

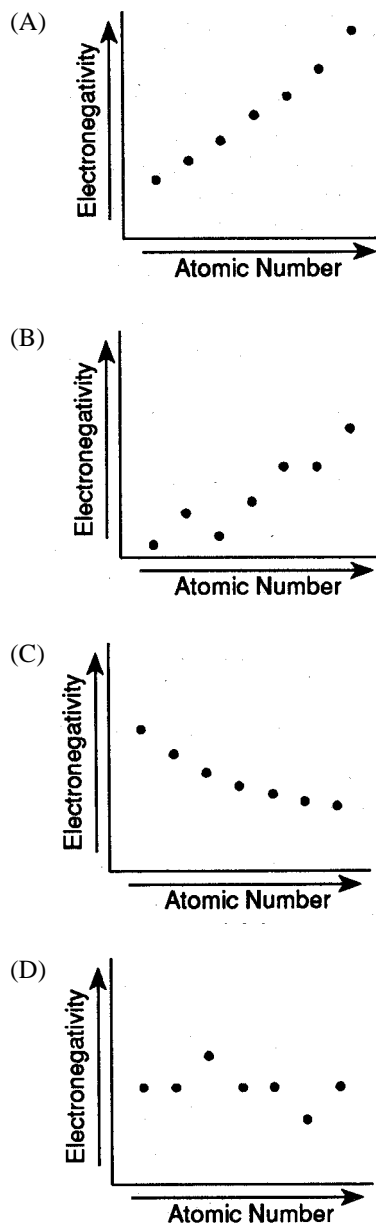
Worksheet: Periodic Trends

Name _____
Period _____

- ____1. Which statement best describes Group 2 elements as they are considered in order from top to bottom of the Periodic Table?
- (A) The number of principal energy levels increases, and the number of valence electrons increases.
(B) The number of principal energy levels increases, and the number of valence electrons remains the same.
(C) The number of principal energy levels remains the same, and the number of valence electrons increases.
(D) The number of principal energy levels remains the same, and the number of valence electrons decreases.
- ____2. What is the total number of valence electrons in an atom of boron in the ground state?
- (A) 1 (C) 3
(B) 7 (D) 5
- ____3. What is the total number of valence electrons in an atom of xenon, Xe?
- (A) 0 (C) 8
(B) 2 (D) 18
- ____4. The elements calcium and strontium have similar chemical properties because they both have the same
- (A) atomic number
(B) mass number
(C) number of valence electrons
(D) number of completely filled sublevels
- ____5. On the Periodic Table of the Elements, all the elements within Group 16 have the same number of
- (A) valence electrons (C) protons
(B) energy levels (D) neutrons
- ____6. An element with a partially filled d sublevel in the ground state is classified as
- (A) a halogen (C) an alkali metal
(B) a transition metal (D) an alkaline earth metal
- ____7. Which electron configuration represents a transition element?
- (A) $1s^2 2s^2 2p^5$ (C) $[\text{Ar}] 3d^5 4s^2$
(B) $[\text{Ne}] 3s^2$ (D) $[\text{Ar}] 3d^{10} 4s^2 4p^6$
- ____8. Which element in Period 5 of the Periodic Table is a transition element?
- (A) Sr (C) Ag
(B) Sb (D) Xe
- ____9. Which of the following atoms has the largest atomic radius?
- (A) Na (C) Mg
(B) K (D) Ca
- ____10. Which noble gas has the highest first ionization energy?
- (A) radon (C) neon
(B) krypton (D) helium
- ____11. Which sequence of elements is arranged in order of decreasing atomic radii?
- (A) Al, Si, P (C) Cl, Br, I
(B) Li, Na, K (D) N, C, B
- ____12. Which list of elements from Group 2 on the Periodic Table is arranged in order of increasing atomic radius?
- (A) Be, Mg, Ca (C) Ba, Ra, Sr
(B) Ca, Mg, Be (D) Sr, Ra, Ba
- ____13. As each successive element in Group 15 of the Periodic Table is considered in order of increasing atomic number, the atomic radius
- (A) decreases (C) remains the same
(B) increases
- ____14. The strength of an atom's attraction for the electrons in a chemical bond is the atom's
- (A) electronegativity (C) heat of reaction
(B) ionization energy (D) heat of formation
- ____15. Which properties are most common in nonmetals?
- (A) low ionization energy and low electronegativity
(B) low ionization energy and high electronegativity
(C) high ionization energy and low electronegativity
(D) high ionization energy and high electronegativity
- ____16. Which Group 17 element has the least attraction for electrons?
- (A) F (C) Br
(B) Cl (D) I
- ____17. Which element in Group 16 has the greatest tendency to gain electrons?
- (A) Te (C) S
(B) Se (D) O
- ____18. The Group 17 element with the highest electronegativity is
- (A) fluorine (C) bromine
(B) chlorine (D) iodine
- ____19. As the elements of Group 1 on the Periodic Table are considered in order of increasing atomic radius, the ionization energy of each successive element generally
- (A) decreases (C) remains the same
(B) increases
- ____20. The amount of energy required to remove the outermost electron from a gaseous atom in the ground state is known as
- (A) first ionization energy (C) conductivity
(B) activation energy (D) electronegativity
- ____21. Which element is a member of the halogen family?
- (A) K (C) I
(B) B (D) S

22. Which of the following Group 2 elements has the *lowest* first ionization energy?
- (A) Be (C) Ca
(B) Mg (D) Ba
23. As elements of Group 1 of the Periodic Table are considered in order from top to bottom, the ionization energy of each successive element decreases. This decrease is due to
- (A) decreasing radius and decreasing shielding effect
(B) decreasing radius and increasing shielding effect
(C) increasing radius and decreasing shielding effect
(D) increasing radius and increasing shielding effect
24. Which sequence correctly places the elements in order of increasing ionization energy?
- (A) $H \rightarrow Li \rightarrow Na \rightarrow K$ (C) $O \rightarrow S \rightarrow Se \rightarrow Te$
(B) $I \rightarrow Br \rightarrow Cl \rightarrow F$ (D) $H \rightarrow Be \rightarrow Al \rightarrow Ga$
25. Compared to the atomic radius of a sodium atom, the atomic radius of a magnesium atom is smaller. The smaller radius is primarily a result of the magnesium atom having
- (A) a larger nuclear charge
(B) a smaller nuclear charge
(C) more principal energy levels
(D) fewer principal energy levels
26. Which of these elements has the *least* attraction for electrons in a chemical bond?
- (A) oxygen (C) nitrogen
(B) fluorine (D) chlorine
27. The ability of carbon to attract electrons is
- (A) greater than that of nitrogen, but less than that of oxygen
(B) less than that of nitrogen, but greater than that of oxygen
(C) greater than that of nitrogen and oxygen
(D) less than that of nitrogen and oxygen
28. As the elements Li to F in Period 2 of the Periodic Table are considered in succession, how do the relative electronegativity and the covalent radius of each successive element compare?
- (A) The relative electronegativity decreases, and the atomic radius decreases.
(B) The relative electronegativity decreases, and the atomic radius increases.
(C) The relative electronegativity increases, and the atomic radius decreases.
(D) The relative electronegativity increases, and the atomic radius increases.

29. Which diagram correctly shows the relationship between electronegativity and atomic number for the elements of Period 3?



Reference Tables

Table S
Properties of Selected Elements

Atomic Number	Symbol	Name	Ionization Potential (eV)	Electron Configuration	Melting Point (°C)	Boiling Point (°C)	Density* (g/cm ³)	Atomic Weight
1	H	hydrogen	13.12	1s ¹	-252.87	-252.87	0.08989	1.00794
2	He	helium	23.72	1s ²	-272.2	-268.9	0.1786	4.00260
3	Li	lithium	5.39	1s ² 2s ¹	180.5	1342	0.534	6.941
4	Be	beryllium	9.00	1s ² 2s ²	1287	2970	1.848	9.0122
5	B	boron	8.01	1s ² 2s ² 2p ¹	2075	2550	2.35	10.811
6	C	carbon	11.01	1s ² 2s ² 2p ²	3550	4827	2.26	12.011
7	N	nitrogen	14.51	1s ² 2s ² 2p ³	-210	-196	0.808	14.0064
8	O	oxygen	13.62	1s ² 2s ² 2p ⁴	-218.79	-182.96	1.429	15.999
9	F	fluorine	16.81	1s ² 2s ² 2p ⁵	-219.67	-188.11	1.681	18.9984
10	Ne	neon	20.81	1s ² 2s ² 2p ⁶	-248.6	-246.1	0.9002	20.1797
11	Na	sodium	5.14	[Ne] 3s ¹	97.72	883	0.97	22.98977
12	Mg	magnesium	7.38	[Ne] 3s ²	650	1103	1.738	24.304
13	Al	aluminum	5.78	[Ne] 3s ² 3p ¹	933	2542	2.70	26.98154
14	Si	silicon	10.85	[Ne] 3s ² 3p ²	1414	2355	2.33	28.08558
15	P	phosphorus	10.49	[Ne] 3s ² 3p ³	44.1	281	1.82	30.97376
16	S	sulfur	10.00	[Ne] 3s ² 3p ⁴	115.21	444.6	2.07	32.065
17	Cl	chlorine	12.51	[Ne] 3s ² 3p ⁵	-101.5	-34.6	3.214	35.453
18	Ar	argon	15.21	[Ne] 3s ² 3p ⁶	-189.34	-185.97	1.781	39.948
19	K	potassium	4.19	[Ar] 4s ¹	63.5	774	0.86	39.0983
20	Ca	calcium	5.90	[Ar] 4s ²	842.8	1484	1.54	40.078
21	Sc	scandium	6.56	[Ar] 3d ¹ 4s ²	1539	2835	2.98	44.95591
22	Ti	titanium	7.08	[Ar] 3d ² 4s ²	1668	3560	4.54	47.88
23	V	vanadium	6.50	[Ar] 3d ³ 4s ²	1910	3680	6.1	50.9415
24	Cr	chromium	7.77	[Ar] 3d ⁵ 4s ¹	1907	2671	7.19	51.9961
25	Mn	manganese	7.43	[Ar] 3d ⁵ 4s ²	1246	2061	7.43	54.938045
26	Fe	iron	7.64	[Ar] 3d ⁶ 4s ²	1538	2750	7.874	55.845
27	Co	cobalt	7.86	[Ar] 3d ⁷ 4s ²	1495	2709	8.86	58.933195
28	Ni	nickel	7.64	[Ar] 3d ⁸ 4s ²	1455	2732	8.908	58.6934
29	Cu	copper	7.73	[Ar] 3d ¹⁰ 4s ¹	1083	2567	8.96	63.546
30	Zn	zinc	9.00	[Ar] 3d ¹⁰ 4s ²	419.5	907	7.14	65.38
31	Ga	gallium	5.79	[Ar] 3d ¹⁰ 4p ¹	29.76	2403	5.907	69.723
32	Ge	germanium	7.86	[Ar] 3d ¹⁰ 4p ²	231.9	958	5.323	72.6308
33	As	arsenic	9.44	[Ar] 3d ¹⁰ 4p ³	361.5	611	5.776	74.9216
34	Se	selenium	9.41	[Ar] 3d ¹⁰ 4p ⁴	221	685	4.79	78.96
35	Br	bromine	11.51	[Ar] 3d ¹⁰ 4p ⁵	-7.2	58.8	3.122	79.904
36	Kr	krypton	13.99	[Ar] 3d ¹⁰ 4p ⁶	-153.3	-153.3	3.709	83.80
37	Rb	rubidium	4.18	[Kr] 5s ¹	39.3	686	1.496	85.4678
38	Sr	strontium	5.49	[Kr] 5s ²	908	1382	2.54	87.62
39	Y	yttrium	6.00	[Kr] 4d ¹ 5s ²	1522	2775	4.473	88.90584
40	Zr	zirconium	6.90	[Kr] 4d ² 5s ²	1855	4030	6.522	91.224

Reference Tables

Formula	Name
HCl(aq)	hydrochloric acid
$\text{HNO}_3\text{(aq)}$	nitric acid
$\text{H}_2\text{SO}_4\text{(aq)}$	sulfuric acid
$\text{H}_3\text{PO}_4\text{(aq)}$	phosphoric acid
$\text{H}_2\text{CO}_3\text{(aq)}$ or $\text{CO}_2\text{(aq)}$	carbonic acid
$\text{CH}_3\text{COOH(aq)}$ or $\text{HC}_2\text{H}_3\text{O}_2\text{(aq)}$	ethanoic acid (acetic acid)

Answer Key

1. B
 2. C
 3. C
 4. C
 5. A
 6. B
 7. C
 8. C
 9. B
 10. D
 11. A
 12. A
 13. B
 14. A
 15. D
 16. D
 17. D
 18. A
 19. A
 20. A
 21. C
 22. D
 23. D
 24. B
 25. A
 26. C
 27. D
 28. C
 29. A
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Question ID's in Test Order.

1. 4034
 2. 3906
 3. 3844
 4. 3417
 5. 3078
 6. 4201
 7. 1493
 8. 2081
 9. 938
 10. 536
 11. 5941
 12. 5278
 13. 5011
 14. 4151
 15. 3195
 16. 2973
 17. 371
 18. 5360
 19. 5237
 20. 4965
 21. 4437
 22. 4265
 23. 4036
 24. 935
 25. 3134
 26. 5323
 27. 4759
 28. 986
 29. 928
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