

CHAPTER REVIEW

History of the Periodic Table

SECTION 1 REVIEW

- Describe the contributions made by the following scientists to the development of the periodic table:
 - Stanislao Cannizzaro
 - Dmitri Mendeleev
 - Henry Moseley
- State the periodic law.
- How is the periodic law demonstrated within the groups of the periodic table?

Electron Configuration and the Periodic Table

SECTION 2 REVIEW

- How do the electron configurations within the same group of elements compare?
 - Why are the noble gases relatively unreactive?
- What determines the length of each period in the periodic table?
- What is the relationship between the electron configuration of an element and the period in which that element appears in the periodic table?
- What information is provided by the specific block location of an element?
 - Identify, by number, the groups located within each of the four block areas.
- Which elements are designated as the alkali metals?
 - List four of their characteristic properties.
- Which elements are designated as the alkaline-earth metals?
 - How do their characteristic properties compare with those of the alkali metals?
- Write the group configuration notation for each *d*-block group.
 - How do the group numbers of those groups relate to the number of outer *s* and *d* electrons?

- What name is sometimes used to refer to the entire set of *d*-block elements?
- What types of elements make up the *p* block?
 - How do the properties of the *p*-block metals compare with those of the metals in the *s* and *d* blocks?
- Which elements are designated as the halogens?
 - List three of their characteristic properties.
- Which elements are metalloids?
 - Describe their characteristic properties.
- Which elements make up the *f* block in the periodic table?
- What are the main-group elements?
 - What trends can be observed across the various periods within the main-group elements?

PRACTICE PROBLEMS

- Write the noble-gas notation for the electron configuration of each of the following elements, and indicate the period in which each belongs.
 - Li
 - Cu
 - Sn
 - O
 - Br
- Without looking at the periodic table, identify the period, block, and group in which the elements with the following electron configurations are located. (Hint: See Sample Problem A.)
 - $[\text{Ne}]3s^23p^4$
 - $[\text{Kr}]4d^{10}5s^25p^2$
 - $[\text{Xe}]4f^{14}5d^{10}6s^26p^5$
- Based on the information given below, give the group, period, block, and identity of each element described. (Hint: See Sample Problem B.)
 - $[\text{He}]2s^2$
 - $[\text{Ne}]3s^1$
 - $[\text{Kr}]5s^2$
 - $[\text{Ar}]4s^2$
 - $[\text{Ar}]3d^54s^1$
- Without looking at the periodic table, write the expected outer electron configuration for each of the following elements. (Hint: See Sample Problem C.)
 - Group 7, fourth period
 - Group 3, fifth period
 - Group 12, sixth period

21. Identify the block, period, group, group name (where appropriate), element name, element type, and relative reactivity for the elements with the following electron configurations. (Hint: See Sample Problem D.)
- $[\text{Ne}]3s^23p^1$
 - $[\text{Ar}]3d^{10}4s^24p^6$
 - $[\text{Kr}]4d^{10}5s^1$
 - $[\text{Xe}]4f^15d^16s^2$
29. For each of the following groups, indicate whether electrons are more likely to be lost or gained in compound formation and give the number of such electrons typically involved.
- Group 1
 - Group 2
 - Group 13
 - Group 16
 - Group 17
 - Group 18
30. a. What is electronegativity?
b. Why is fluorine special in terms of electronegativity?
31. Identify the most- and least-electronegative groups of elements in the periodic table.

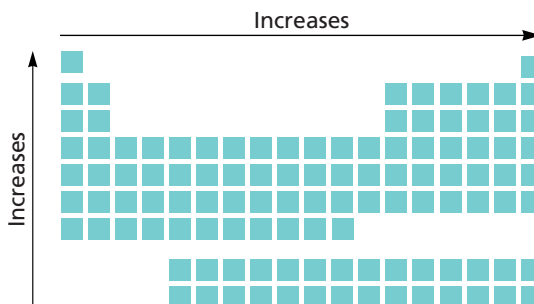
Electron Configuration and Periodic Properties

SECTION 3 REVIEW

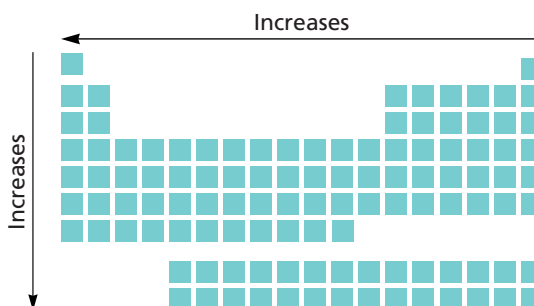
22. a. What is meant by atomic radius?
b. What trend is observed among the atomic radii of main-group elements across a period?
c. Explain this trend.
23. a. What trend is observed among the atomic radii of main-group elements down a group?
b. Explain this trend.
24. Define each of the following terms:
- ion
 - ionization
 - first ionization energy
 - second ionization energy
25. a. How do the first ionization energies of main-group elements vary across a period and down a group?
b. Explain the basis for each trend.
26. a. What is electron affinity?
b. What signs are associated with electron affinity values, and what is the significance of each sign?
27. a. Distinguish between a cation and an anion.
b. How does the size of each compare with the size of the neutral atom from which it is formed?
28. a. What are valence electrons?
b. Where are such electrons located?
32. Of cesium, Cs, hafnium, Hf, and gold, Au, which element has the smallest atomic radius? Explain your answer in terms of trends in the periodic table. (Hint: see Sample Problem E.)
33. a. Distinguish between the first, second, and third ionization energies of an atom.
b. How do the values of successive ionization energies compare?
c. Why does this occur?
34. Without looking at the electron affinity table, arrange the following elements in order of *decreasing* electron affinities: C, O, Li, Na, Rb, and F.
35. a. Without looking at the ionization energy table, arrange the following elements in order of decreasing first ionization energies: Li, O, C, K, Ne, and F.
b. Which of the elements listed in (a) would you expect to have the highest second ionization energy? Why?
36. a. Which of the following cations is least likely to form: Sr^{2+} , Al^{3+} , K^{2+} ?
b. Which of the following anions is least likely to form: I^- , Cl^- , O^{2-} ?
37. Which element is the most electronegative among C, N, O, Br, and S? Which group does it belong to? (Hint: See Sample Problem G.)
38. The two ions K^+ and Ca^{2+} each have 18 electrons surrounding the nucleus. Which would you expect to have the smaller radius? Why?

MIXED REVIEW

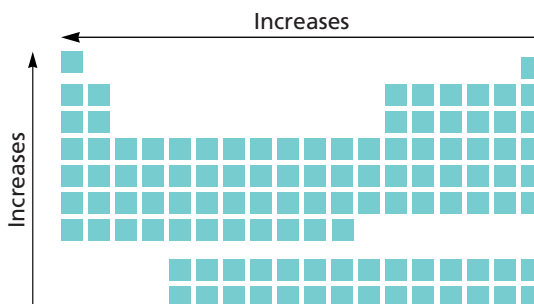
39. Without looking at the periodic table, identify the period, block, and group in which each of the following elements is located.
- $[\text{Rn}]7s^1$
 - $[\text{Ar}]3d^24s^2$
 - $[\text{Kr}]4d^{10}5s^1$
 - $[\text{Xe}]4f^{14}5d^96s^1$
40. a. Which elements are designated as the noble gases?
b. What is the most significant property of these elements?
41. Which of the following does not have a noble-gas configuration: Na^+ , Rb^+ , O^{2-} , Br^- , Ca^+ , Al^{3+} , S^{2-} ?
42. a. How many groups are in the periodic table?
b. How many periods are in the periodic table?
c. Which two blocks of the periodic table make up the main-group elements?
43. Write the noble-gas notation for the electron configuration of each of the following elements, and indicate the period and group in which each belongs.
- Mg
 - P
 - Sc
 - Y
44. Use the periodic table to describe the chemical properties of the following elements:
- fluorine, F
 - xenon, Xe
 - sodium, Na
 - gold, Au
45. For each element listed below, determine the charge of the ion that is most likely to be formed and the identity of the noble gas whose electron configuration is thus achieved.
- | | | |
|-------|-------|-------|
| a. Li | e. Mg | i. Br |
| b. Rb | f. Al | j. Ba |
| c. O | g. P | |
| d. F | h. S | |
46. Describe some differences between the *s*-block metals and the *d*-block metals.
47. Why do the halogens readily form 1- ions?
48. Identify which trends in the diagrams below describe atomic radius, ionization energy, electron affinity, and electronegativity.



a.



b.



c.

49. The electron configuration of argon differs from those of chlorine and potassium by one electron each. Compare the reactivity of these three elements.

CRITICAL THINKING

As a member on the newly-inhabited space station Alpha, you are given the task of organizing information on newly discovered elements as it comes in from the laboratory. To date, five elements have been discovered and have been assigned names and symbols from the Greek alphabet. An analysis of the new elements has yielded the following data:

Element name	Atomic no.	Atomic mass	Properties
Epsilon ϵ	23	47.33	nonmetal, very reactive, produces a salt when combined with a metal, gaseous state
Beta β	13	27.01	metal, very reactive, soft solid, low melting point
Gamma γ	12	25.35	nonmetal, gaseous element, extremely unreactive
Delta Δ	4	7.98	nonmetal, very abundant, forms compounds with most other elements
Lambda Λ	9	16.17	metal, solid state, good conductor, high luster, hard and dense

- 50. Applying Models** Create a periodic table based on the properties of the five new elements.
- 51. Predicting Outcomes** Using your newly created periodic table, predict the atomic number of an element with an atomic mass of 11.29 that has nonmetallic properties and is very reactive.
- 52. Predicting Outcomes** Predict the atomic number of an element having an atomic mass of 15.02 that exhibits metallic properties but is softer than lambda and harder than beta.
- 53. Analyzing Information** Analyze your periodic table for trends, and describe those trends.
- 55.** Because transition metals have vacant *d* orbitals, they form a greater variety of colored compounds than do the metals of Groups 1 and 2. Review the section of the *Elements Handbook* on transition metals (pages 798–807) and answer the following:
- What colors are exhibited by chromium in its common oxidation states?
 - What gems contain chromium impurities?
 - What colors are often associated with the following metal ions: copper, cadmium, cobalt, zinc, and nickel?
 - What transition elements are considered noble metals? What are the characteristics of a noble metal?

RESEARCH & WRITING

- 56.** Prepare a report tracing the evolution of the current periodic table since 1900. Cite the chemists involved and their major contributions.
- 57.** Write a report describing the contributions of Glenn Seaborg toward the discovery of many of the actinide elements.

ALTERNATIVE ASSESSMENT

- 58.** Construct your own periodic table or obtain a poster that shows related objects, such as fruits or vegetables, in periodic arrangement. Describe the organization of the table and the trends it illustrates. Use this table to make predictions about your subject matter.

extension


Graphing Calculator
Graphing Atomic Radii

Go to go.hrw.com for a graphing calculator exercise that asks you to graph atomic radii versus atomic number for the Period 2 elements.



Keyword: HC6PERX



USING THE HANDBOOK

- 54.** Review the boiling point and melting point data in the tables of the *Elements Handbook*. Make a list of the elements that exist as liquids or gases at the boiling point of water, 100°C.