

Development of the Periodic Table

Modern Periodic Table.

The modern periodic table is organized into 7 periods and 18 groups. Elements are color-coded by their properties:

- Metals:**
 - Alkali Metals (pink)
 - Alkaline-Earth Metals (purple)
 - Transition Metals (red)
 - Rare-Earth Metals (light red)
- Nonmetals:**
 - Halogens (orange)
 - Other Nonmetals (green)
 - Noble Gases (yellow)
 - Hydrogen (light blue)
- Metalloids:** (light orange)
- Poor Metals:** (light blue)

Periodic Table Organization

- The periodic table is organized by groups and periods
- The rows of the table are called **Periods**
- The columns of the table are called **Groups or Families**

Parts of the Periodic Table

s-block and p-block elements are called either:

- Main Group Elements
- Representative Elements

d-block elements are called:

- Transition Elements

f-block elements are called:

- Inner Transition Elements
- Often called Rare Earth Metals

The Full Sized Periodic Table

The full sized periodic table shows the placement of s, p, d, and f blocks. The s-block includes groups 1 and 2, and the p-block includes groups 13-18. The d-block is the transition metal region, and the f-block is the inner transition metal region.

The "page friendly" Periodic Table

The page friendly periodic table is a condensed version of the full table, showing the same block organization.

Three types of elements

Metals

- good conductors of heat and electricity
- Malleability → hammered or rolled, bendable
- Ductile → can be pulled into wire
- Luster → shiny when polished

Nonmetals

- Brittle → not malleable or ductile
- Poor conductor of heat and electricity

Metalloids

- brittle solids
- have some properties of metals and nonmetals
- semiconductors of electricity

Element Types

Legend:

- Metals (solid grey)
- Metalloids (diagonal lines)
- Nonmetals (white)

Development of the Periodic Table

Periodic Families

Hydrogen and Helium

- | | |
|---------------------------------|----------------------------|
| Group 1 – Alkali Metals | Group 13 – Boron Family |
| Group 2 – Alkaline Earth Metals | Group 14 – Carbon Family |
| Group 3-12 – Transition Metals | Group 15 – Nitrogen Family |
| | Group 16 – Oxygen Family |
| Rare Earth Metals (f-block) | Group 17 – Halogens |
| Row 6 – Lanthanides | Group 18 – Noble Gases |
| Row 7 – Actinides | |

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Common Groups

G1		Hydrogen is unique										G18						
1	H											B	C	N	O	He		
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg							

6 La Ce Pr Nd Pm Sm Eu Gd Dy Ho Er Tm Yb
7 Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No

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Hydrogen and Helium

- They do not fit properly with rest of periodic table
- Hydrogen is considered most explosive element
- Helium is considered most inert element

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Alkali Metals

- extremely reactive, reacts with water, air, and nonmetals
- silvery
- soft, can be cut with a knife
- they are not found as pure elements in nature
- Li, Na, and K are all less dense than water

G1												G18						
1	H	He											He					
2	Li	Be											Ne					
3	Na	Mg	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg							

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Alkaline-Earth Metals

- harder, denser and stronger than alkalis
- not as reactive as alkalis, but still very reactive
- they are not found as pure elements in nature

G1												G18						
1	H	He											He					
2	Li	Be											Ne					
3	Na	Mg	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg							

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Transition Metals

- good conductors of electricity
- tend to have a high luster
- typically less reactive than alkali and alkaline-earth elements
- many are found in pure form
- some are the most dense of all elements
- some are least reactive elements

G1												G18						
1	H	He											He					
2	Li	Be											Ne					
3	Na	Mg	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg							

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p-Block Metals (Poor Metals)

- harder, more dense, and less reactive than group 2 metals.
- softer, less dense, and more reactive than transition metals.
- usually found in nature as a compound
- stable in air once purified

1	H	He																	He
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg											Al	Si	P	S	Cl	Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg								
			6	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Td	Dy	Ho	Er	Tm	Yb		
			7	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

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Halogens

- most reactive nonmetals
- react with most metals to form compounds called salts
- fluorine and chlorine are gases
- bromine is a reddish liquid
- iodine is a volatile purple solid
- astatine is unstable

1	H	He																	He
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg											Al	Si	P	S	Cl	Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg								
			6	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Td	Dy	Ho	Er	Tm	Yb		
			7	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

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Noble Gases

- Inert gases that do not react with anything, found as individual atoms
- Helium is used for balloons
- Neon, Argon, Krypton, and Xenon are all used for different types of lighting
- Radon is radioactive
- A few noble gas compounds have been formed under extreme conditions

1	H	He																	He
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg											Al	Si	P	S	Cl	Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg								
			6	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Td	Dy	Ho	Er	Tm	Yb		
			7	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

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Lanthanides and Actinides

- once called rare-earth elements
- there are 14 or 15 in each series
- lanthanides have similar reactivity to group 2 elements
- actinides are all radioactive
- elements after U (92) are called transuranium and are synthetic
- trace amounts of neptunium and plutonium have been found in uranium ore due to beta decay

6	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Td	Dy	Ho	Er	Tm	Yb	
7	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	

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но въ ней, жиѣ кажется, уже ясно выражается приближность, представляема мною начала ко всей совокупности элементовъ, най которыхъ извѣстность съ достоверностию. На этотъ разъ я и желалъ преимущественно найти общую систему элементовъ. Вотъ этотъ опытъ:

		Ti=50	Zr=90	?=180.	
		V=51	Nb=94	Ta=182.	
		Cr=52	Mo=96	W=186.	
		Mn=55	Rh=104,4	Pt=197,4	
		Fe=56	Ru=104,4	Ir=198.	
		Ni=Co=59	Pi=106,8	Os=199.	
		Cu=63,4	Ag=108	Hg=200.	
H=1	Be=9,4	Mg=24	Zn=65,2	Cd=112	
	B=11	Al=27,4	?=68	Ur=116	Au=197?
	C=12	Si=28	?=70	Su=118	
	N=14	P=31	As=75	Sb=122	Bi=210
	O=16	S=32	Se=79,4	Te=125?	
	F=19	Cl=35,5	Br=80	I=127	
Li=7	Na=23	K=39	Rb=85,4	Cs=133	Tl=201
		Ca=40	Sr=87,6	Ba=137	Pb=207.
		?=45	Ce=92		
		?Er=56	La=94		
		?Yt=60	Di=95		
		?An=75,8	Th=118?		

ОПЫТЪ СИСТЕМЫ ЭЛЕМЕНТОВЪ.

ОСНОВАННОЙ НА ВѢТЪ АТОМНОМЪ ВѢСЪ И ХИМИЧЕСКОМЪ СХОДСТВѢ.

		Ti=50	Zr=90	?=180.	
		V=51	Nb=94	Ta=182.	
		Cr=52	Mo=96	W=186.	
		Mn=55	Rh=104,4	Pt=197,4	
		Fe=56	Ru=104,4	Ir=198.	
		Ni=Co=59	Pi=106,8	Os=199.	
		Cu=63,4	Ag=108	Hg=200.	
H=1	Be=9,4	Mg=24	Zn=65,2	Cd=112	
	B=11	Al=27,4	?=68	Ur=116	Au=197?
	C=12	Si=28	?=70	Su=118	
	N=14	P=31	As=75	Sb=122	Bi=210?
	O=16	S=32	Se=79,4	Te=128?	
	F=19	Cl=35,5	Br=80	I=127	
Li=7	Na=23	K=39	Rb=85,4	Cs=133	Tl=204.
		Ca=40	Sr=87,6	Ba=137	Pb=207.
		?=45	Ce=92		
		?Er=56	La=94		
		?Yt=60	Di=95		
		?An=75,8	Th=118?		

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