

Ch 4, Sec 1 – How are Elements Organized?

1. Explain the method that John Newlands used to organize the elements.
2. What method did Dmitri Mendeleev use to arrange his periodic table? Why did he have gaps in his table? How did he use these gaps?
3. What was Henry Moseley's contribution to the periodic table? Why was he able to resolve the discrepancies in Mendeleev's table?
4. Explain the importance of valence electrons.
5. How is the electron configuration similar for each element in a group?
6. How is the electron configuration similar for each element in a period?

Section: Tour of the Periodic Table

Complete each statement below by choosing a term from the following list. Terms may be used more than once.

main-group elements halogens metals transition metals
alkaline earth metals alkali metals hydrogen noble gases

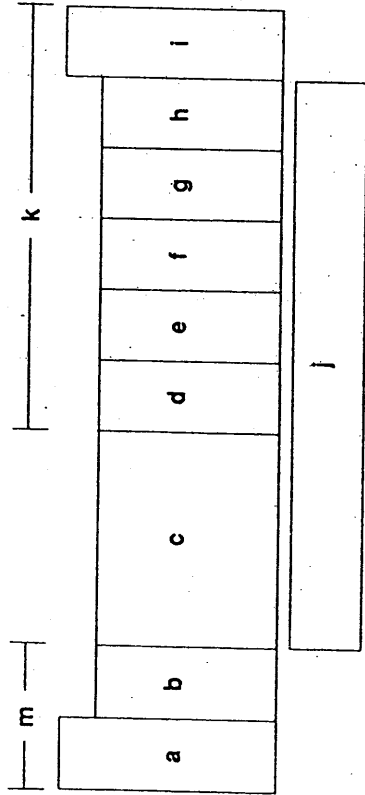
1. The _____ have a single electron in the highest occupied energy level.
2. The _____ are in the *s*- and *p*-blocks of the periodic table.
3. All the _____ have two valence electrons and get to a stable electron configuration by losing two electrons.
4. Unlike the main-group elements, each group of the _____ does not have the identical outer electron configuration.
5. The _____, the most reactive group of non-metals, achieve stable electron configurations by gaining one electron.
6. The _____ have a full set of electrons in their outermost energy level.
7. The _____ are very stable and have low reactivity.
8. The _____ are highly reactive and readily form salts with metals.
9. In general, the _____ are metals that are less reactive than the alkali metals and the alkaline earth metals.
10. The _____ are metals that lose one electron when they react with water to form alkaline solutions.
11. Most elements are _____.
12. With its one valence electron, _____ reacts with many other elements.

Review and Reinforcement

Reading the Periodic Table

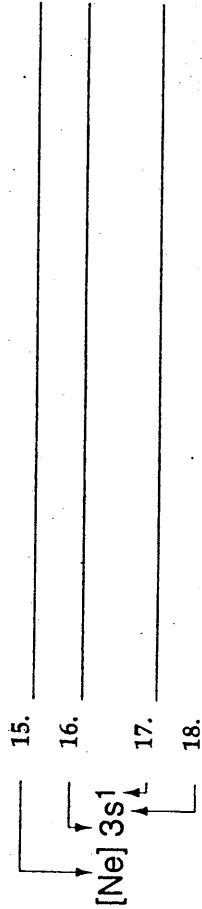
On the line at the left, write the letter of the appropriate location of each group of elements on the periodic table below. Some letters will be used more than once.

- | | | | |
|-------|----------------------------|-------|--|
| _____ | 1. carbon family | _____ | 8. f-block elements |
| _____ | 2. alkaline earth metals | _____ | 9. noble gases |
| _____ | 3. inner transition metals | _____ | 10. p-block elements |
| _____ | 4. halogens | _____ | 11. nitrogen family |
| _____ | 5. d-block elements | _____ | 12. s-block elements |
| _____ | 6. oxygen group | _____ | 13. transition metals |
| _____ | 7. alkali metals | _____ | 14. group of one semimetal and four metals |



Use the skills you developed in Section 5-2 to answer each of the following questions.

Below is the abbreviated electron configuration for sodium. Explain each part of this configuration in the space provided.



(2)

Review and Reinforcement (continued)

Identify each of the following elements as a metal (M), nonmetal (NM), or semimetal (SM).

- | | |
|-------|--------------|
| _____ | 19. sodium |
| _____ | 20. silicon |
| _____ | 21. neon |
| _____ | 22. calcium |
| _____ | 23. nitrogen |

Write the family names that have been given to each of the following groups.

- | | |
|--------------|-------|
| 24. Group 1 | _____ |
| 25. Group 2 | _____ |
| 26. Group 17 | _____ |
| 27. Group 18 | _____ |

Answer each of the following questions in the space provided.

28. What information is contained in each of the 109 squares on the periodic table?

29. What properties distinguish metals from nonmetals?

30. What is an electron configuration, and what does it tell you about an element?

(3)

Skills Worksheet

Concept Review

Section: Trends in the Periodic Table

Complete each statement below by writing the correct word or words in the space provided.

- The amount of energy needed to remove an electron from a specific atom is called the _____ energy of the atom.
- The _____ is half the distance from center to center of two like atoms bonded together.
- _____ is the energy change that occurs when a neutral atom gains an electron.
- _____ is a numerical value that reflects how much an atom in a molecule attracts electrons.
- As the nuclear charge increases across a period, the effective nuclear charge _____ pulling the electrons closer to the nucleus and _____ the size of the atom.

Circle the letter of the choice that best answers the question.

- Which of the following elements has the largest atomic radius?
 - boron
 - aluminum
 - gallium
 - indium
- Which of the following elements has the smallest ionization energy?
 - potassium
 - arsenic
 - nitrogen
 - bismuth

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Concept Review continued

- Which of the following elements has the largest electronegativity?
 - lithium
 - carbon
 - chlorine
 - iodine

Answer the following questions in the space provided.

- Explain why the exact size of an atom is difficult to determine.

- Which metal has the larger radius, Li or Na? Why?

- What is electron shielding?

- Explain the large decrease in atomic radii as you move across a period from Group 1 to Group 14.

- Explain why ionization energies tend to decrease down a group.

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Apply

Using the Periodic Table

Deepa was asked to identify nine unknown elements that were sealed in separate glass containers. Additional information about each element was attached to its container. Deepa recorded the properties of the nine elements in the following table.

Element	Appearance	Additional Information
1	pale yellow gas	poisonous, reactive element; found in compound used in toothpaste
2	silvery solid	very malleable; easily cut with a knife; catches fire spontaneously in water
3	silvery solid	very malleable; easily cut with a knife; reacts violently with water; found in table salt, saltpeter, and baking soda
4	colorless gas	inert; used in incandescent light bulbs
5	silvery solid	fairly hard; found in upset stomach remedies; burns with a bright light in air
6	colorless gas	inert gas; one of the heaviest gases; used in stroboscopic lamps
7	silvery solid	rather hard; compounds found in bones and hard water
8	colorless gas	inert gas; used to fill balloons
9	greenish gas	poisonous; found in bleach

- List the elements in the table that are metals.
- List the elements that belong to the
 - halogen group.
 - noble gases.
- Would you expect elements 1 and 8 to belong in the same group? Why or why not?
- Use what you know about the properties of elements 3, 6, 7, and 9 to place them in their correct locations on the periodic table below. What are the names of these elements?

H								
Li	Be							
	Mg							
K								
Rb	Sr							
Cs	Ba							

B	C	N	O	F		He
Al	Si	P	S		Ar	Ne
Ga	Ge	As	Se	Br	Kr	
In	Sn	Sb	Te	I		
Tl	Pb	Bi	Po	At	Rn	

PERIODIC TABLE WORKSHEET

Name _____

- Where are the most active metals located? _____
- Where are the most active nonmetals located? _____
- As you go from left to right across a period, the atomic size (decreases / increases) / Why? _____
- As you travel down a group, the atomic size (decreases / increases) / Why? _____
- A negative ion is (larger / smaller) than its parent atom.
- A positive ion is (larger / smaller) than its parent atom.
- As you go from left to right across a period, the first ionization energy generally (decreases / increases) / Why? _____
- As you go down a group, the first ionization energy generally (decreases / increases) / Why? _____
- Where is the highest electronegativity found? _____
- Where is the lowest electronegativity found? _____
- Elements of Group 1 are called _____
- Elements of Group 2 are called _____
- Elements of Group 3-12 are called _____
- As you go from left to right across the periodic table, the elements go from (metals / nonmetals) to (metals / nonmetals) / _____
- Group 17 elements are called _____
- The most active element in Group 17 is _____
- Group 18 elements are called _____
- What sublevels are filling across the Transition Elements? _____
- Elements within a group have a similar number of _____
- Elements across a series have the same number of _____
- A colored ion generally indicates a _____
- As you go down a group, the elements generally become (more / less) metallic.
- The majority of elements in the periodic table are (metals / nonmetals) / _____
- Elements in the periodic table are arranged according to their _____
- An element with both metallic and nonmetallic properties is called a _____

The Periodic Law

MIXED REVIEW

SHORT ANSWER Answer the following questions in the space provided.

- Consider the neutral atom with 53 protons and 74 neutrons to answer the following questions.
 - What is its atomic number?
 - What is its mass number?
 - Is the element's position in a modern periodic table determined by its atomic number or by its atomic mass?
- Consider an element whose outermost electron configuration is $3d^{10}4s^24p^5$.
 - To which period does the element belong?
 - If it is a halogen, what is the value of x ?
 - The group number will equal $(10 + 2 + x)$. True or False?
 - In which block are metalloids found, s , p , d , or f ?
 - In which block are the hardest, densest metals found, s , p , or d ?
 - Name the most chemically active halogen.
 - Write its electron configuration.
 - Write the configuration of the most stable ion this element makes.
- Refer only to the periodic table at the top of the review of Section 2 to answer the following questions on periodic trends.
 - Which has the larger radius, Al or In?
 - Which has the larger radius, Se or Ca?
 - Which has a larger radius, Ca or Ca^{2+} ?
 - Which class has greater ionization energies, metals or nonmetals?
 - Which has the greater ionization energy, As or Cl?
 - An element with a large negative electron affinity is most likely to form a (positive ion, negative ion, or neutral atom)?

MIXED REVIEW continued

- In general, which has a stronger electron attraction, a large atom or a small atom?
 - Which has greater electronegativity, O or Se?
 - In the covalent bond between Se and O, to which atom is the electron pair more closely drawn?
 - How many valence electrons are there in a neutral atom of Se? Identify all of the following ions that do not have noble-gas stability: K^+ , S^{2-} , Ca^+ , I^- , Al^{3+} , Zn^{2+}
- Use only the periodic table in the review of Section 2 to give the noble-gas notation of the following:
 - Br
 - Br^-
 - the element in Group 13, Period 5
 - the lanthanide with the smallest atomic number
 - Use electron configuration and position in the periodic table to describe the chemical properties of calcium and oxygen.
 - Copper's electron configuration might be predicted to be $3d^94s^2$. But in fact, its configuration is $3d^{10}4s^1$. The two elements below copper in Group 11 behave similarly. (Confirm this in the periodic table in Figure 6 on pages 140–141 of the text.)
 - Which configuration for copper is apparently more stable?
 - Is the d sublevel completed in the atoms of these three elements?
 - Every element in Period 4 has four levels of electrons established. True or False?