

- Periods are rows, Groups are columns
- Atomic mass $\rightarrow$ weighted average of all isotopes
- Atomic structure $\rightarrow$ protons = atomic number;
protons+ neutrons = atomic mass
- Oxidation numbers $\rightarrow$ group no., easiest path to an octet
- Electronic configuration $\rightarrow$ walk across from left to right
- HOFBrICl $\rightarrow$ diatomic elements

s-orbitals

Alkali metals 1+		Alkaline earth metals 2+	
1A		IIA	
1	1.0079		
H			
Hydrogen			
3	6.941	4	9.0122
Li		Be	
Lithium		Beryllium	
11	22.98977	12	24.312
Na		Mg	
Sodium		Magnesium	
19	39.0983	20	40.08
K		Ca	
Potassium		Calcium	
37	85.47	38	87.62
Rb		Sr	
Rubidium		Strontium	
55	132.9054	56	137.33
Cs		Ba	
Cesium		Barium	
87	(223)	88	226.0254
Fr		Ra	
Francium		Radium	
89	(227)	90	(261)
Ac		Unq	
Actinium		Unnilquadium	
104	(262)	105	(262)
Unp		Unh	
Unnilpentium		Unnilhexium	
106	(263)	107	(262)
Uns		Une	
Unnilseptium		Unnilennium	

p-orbitals

(except H and He)

				Halogens 1-		Noble gases	
				VIIA		VIIIA	
				1	1.0079	2	4.0026
				H		He	
				Hydrogen		Helium	
3+	4-	3-	2-	9	18.99840	10	20.183
4+	4+	5+	6+	F		Ne	
IIIA	IVA	VA	VIA	Fluorine		Neon	
5	10.811	6	12.01115	17	35.453	18	39.948
B		C		Cl		Ar	
Boron		Carbon		Chlorine		Argon	
7	14.0067	8	15.9994	35	79.904	36	83.80
N		O		Br		Kr	
Nitrogen		Oxygen		Bromine		Krypton	
13	26.98154	14	28.0855	53	126.9044	54	131.30
Al		Si		I		Xe	
Aluminum		Silicon		Iodine		Xenon	
15	30.97376	16	32.064	85	(210)	86	(222)
P		S		At		Rn	
Phosphorus		Sulfur		Astatine		Radon	
31	69.72	32	72.59	83	208.9804	84	(210)
Ga		Ge		Po		At	
Gallium		Germanium		Polonium		Astatine	
49	114.82	50	118.69	81	204.37	82	207.19
In		Sn		Tl		Pb	
Indium		Tin		Thallium		Lead	
81	204.37	82	207.19	83	208.9804	84	(210)
As		Sb		Bi		Po	
Arsenic		Antimony		Bismuth		Polonium	
33	74.9216	34	78.96	85	(210)	86	(222)
Se		Te		At		Rn	
Selenium		Tellurium		Astatine		Radon	
51	121.75	52	127.60	83	208.9804	84	(210)
Br		I		Po		At	
Bromine		Iodine		Polonium		Astatine	
35	79.904	36	83.80	85	(210)	86	(222)
Kr		Xe		At		Rn	
Krypton		Xenon		Astatine		Radon	

d-orbitals

Transition metals

aufbau exceptions

IIIB		IVB		VB		VIB		VIIB		VIII		IB		IIB	
21	44.956	22	47.90	23	50.9415	24	51.996	25	54.9380	26	55.847	27	58.9332	28	58.70
Sc		Ti		V		Cr		Mn		Fe		Co		Ni	
Scandium		Titanium		Vanadium		Chromium		Manganese		Iron		Cobalt		Nickel	
39	88.905	40	91.22	41	92.906	42	95.94	43	98.9062	44	101.07	45	102.905	46	106.4
Y		Zr		Nb		Mo		Tc		Ru		Rh		Pd	
Yttrium		Zirconium		Niobium		Molybdenum		Technetium		Ruthenium		Rhodium		Palladium	
57	138.91	58	137.33	59	138.91	60	137.33	61	138.91	62	137.33	63	137.33	64	137.33
La		Ce		Pr		Nd		Pm		Sm		Eu		Gd	
Lanthanum		Cerium		Praseodymium		Neodymium		Promethium		Samarium		Europium		Gadolinium	
71	174.967	72	175.053	73	175.053	74	175.053	75	175.053	76	175.053	77	175.053	78	175.053
Lu		Hf		Ta		W		Re		Os		Ir		Pt	
Lutetium		Hafnium		Tantalum		Tungsten		Rhenium		Osmium		Iridium		Platinum	
101	256.1	102	256.1	103	256.1	104	256.1	105	256.1	106	256.1	107	256.1	108	256.1
Tm		Yb		Lu		U		Np		Pu		Am		Cm	
Thulium		Ytterbium		Lutetium		Uranium		Neptunium		Plutonium		Americium		Curium	
69	168.934	70	173.04	71	174.967	72	175.053	73	175.053	74	175.053	75	175.053	76	175.053
Er		Tm		Yb		Lu		U		Np		Pu		Am	
Erbium		Thulium		Ytterbium		Lutetium		Uranium		Neptunium		Plutonium		Americium	
68	167.26	69	168.934	70	173.04	71	174.967	72	175.053	73	175.053	74	175.053	75	175.053
Ho		Er		Tm		Yb		Lu		U		Np		Pu	
Holmium		Erbium		Thulium		Ytterbium		Lutetium		Uranium		Neptunium		Plutonium	
67	164.9304	68	167.26	69	168.934	70	173.04	71	174.967	72	175.053	73	175.053	74	175.053
Dy		Ho		Er		Tm		Yb		Lu		U		Np	
Dysprosium		Holmium		Erbium		Thulium		Ytterbium		Lutetium		Uranium		Neptunium	
66	162.50	67	164.9304	68	167.26	69	168.934	70	173.04	71	174.967	72	175.053	73	175.053
Tb		Dy		Ho		Er		Tm		Yb		Lu		U	
Terbium		Dysprosium		Holmium		Erbium		Thulium		Ytterbium		Lutetium		Uranium	
65	158.924	66	162.50	67	164.9304	68	167.26	69	168.934	70	173.04	71	174.967	72	175.053
Gd		Tb		Dy		Ho		Er		Tm		Yb		Lu	
Gadolinium		Terbium		Dysprosium		Holmium		Erbium		Thulium		Ytterbium		Lutetium	
64	157.25	65	158.924	66	162.50	67	164.9304	68	167.26	69	168.934	70	173.04	71	174.967
Eu		Gd		Tb		Dy		Ho		Er		Tm		Yb	
Europium		Gadolinium		Terbium		Dysprosium		Holmium		Erbium		Thulium		Ytterbium	
63	151.96	64	157.25	65	158.924	66	162.50	67	164.9304	68	167.26	69	168.934	70	173.04
Sm		Eu		Gd		Tb		Dy		Ho		Er		Tm	
Samarium		Europium		Gadolinium		Terbium		Dysprosium		Holmium		Erbium		Thulium	
62	150.35	63	151.96	64	157.25	65	158.924	66	162.50	67	164.9304	68	167.26	69	168.934
Pm		Sm		Eu		Gd		Tb		Dy		Ho		Er	
Promethium		Samarium		Europium		Gadolinium		Terbium		Dysprosium		Holmium		Erbium	
61	144.9	62	150.35	63	151.96	64	157.25	65	158.924	66	162.50	67	164.9304	68	167.26
Nd		Pm		Sm		Eu		Gd		Tb		Dy		Ho	
Neodymium		Promethium		Samarium		Europium		Gadolinium		Terbium		Dysprosium		Holmium	
60	144.24	61	144.9	62	150.35	63	151.96	64	157.25	65	158.924	66	162.50	67	164.9304
Pr		Nd		Pm		Sm		Eu		Gd		Tb		Dy	
Praseodymium		Neodymium		Promethium		Samarium		Europium		Gadolinium		Terbium		Dysprosium	
59	140.907	60	144.24	61	144.9	62	150.35	63	151.96	64	157.25	65	158.924	66	162.50
Ce		Pr		Nd		Pm		Sm		Eu		Gd		Tb	
Cerium		Praseodymium		Neodymium		Promethium		Samarium		Europium		Gadolinium		Terbium	
58	140.12	59	140.907	60	144.24	61	144.9	62	150.35	63	151.96	64	157.25	65	158.924
La		Ce		Pr		Nd		Pm		Sm		Eu		Gd	
Lanthanum		Cerium		Praseodymium		Neodymium		Promethium		Samarium		Europium		Gadolinium	

Metals $\leftarrow$ $\rightarrow$ Nonmetals

Semiconductors
Metalloids

f-orbitals

Inner Transition metals

58	140.12	59	140.907	60	144.24	61	144.9	62	150.35	63	151.96	64	157.25	65	158.924	66	162.50	67	164.9304	68	167.26	69	168.934	70	173.04	71	174.967
Ce		Pr		Nd		Pm		Sm		Eu		Gd		Tb		Dy		Ho		Er		Tm		Yb		Lu	
Cerium		Praseodymium		Neodymium		Promethium		Samarium		Europium		Gadolinium		Terbium		Dysprosium		Holmium		Erbium		Thulium		Ytterbium		Lutetium	
90	232.0381	91	231.0359	92	238.029	93	237.0482	94	239.1	95	243.1	96	247.1	97	247.1	98	252.1	99	252.1	100	257.1	101	256.1	102	259.1	103	260.1
Th		Pa		U		Np		Pu		Am		Cm		Bk		Cf		Es		Fm		Md		No		Lr	
Thorium		Protactinium		Uranium		Neptunium		Plutonium		Americium		Curium		Berkelium		Californium		Einsteinium		Fermium		Mendelevium		Nobelium		Lawrencium	

Lanthanides

Actinides

Aufbau
exception

Student Packet: 1.6: The Periodic Table: AssessMe questions

- 1) Which of the following could be an isotope of chlorine?
- A) $^{17}_{37}\text{Cl}$ B) $^{17}_{17}\text{Cl}$ C) $^{35.5}_{17}\text{Cl}$ D) $^{37}_{17}\text{Cl}$ E) I'm clueless
- 2) One species of element M has an atomic number of 10 and a mass number of 20; one species of element N has an atomic number of 11 and a mass number of 20. Which of the following statements about these two species is true?
- A) They are isotopes.
B) They are isomers.
C) They are isoelectronic.
D) The sum of their protons and neutrons is the same.
E) I'm clueless
- 3) Assume that an element has the following ionization energies:
- 1st IE = 600 kJ/mol
2nd IE = 1,800 kJ/mol
3rd IE = 2,750 kJ/mol
4th IE = 11,600 kJ/mol
5th IE = 15,000 kJ/mol
- Which of the following is the most probable electron configuration for this element?
- A) $1s^2 2s^2 2p^6$
B) $1s^2 2s^2 2p^6 3s^2$
C) $1s^2 2s^2 2p^6 3s^1$
D) $1s^2 2s^2 2p^6 3s^2 3p^1$
E) I'm clueless
- 4) Which alkali metal would you expect to have the highest first ionization energy?
- A) Li B) Na C) K D) Rb E) I'm clueless
- 5) Which of the following is least metallic?
- A) I B) O C) Cs D) K E) I'm clueless
- 6) In general, which of the following statements about metals are true?
- A) They have large atomic radii.
B) They have high ionization energies.
C) They have high electron affinities.
D) They are found on the lower left of the periodic table.
E) I'm clueless

Student Packet: 1.6: The Periodic Table: ShowMe questions

- 1) What are the electron configurations of the following atoms and ions?
 - a) P
 - b) Ni
 - c) Ta
 - d) Zn^{2+}
 - e) S^{2-}
 - f) Na^+
 - g) Ti^{4+}

- 2) Predict the following properties of the as-yet-undiscovered element with atomic number 116.
 - a) Electron configuration.
 - b) Most stable anion formed.
 - c) Formulas of most stable binary compounds form with sodium and magnesium.
 - d) Element which it most closely resembles chemically.

- 3) ^{12}C and ^{13}C are the only two isotopes of carbon which have large enough natural abundance to contribute significantly to the average atomic weight. What is the natural abundance of ^{12}C and ^{13}C ?

- 4) What is the common name of each of the following sections of the periodic table?
 - a) Group 1A
 - b) Group 2A
 - c) Group 6A
 - d) Group 7A
 - e) Group 8A
 - f) Elements 57-70
 - g) Elements 89-102

Student Packet: 1.6: The Periodic Table: TestMe questions

1) In which of the following pairs do the two species have the same electron configuration?

I. Na and Na⁺

II. Na⁺ and Ne

III. Na⁺ and F⁻

A) I only

B) II only

C) III only

D) I and II

E) II and III

2) In which of the following pairs do the two species have the same electron configuration?

I. Cu⁺ and Zn²⁺

II. Cu⁺ and Ni

III. Cu²⁺ and Ni

A) I only

B) II only

C) I and II

D) II and III

E) I, II, and III

3) Which of the following is most likely to be a property of francium?

A) Readily forms Fr⁻ an ion

B) Readily forms MgFr₂

C) Readily forms Fr⁺ cation

D) Does not react violently with water

E) None of the above

4) How many neutrons does an atom of ¹⁹⁶Pt have?

A) 78

B) 98

C) 118

D) 195

E) 196

5) Which of the following is the correct number of protons, neutrons and electrons for ⁵⁵Fe³⁺?

A) 26 protons, 29 neutrons, 26 electrons

B) 26 protons, 29 neutrons, 23 electrons

C) 29 protons, 26 neutrons, 26 electrons

D) 29 protons, 29 neutrons, 26 electrons

E) 26 protons, 26 neutrons, 29 electrons