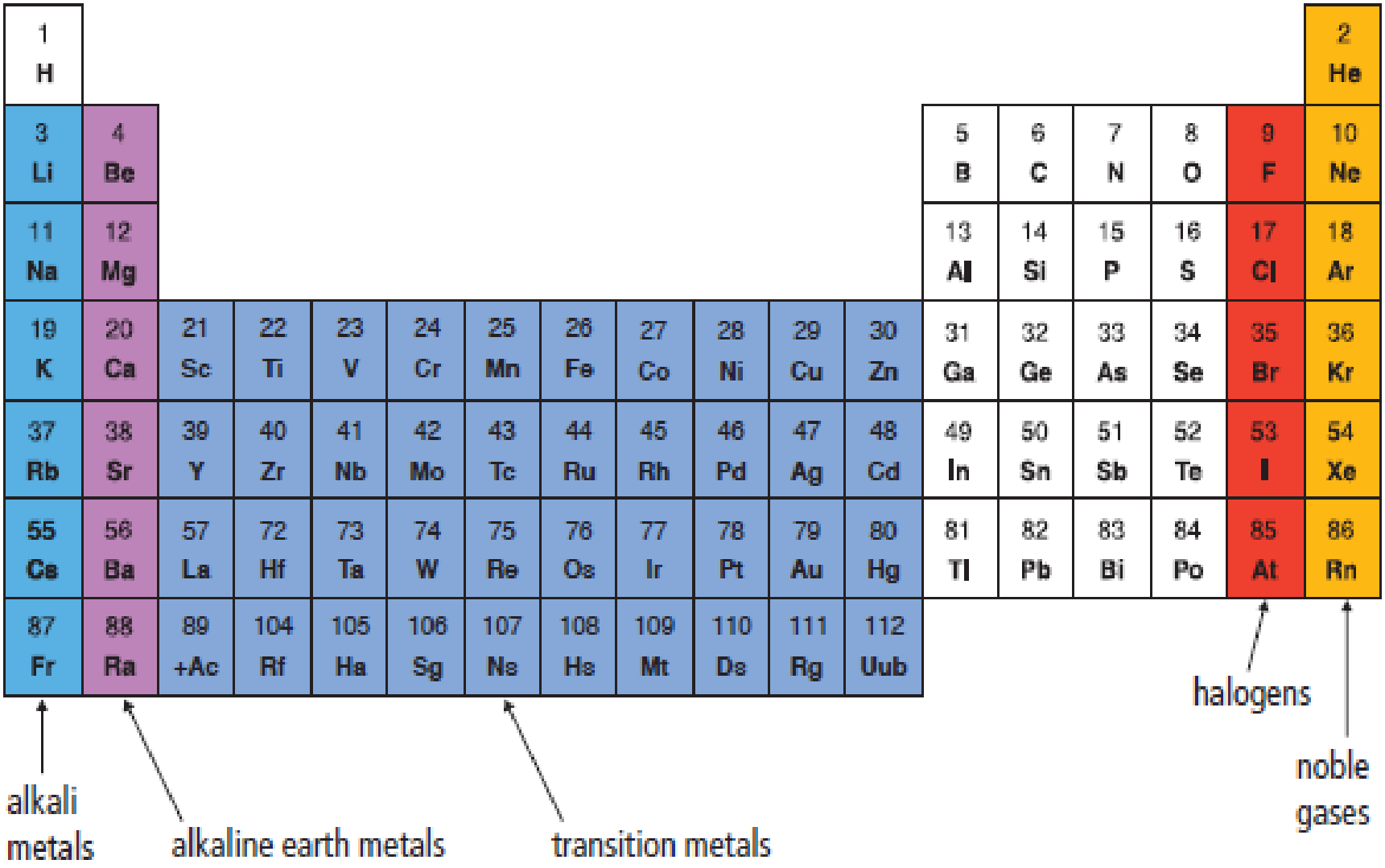




The Noble Gases

The Noble Gases

- Elements in group 18
- VERY unreactive, gases
- Used in lighted “neon” signs
- Used in blimps to fix the Hindenberg problem.


1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
57 La
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 +Ac
104 Rf
105 Ha
106 Sg
107 Ns
108 Hs
109 Mt
110 Ds
111 Rg
112 Uub
halogens
noble gases
alkali metals
alkaline earth metals
transition metals

Periodic Table of Videos