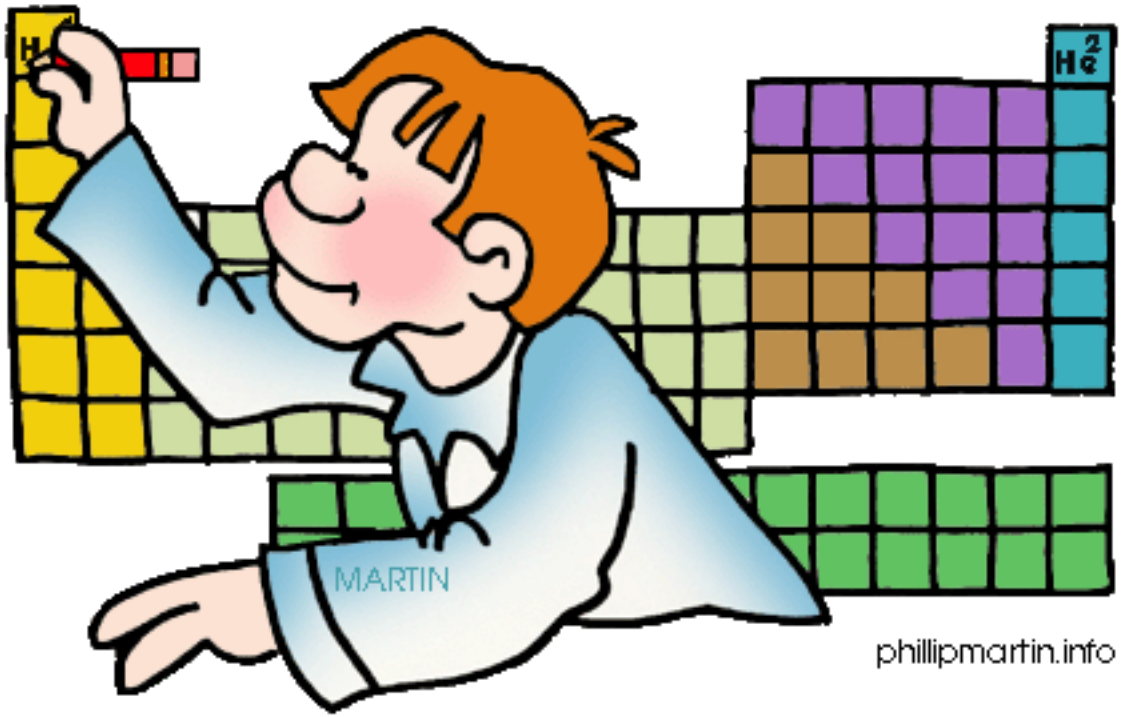
The Elements and the Periodic Table



Periodic Table Timeline

Periodic Table Timeline

1669 – An unknown element (**phosphorus**) is discovered.

How? Hennig Brand attempted to make gold by boiling urine.

Antoine Lavoisier

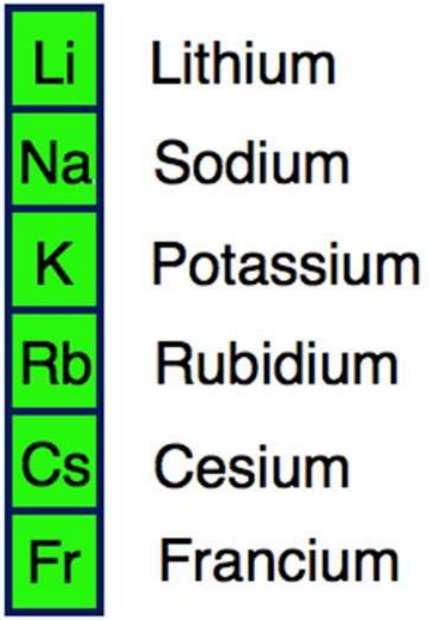
1789 – Known elements are grouped by metals (**solids**) and nonmetals (**gases**).

Periodic Table Timeline

1809 – At least 47 elements have been discovered. Scientists are noticing other **patterns**.

1829 – Known elements are being sorted by chemical **properties**. Predictions about known elements are being made.

Johann Döbereiner looked at the reactions of lithium, sodium, and potassium when they were placed in water.

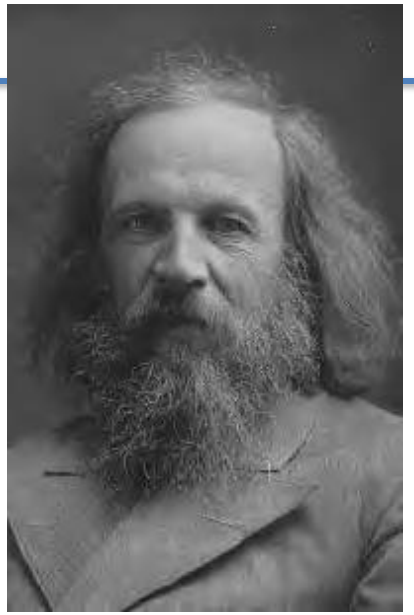


Periodic Table Timeline

1860 – A list is released with the atomic **masses** of known elements.

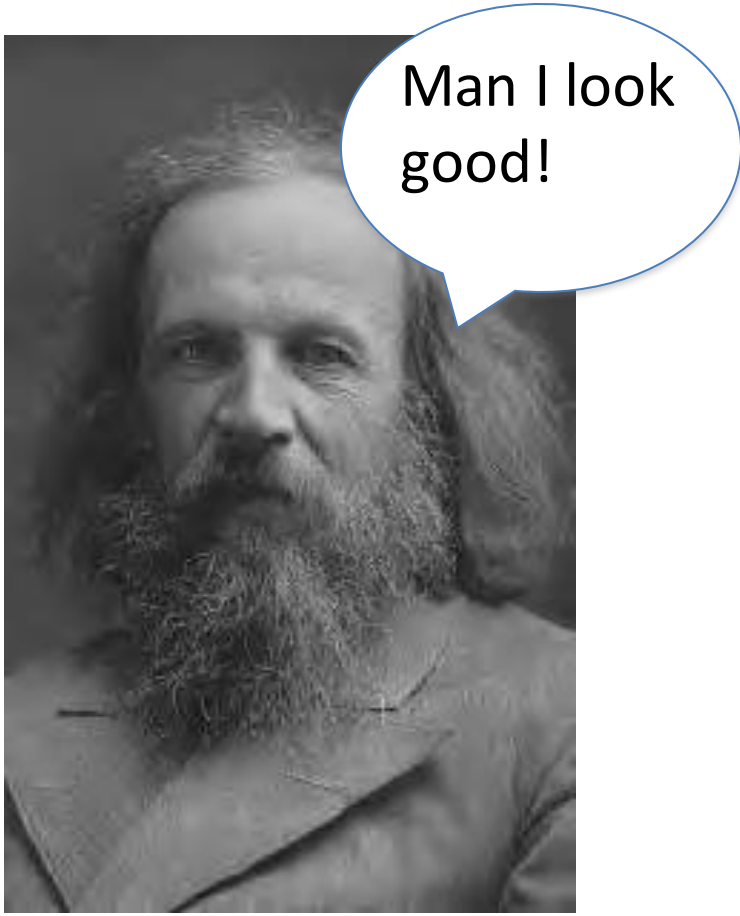
1869 – The Father of the Modern Periodic Table arranges Periodic Table based on known **properties**.

Hydrogen	1
Azot	4.2
Carbon	4.3
Ammonia	5.2
Oxygen	5.5
Water	6.5
Phosphorus	7.2
Phosphuretted hydrogen	8.2
Nitrous gas	9.3
Ether	9.6
Gaseous oxide of carbon	9.8
Nitrous oxide	13.7
Sulphur	14.4
Nitric acid	15.2
Sulphuretted hydrogen	15.4
Carbonic acid	15.3
Alcohol	15.1
Sulphurous acid	19.9
Sulphuric acid	25.4
Carburetted hydrogen from stagnant water	6.3



Dmitri Mendeleev

- In 1869, Dmitri Mendeléev created the first periodic table based off element properties and atomic masses
- He discovered a pattern!
  - **<u>Columns</u>** showed similar properties

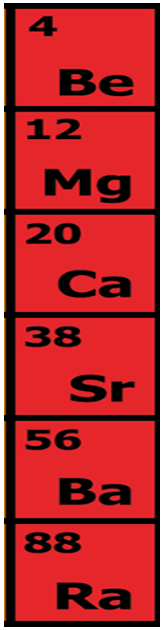


I	II	III	IV	V	VI	VII			
H 1.01									
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0			
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5		VIII	
K 39.1	Ca 40.1		Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7
Cu 63.5	Zn 65.4			As 74.9	Se 79.0	Br 79.9			
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127			
Ce 133	Ba 137	La 139		Ta 181	W 184		Os 194	Ir 192	Pt 195
Au 197	Hg 201	Ti 204	Pb 207	Bi 209					
			Th 232		U 238				

Modern Periodic Table

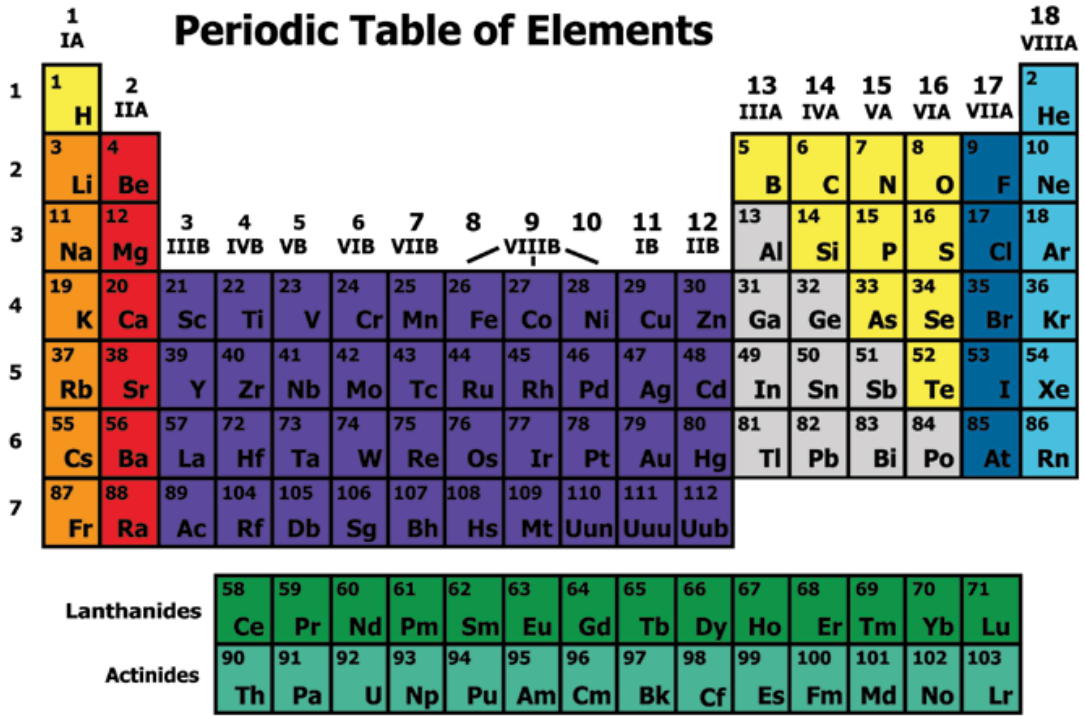
Elements are arranged:

Vertically into **Families** or **Groups**

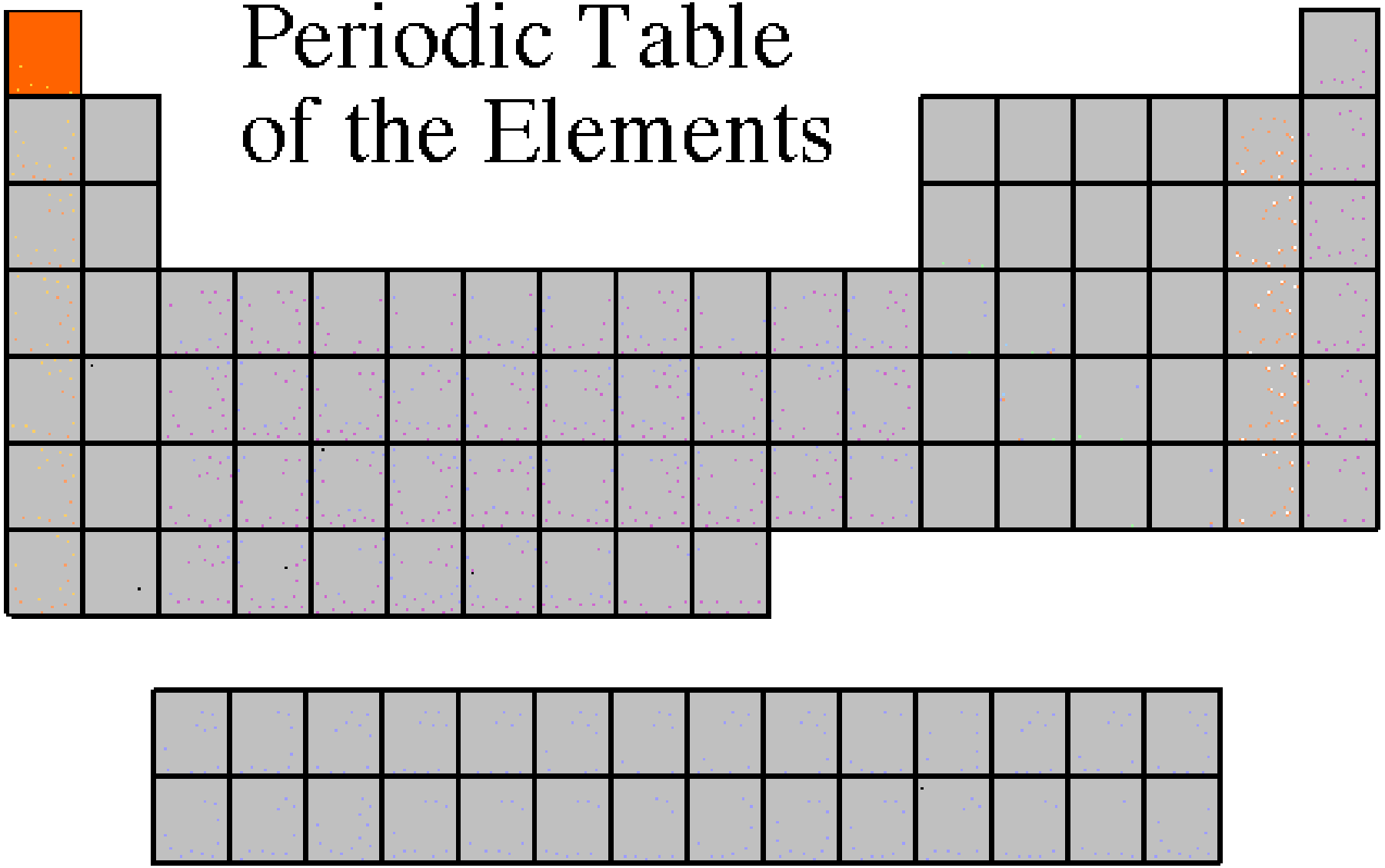


Each family has distinct properties..

- All groups/families share similar properties and the same number of electrons in their outer shell.



Periodic Table of the Elements

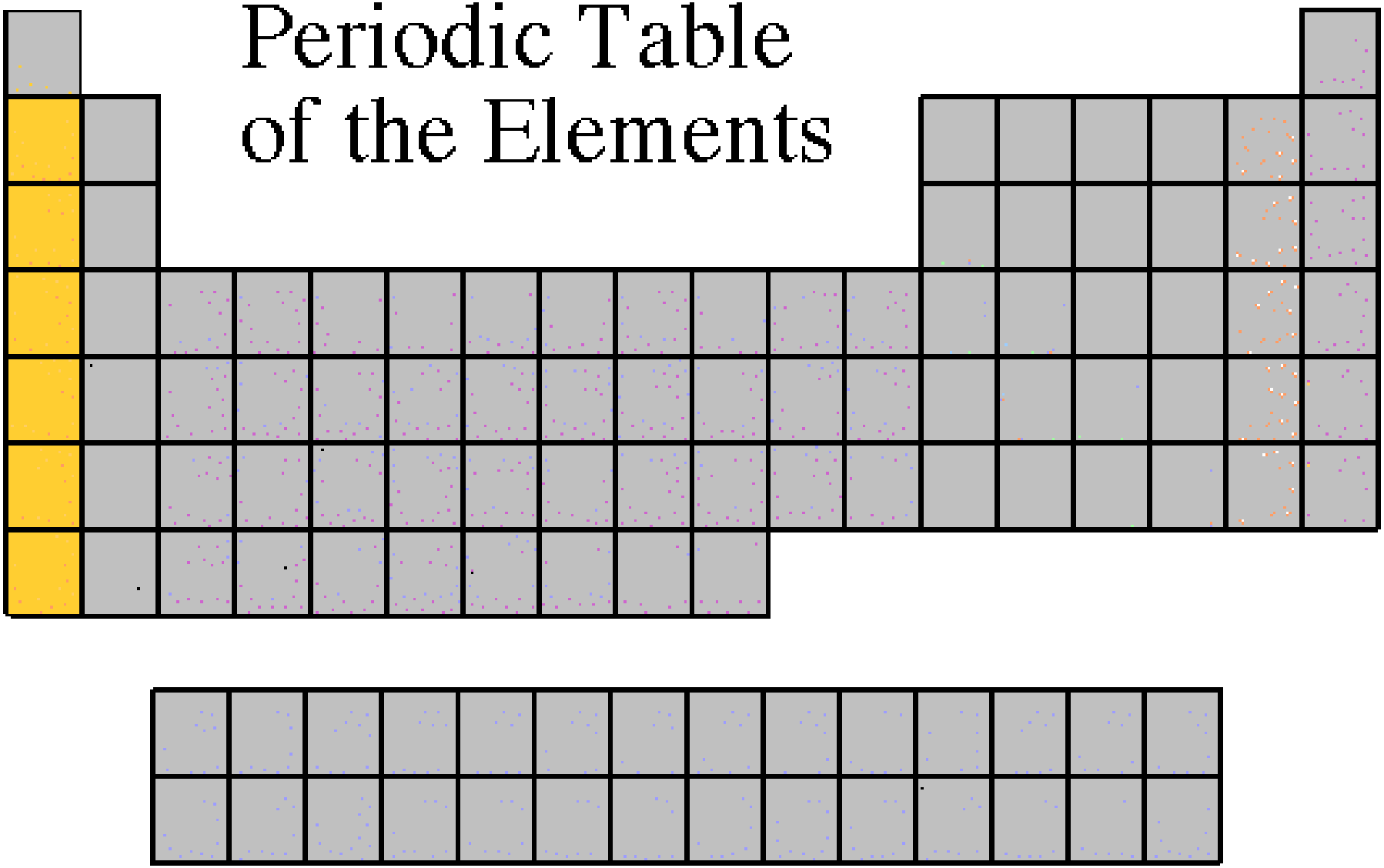


Hydrogen Group

- Has **one** electron
- Very **flammable gas**

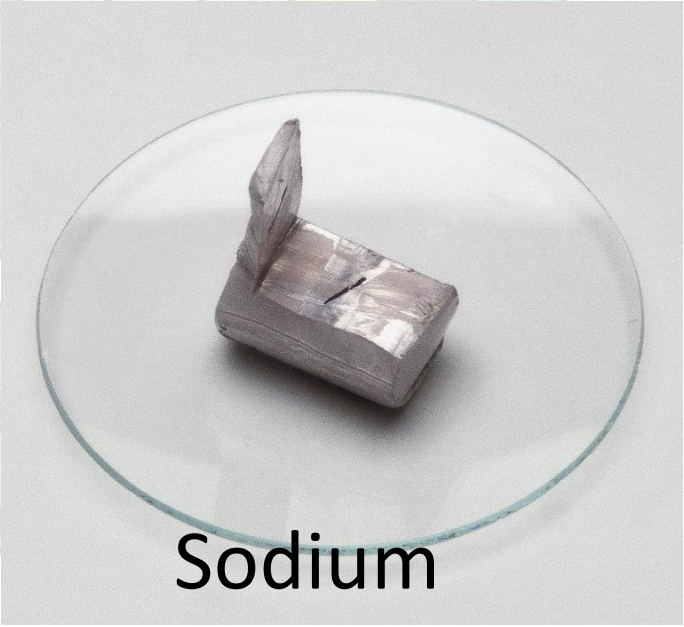
- *Fact:*
  - *The Hindenburg blimp exploded because it was filled with hydrogen*
  - *Hydrogen is the most abundant element in the universe, because it makes up stars*

Periodic Table of the Elements



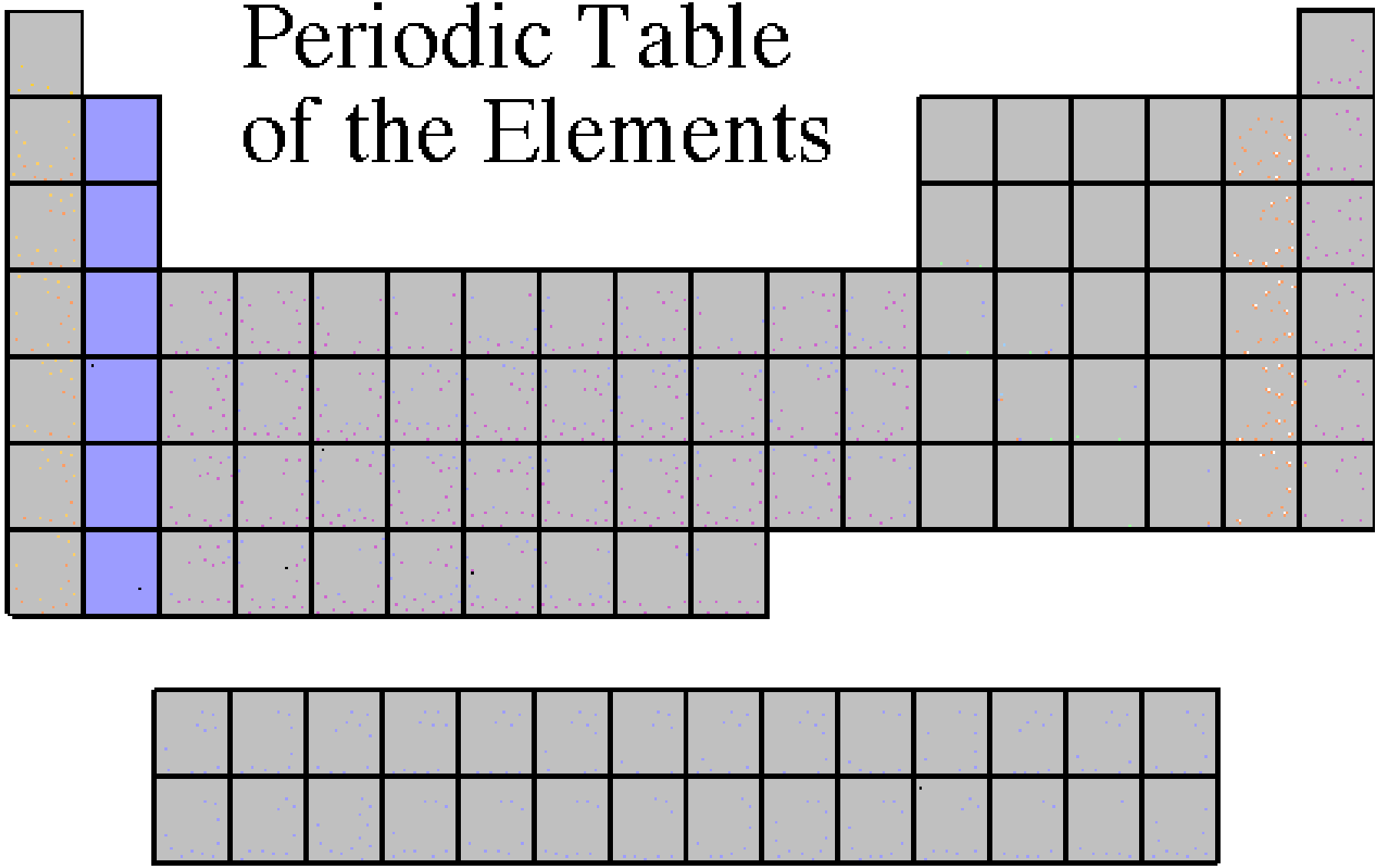
Group 1:
Alkali Metals

- Soft, silvery **metals**
- Loses **one** electron
- Very **reactive** (especially with **water**)



Sodium

Periodic Table of the Elements



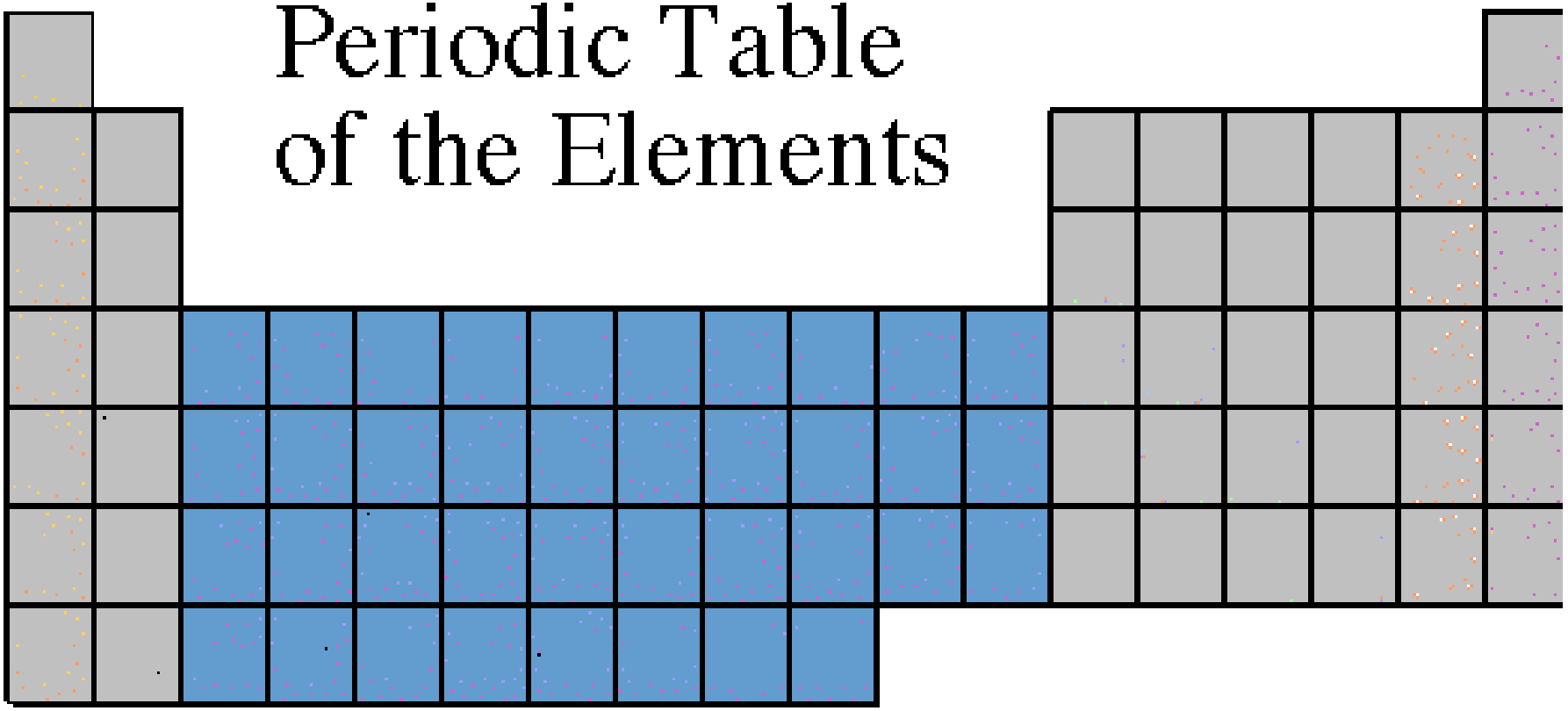
Group 2:

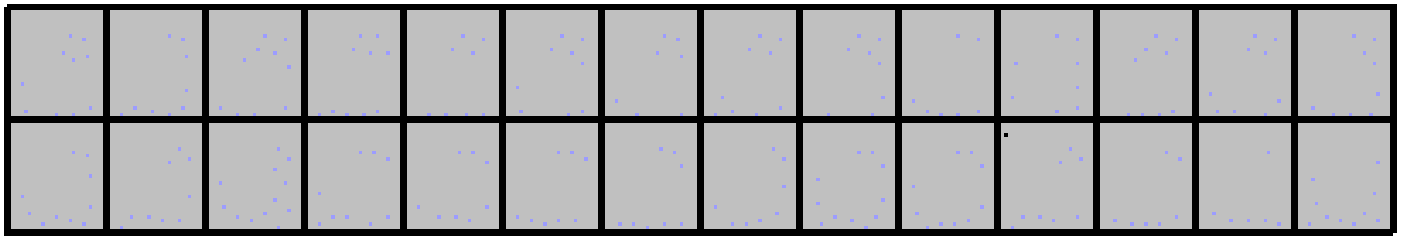
Alkaline Earth Metals

- Silvery-White Metals
- Loses **two** electrons
- **Reactive**
- Found in **rocks** in the earth's crust
- Used in **fireworks** and **flares**

Calcium

Periodic Table of the Elements





Group 3-12: Transition Metals

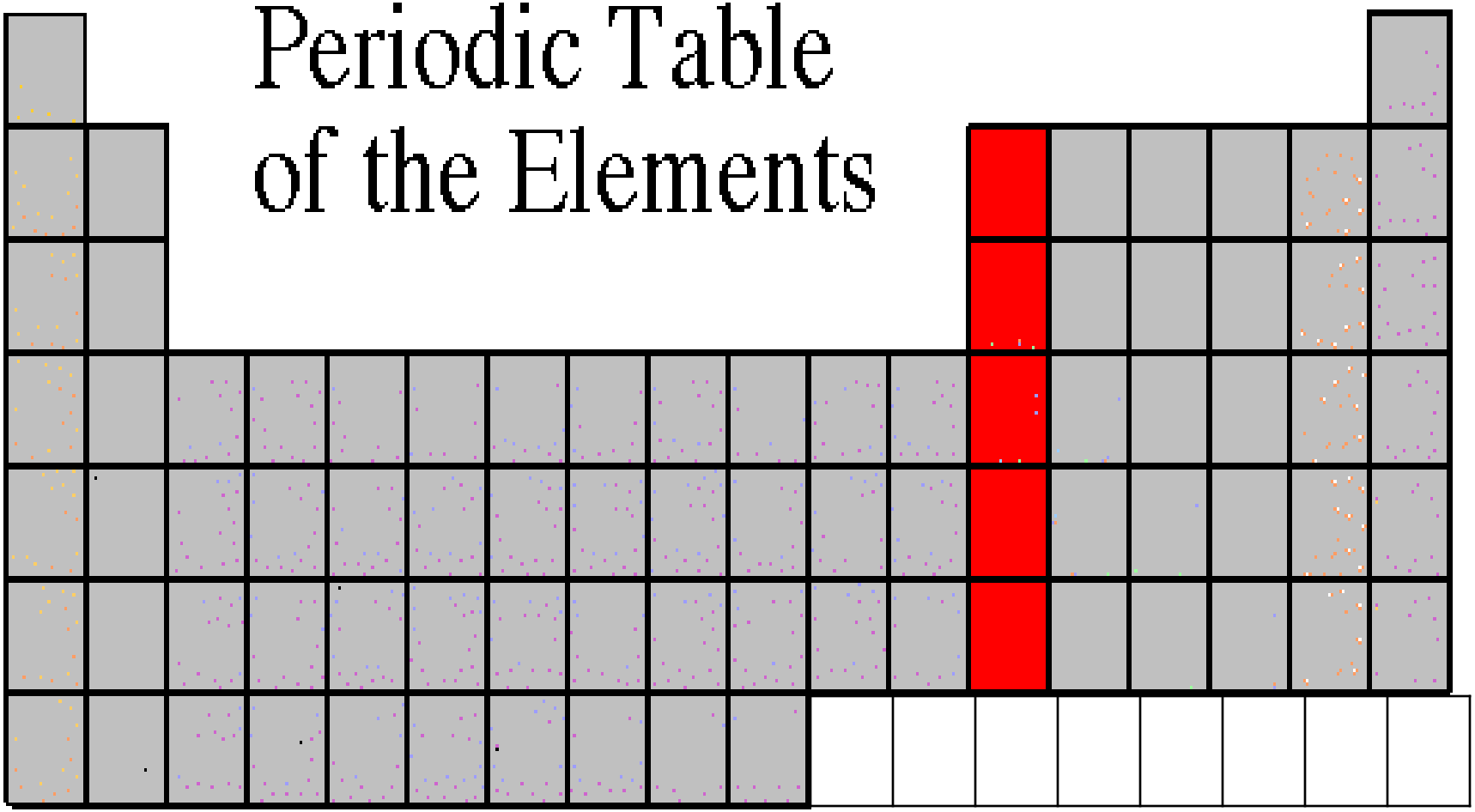
21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn
39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd
	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg
	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub

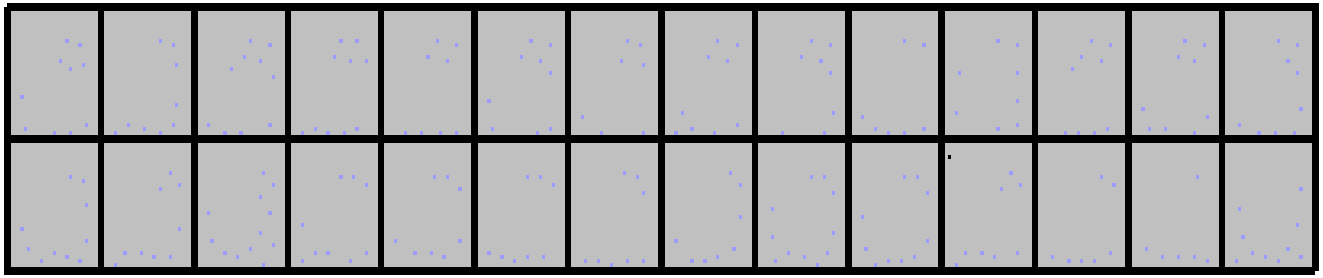
Copper

Iron

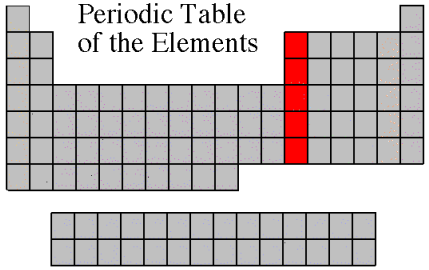
- Good & excellent conductors of **heat** and **electricity**
- **Malleable** and ductile
- Electrons **vary** (N/A)

Periodic Table of the Elements





Group 13:
Boron Family

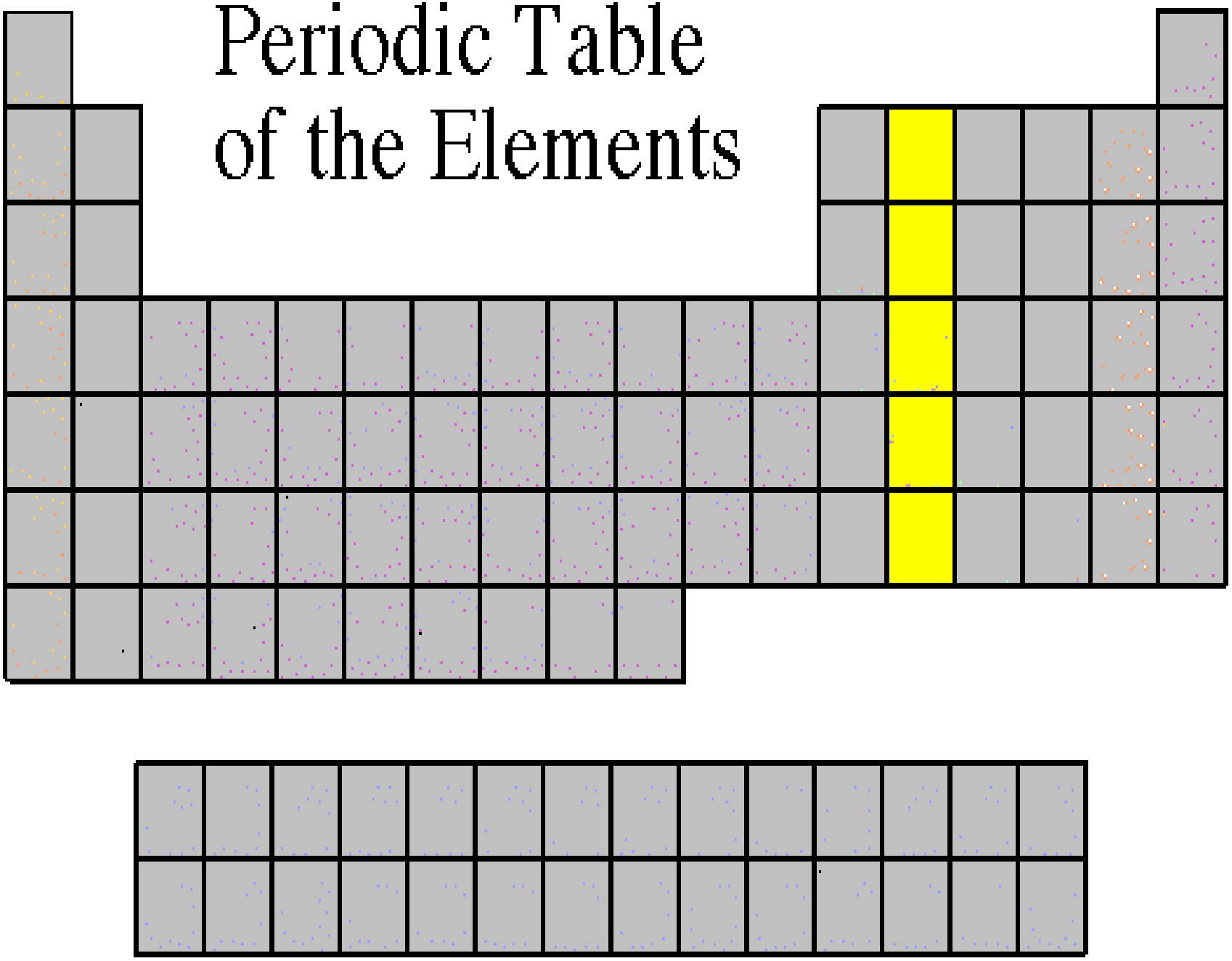


- Gains/shares/loses **five** electrons
- **Aluminum** is the most abundant metal in Earth's crust.

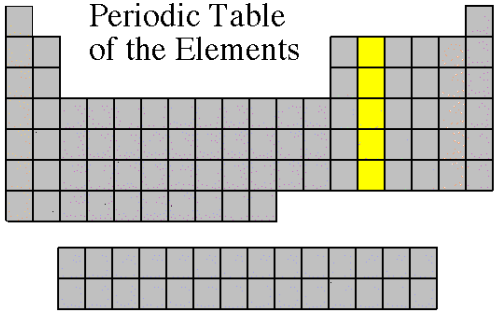
Aluminum

- *Fun Facts:*
  - *Named after the first element in the family.*
  - *Aluminum is used for foil wrap, pop cans, cooking pans, and siding on houses.*
  - *Aluminum was once seen as more precious than gold*

Periodic Table of the Elements



Group 14:
Carbon Family

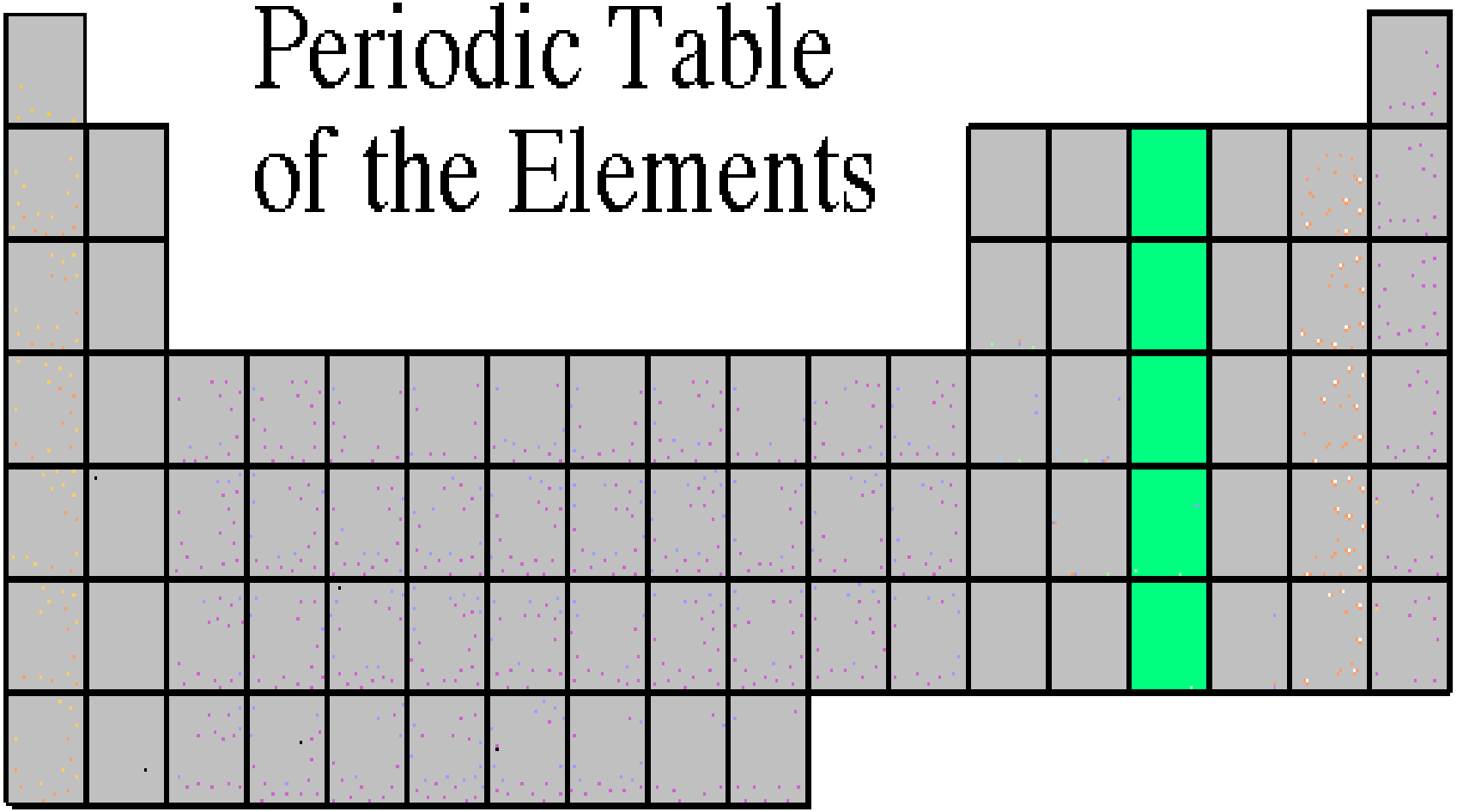


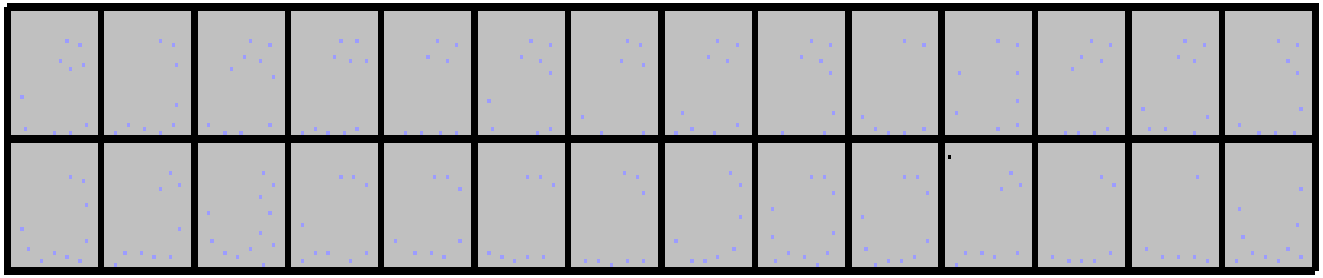
- Shares/gains/loses **four** electrons
- The element **carbon** is called the "basis of life".
- **Silicon** is mostly found in sand.
- Includes a non-metal **(carbon),** metalloids, and **metals**.


Silicon

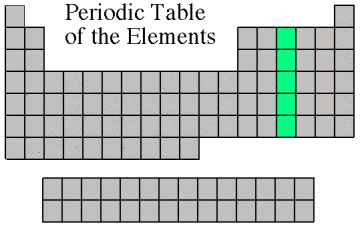
- *Facts:*
  - *Named after first element in the family.*
  - *There is an entire branch of chemistry devoted to carbon compounds called organic chemistry.*
  - *Silicon is 2nd only to oxygen in abundance in Earth's crust.*

Periodic Table of the Elements





Group 15:
Nitrogen Family

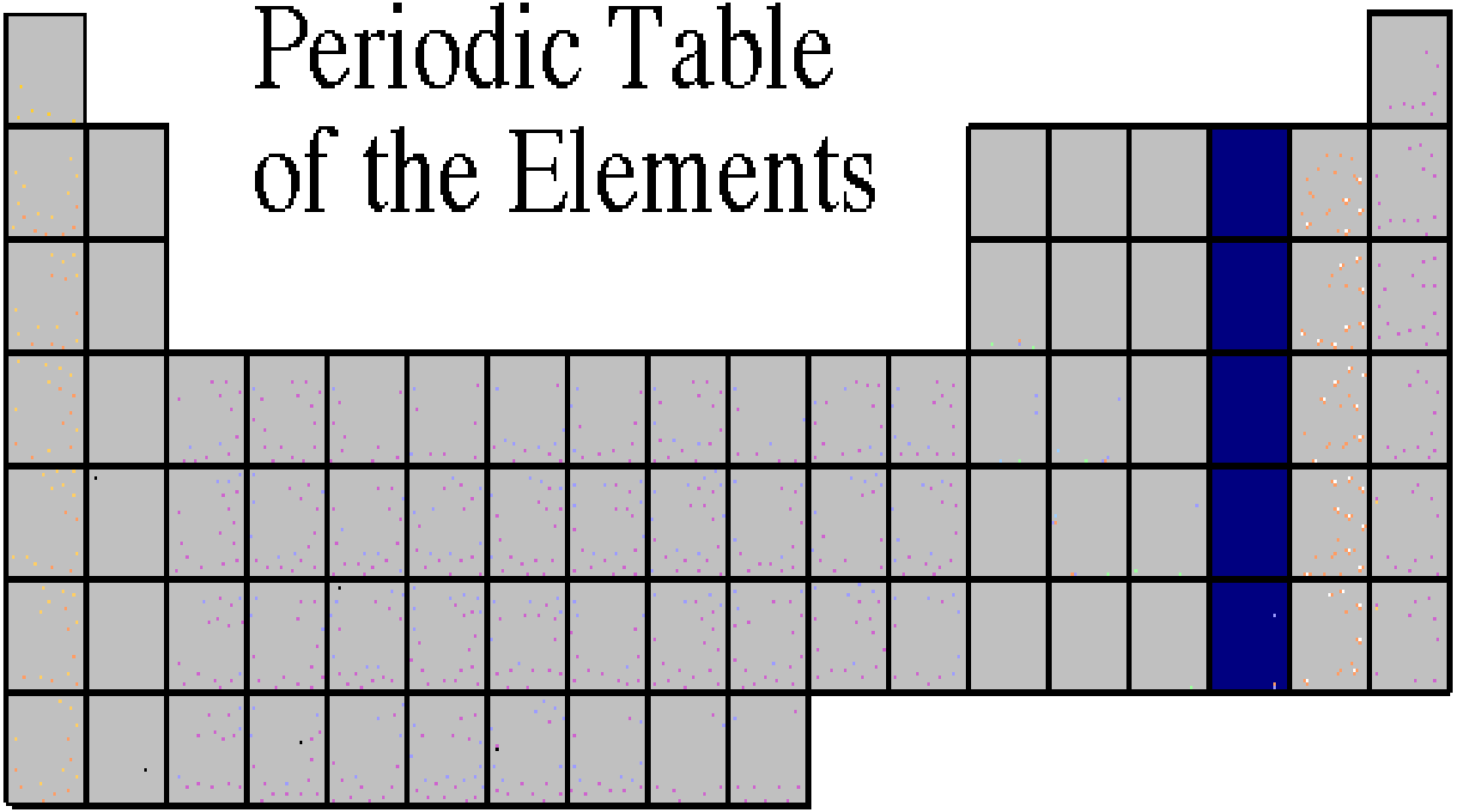


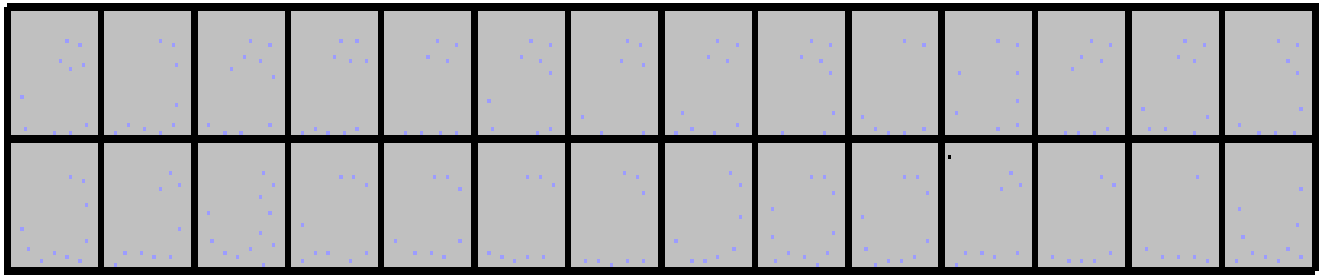
- Gains or shares **three** electrons
- **Nitrogen** makes up 78% of our atmosphere.

- *Facts:*
  - *Phosphorus is used for many things such as water softeners, match heads, and fine china.*
  - *Antimony and bismuth are added to other metals to lower their melting point. Bismuth is used on fire-sprinkler heads.*

Phosphorus

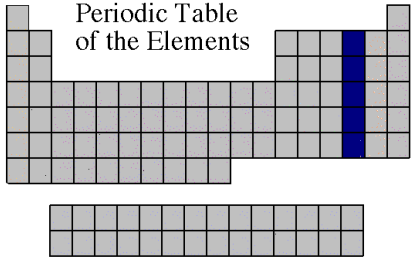
Periodic Table of the Elements





Group 16:

Oxygen Family

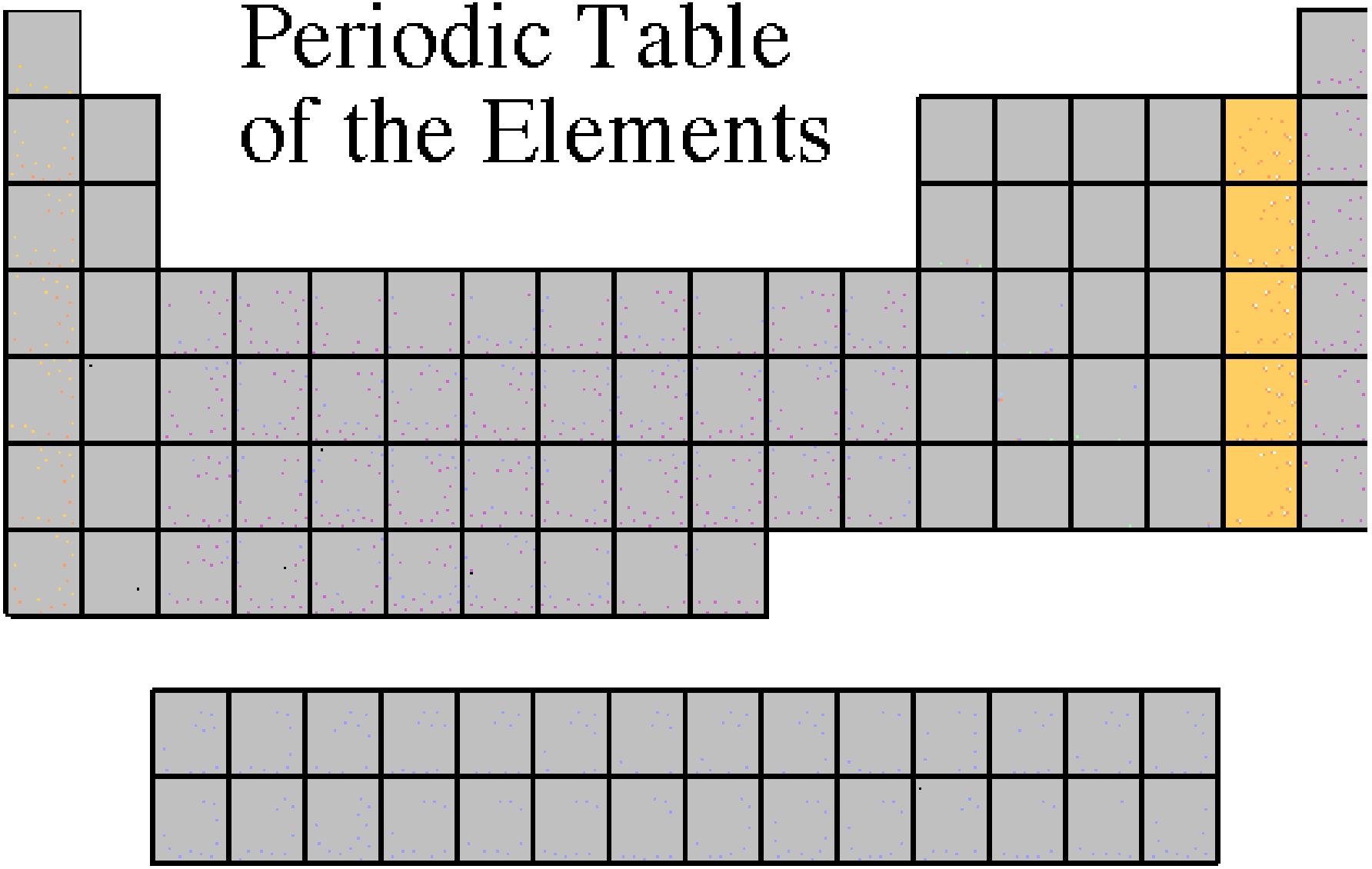


- Gains or shares **two** electrons
- **Oxygen** is the most abundant element in the earth's crust

- *Facts:*
  - *Sulfur is a non-metal that combines with metals to form sulfides with distinct colors that are used in paints.*
  - *Selenium is needed in trace amounts in your diet. It is also used in photocopiers.*

Sulfur

Periodic Table of the Elements



Group 17:
Halogens

- Most are **Poisonous**
- Gains or shares **one** electron
- Very **reactive**
- React with **alkali metals** to form salts
- *Facts:*
  - *Fluorine is the most reactive element*
  - *Chlorine is used in pools and cleaning products*
  - *Bromine is used in dyes in cosmetics*
  - *Iodine is essential in diets*

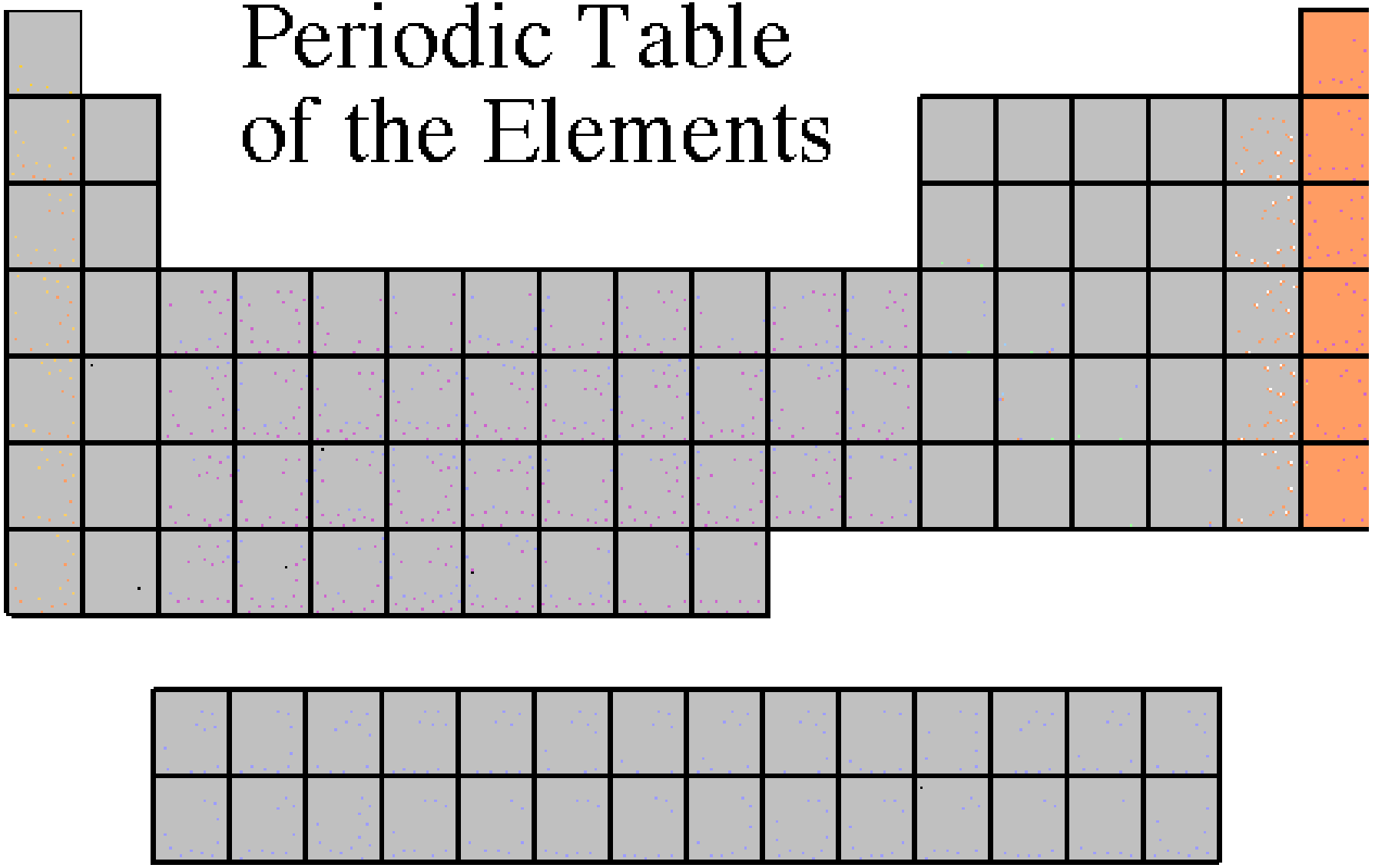
YouTube Video

Question 8 Mendeleev Lab

Chlorine Gas was used as a chemical weapon during World War I.

It was used by the Nazis in World War II.

Periodic Table of the Elements



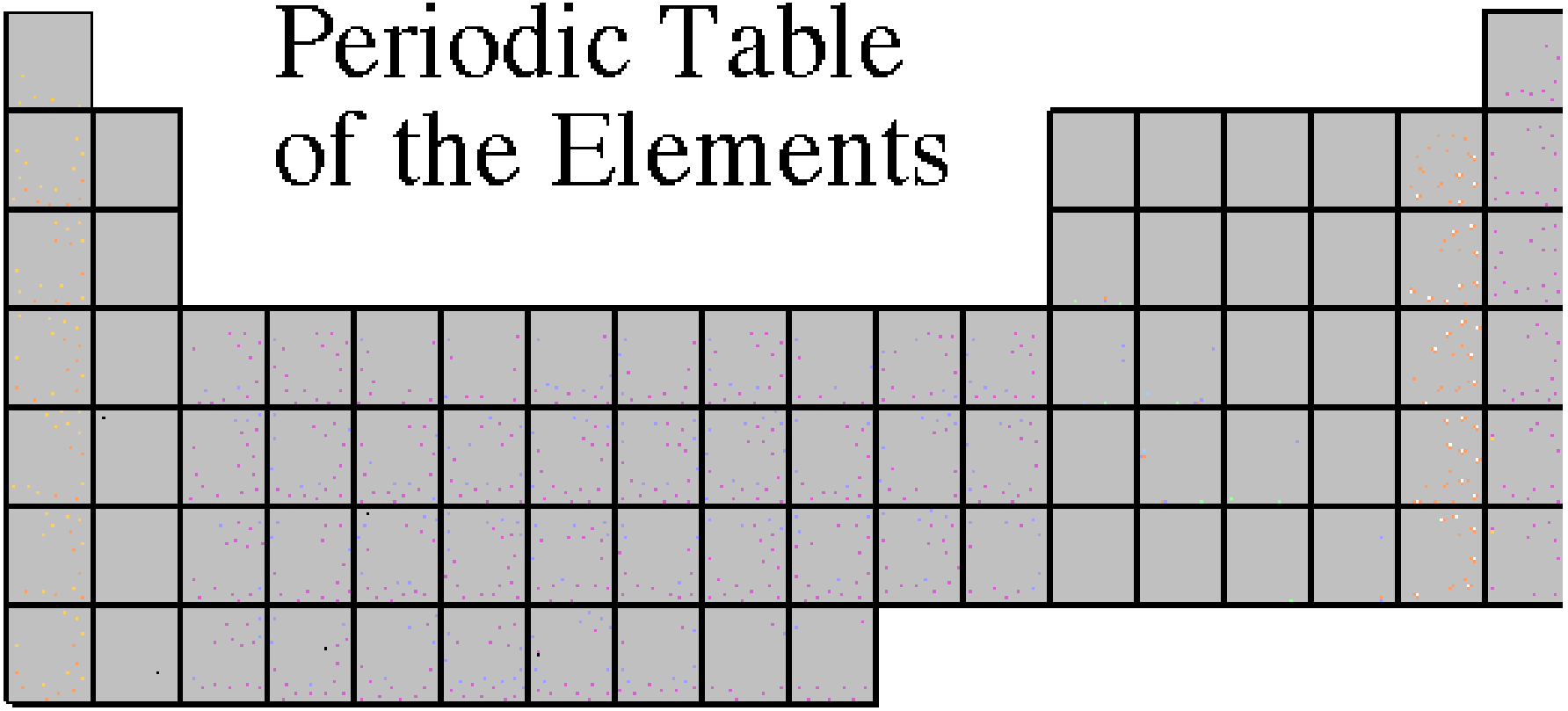
Group 18:

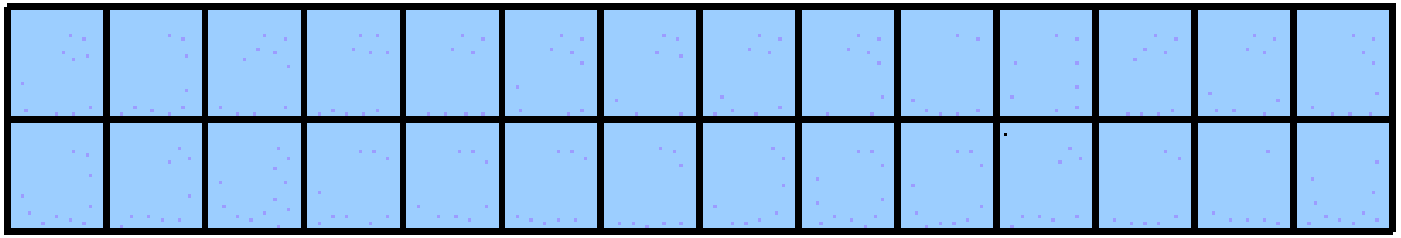
Noble Gases

YouTube Video

- **Non**-reactive; inert
- **Does not** gain or lose electrons
- **Colorless** gases

Periodic Table of the Elements





Rare Earth Metals

- At the **bottom** of the Periodic Table
- Composed of **two** series

1) Lanthanide Series

- Top row (#s 57-71)
- Very **reactive**
- Typically **silver** in color

2) Actinide Series

- Bottom Row (#s 89-103)
- All are **radioactive**