atomic #	element	symbol	P+ number	e- number	e- config (Quantum #'s)	nobel gas notation	# of valence electrons	e- dot structure
1	Hydrogen	H	1	1	$1s^1$	not now	1	H
2	Helium	He	2	2	$1s^2$	not now	2	He
3	lithium	Li	3	3	$1s^2\ 2s^1$	not now	~~3~~ 1	Li
4	beryllium	Be	4	4	$1s^2\ 2s^2$	not now	2	Be
5	boron	B	5	5	$1s^2\ 2s^2\ 2p^1$	not now	3	B
6	carbon	C	6	6	$1s^2\ 2s^2\ 2p^2$	not now	4	C
7	nitrogen	N	7	7	$1s^2\ 2s^2\ 2p^3$	not now	5	N
8	Oxygen	O	8	8	$1s^2\ 2s^2\ 2p^4$	not now	6	O
9	fluorine	F	9	9	$1s^2\ 2s^2\ 2p^5$	not now	7	F
10	Neon	Ne	10	10	$1s^2\ 2s^2\ 2p^6$	not now	8	Ne
25	Manganese	Mn	25	25	switch to here - ------------------------->	[Ar] $4s^2\ 3d^5$	2	Mn
30	Zinc	Zn	30	30	switch to here - ------------------------->	[Ar] $4s^2\ 3d^{10}$	2	Zn
35	Bromine	Br	35	35	switch to here - ------------------------->	[Ar] $4s^2\ 3d^{10}\ 4p^5$	7	Br
38	Strontium	Sr	38	38	switch to here - ------------------------->	[Kr] $5s^2$	2	Sr
39	Ytrium	Y	39	39	switch to here - ------------------------->	[Kr] $5s^2\ 4d^1$	2	Y
40	Zirconium	Zr	40	40	switch to here - ------------------------->	[Kr] $5s^2\ 4d^2$	2	Zr
41	Niobium	Nb	41	41	switch to here - ------------------------->	[Kr] $5s^2\ 4d^3$	2	Nb

orbital
filling
seq OK
is good
here

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CHAPTER 6 STUDY GUIDE FOR CONTENT MASTERY

The Periodic Table and Periodic Law

Section 6.1 Development of the Modern Periodic Table

In your textbook, reads about the history of the periodic table's development.

Use each of the terms below just once to complete the passage.

octaves	atomic mass	atomic number	nine
elements	properties	Henry Moseley	eight
protons	periodic law	Dmitri Mendeleev	accepted

The table below was developed by John Newlands and is based on a relationship called the law of **(1)** Octaves. According to this law, the properties of the elements repeated every **(2)** eight elements. Thus, for example, element two and element **(3)** nine have similar properties. The law of octaves did not work for all the known elements and was not generally **(4)** accepted.

1	2	3	4	5	6	7
H	Li	G	Bo	C	N	O
8	9	10	11	12	13	14
F	Na	Mg	Al	Si	P	S

The first periodic table is mostly credited to **(5)** D mendeleev. In his table, the elements were arranged according to increasing **(6)** Mass. One important result of this table was that the existence and properties of undiscovered **(7)** elements could be predicted.

The element's in the modern periodic table are arranged according to increasing **(8)** atomic #, as a result of the work of **(9)** H Moseley. This arrangement is based on number of **(10)** protons in the nucleus of an atom of the element. The modern form of the periodic table results in the **(11)** periodic law, which states that when elements are arranged according to increasing atomic number, there is a periodic repetition of their chemical and physical **(12)** properties.

Section 6.1 *continued*

In your textbook, read about the modern periodic table.

Use the information in the box on the left taken from the periodic table to complete the table on the right.

7	1
N	2
Nitrogen	3
14.007	4
$[He]2s^2 2p^3$	5

Duh!

Atomic Mass	**13.** 4
Atomic Number	**14.** 1
Electron Configuration	**15.** 5
Chemical Name	**16.** 3
Chemical Symbol	**17.** 2

For each item in Column A, write the letter of the matching item in Column B.

Column A	Column B
b **18.** A column on the periodic table	**a.** metals
C **19.** A row on the periodic table	**b.** group
D **20.** Group A elements	**c.** period
A **21.** Elements that are shiny and conduct electricity	**d.** representative elements
E **22.** Group B elements	**e.** transition elements

In the space at the left, write *true* if the statement is true; if the statement is false, change the italicized word or phrase to make it true.

Yes T **23.** There are *two* main classifications of elements. Rep / non Rep

False **24.** More than three-fourths of the elements in the periodic table are ~~*nonmetals*~~. metals Metals lose e⁻, non-metals gain e⁻s

Yes T **25.** Group 1A elements (except for hydrogen) are known as the *alkali metals*.

False **26.** *Group ~~3A~~* 2A elements are the alkaline earth metals.

Yes T **27.** Group 7A elements are highly reactive nonmetals known as *halogens*.

False **28.** Group 8A elements are very unreactive elements known as ~~*transition metals*~~. noble gases

F **29.** Metalloids have properties of both metals and ~~*inner transition metals*~~. non-metals

The s-, p-, d-, and f-Block Elements

Use with Chapter 6, Section 6.2

1. What are the four sections, or blocks, of the periodic table? S P D F

2. What does each block represent?
highest occupied electronic orbital shape

3. What do elements in the s-block have in common?
each element has an outer S shaped orbital

4. What is the valence electron configuration of each element in group 1A? s^1 or ns^1

5. What is the valence electron configuration of each element in group 2A? s^2 or ns^2

6. Why does the s-block span two groups of elements?
One S orbital can only hold two electrons

7. Why does the p-block span six groups of elements?
each of the 3 p sublevels can hold 2 electrons
$3 \times 2 = 6$ each block/column is one electron

8. Why are there no p-block elements in period 1?
Atoms that small can not support an orbital as large as a p orbital

9. What is the ending of the electron configuration of each element in group 4A? ns^2np^2

10. What is the electron configuration of neon? $1s^2 2s^2 2p^6$

11. In what period does the first d-energy sublevel appear? 4th (3rd energy level)

12. Why does the d-block span ten groups of elements?
5 d orbitals $\times$ 2 e^- each = 10 d electrons

13. What is the ending of the electron configuration of each element in group 3B? $ns^2(n-1)d^1$

14. What is the electron configuration of titanium? $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$

15. In what period does the first f-energy sublevel appear? Period 6

16. Determine the group, period, and block for the element having the electron configuration $[Xe]4f^{14}5d^{10}6s^26p^3$.

a. group 15 b. period 6 c. block p

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TEACHING TRANSPARENCY MASTER **19**

The s-, p-, d-, and f-Block Elements

Use with Chapter 6, Section 6.2

s block		d block										p block						
s^1	s^2	d^1	d^2	d^3	d^4	d^5	d^6	d^7	d^8	d^9	d^{10}	p^1	p^2	p^3	p^4	p^5	p^6	s^2
1 H																		2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne	
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	
55 Cs	56 Ba	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	
87 Fr	88 Ra	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub							

f block													
f^1	f^2	f^3	f^4	f^5	f^6	f^7	f^8	f^9	f^{10}	f^{11}	f^{12}	f^{13}	f^{14}
57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No

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TEACHING TRANSPARENCY WORKSHEET 20

Atomic and Ionic Radii

Use with Chapter 6, Section 6.3

1. Which groups and periods of elements are shown in the table of atomic radii?
Representative elements

2. In what unit is atomic radius measured? Express this unit in scientific notation.
picometers 1×10^{-12} meters

3. What are the values of the smallest and largest atomic radii shown? What elements have these atomic radii?
~~31~~ - 31-265 He ~~B~~ Cs

4. What happens to atomic radii within a period as the atomic number increases?
Atomic radii goes down in a period

5. Cite any exceptions to the generalization you stated in your answer to question 4.
Bismuth - polonium tin - antimony

6. What accounts for the trend in atomic radii within a period?
increasing positive charge in the nucleus pulls the electrons in the outer layer closer

7. What happens to atomic radii within a group as the atomic number increases?
more layers of electrons cause the atom to become larger than the one above it.

8. Cite any exceptions to the generalization you stated in your answer to question 7.
Aluminum and gallium

9. What accounts for the trend in atomic radii within a group?
See question 7 is answer atoms get larger as you go down a group.

10. In the table of ionic radii, how is the charge of the ions of elements in groups 1A–4A related to the group number of the elements?
Yes they are related by the fact that for each group there is a corresponding e⁻ to loose, 3e⁻ lost = a 3⁻ charge

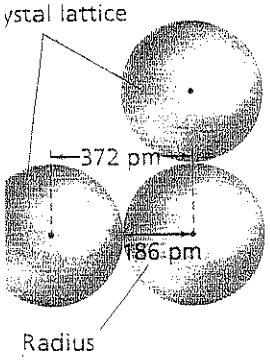
on 6.3 Periodic Trends

:operties of the elements tend to change in a predictable way, known
ıd, as you move across a period or down a group. You will explore
periodic trends in this section. Do the **miniLAB** on the next page to
several properties that behave periodically.

ıic Radius

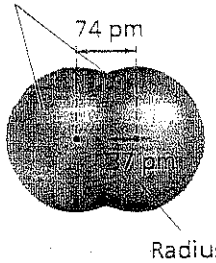
ctron cloud surrounding a nucleus is based on probability and does
e a clearly defined edge. It is true that the outer limit of an electron
defined as the spherical surface within which there is a 90% proba-
finding an electron. However, this surface does not exist in a phys-
y, as the outer surface of a golf ball does. Atomic size is defined by
ısely an atom lies to a neighboring atom. Because the nature of the
ıring atom can vary from one substance to another, the size of the atom
so tends to vary somewhat from substance to substance.
netals such as sodium, the atomic radius is defined as half the distance
ı adjacent nuclei in a crystal of the element. See **Figure 6-11a.** For
ts that commonly occur as molecules, such as many nonmetals, the

ded metallic
um atoms in
ystal lattice



e radius of a metal atom in
netallic crystal is one-half
e distance between two
jacent atoms in the crystal.

nded nonmetal
ydrogen atoms



ıe radius of a nonmetal
om is often determined
ɔm a diatomic molecule of
ı element.

Objectives

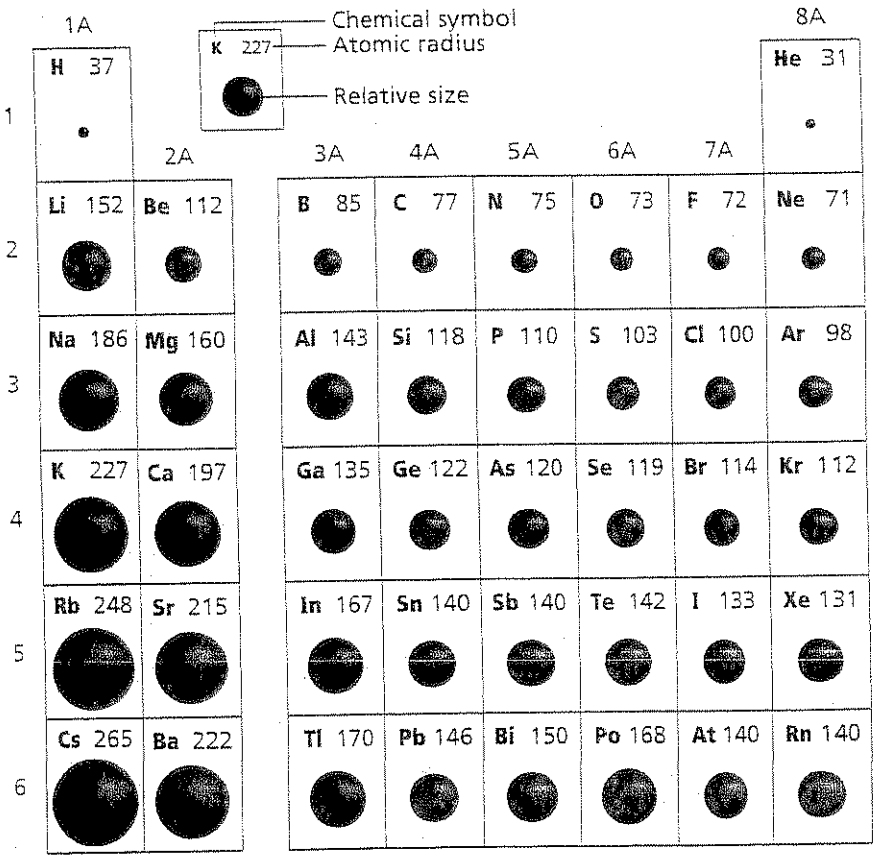
- **Compare** period and group trends of several properties.
- **Relate** period and group trends in atomic radii to electron configuration.

Vocabulary

ion
ionization energy
octet rule
electronegativity

Figure 6-11

The table gives atomic radii of the representative elements.



The atomic radii of the representative elements are given in picometers (1×10^{-12} meters) and their relative sizes are shown. The radii for the transition metals have been omitted because they exhibit many exceptions to the general trends shown here. What causes the increase in radii as you move down a group?

Section 6.3 Periodic Trends

In your textbook, read about atomic radius and ionic radius.

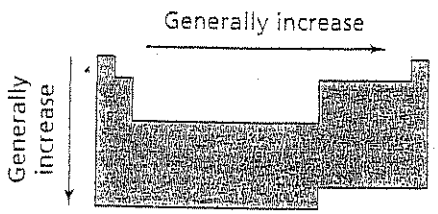
Circle the letter of the choice that best completes the statement or answers the question.

1. Atomic radii cannot be measured directly because the electron cloud surrounding the nucleus does not have a clearly defined

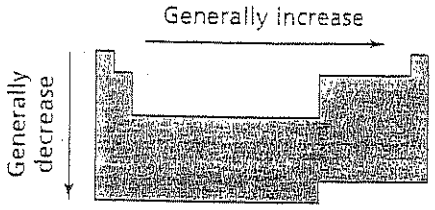
   a. charge. **b.** mass. **c.** outer edge. **d.** probability.

2. Which diagram best represents the group and period trends in atomic radii in the periodic table?

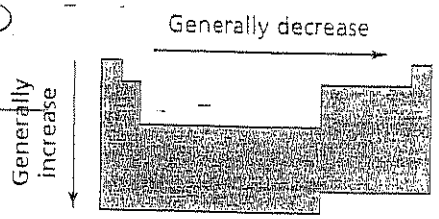
   a.

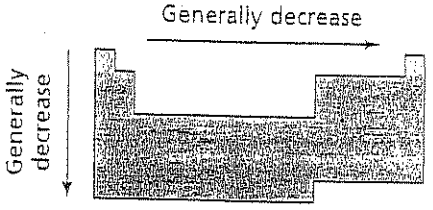
   b.

   c.

   d.

3. The general trend in the radius of an atom moving down a group is partially accounted for by the

   a. decrease in the mass of the nucleus. **c.** increase in the charge of the nucleus.

   b. fewer number of filled orbitals. **d.** shielding of the outer electrons by inner electrons.

4. A(n) _____ is an atom, or bonded group of atoms, that has a positive or negative charge.

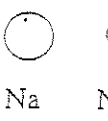
   a. halogen **b.** ion **c.** isotope **d.** molecule

5. An atom becomes negatively charged by

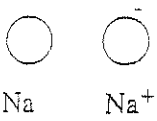
   a. gaining an electron. **b.** gaining a proton. **c.** losing an electron. **d.** losing a neutron.

6. Which diagram best represents the relationship between the diameter of a sodium atom and the diameter of a positive sodium ion?

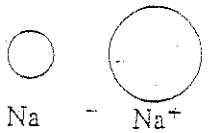
   a.

   b.

   c.

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Section 6.3 *continued*

In your textbook, read about ionization energy and electronegativity.

Answer the following questions.

7. What is ionization energy?
energy required to remove an electron

8. Explain why an atom with a high ionization-energy value is not likely to form a positive ion.
removing an electron makes an atom + hard to remove = hard to make positive

9. What is the period trend in the first ionization energies? Why?
It gets progressively harder to remove an electron the closer the valence shell gets to being filled

10. What is the group trend in the first ionization energies? Why?
Ionization energy decreases moving down. Shielding of outer electrons by inner layers make them easier to remove.

11. State the octet rule.
When atoms get eight valence electrons on their outside they become stable and unreactive

12. What does the electronegativity of an element indicate?
ability of an atom to attract the electrons shared between two bonded atoms

13. What are the period and group trends in electronegativities?
lowest in lower left, highest in upper right