Unit 2 – Periodic Table

At the end of this unit, you'll be able to…

- ✓ Describe the origin of the periodic table
- ✓ State the modern periodic law
- ✓ "Key" the periodic table according to metals vs. nonmetals and all 3 phases
- ✓ Explain how an element's electron configuration is related to the element's placement within a period and a group on the periodic table
- ✓ Identify and state the properties of the following groups in the periodic table:
- ✓ Alkali metals
- ✓ Alkaline earth metals
- ✓ Halogens
- ✓ Noble Gases
- ✓ Transition metals
- ✓ State the trends of the following properties within periods and groups of elements including:
  - o Ionization energy
  - o Electronegativity
  - o Atomic Radius
  - o Chemical Reactivity
  - o Metallic/Nonmetallic character

Unit 2 The Periodic Table

Vocab

Term	Definition
Alkali metals	all elements located in Group 1 on the periodic table except hydrogen; contains the most reactive metals
Alkaline Earth metals	all elements located in Group 2 on the periodic table
Allotrope	1 of 2 or more different forms of an element (nonmetal) in the same phase, but with different formulas and physical/chemical properties
Atomic Radius	the radius of an atom; measured in pm (picometers)
Chemical Reactivity	the tendency for an atom of a given element to gain or lose electrons when interacting with an atom of another element
Diatomic elements	elements that can't exist alone in nature; travel in pairs; contain 2 identical atoms (same element);Br2I2N2Cl2H2O2F2
Electronegativity	a measure of the relative tendency of an atom of an element to attract or gain electrons; the "desire" to gain electrons; electronegativity is based on a scale from 0.0-4.0
Families	elements with similar properties; group 1, 2, 17, and 18 on periodic table
Gases	have no definite shape and fill their container; at STP this includes H, N, O, F, Cl, & all of group 18 (the noble gases)
Groups	vertical columns on periodic table
Halogens	all elements located in Group 17 on the periodic table; have high electronegativities
Ionic Radius	the radius of an ion; cations (lose electrons) decrease in radius; anions (gain electrons) increase in radius
Ionization energy	the energy required to REMOVE one electron from an atom of an element; measured in kJ/mol
Isoelectronic	atoms or ions that have the SAME number of ELECTRONS
Liquids	take the shape of their container and have definite volume; only 2 elements exist as liquids at STP: Br, and Hg
Metallic Character	metals are malleable (can be hammered into thin sheets and bent), ductile (can be drawn into wire), have luster (shine), and conduct electricity; metals tend to lose electrons; all metals have a "sea of mobile valence electrons"
Metalloids	elements that have two properties/characteristics of metals; located along the "staircase," except for aluminum (Al)
Metals	elements that have all four properties/characteristics of a metal; located under/to the left of the staircase, except for Hydrogen (H)
Noble Gases	all elements located in Group 18 on the periodic table; inert (do not tend to react with atoms of other elements); have a full valence shell
Nonmetallic character	nonmetals are NOT malleable (shatter upon being hit with a hammer), NOT ductile, do NOT have luster (dull), and do NOT conduct electricity
Nonmetals	elements that have zero or one property/characteristic of a metal; located above/to the right of the staircase
Octet	full valence shell; 8 electrons, except for period 1 elements
Periodic	cyclic; repeating pattern/cycle
Periodic Law	elements of the periodic table are periodic functions of their atomic number

Unit 2 The Periodic Table

Vocab

Term	Definition
Periods	horizontal rows on periodic table
Solids	have definite shape and definite volume; most elements are solids at STP
States of matter	any of the three phases in which an element can exist; solid (s), liquid (l), gas (g)
Transition metals	the three rows of elements in the middle of the periodic table from scandium (Sc) to mercury (Hg); reactivity is based on the elements with which they are combined

Name_____ Date _____

Period _____

Intro to the Periodic Table

1. Which element has an atomic mass of 26.98154? _____
2. Does every atom of chlorine have an atomic mass of 35.453? _____ Explain _____

   _____

   _____
3. What is the atomic number of oxygen? _____
4. How many protons does an oxygen atom have? _____
5. If an element is in group 1, how many electrons will it have in its outer shell? _____
6. If an ion has a +2 charge, which group(s) is it most likely to be in? _____
7. If an ion has a -1 charge, which group(s) is it most likely to be in? _____
8. In this periodic table, some elements are marked by letters (NOT their proper symbols) Choose the letters to answer questions a-k

																	H
A												C					
	B															D	
E					F										G		I

   a. Are noble gases _____

   b. Is a metalloid _____

   c. Is in group 2 _____

   d. Has 3 electrons in its outer shell _____

   e. Has an atomic number of 3 _____

   f. Are nonmetals _____

   g. Has 12 electrons _____

   h. Would readily form an ion with a charge of +1 _____

   i. Would form an ion with as many electrons as an atom of element H _____

   j. Has 19 protons _____

   k. Has similar properties to E _____

9. Which 2 elements are liquid at STP?

Name_____ Date _____

Period _____

Intro to the Periodic Table - 2

1. Which list includes elements with the most similar chemical properties?

   A) O, S, Se B) Br, Ga, Hg
   C) Cr, Pb, Xe D) N, O, F

2. Which element has chemical properties that are most similar to the chemical properties of sodium?

   A) calcium B) lithium
   C) beryllium D) magnesium

3. The chemical properties of calcium are most similar to the chemical properties of

   A) Ar B) K C) Mg D) Sc

4. Which two elements have the most similar chemical properties?

   A) Be and Mg B) Na and P
   C) Ca and Br D) Cl and Ar

5. Which statement identifies the element arsenic?

   A) Arsenic has an atomic number of 33.
   B) Arsenic has a melting point of 84 K.
   C) An atom of arsenic in the ground state has eight valence electrons.
   D) An atom of arsenic in the ground state has a radius of 146 pm.

6. Which statement explains why sulfur is classified as a Group 16 element?

   A) Sulfur reacts with most metals.
   B) Sulfur is a yellow solid at STP.
   C) A sulfur atom has 6 valence electrons.
   D) A sulfur atom has 16 neutrons.

7. Which list consists of elements that have the most similar chemical properties?

   A) Mg, Al, and Si B) K, Al, and Ni
   C) Mg, Ca, and Ba D) K, Ca, and Ga

8. The properties of carbon are expected to be most similar to those of

   A) phosphorus B) silicon
   C) aluminum D) boron

9. In which set do the elements exhibit the most similar chemical properties?

   A) Hg, Br, and Rn B) N, O, and F
   C) Al, Si and P D) Li, Na and K

10. All of the atoms of the elements in Period 2 have the same number of

    A) valence electrons
    B) protons
    C) occupied energy levels (shells)
    D) neutrons

11. The observed regularities in the properties of elements are periodic functions of their

    A) non-valence electrons
    B) mass numbers
    C) oxidation states
    D) atomic numbers

12. Which element has properties most similar to those of fluorine?

    A) sulfur B) neon
    C) argon D) chlorine

13. Which element is in Group 2 and Period 7 of the Periodic Table?

    A) radium B) radon
    C) magnesium D) manganese

14. Which is the atomic number of an element in Group 2?

    A) 10 B) 13 C) 12 D) 11

15. The elements of the Periodic Table are arranged in horizontal rows according to each successive element's greater

    A) atomic mass
    B) number of protons
    C) number of neutrons
    D) atomic radius

16. An atom of an element contains 20 protons, 20 neutrons, and 20 electrons. This element is in Group

    A) 4 B) 18 C) 2 D) 1

Name_____ Date _____

Period _____

17. How many Group 17 elements are in Period 3 of the Periodic Table?

A) 1 B) 2 C) 3 D) 4

18. Which sequence of atomic numbers represents elements which have similar chemical properties?

A) 19, 23, 30, 36 B) 9, 16, 33, 50
C) 3, 12, 21, 40 D) 4, 20, 38, 88

Name_____ Date _____

Period _____

It's Elemental

DIRECTIONS: Use the reading below to answer the questions that follow.

We all know by now that the periodic table is arranged according to increasing atomic number. What we're only beginning to learn is the significance of elements within the same column (vertical) and row (horizontal) on the table.

Every element found within a given row, or **period**, has the same number of electron shells, or **principle energy levels**. Despite this one common feature, atoms of one element within a given period do not behave similar to atoms of another element in that same period. In fact, the period in which an element is found really tells you nothing about how the atoms of that element will behave. The only additional thing that we can really say about elements of the same period is that they increase by very little in terms of size (or mass) as we go from left to right on the table—remember, the atomic number, or number of protons only goes up by one. Take out the periodic tables that you labeled and color coordinated. Look at how much the mass increases as you move from left to right in a given period.

Every element found within a given column, or group, has the same number of valence electrons. This is VERY significant because it's the number of valence electrons that determines how atoms of any element are going to "behave." When we say "behave," what we really mean is how they're going to react, or bond with atoms of other elements. However, not all columns or groups qualify as "families." In fact, the only groups that are considered to be families are Group I (Alkalai Metals), Group II (Alkaline Earth Metals), Group XVII (Halogens), and Group XVIII (Noble Gases). The behavior of, and the behavior of the elements within the BCNO group varies greatly from one element to another. An element's family tells you much more about its properties than its period does

All of the elements in the Halogen family have 7 valence electrons. There's an easy way to cheat when it comes to determining the number of valence electrons. Just look at the last digit of the group number above the first element in the family. For the first two families (alkali metals and alkaline earth metals) it's a single digit number, so there's no confusion. Alkali metals are group 1, which means all elements in that family have 1 valence electron. The halogen family, on the other hand, is group 17, which means they have how many electrons in their valence shell? If you said 7, you're right. This trick will help you when it comes to drawing Lewis dot diagrams…

Speaking of the Lewis dot diagram, it's used to show only the **valence** electrons in a given atom or compound. After all, the valence electrons are the only electrons involved in **bonding**. There are four basic spots that an electron can occupy in a Lewis dot diagram and by rule, the maximum number of valence electrons that an atom of an element can hold is eight. We refer to this as the **octet rule**. The exceptions to the octet rule are elements that have only one energy level or seek to have one energy level. These elements include hydrogen, helium, lithium, beryllium, and boron. These elements also seek to have a full valence shell, but it will only contain two electrons.

All atoms seek to have a full valence shell, and the easiest way to do that is to form bonds with other atoms. We mentioned before that atoms in the family of noble gases already have a full valence shell, and that's why they rarely ever seek to bond with other atoms. For all other element families, the atoms seek to form bonds in order to complete their valence shell. As a general rule, the number of **unpaired** valence electrons tells you the number of bonds that atoms of a given element "like" to form. Halogens, like chlorine (Cl), have 7 valence electrons and only one unpaired valence electrons. That means that the halogens have two choices:

Name_____ Date _____

Period _____

1. They can steal an electron from a metal, like sodium (Na), or a polyatomic ion. This **transfer of electrons** is what we call an **ionic bond**.
2. The other choice an atom like chlorine has is to share an electron with an atom that's also one short of having a full valence shell, like another chlorine atom. This **sharing of electrons** is an example of a **covalent bond**. As we said before, carbon has 4 valence electrons, which means that all of them can occupy a seat unpaired for a maximum of 4 unpaired valence electrons.

That's why carbon looks to share each of its 4 single valence electrons in order to end up with 4 **pairs**, giving it the full 8 it needs to fill its valence shell. In other words, carbon will form 4 covalent bonds. A single line is used to illustrate a bond between two atoms, and each single line represents 2 electrons.

1. How is the periodic table arranged? (According to what?) _____

   _____

2. What do we call the horizontal rows of the periodic table? _____
3. What do all the elements in a given row have in common? _____

   _____

4. What do we call the vertical columns of the periodic table? _____

   _____

5. What do all the elements in a given column have in common?_____

   _____

6. Which tells us more about an element's properties, its row or its column? _____

   Why is this? _____

   _____

7. Chlorine's chemical properties are most similar to which of the following elements?

   a. fluorine (F)

   b. sulfur (S)

   c. oxygen (O)

   d. argon (Ar)

Name_____ Date _____

Period _____

8. Are atoms of the elements in the family of noble gases reactive (do they readily form bonds with other atoms)?_____ Why is this? _____

   _____

9. How are ionic bonds formed? _____

   _____

10. How are covalent bonds formed? _____

    _____

11. What determines how many bonds an atom will form? _____

    _____

12. What is the easiest way for atoms without a full valence shell to gain a full valence shell? _____

    _____

    _____

13. If an atom of an element has four valence electrons, what is the maximum number of unpaired electrons it can have? _____

14. Draw a Lewis Dot diagram of an element that fits this description.

15. Draw a Lewis Dot diagram of an element with 6 valence electrons.

    How many bonds can it form? _____

Name_____ Date _____

Period _____

16. Why do chlorine (Cl) and sodium (Na) bond so easily with one another? (Hint: Draw Lewis dot diagrams of each element.) _____

_____

_____

17. Which element, carbon (C) or fluorine (F) would you expect to be more reactive?

Explain your answer. (Hint: Think about which element is closer to its goal.)

Name_____ Date _____

Period _____

Periodic Table – The Basics

1. The periodic table was **originally** arranged according to _____

2. Our current periodic table is arranged according to _____

3. The periodic table is essentially divided into two types or categories of elements.

Those categories are _____ and _____

4. The dividing line between these two categories of elements is in the shape of a

_____

5. The elements that border or touch this dividing line are referred to as

_____

6. Explain why the elements from question #5 have this name:

_____

7. The first period on the table in which we see transition metals is period _____

8. The transition metals represent a gradual transition or change from _____

to _____

9. The **most** metallic elements on the periodic table are found in the
   a. upper right
   b. lower right
   c. upper left
   d. lower left

10. The **least** metallic elements on the periodic table are found in the
   a. upper right
   b. lower right
   c. upper left
   d. lower left

11. Which of the following is NOT a Group I metal?
a. Hydrogen
b. Lithium
c. Sodium
d. Potassium

12. Name the only four groups on the periodic table that qualify as families.

_____

_____

Name_____ Date _____

Period _____

Periodic Table – Groups and Families

1. Which element can react with fluorine to form more than one binary compound?

   A) Co B) Na C) Mg D) K

2. Which element is an alkali metal?

   A) zinc B) calcium
   C) sodium D) hydrogen

3. Which group contains both metals and nonmetals?

   A) 7 B) 3 C) 1 D) 15

4. When transition elements react chemically, they may lose electrons from the

   A) *p* sublevel, only B) *s* and *d* sublevels
   C) *s* sublevel, only D) *s* and *p* sublevels

5. Which atom has multiple oxidation states and forms an ion that is colored when in solution?

   A) Cu B) Zn C) F D) Cl

6. Which group is known as the halogens?

   A) 1 B) 2 C) 17 D) 18

7. Which represents the electron configuration of a metalloid in the ground state?

   A) 2-8-5 B) 2-3
   C) 2-5 D) 2-8-6

8. Aqueous solutions of compounds containing element *X* are blue. Element *X* could be

   A) sodium B) copper
   C) carbon D) sulfur

9. Alkali metals, alkaline earth metals, and halogens are elements found respectively in Groups

   A) 1, 2, and 14 B) 2, 13, and 17
   C) 1, 2, and 18 D) 1, 2, and 17

10. Which of the following gases is monatomic at STP?

    A) hydrogen B) helium
    C) chlorine D) oxygen

11. An atom in the ground state has a stable valence electron configuration. This atom could be an atom of

    A) Al B) Na C) Cl D) Ne

12. Which group of elements in the Periodic Table contains a metalloid?

    A) 1 B) 13 C) 18 D) 7

13. An aqueous solution of XCl_2 contains colored ions. Element *X* could be

    A) Ca B) Ni C) Ba D) Bi

14. Which group contains elements composed of diatomic molecules at STP?

    A) 11 B) 2 C) 7 D) 17

15. Which Group 15 element exists as a diatomic molecule at STP?

    A) bismuth B) arsenic
    C) nitrogen D) phosphorus

16. In which section of the Periodic Table are the most active metals located?

    A) lower right corner
    B) upper right corner
    C) lower left corner
    D) upper left corner

17. More than two-thirds of the elements of the Periodic Table are classified as

    A) metals B) metalloids
    C) noble gases D) nonmetals

18. Which statement explains why neon is a Group 18 element?

    A) Neon is a gas at STP.
    B) Neon has a low melting point.
    C) Neon atoms have a stable valence electron configuration.
    D) Neon atoms have two electrons in the first shell.

19. Which of the following Period 3 elements has the *least* metallic character?

    A) Si B) Al C) Na D) Mg

20. Which group in the Periodic Table contains elements that are all monatomic gases at STP?

    A) 16 B) 17 C) 18 D) 15

Name_____ Date _____

Period _____

21. Which period of the Periodic Table contains more metallic elements than nonmetallic elements?

A) Period 1 B) Period 2
C) Period 3 D) Period 4

22. The presence of which ion usually produces a colored solution?

A) F^- B) Fe^{2+} C) S^{2-} D) K^+

23. On the Periodic Table, an element classified as a semimetal (metalloid) can be found in

A) Period 6, Group 15
B) Period 2, Group 14
C) Period 4, Group 15
D) Period 3, Group 16

24. Most of the groups in the Periodic Table of the Elements contain

A) nonmetals and metals
B) nonmetals, only
C) metals and metalloids
D) metals, only

25. The number of atoms in a molecule of helium is

A) 1 B) 2 C) 3 D) 4

26. Which of the following elements has the most pronounced metallic properties?

A) Al B) C C) Rb D) Co

27. The metalloids that are included in Group 15 are antimony (Sb) and

A) N B) As C) Bi D) P

28. Which three elements have the most similar chemical properties?

A) K, Rb, Cs B) O, N, Si
C) Ar, Kr, Br D) B, C, N

29. Which set of properties is most characteristic of transition elements?

A) colored ions in solution, multiple positive oxidation states
B) colored ions in solution, multiple negative oxidation states
C) colorless ions in solution, multiple positive oxidation states
D) colorless ions in solution, multiple negative oxidation states

30. Which pair of Group 15 elements are nonmetals?

A) nitrogen and arsenic
B) arsenic and antimony
C) nitrogen and phosphorus
D) phosphorus and bismuth

31. The *least* active metal of those represented below has an electron configuration abbreviated as

A) 2-8-18-8-2 B) 2-8-2
C) 2-8-18-18-2 D) 2-8-8-2

32. As the elements in Group 15 are considered in order of increasing atomic number, which sequence in properties occurs?

A) metal → metalloid → nonmetal
B) metalloid → metal → nonmetal
C) metal → nonmetal → metalloid
D) nonmetal → metalloid → metal

33. Which element in Period 5 of the Periodic Table is a transition element?

A) Sr B) Ag C) Sb D) Xe

34. Which list of elements contains a metal, a metalloid, a nonmetal, and a noble gas?

A) Be, Si, Cl, Kr B) C, N, Ne, Ar
C) Na, Zn, As, Sb D) K, Fe, B, F

35. Which element is an alkali metal?

A) Al B) Cl C) Mg D) Na

36. Compared to the atoms of nonmetals in Period 3, the atoms of metals in Period 3 have

A) fewer electron shells
B) more electron shells
C) fewer valence electrons
D) more valence electrons

Name_____ Date _____

Period _____

37. Which list of elements consists of a metal, a metalloid, and a nonmetal?

A) Li, Na, Rb B) O, S, Te
C) Cr, Mo, W D) Sn, Si, C

38. Which compound is colorless in a water solution?

A) $Co_2(SO_4)_3$ B) $Cr_2(SO_4)_3$
C) $Fe_2(SO_4)_3$ D) $Al_2(SO_4)_3$

39. An element with a partially filled *d* sublevel in the ground state is classified as

A) an alkaline earth metal
B) an alkali metal
C) a transition metal
D) a halogen

40. Which three groups of the Periodic Table contain the most elements classified as metalloids (semimetals)?

A) 1, 2, and 13 B) 2, 13, and 14
C) 14, 15, and 16 D) 16, 17, and 18

41. The elements in Group 2 are classified as

A) noble gases B) metalloids
C) nonmetals D) metals

42. Which element has properties most like those of magnesium?

A) sodium B) calcium
C) cesium D) potassium

43. An atom of argon in the ground state tends *not* to bond with an atom of a different element because the argon atom has

A) a total of two valence electrons
B) more protons than neutrons
C) more neutrons than protons
D) a total of eight valence electrons

44. A metallic element whose aqueous ions produce colorless solutions would be found in Period 4 and Group

A) VII*A* B) VIII C) *O* D) L*A*

45. Element *X* is a solid that is brittle, lacks luster,and has six valence electrons. In which group on the Periodic Table would element *X* be found?

A) 2 B) 16 C) 15 D) 1

46. Which of the following elements in Period 3 has the greatest metallic character?

A) Mg B) Ar C) Si D) S

47. Elements on the modern Periodic Table are arranged in order of increasing

A) atomic number
B) atomic mass
C) number of valence electrons
D) number of neutrons

48. Which list of elements contains a metal, a metalloid, and a nonmetal?

A) Cd, Sb, I B) F, Cl, Br
C) Zn, Ga, Ge D) Si, Ge, Sn

49. Which element would most likely be found uncombined in nature?

A) K B) Ag C) I D) Mg

50. Which of the following Period 4 elements has the most metallic characteristics?

A) Ca B) As C) Br D) Ge

51. Which compound forms a green aqueous solution?

A) $CaCl_2$ B) RbCl
C) $NiCl_2$ D) $ZnCl_2$

52. The observed regularities in the properties of elements are periodic functions of their

A) oxidation states
B) atomic numbers
C) mass numbers
D) non-valence electrons

Name_____ Date _____

Period _____

Periodic Table – Metals and NonMetals

1. Which of the following Group 15 elements has the greatest metallic character?

   A) nitrogen B) bismuth
   C) phosphorus D) antimony

2. Which properties are characteristic of non-metals?

   A) high thermal conductivity and low electrical conductivity
   B) low thermal conductivity and low electrical conductivity
   C) high thermal conductivity and high electrical conductivity
   D) low thermal conductivity and high electrical conductivity

3. As the elements in Group 15 are considered in order of increasing atomic number, which sequence in properties occurs?

   A) metal → metalloid → nonmetal
   B) metal → nonmetal → metalloid
   C) metalloid → metal → nonmetal
   D) nonmetal → metalloid → metal

4. Atoms of metallic elements tend to

   A) gain electrons and form negative ions
   B) lose electrons and form negative ions
   C) gain electrons and form positive ions
   D) lose electrons and form positive ions

5. What is a property of most metals?

   A) They are poor conductors of heat.
   B) They are poor conductors of electricity.
   C) They tend to lose electrons easily when bonding.
   D) They tend to gain electrons easily when bonding.

6. In which section of the Periodic Table are the most active metals located?

   A) lower right corner B) upper left corner
   C) lower left corner D) upper right corner

7. The observed regularities in the properties of elements are periodic functions of their

   A) oxidation states
   B) mass numbers
   C) atomic numbers
   D) non-valence electrons

8. The *least* active metal of those represented below has an electron configuration abbreviated as

   A) 2-8-18-8-2 B) 2-8-2
   C) 2-8-18-18-2 D) 2-8-8-2

9. Which element is classified as a nonmetal?

   A) Al B) Be C) Si D) Cl

10. The element in Period 4 and Group 1 of the Periodic Table would be classified as a

    A) noble gas B) metalloid
    C) nonmetal D) metal

11. At STP, which element is solid, brittle, and a poor conductor of electricity?

    A) K B) Al C) Ne D) S

12. Which element exists as a diatomic molecule at STP?

    A) argon B) rubidium
    C) bromine D) sulfur

13. Which element is malleable and ductile?

    A) S B) Au C) Si D) Ge

14. Which statement describes a chemical property of iron?

    A) Iron conducts electricity and heat.
    B) Iron can be drawn into a wire.
    C) Iron combines with oxygen to form rust.
    D) Iron can be flattened into sheets.

15. A solid element that is malleable, a good conductor of electricity, and reacts with oxygen is classified as a

    A) nonmetal B) noble gas
    C) metal D) metalloid

Name_____ Date _____

Period _____

16. Metallic substances will conduct electricity in

A) the solid phase, only
B) the liquid phase, only
C) both the solid and the liquid phase
D) neither the solid nor the liquid phase

17. Which Group 15 element exists as a diatomic molecule at STP?

A) bismuth B) phosphorus
C) arsenic D) nitrogen

18. Which elements are malleable and good conductors of electricity?

A) iodine and xenon B) iodine and silver
C) tin and xenon D) tin and silver

19. Which element is a liquid at 305 K and 1.0 atmosphere?

A) gallium B) iodine
C) magnesium D) fluorine

20. The table below shows some properties of elements *A*, *B*, *C*, and *D*.

Element	Ionization Energy	Electronegativity	Conductivity of Heat and Electricity
A	low	low	low
B	low	low	high
C	high	high	low
D	high	high	high

Which element is most likely a nonmetal?

A) *A* B) *B* C) *C* D) *D*

21. Which group contains elements composed of diatomic molecules at STP?

A) 11 B) 2 C) 7 D) 17

22. In which area of the Periodic Table are the elements with the strongest nonmetallic properties located?

A) lower right B) upper right
C) lower left D) upper left

23. Which element is an active nonmetal?

A) neon B) oxygen
C) chromium D) zinc

24. An element that is malleable and a good conductor of heat and electricity could have an atomic number of

A) 16 B) 18 C) 35 D) 29

25. Which Group 14 element is classified as a metal?

A) germanium B) silicon
C) tin D) carbon

Name_____ Date _____

Period _____

26. Which characteristics describe most nonmetals in the solid phase?

A) They are malleable and lack metallic luster.
B) They are malleable and have metallic luster.
C) They are brittle and have metallic luster.
D) They are brittle and lack metallic luster.

27. The elements located in the lower left corner of the Periodic Table are classified as

A) noble gases B) metalloids
C) nonmetals D) metals

28. A sample of an element is malleable and can conduct electricity. This element could be

A) S B) He C) H D) Sn

Name_____ Date _____

Period _____

Periodic Trends – Atomic Radius

1. Atoms of which of the following elements have the *smallest* atomic radius?

   A) P B) Si C) Cl D) S

2. The distance across an atom of an element in the solid phase is 256 pm. The atomic radius of an atom of this element is closest to

   A) 64 pm B) 128 pm
   C) 512 pm D) 256 pm

3. Solid samples of the element phosphorus can be white, black, or red in color. The variations in color are due to different

   A) nuclear charges
   B) atomic masses
   C) ionization energies
   D) molecular structures

4. Which ion would have the *smallest* radius?

   A) Ca^{2+} B) Ba^{2+}
   C) Sr^{2+} D) Mg^{2+}

5. What occurs as the atomic number of the elements in Period 2 increases?

   A) The nuclear charge of each successive atom increases, and the atomic radius decreases.
   B) The nuclear charge of each successive atom decreases, and the atomic radius decreases.
   C) The nuclear charge of each successive atom increases, and the atomic radius increases.
   D) The nuclear charge of each successive atom decreases, and the atomic radius increases.

6. As the elements of Group 16 are considered in order from top to bottom, the covalent radius of each successive element increases. This increase is primarily due to an increase in

   A) atomic number
   B) the number of protons occupying the nucleus
   C) the number of occupied electron shells
   D) mass number

7. The radius of a calcium ion is smaller than the radius of a calcium atom because the calcium ion contains the same nuclear charge and

   A) fewer electrons B) more protons
   C) fewer protons D) more electrons

8. The two forms of oxygen, $O_2(g)$ and $O_3(g)$, have

   A) different molecular structures and identical properties
   B) different molecular structures and different properties
   C) identical molecular structures and identical properties
   D) identical molecular structures and different properties

9. As atomic number increases within Group 15 on the Periodic Table, atomic radius

   A) decreases, only
   B) increases, only
   C) decreases, then increases
   D) increases, then decreases

10. At STP, both diamond and graphite are solids composed of carbon atoms. These solids have

    A) different crystal structures and the same properties
    B) different crystal structures and different properties
    C) the same crystal structure and the same properties
    D) the same crystal structure and different properties

11. Which statement best compares the atomic radius of a potassium atom and the atomic radius of a calcium atom?

    A) The radius of the potassium atom is larger because of its smaller nuclear charge.
    B) The radius of the potassium atom is smaller because of its smaller nuclear charge.
    C) The radius of the potassium atom is larger because of its larger nuclear charge.
    D) The radius of the potassium atom is smaller because of its larger nuclear charge.

12. An atom with the electron configuration 2-8-2 would most likely

    A) decrease in size as it forms a positive ion
    B) increase in size as it forms a positive ion
    C) decrease in size as it forms a negative ion
    D) increase in size as it forms a negative ion

Name_____ Date _____

Period _____

13. Which list of elements from Group 2 on the Periodic Table is arranged in order of increasing atomic radius?

A) Ba, Ra, Sr B) Be, Mg, Ca
C) Ca, Mg, Be D) Sr, Ra, Ba

14. As the elements in Period 2 of the Periodic Table are considered in succession from left to right, there is a decrease in atomic radius with increasing atomic number. This may best be explained by the fact that the

A) number of protons increases, and the number of shells of electrons increases
B) number of protons decreases, and the number of shells of electrons remains the same
C) number of protons increases, and the number of shells of electrons remains the same
D) number of protons decreases, and the number of shells of electrons increases

15. Which list of elements is arranged in order of increasing atomic radii?

A) Sc, Ti, V, Cr B) Sr, Ca, Mg, Be
C) Li, Be, B, C D) F, Cl, Br, I

16. Which characteristics both generally *decrease* when the elements in Period 3 on the Periodic Table are considered in order from left to right?

A) metallic properties and atomic radius
B) metallic properties and ionization energy
C) nonmetallic properties and ionization energy
D) nonmetallic properties and atomic radius

17. Which ion has the largest radius?

A) Ca^{2+} B) Na^{+}
C) K^{+} D) Mg^{2+}

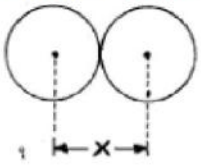
18. Which elements atoms have a larger atomic radius than atoms of silicon?

A) sulfur B) chlorine
C) carbon D) sodium

19. An Mg atom differs from an Mg^{2+} ion in that the atom has a

A) larger radius B) larger nucleus
C) smaller radius D) smaller nucleus

20. The diagram represents two adjacent atoms of sulfur. Distance *X* is closest to



A) 127 pm B) 63.5 pm
C) 208 pm D) 190 pm

21. Which of the following particles has the smallest radius?

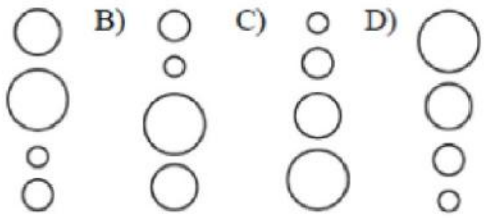
A) K^0 B) Na^+ C) Na^0 D) K^+

22. When a fluorine atom becomes an ion, it will

A) gain an electron and decrease in size
B) lose an electron and decrease in size
C) gain an electron and increase in size
D) lose an electron and increase in size

23. Which grouping of circles, when considered in order from the top to the bottom, best represents the relative size of the atoms of Li, Na, K, and Rb, respectively?

A) B) C) D)



24. When an atom of phosphorus becomes a phosphide ion (P^{3-}), the radius

A) decreases B) increases
C) remains the same

25. Which of the following electron configurations represents the element with the smallest atomic radius?

A) 2-6 B) 2-5 C) 2-7 D) 2-4

26. Which particle has the largest radius?

A) Cu^{2+} B) Cu C) Se D) Se^{2-}

27. Which of the following ions has the *smallest* radius?

A) K^+ B) Ca^{2+} C) F^- D) Cl^-

Name_____ Date _____

Period _____

28. The radius of a Li^+ *ion* is approximately 100 pm. The radius of a Na atom is 190 pm. From this information, what would be the most likely radius of a Na^+ ion?

A) greater than 190 pm
B) less than 100 pm
C) 190 pm
D) greater than 100 pm but less than 190 pm

29. 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) more principal energy levels
C) fewer principal energy levels
D) a smaller nuclear charge

30. How does the size of a barium ion compare to the size of a barium atom?

A) The ion is larger because it has fewer electrons.
B) The ion is larger because it has more electrons.
C) The ion is smaller because it has fewer electrons.
D) The ion is smaller because it has more electrons.

31. The atom of which element has an ionic radius smaller than its atomic radius?

A) N B) S C) Br D) Rb

32. How do the atomic radius and metallic properties of sodium compare to the atomic radius and metallic properties of phosphorus?

A) Sodium has a larger atomic radius and is more metallic.
B) Sodium has a smaller atomic radius and is less metallic.
C) Sodium has a larger atomic radius and is less metallic.
D) Sodium has a smaller atomic radius and is more metallic.

33. Which group in the Periodic Table contains elements that form ions which are larger than their atoms?

A) 1 B) 2 C) 13 D) 17

34. How does the size of an aluminum atom change when it becomes an ion with a charge of 3^+?

A) It becomes smaller by gaining 3 electrons.
B) It becomes larger by losing 3 electrons.
C) It becomes smaller by losing 3 electrons.
D) It becomes larger by gaining 3 electrons.

35. A chloride ion *differs* from a chlorine atom in that the chloride ion has

A) more protons B) fewer protons
C) a larger radius D) a smaller radius

36. An atom of which element has the largest atomic radius?

A) Si B) Fe C) Mg D) Zn

Name_____ Date _____

Period _____

37. The data table below shows elements *Xx*, *Yy*, and *Zz* from the same group on the Periodic Table.

Element	**Atomic Mass** (atomic mass unit)	**Atomic Radius** (pm)
Xx	69.7	141
Yy	114.8	?
Zz	204.4	171

What is the most likely atomic radius of element *Yy*?

A) 185 pm B) 103 pm C) 166 pm D) 127 pm

---

38. The carbon atoms in graphite and the carbon atoms in diamond have different

A) atomic masses
B) electronegativities
C) structural arrangements
D) atomic numbers

39. An ion of which element has a larger radius than an atom of the same element?

A) magnesium B) sodium
C) aluminum D) chlorine

40. Which element in Period 3 has the largest atomic radius?

A) Cl B) Na C) Al D) P

Name_____ Date _____

Period _____

Periodic Trends – Electronegativity, IE, Activity

1. Which general trend is found in Period 3 as the elements are considered in order of increasing atomic number?

   A) decreasing atomic mass
   B) increasing atomic radius
   C) increasing electronegativity
   D) decreasing first ionization energy

2. Which atom has the *weakest attraction for the electrons in a bond with an H atom?*

   A) Cl atom B) O atom
   C) F atom D) S atom

3. An atom of which element has the greatest attraction for electrons in a chemical bond?

   A) As B) Ge C) Se D) Ga

4. Which general trend is demonstrated by the Group 17 elements as they are considered in order from top to bottom on the Periodic Table?

   A) an increase in nonmetallic behavior
   B) a decrease in atomic radius
   C) an increase in first ionization energy
   D) a decrease in electronegativity

5. Atoms of which element have the greatest tendency to gain electrons?

   A) iodine B) chlorine
   C) bromine D) fluorine

6. Based on Reference Table S, atoms of which of these elements have the strongest attraction for the electrons in a chemical bond?

   A) Si B) P C) Al D) S

7. Which of these elements has the *least* attraction for electrons in a chemical bond?

   A) oxygen B) chlorine
   C) nitrogen D) fluorine

8. The strength of an atom's attraction for the electrons in a chemical bond is the atom's

   A) electronegativity B) ionization energy
   C) heat of formation D) heat of reaction

9. Which of the following elements has the highest electronegativity?

   A) Al B) H C) Ca D) K

10. The strongest forces of attraction occur between molecules of

    A) HI B) HBr C) HF D) HCl

11. Which of the following atoms has the greatest tendency to attract electrons?

    A) bromine B) barium
    C) beryllium D) boron

12. Which trends appear as the elements in Period 3 are considered from left to right?

    A) Metallic character increases, and electronegativity increases.
    B) Metallic character decreases, and electronegativity increases.
    C) Metallic character decreases, and electronegativity decreases.
    D) Metallic character increases, and electronegativity decreases.

13. The ability of carbon to attract electrons is

    A) less than that of nitrogen and oxygen
    B) greater than that of nitrogen and oxygen
    C) less than that of nitrogen, but greater than that of oxygen
    D) greater than that of nitrogen, but less than that of oxygen

14. Compared to atoms of metals, atoms of nonmetals generally

    A) lose electrons more readily
    B) have higher electronegativities
    C) have lower first ionization energies
    D) conduct electricity more readily

Name_____ Date _____

Period _____

15. Which properties are most common in nonmetals?

A) high ionization energy and low electronegativity
B) low ionization energy and high electronegativity
C) high ionization energy and high electronegativity
D) low ionization energy and low electronegativity

16. Which element in Group 16 has the greatest tendency to gain electrons?

A) S B) O C) Te D) Se

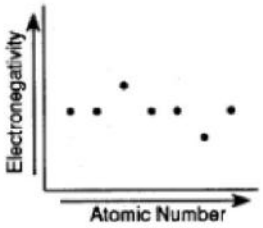
17. Of all the elements, the one with the highest electronegativity is found in Period

A) 1 B) 2 C) 3 D) 4

18. Which element in Period 2 has the greatest tendency to form a negative ion?

A) fluorine B) neon
C) carbon D) lithium

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

A)


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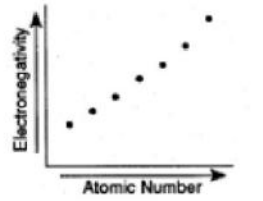

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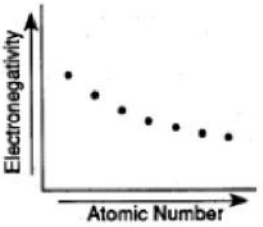
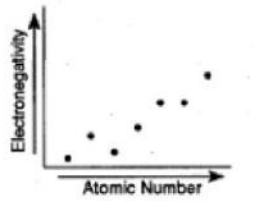


D)


20. Which atom in the ground state requires the *least amount of energy to remove its valence electron?*

A) rubidium atom B) lithium atom
C) sodium atom D) potassium atom

21. Samples of four Group 15 elements, antimony, arsenic, bismuth, and phosphorus, are in the gaseous phase. An atom in the ground state of which element requires the *least* amount of energy to remove its most loosely held electron?

A) Bi B) Sb C) As D) P

22. In the ground state, each atom of an element has two valence electrons. This element has a lower first ionization energy than calcium. Where is this element located on the Periodic Table?

A) Group 1, Period 4
B) Group 2, Period 5
C) Group 2, Period 3
D) Group 3, Period4

Name_____ Date _____

Period _____

23. Which general trend is found in Period 2 on the Periodic Table as the elements are considered in order of increasing atomic number?

A) increasing atomic radius
B) increasing first ionization energy
C) decreasing electronegativity
D) decreasing atomic mass

24. 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 B) increases
C) remains the same

25. The amount of energy required to remove the outermost electron from a gaseous atom in the ground state is known as

A) electronegativity
B) first ionization energy
C) conductivity
D) activation energy

26. From which of these atoms in the ground state can a valence electron be removed using the *least* amount of energy?

A) oxygen B) nitrogen
C) carbon D) chlorine

27. Based on Reference Table *S*, which of the following atoms requires the *least* energy for the removal of the most loosely bound electron?

A) Br B) Sr C) Be D) Sn

28. 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) increasing radius and increasing shielding effect
B) increasing radius and decreasing shielding effect
C) decreasing radius and increasing shielding effect
D) decreasing radius and decreasing shielding effect

29. How much energy is required to remove the most loosely bound electron from a neutral atom of carbon in the gaseous phase?

A) 363 kJ B) 1086 kJ
C) 441 kJ D) 1242 kJ

30. In Period 2 of the Periodic Table, which Group contains the element with the highest first ionization energy?

A) alkali metals
B) halogens
C) alkaline earth metals
D) noble gases

31. Which sequence correctly places the elements in order of increasing ionization energy?

A) $I \rightarrow Br \rightarrow Cl \rightarrow F$
B) $H \rightarrow Be \rightarrow Al \rightarrow Ga$
C) $O \rightarrow S \rightarrow Se \rightarrow Te$
D) $H \rightarrow Li \rightarrow Na \rightarrow K$

32. Which electron configuration represents an element with the highest first ionization energy?

A) 2-8-1 B) 2-8-2
C) 2-1 D) 2-2

33. Which noble gas has the highest first ionization energy?

A) radon B) neon
C) krypton D) helium

34. Which of these metals loses electrons most readily?

A) sodium B) calcium
C) magnesium D) potassium

35. Which number most likely represents the first ionization energy, in kiloJoules per mole of atoms, for a nonmetallic element?

A) 900 B) 500 C) 70 D) 1100

36. The element in Period 3 that has the highest first ionization energy is found in Group

A) 1 B) 2 C) 17 D) 18

Name_____ Date _____

Period _____

37. What is the first ionization energy of an element that has the electron configuration 2-8?

A) 2372 kJ B) 2081 kJ
C) 1313 kJ D) 10 kJ

38. As the Group 1 elements of the Periodic Table are considered from top to bottom, the first ionization energy of each successive element decreases. One reason for this is that the

A) number of principal energy levels is decreasing
B) number of neutrons is increasing
C) distance between the valence electron and the nucleus is increasing
D) nuclear charge is decreasing

39. In general, the elements with the *lowest* ionization energies would be classified as

A) metalloids B) noble gases
C) metals D) nonmetals

40. In which reaction is the first ionization energy greatest?

A) $Na + energy \rightarrow Na^+ + e^-$
B) $Al + energy \rightarrow Al^+ + e^-$
C) $Mg + energy \rightarrow Mg^+ + e^-$
D) $K + energy \rightarrow K^+ + e^-$

41. Which element is most chemically similar to chlorine?

A) S B) F C) Fr D) Ar

42. As the atoms of the Group 17 elements in the ground state are considered from top to bottom, each successive element has

A) an increasing number of valence electrons and identical chemical properties
B) the same number of valence electrons and similar chemical properties
C) an increasing number of valence electrons and similar chemical properties
D) the same number of valence electrons and identical chemical properties

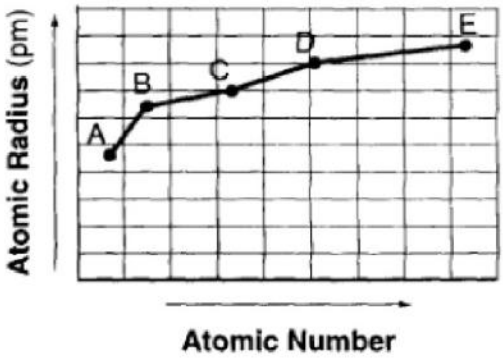
43. Which Group of the Periodic Table contains atoms with a stable outer electron configuration?

A) 1 B) 8 C) 16 D) 18

44. As the elements in Group 17 are considered in order of increasing atomic number, the chemical reactivity of each successive element

A) increases B) remains the same
C) decreases

45. The graph below represents the relationship between atomic radii, in picometers, and increasing atomic number for elements in Group 15.



Which element is most metallic

A) *A* B) *B* C) *D* D) *E*

46. Most metals have the properties of

A) brittleness and high ionization energy
B) brittleness and low ionization energy
C) ductility and high ionization energy
D) ductility and low ionization energy

47. Which element has the highest electrical conductivity?

A) He B) Cl C) H D) Mg

48. Which statement is true about the properties of the elements in any one period of the Periodic Table?

A) They are determined by the number of electrons in the first shell.
B) They change in a random, unpredictable manner.
C) They change in a generally systematic manner.
D) They are determined by the number of neutrons.

Name_____ Date _____

Period _____

49. As the atomic number of elements within Group 2 increases, the metallic character of each successive element

A) decreases B) increases
C) remains the same

50. Compared to an atom of potassium, an atom of calcium has a

A) smaller radius and lower reactivity
B) smaller radius and higher reactivity
C) larger radius and higher reactivity
D) larger radius and lower reactivity

51. Which element in Period 4 is classified as an active nonmetal?

A) Kr B) Ga C) Br D) Ge

52. At which location in the Periodic Table would the most active metallic element be found?

A) in Group 17 at the bottom
B) in Group 1 at the top
C) in Group 17 at the top
D) in Group 1 at the bottom

53. Based upon your knowledge of metallic activity, which element would most readily react with water?

A) Li B) Fe C) Zn D) Cu

54. Which of the following groups in the Periodic Table contain elements so highly reactive they are never found in the free state?

A) 11 and 15 B) 1 and 2
C) 1 and 11 D) 2 and 15

55. Which is the most active nonmetallic element in Group 16?

A) selenium B) tellurium
C) sulfur D) oxygen

56. Which Group 2 element is most active?

A) Mg B) Sr C) Ca D) Ba

57. Which element is more reactive than strontium?

A) calcium B) potassium
C) iron D) copper

58. The most active metals are in Group

A) 17 B) 15 C) 13 D) 1

59. Which represents the correct order of activity for the Group 17 elements? [> means greater than.]

A) iodine > bromine > chlorine > fluorine
B) fluorine > bromine > chlorine > iodine
C) bromine > iodine > fluorine > chlorine
D) fluorine > chlorine > bromine > iodine

60. Which of the following electron configurations represents the least active metal?

A) 2-8-8-2 B) 2-8-18-8-2
C) 2-8-18-18-8-2 D) 2-8-2

61. Which nonmetal is the most reactive?

A) bromine B) fluorine
C) iodine D) chlorine

62. The atoms of the most active nonmetals have

A) large atomic radii and high ionization energies
B) large atomic radii and low ionization energies
C) small atomic radii and high ionization energies
D) small atomic radii and low ionization energies

63. As the elements in Period 3 of the Periodic Table are considered from left to right, the degree of nonmetallic character of each successive element tends to

A) decrease B) increase
C) remain the same

Name _____ Date _____

Period _____

Periodic Trends

1. Why is it difficult to measure the size of an atom? _____

   _____

2. What does the term atomic radius mean? _____

   _____

3. What is ionization energy? _____

   _____

4. What periodic trends exist for ionization energy? _____

   _____

   _____

5. What exceptions exist in this trend? _____

   _____

6. What trend is evident in atomic radius as you proceed down a group of elements? _____

7. How does this trend progress as you move across a period? _____

8. Define the term electron shielding. _____

   _____

   _____

9. What effect does electron shielding have on atomic radius? _____

   _____ On ionization energy? _____

   _____

10. When an atom loses an electron, what is its charge? _____ What do you think happens to the atomic radius of the atom? _____

    _____

Name _____ Date _____

Period _____

11. When an atom gains an electron, what is its charge? _____ What do you think happens to its atomic radius? _____

_____

12. What metal in period 6 has the lowest melting point? _____ The lowest boiling point? _____

13. Compare metals and non metals according to the following properties:

    a) 1st Ionization energies _____

    _____

    b) Electronegativities _____

    _____

    c) Phase at STP _____

    _____

    d) Malleability, ductility, brittleness _____

    _____

    e) Conductivity; heat and electricity _____

    _____

    f) Luster _____

    _____

14. Compare the radius of a metal atom with the radius of its ion. (Ex: Na vs. Na+1) _____

_____

15. Compare the radius of a nonmetal atom with the radius of its ion. (Ex: Cl vs. Cl-1) _____

_____

Name _____ Date _____

Period _____

16. What is true of all elements in a group? _____

    What do they have in common, what are some trends? _____

    _____

    _____

17. What is true of all elements in a period? _____

    What do they have in common, what are some trends? _____

    _____

    _____

18. Why is sulfur less reactive than oxygen? _____

    _____

19. Why is sodium more reactive than lithium? _____

    _____

20. Which atom in each pair has the larger atomic radius? Circle the correct one for each.

    a. Li or Rb
    b. Ca or K
    c. B or Al
    d. Al or P
    e. C or Br
    f. Po or Se

21. How does one measure the atomic radius of an atom? _____

    _____

22. Why do atoms get smaller as you move across a period? _____

    _____

23. Explain why the atomic radius will increase as you go down a group. _____

    _____

Name _____ Date _____

Period _____

24. Which atom in each pair has the larger ionization energy? Circle the correct one.

    a) C or B
    b) Li or K
    c) C or F
    d) Ca or Cs
    e) O or S
    f) Na or Cl

25. What effect does the nuclear charge of an atom have on the ionization energy? _____

    _____

26. Explain why potassium, with a larger nuclear charge (more protons in the nucleus), still has a lower ionization energy than lithium. _____

    _____

27. Which atom in each pair has the larger atomic radius?

    a) Li or K
    b) Ca or Ni
    c) Ga or B
    d) O or C
    e) Cl or Br
    f) Be or Ba
    g) Si or S
    h) Fe or Au

28. Which ion in each pair has the smaller ionic radius?

    a) K+ or O2-
    b) Ba2+ or I-
    c) Al3+ or P3-
    d) K+ or Cs+
    e) Fe2+ or Fe3+
    f) F- or S2-

Name _____ Date _____

Period _____

29. Define ionization energy. _____

_____

30. Which atom in each pair has the larger ionization energy?

    a) Na or O
    b) Be or Ba
    c) Ar or F
    d) Cu or Ra
    e) I or Ne
    f) K or V
    g) Ca or Fr
    h) W or Se

31. Write the charge that each of the following atoms will acquire when it has a complete set of valence electrons (when it becomes its appropriate ion).

    a) O _____
    b) Na _____
    c) F _____
    d) N _____
    e) Ca _____
    f) Ar _____

32. Define atomic radius. _____

_____

33. Why do atoms get smaller as you move across a period. _____

_____

34. Explain the relationship between the relative size of an ion to its atom and the charge on the ion. _____

_____

_____

Name _____ Date _____

Period _____

35. Explain why noble gases are inert and do not form bonds or ions. _____

_____

36. Define the term electronegativity. _____

_____

37. What is the trend for electronegativity as you go down a group? _____

_____

38. What is the trend for electronegativity as you go across a period (left to right)? _____

_____

39. Which of the following within each pair has the greatest electronegativity?

    a) Li or K
    b) Na or O
    c) Be or Ba
    d) Ne or F
    e) S or Se
    f) Ca or Mg

40. What happens to ionization energy as you move across a period (from left to right)? _____

_____

    Explain your answer in terms of nuclear charge and shielding. _____

_____

41. What happens to ionization energy as you move down a group? _____

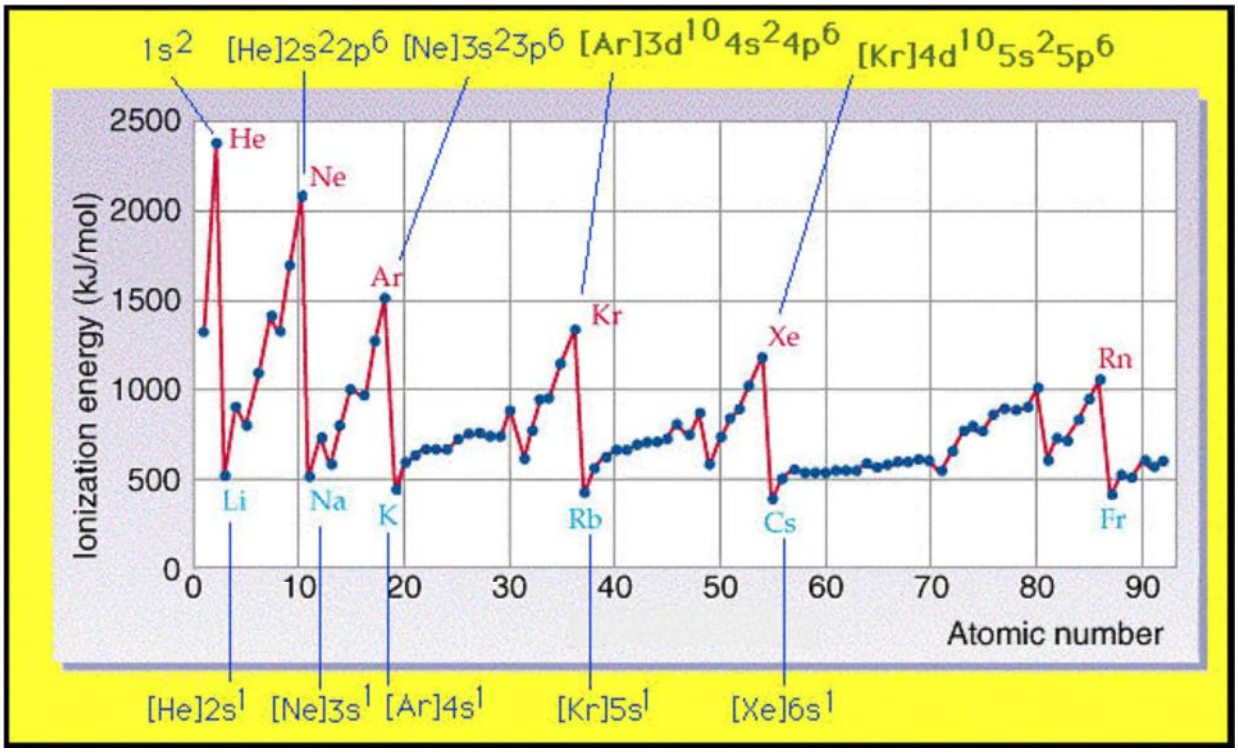
_____

    Explain your answer in terms of nuclear charge and shielding. _____

_____

Name _____ Date _____

Period _____



42. Look at the chart above. Elements from which group or family represent each of the peaks along the curve?

_____

43. Explain this trend of "peaks and valleys" for ionization energy in terms of both nuclear charge and shielding.

_____

_____

_____

44. What happens to electronegativity as you move across a period (from left to right)? _____

Explain in terms of shielding and nuclear charge. _____

_____

_____

Name _____ Date _____

Period _____

45. What happens to electronegativity as you move down a group? _____ Explain in terms of shielding and nuclear charge. . _____

_____

_____

46. What happens to the reactivity of metals as you move across a period? _____ Explain in terms of shielding and nuclear charge. . _____

_____

_____

47. What happens to the reactivity of metals as you move down a group? _____ Explain in terms of shielding and nuclear charge. . _____

_____

_____

48. What happens to the reactivity of nonmetals as you move across a period? _____ Explain in terms of shielding and nuclear charge. . _____

_____

_____

49. What happens to the reactivity of nonmetals as you move down a group? _____ Explain in terms of shielding and nuclear charge. . _____

_____

_____

Name _____ Date _____

Period _____

Periodic Table –Fill In

Directions: Use the word bank below to fill in the blanks in the passage that follows.

Actinide series	Group	Nonmetal
Alkali metal	Halogen	Period
Alkaline earth metal	Lanthanide series	Periodic law
Atomic mass	Metal	Periodic table
Atomic number	Metalloid	Transition element
Family	Noble gas	

Dmitri Mendeleev developed a chart-like arrangement of the elements called the _____. He arranged the elements in order of increasing _____, but what he discovered were many gaps. The chart was not that organized and easy to use. The arrangement used today differs from that of Mendeleev in that Henry Mosely arranged the elements in order of increasing _____. He called this the _____ of the elements. Each horizontal row of elements is called a(n) _____. Each vertical column is called a(n) _____, or because of the resemblance between elements in the same column, a(n) _____.

In rows 4 through 7, there is a wide central section containing elements, each of which is called a(n) _____. Rows 6 and 7 also contain two other sets of elements that are listed below the main chart. These are called the _____ and the _____ respectively. In Group 13 between boron and aluminum, there is a "staircase." All elements to the left of that staircase are _____, and all elements to the right of that staircase are _____. All of the elements touching the staircase (except Al) have some but not all of the properties of metals, and are called _____.

Each of the elements in Group 1 is called a(n) _____

Each of the elements in Group 2 is called a(n) _____

Each of the elements in Group 17 is called a(n) _____

Each of the elements in Group 18 is called a(n) _____

Name _____ Date _____

Period _____

Reactivity and Ionic Radius

1. When metals react what occurs in terms of their valence electrons?

_____

2. How does a metal's atomic radius vary from its ionic radius? Explain this difference.

_____

_____

_____

3. Predict which of the following metals are most reactive:

a. Na or Mg

b. Mg or Ra

c. Ti r Cu

d. Cu or Fr

4. How does a nonmetal's atomic radius vary from its ionic radius? Explain this difference.

_____

_____

_____

5. Predict which of the following nonmetals are least reactive:

a. N or O

b. S or O

c. Cl or F

d. P or S

6. Why are noble gases considered inert?

_____

_____

Name _____ Date _____

Period _____

REVIEW of the PERIODIC TRENDS

1. Describe the trend for atomic radius as you go across a Period.

_____

2. What is an explanation for this trend?

_____

3. Describe the trend for atomic radius as you go down a group.

_____

4. What is an explanation for this trend?

_____

5. Describe the trend for the 1st ionization energy as you go across a period.

_____

6. What is an explanation for this trend?

_____

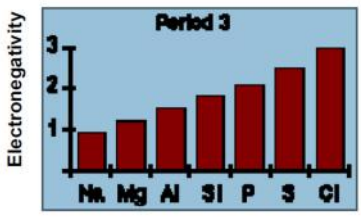
7. Describe the trend for the 1st ionization energy as you go down a group.

_____

8. What is an explanation for this trend?

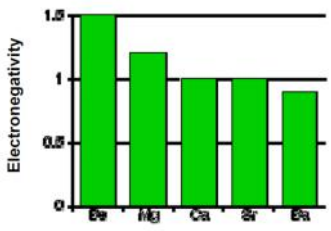
_____

9. Describe the trend illustrated by the graph below and explain why it occurs.



_____
_____
_____
_____

10. Describe the trend illustrated by the graph below and explain why it occurs.



_____
_____
_____
_____

Name _____ Date _____

Period _____

11. Describe the trend for metallic character/reactivity as you go across a period.

_____

12. What is an explanation for this trend?

_____

13. Describe the trend for metallic character/reactivity as you go down a group.

_____

14. What is an explanation for this trend?

_____

15. Describe the trend for reactivity of nonmetals as you go across a period.

_____

16. What is an explanation for this trend?

_____

17. Describe the trend for reactivity of nonmetals as you go down a group.

_____

18. What is an explanation for this trend?

_____

Name _____ Date _____

Period _____

The Activity Series of Metals

1. Put these metals in order of reactivity starting with the most reactive first.

    _____a. Potassium

    _____b. Gold

    _____c. Aluminum

    _____d. Silver

    _____e. Lead

    _____f. Sodium

    _____g. Iron

    _____h. Coppe

    _____i. Zinc

For # 2-20, write **will** or **will not** in the blank

2. Ag _____ replace K
3. Zn _____ replace Ag
4. Cl _____ replace I
5. Li _____ replace H
6. Cu _____ replace Fe
7. Na _____ replace H
8. Fe _____ replace Pb
9. Cu _____ replace
10. Cu _____ replace Al
11. Al _____ replace Pb
12. I _____ replace Cl
13. Fe _____ replace Ag

Name _____ Date _____

Period _____

14. Al _____ replace Cu

15. Al _____ replace H

16. Br _____ replace I

17. Mg _____ replace H

18. Zn _____ replace H

19. Fe _____ replace Cu

20. Mg _____ replace Li

21. Draw Lewis structures for an atom of sodium metal and an atom of magnesium metal.

Mg

Na

22. In terms of atomic structure, explain why magnesium is less reactive than sodium.

_____

_____

_____

_____

Name: _____

ART A: For each statement or questions, write on the blank provided the number of teh word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the Reference Tables for Physical Setting/Chemistry.

___ 1) In the modern Periodic Table, the elements are arranged according to

A) mass number
B) oxidation number
C) atomic mass
D) atomic number

___ 2) Which element is in Group 2 and Period 7 of the Periodic Table?

A) magnesium B) radon C) radium D) manganese

___ 3) Who was credited with creating the first Periodic Table that organized the elements according to atomic mass?

A) John Dalton
B) Dmitri Mendeleev
C) Henry Moseley
D) Ernest Rutherford

___ 4) An atom of an element contains 20 protons, 20 neutrons, and 20 electrons. This element is

A) a noble gas
B) a halogen
C) an alkali metal
D) an alkaline earth metal

___ 5) On the Periodic Table, an element classified as a semimetal (metalloid) can be found in

A) Period 6, Group 15
B) Period 3, Group 16
C) Period 4, Group 15
D) Period 2, Group 14

___ 6) The elements of Period 2 have the same

A) number of occupied sublevels
B) atomic number
C) atomic mass
D) number of occupied principal energy levels

___ 7) 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 smaller nuclear charge
B) fewer principal energy levels
C) a larger nuclear charge
D) more principal energy levels

___ 8) As a sulfur atom gains electrons, its radius

A) remains the same B) decreases C) increases

___ 9) Which element has properties of electrical conductivity and luster and exists as a liquid at STP?

A) I B) Hg C) C D) Br

___ 10) Which of the following statements describes a chemical property of the element iodine?

A) Its crystals are a metallic gray.
B) It forms a violet-colored gas.
C) It reacts with hydrogen to form a gas.
D) It dissolves in alcohol.

___ 11) The table below shows some properties of elements *A*, *B*, *C*, and *D*.

Element	Ionization Energy	Electronegativity	Conductivity of Heat and Electricity
A	low	low	low
B	low	low	high
C	high	high	low
D	high	high	high

Which element is *most* likely a nonmetal?

A) *A* B) *B* C) *C* D) *D*

___ 12) Which is the *most* active nonmetal in the Periodic Table of Elements?

A) Cl B) F C) I D) Na

___ 13) Which two groups of the Periodic Table contain metals that are so active chemically that they occur naturally only in compounds?

A) 11 and 12 B) 1 and 11 C) 1 and 2 D) 2 and 12

___ 14) What type of energy is represented in the equation $Na + energy \longrightarrow Na^+ + e^-$?

A) formation energy
B) ionization energy
C) nuclear energy
D) neutralization energy

___ 15) Which atom has the *greatest* tendency to gain electrons?

A) Rb B) I C) Al D) F

___ 16) Which electron-dot symbol represents the atom in Period 1 with the highest first ionization energy?

A)  B)  C)  D) 

___ 17) As the Group 1 elements of the Periodic Table are considered from top to bottom, the first ionization energy of each successive element decreases. One reason for this is that the

A) number of principal energy levels is decreasing
B) number of neutrons is increasing
C) distance between the valence electron and the nucleus is increasing
D) nuclear charge is decreasing

___ 18) Which element forms a colored ion in solution?

A) K B) Ni C) Mg D) Li

___ 19) What is the total number of electrons found in the valence shell of a halogen in the ground state?

A) 1 B) 2 C) 7 D) 8

___ 20) Which represents the correct electron configuration of a Group 18 element in the ground state?

A) 2-8-7-1 B) 2-8 C) 8 D) 1-1

PART B: Record your answers in the space provided. Some questions may require the use the the Reference Tables for Physical Setting/Chemistry.

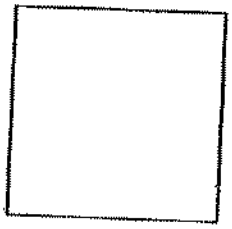
21) A neutral atom has the following electron configuration: 2-8-8-1

(a) State the group and period this element is found on the Periodic Table.

(b) Identify this element.

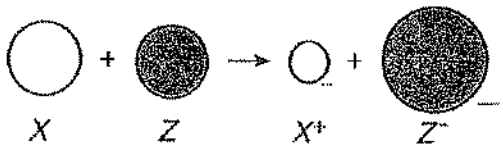
(c) Classify this element as a metal, nonmetal, or metalloid.

(d) In the box below, draw a Lewis electron-dot structure for this element.



(e) List *two* other elements likely to have properties similar to this element.

22) The diagram below represents atoms of two unknown elements (*X* and *Z*) undergoing a reaction.

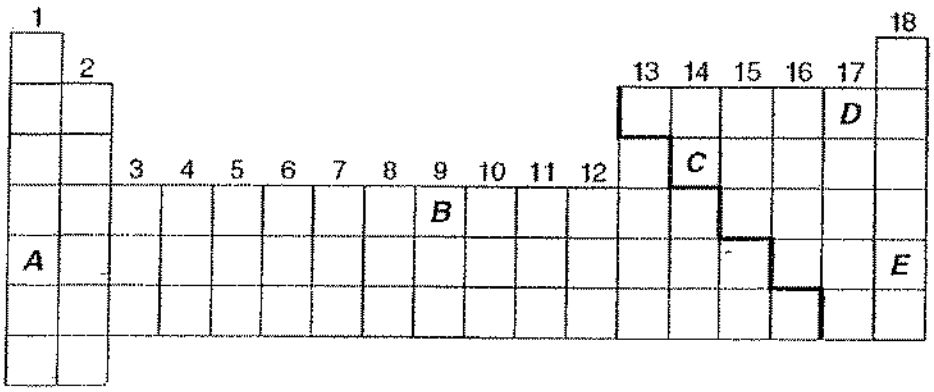


(a) Which particle (*X* or *Z*) most likely represents a metal atom? [*Give one reason to support your answer.*]

(b) Which particle (*X* or *Z*) most likely represents a nonmetal atom? [*Give one reason to support your answer.*]

Questions 23 through 25 refer to the following:

The diagram below represents the *Periodic Table of Elements*. Selected elements are represented by the letters *A* through *E*.



23) Which element exists as a diatomic gas at STP?

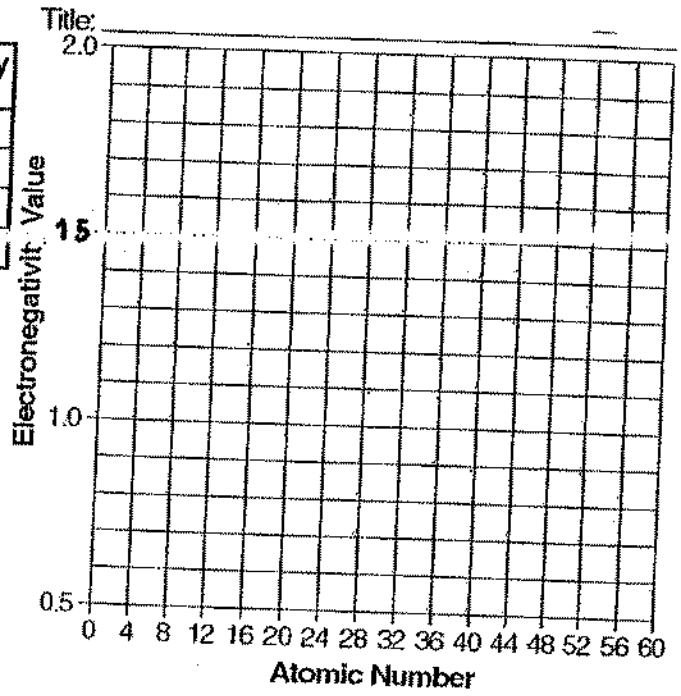
24) Which element has properties of *both* metals and nonmetals?

25) Which element is the *most* reactive metal?

26) (a) Using the *Properties of Selected Elements* chemistry reference table, complete the data table for the following Group 2 elements.

DATA TABLE

Atomic Number	Element	Electronegativity Value
4	Be	
12	Mg	
20	Ca	
56	Ba	



(b) Using the information from the data table completed in *part (a)*, construct a line graph on the grid provided. Circle each point and connect the points with a best-fit curve.

(c) Write an appropriate title on the graph.

(d) Describe the trend in electronegativity values of Group 2 elements as the atomic number increases.

(e) Account for the trend in electronegativty in Group 2 elements in relation to atomic structure.

(f) Using the graph completed in *part (b)*, predict the electronegativity value for the element with atomic number 38.

BONUS:

27) Sodium and cesium are both elements in Group 1. They have the same number of valence electrons and similar chemical properties. For example, they both explode in water. However, cesium reacts more violently in water than sodium. Explain why cesium is more reactive than sodium

28) Relate the colored lines seen on an emission spectrum to electron transitions within an atom.

REGENTS CHEMISTRY Periodic Table Test 2008 Name _____
Mr. Dolgos Period ____

1. ____
2. ____
3. ____
4. ____
5. ____
6. ____
7. ____
8. ____
9. ____
10. ____
11. ____
12. ____
13. ____
14. ____
15. ____
16. ____
17. ____
18. ____
19. ____
20. ____

21. A neutral atom has the following electron configuration: 2-8-8-1

a.) State the group and period this element is found on the Periodic Table.

b.) Identify this element.

c.) Classify this element as a metal, nonmetal, or metalloid.

d.) In the box below, draw a Lewis electron-dot structure for this element.

e.) List *two* other elements likely to have praperties similar to this element.

22. Use the diagram from the test to answer the questions below.

a) Which particle (X or Z) most likely represents a metal atom? (Give one reason to support your answer.

b) Which particle (X or Z) most likely represents a nonmetal atom? (Give one reason to support your answer.

23-25 Use the diagram from the test to answer the questions below.

23. Which element exists as a diatomic gas at STP?

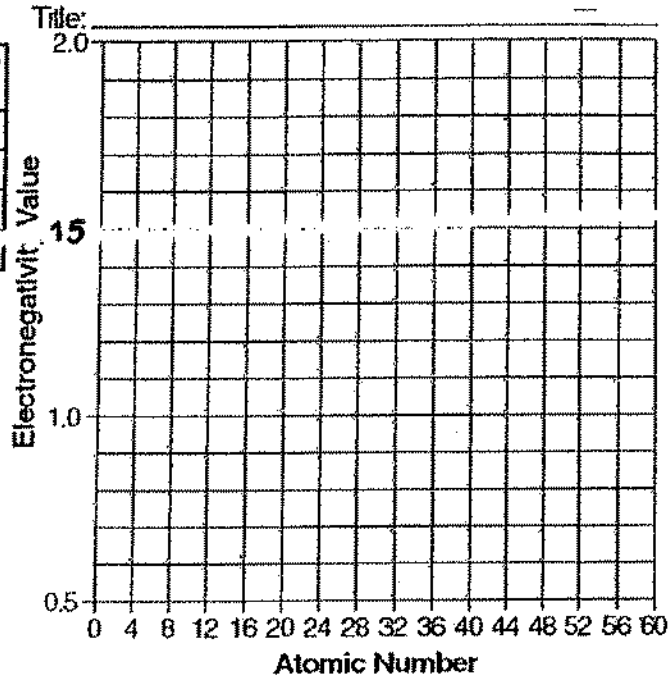
24. Which element has properties of *both* metals and nonmetals?

25. Which element is the *most* reactive metal?

26) (a) Using the *Properties of Selected Elements* chemistry reference table, complete the data table for the following Group 2 elements.

DATA TABLE

Atomic Number	Element	Electronegativity Value
4	Be	
12	Mg	
20	Ca	
56	Ba	



(b) Using the information from the data table completed in *part (a)*, construct a line graph on the grid provided. Circle each point and connect the points with a best-fit curve.

(c) Write an appropriate title on the graph.

(d) Describe the trend in electronegativity values of Group 2 elements as the atomic number increases.

(e) Account for the trend in electronegativty in Group 2 elements in relation to atomic structure.

(f) Using the graph completed in *part (b)*, predict the electronegativity value for the element with atomic number 38.

BONUS:

27) Sodium and cesium are both elements in Group 1. They have the same number of valence electrons and similar chemical properties. For example, they both explode in water. However, cesium reacts more violently in water than sodium. Explain why cesium is more reactive than sodium.

28) Relate the colored lines seen on an emission spectrum to electron transitions within an atom.