

ATOMIC STRUCTURE MIDTERM REVIEW

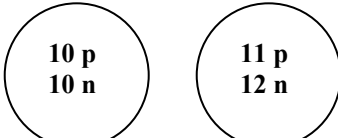
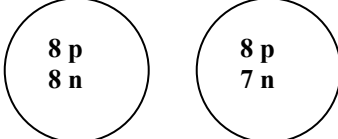
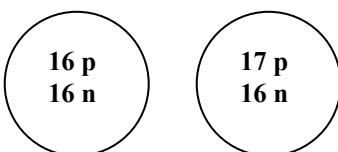
- ___ 1) An atom has the electron configuration 2-8-7. The electron-dot symbol for this element is
- A) $\cdot\ddot{X}:$ B) $:\ddot{X}:$ C) $X:$ D) $X:$
- ___ 2) Compared to the entire atom, the nucleus of the atom is
- A) larger and contains little of the atom's mass
B) smaller and contains little of the atom's mass
C) smaller and contains most of the atom's mass
D) larger and contains most of the atom's mass
- ___ 3) What is the maximum number of electrons in an energy level with a principal quantum number of 3?
- A) 18 B) 6 C) 3 D) 9
- ___ 4) The mass number of an atom is equal to the number of
- A) protons, only C) neutrons plus protons
B) electrons plus protons D) neutrons, only
- ___ 5) What is the total number of valence electrons in an atom of phosphorus in the ground state?
- A) 5 B) 2 C) 3 D) 7
- ___ 6) The nucleus of an atom consists of 8 protons and 6 neutrons. The total number of electrons present in a neutral atom of this element is
- A) 14 B) 6 C) 2 D) 8
- ___ 7) The atomic number of an atom is *always* equal to the total number of
- A) protons in the nucleus
B) neutrons in the nucleus
C) neutrons plus protons in the atom
D) protons plus electrons in the atom

- ___ 8) Which of the following statements *best* describes an electron?
- A) It has a smaller mass than a proton and a negative charge.
B) It has a smaller mass than a proton and a positive charge.
C) It has a greater mass than a proton and a positive charge.
D) It has a greater mass than a proton and a negative charge.
- ___ 9) What two particles account for most of the mass in the atom?
- A) neutrons and positrons
B) neutrons and electrons
C) protons and neutrons
D) protons and electrons
- ___ 10) Compared to a Be^{2+} ion, a Be^0 atom has
- A) fewer electrons
B) fewer protons
C) more electrons
D) more protons
- ___ 11) Which electron configuration represents an atom in an excited state?
- A) 2-7
B) 2-8-1
C) 2-8-2
D) 2-7-1
- ___ 12) What is the maximum number of electrons that can occupy an orbital?
- A) 1
B) 2
C) 3
D) 6
- ___ 13) Which pair of atoms contain the same number of neutrons?
- A) ${}^1_1\text{H}$ and ${}^3_2\text{He}$
B) ${}^2_1\text{H}$ and ${}^4_2\text{He}$
C) ${}^3_1\text{H}$ and ${}^4_2\text{He}$
D) ${}^3_1\text{H}$ and ${}^3_2\text{He}$
- ___ 14) As the number of neutrons in the nucleus of an atom increases, the nuclear charge of the atom
- A) remains the same
B) decreases
C) increases
- ___ 15) Which pair of atoms represent different isotopes of the same element?
- A) ${}^{35}_{17}\text{Cl}$ and ${}^{35}_{17}\text{Cl}$
B) ${}^{58}_{27}\text{Co}$ and ${}^{59}_{28}\text{Ni}$
C) ${}^{12}_6\text{C}$ and ${}^{13}_6\text{C}$
D) ${}^{39}_{18}\text{Ar}$ and ${}^{39}_{19}\text{K}$

- ___ 16) What is the total number of electrons in a Mg^{2+} ion?
A) 10 B) 2 C) 24 D) 12
- ___ 17) What is the nuclear charge of an atom with a mass of 23 and an atomic number of 11?
A) 11+ B) 34+ C) 12+ D) 23+
- ___ 18) The questions below refer to a neutral atom in the ground state having the electron configuration 2-8-1.
- (a) Name the element with this electron configuration.
- (b) How many protons are contained in the nucleus of this atom?
- (c) How many valence electrons does this element contain?
- (d) What principal energy level do the valence electrons occupy?
- (e) Write a possible electron configuration for this atom in the excited state.
- ___ 19) Which two particles have approximately the same mass?
A) neutron and deuteron C) neutron and electron
B) proton and electron D) proton and neutron
- ___ 20) A region of *most* probable electron location in an atom is called
A) an orbital C) a nucleus
B) a nucleon D) a photon
- ___ 21) After bombarding a gold foil sheet with alpha particles, scientists concluded that atoms consist mainly of
A) neutrons C) empty space
B) electrons D) protons
- ___ 22) What particle is electrically neutral?
A) electron C) neutron
B) proton D) positron

ATOMIC STRUCTURE CONSTRUCTED RESPONSE

1. Who was the scientist associated with the Gold Foil Experiment? What did the results of the experiment reveal about the model of the atom?
2. What was J.J. Thomson's discovery related to the structure of the atom? What experiment did he use to prove his theory?
3. **In terms of subatomic particles**, explain how an atom of Ca is different from an ion of Ca^{2+} .
4. **In terms of subatomic particles**, explain how an atom of C-12 is different from an atom of C-14. What are these two particles called?
5. Which of the following pairs of nuclei represent an isotope?

- a. 
- b. 
- c. 

Explain why your choice represents an isotope.

6. Sulfur exists in nature in the form of four naturally occurring isotopes:
- S-32 has a percent abundance of 95%
 - S-33 has a percent abundance of 0.76%
 - S-34 has a percent abundance of 4.22%
 - S-36 has a percent abundance of 0.014%
- a. Which whole number with the average atomic mass of sulfur be closest to: 32, 33, 34 or 36? Support your answer.
- b. Calculate the average atomic mass of sulfur using the information above.
BE SURE TO SHOW ALL WORK FOR CREDIT AND TO INCLUDE UNITS IN YOUR ANSWER.

Periodic Table Midterm Review

- ___ 1) What group in the Periodic Table contains the *most* active metals?
A) 1 B) 17 C) 7 D) 11
- ___ 2) Which gas is monatomic at STP?
A) helium C) chlorine
B) oxygen D) hydrogen
- ___ 3) As the elements are considered from top to the bottom of Group 15, which sequence in properties occurs?
A) metalloid \rightarrow metal \rightarrow nonmetal C) nonmetal \rightarrow metalloid \rightarrow metal
B) metal \rightarrow metalloid \rightarrow nonmetal D) metal \rightarrow nonmetal \rightarrow metalloid
- ___ 4) Which element is in Group 2 and Period 7 of the Periodic Table?
A) radon C) manganese
B) magnesium D) radium
- ___ 5) Which element has the *highest* first ionization energy?
A) phosphorus C) calcium
B) aluminum D) sodium
- ___ 6) An aqueous solution of XCl_2 contains colored ions. Element X is *most* likely
A) an alkali metal C) a transition metal
B) a halogen D) an alkaline earth
- ___ 7) Which element in Group 15 has the *greatest* metallic character?
A) Bi B) Sb C) P D) N
- ___ 8) What are two properties of *most* nonmetals?
A) low ionization energy and good electrical conductivity
B) high ionization energy and poor electrical conductivity
C) high ionization energy and good electrical conductivity
D) low ionization energy and poor electrical conductivity
- ___ 9) Which halogen is a liquid at STP?
A) F_2 B) I_2 C) Br_2 D) Cl_2

- ___ 10) As the elements of Group 16 are considered from top to bottom on the Periodic Table, the atomic radii
- A) decrease and the ionization energies decrease
 - B) increase and the ionization energies increase
 - C) increase and the ionization energies decrease
 - D) decrease and the ionization energies increase

- ___ 11) In the modern Periodic Table, the elements are arranged according to
- A) mass number
 - B) atomic mass
 - C) atomic number
 - D) oxidation number

- ___ 12) A neutral atom has the following electron configuration: 2-8-8

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

(b) Identify this element.

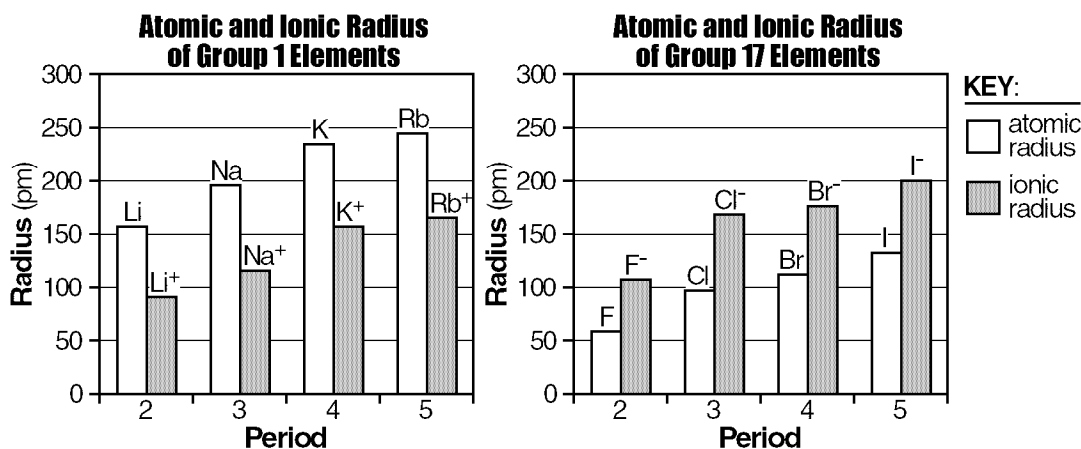
(c) Classify this element as a metal, nonmetal, or noble gas.

(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.

Questions 13 through 15 refer to the following:



- ___ 13) Account for the relationship between atomic and ionic radius in Group 1 elements in the Periodic Table.
- ___ 14) Relate the trend in atomic radius to atomic structure within a group in the Periodic Table.
- ___ 15) State the trend in atomic radius of the Group 1 and Group 17 elements as you go from Period 2 to Period 5 in the Periodic Table.
- ___ 16) Which element has the *largest* atomic radius?
 A) magnesium
 B) barium
 C) strontium
 D) calcium
- ___ 17) Which element is considered malleable?
 A) radon
 B) sulfur
 C) gold
 D) hydrogen
- ___ 18) 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) fewer principal energy levels
 C) more principal energy levels
 D) a smaller nuclear charge

- ___ 19) Elements that readily gain electrons tend to have
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
- ___ 20) On the Periodic Table, an element classified as a semimetal (metalloid) can be found in
A) Period 3, Group 16
B) Period 2, Group 14
C) Period 4, Group 15
D) Period 6, Group 15
- ___ 21) The properties of silicon are characteristic of
A) a metal, only
B) neither a metal nor a nonmetal
C) both a metal and a nonmetal
D) a nonmetal, only
- ___ 22) Who was credited with creating the first Periodic Table that organized the elements according to atomic mass?
A) John Dalton
B) Ernest Rutherford
C) Dmitri Mendeleev
D) Henry Moseley
- ___ 23) Which element is a liquid at room temperature?
A) Mg
B) K
C) I₂
D) Hg
- ___ 24) Which element is brittle and does *not* conduct heat or electricity?
A) Mg(s)
B) K(s)
C) S(s)
D) Al(s)
- ___ 25) An atom of which element has the *greatest* ability to attract electrons?
A) sulfur
B) bromine
C) oxygen
D) silicon
- ___ 26) Which atom will lose an electron *most* readily?
A) calcium
B) strontium
C) rubidium
D) potassium
- ___ 27) Atoms of elements in a group on the Periodic Table have similar chemical properties. This similarity is *most* closely related to the atoms'
A) atomic masses
B) number of principal energy levels
C) atomic numbers
D) number of valence electrons
- ___ 28) Which atom has the *smallest* atomic radius?
A) Be
B) C
C) F
D) Li

- ___ 29) Elements in a given period of the Periodic Table contain the same number of
A) electrons in the outermost level
B) occupied principal energy levels
C) neutrons in the nucleus
D) protons in the nucleus
- ___ 30) Which group contains elements with a total of two electrons in the outermost principal energy level?
A) 16
B) 14
C) 2
D) 18
- ___ 31) Which is the *most* active nonmetal in the Periodic Table of Elements?
A) F
B) Cl
C) Na
D) I
- ___ 32) Which halogen is a solid at STP?
A) chlorine
B) fluorine
C) bromine
D) iodine
- ___ 33) Potassium forms an ion with a charge of
A) 1+ by gaining one electron
B) 1- by gaining one electron
C) 1+ by losing one electron
D) 1- by losing one electron
- ___ 34) Which molecule is relatively inactive and contains a triple bond?
A) O₂
B) H₂
C) N₂
D) Cl₂
- ___ 35) Which part of the Periodic Table contains elements with the *greatest* metallic properties?
A) lower left
B) lower right
C) upper right
D) upper left
- ___ 36) Which element occurs in nature only in compounds?
A) Ne
B) Au
C) Na
D) Ag
- ___ 37) The S²⁻ ion differs from the S⁰ atom in that the S²⁻ ion has a
A) smaller radius and more electrons
B) larger radius and fewer electrons
C) larger radius and more electrons
D) smaller radius and fewer electrons
- ___ 38) The atom of which element has an ionic radius *smaller* than its atomic radius?
A) N
B) S
C) Rb
D) Br
- ___ 39) Which element occurs as a solid at STP?
A) carbon
B) nitrogen
C) mercury
D) bromine

- ___ 40) Which statement correctly describes two forms of oxygen, O_2 and O_3 ?
- A) They have different molecular structures and different properties.
 - B) They have different molecular structures and identical properties.
 - C) They have identical molecular structures and identical properties.
 - D) They have identical molecular structures and different properties.

PERIODIC TABLE CONSTRUCTED RESPONSE:

1. Which of the following groups of elements exhibit the most similar chemical properties?
- a. Na, Mg, Al b. F, O, Cl c. Li, Na, K d. Cu, Zn, Ag

Explain why you selected your answer choice.

2. Which of the following sets of elements are in order of increasing melting point?
- a. B < Be < Li b. Ne < Ar < Kr c. Ti < V < Mn d. Be < Mg < Ca

Explain how you selected your answer choice.

3. Identify each of the following as a metal, nonmetal, metalloid or noble gas.
- | | |
|------------------|--------------------|
| a. neon _____ | d. aluminum _____ |
| b. iron _____ | e. nitrogen _____ |
| c. silicon _____ | f. potassium _____ |

4. Identify the group number of the:
- | | |
|-------------------------|---------------------------------|
| a. Alkali Metals: _____ | c. Noble Gases: _____ |
| b. Halogens: _____ | d. Alkaline Earth Metals: _____ |

5. Identify the number of the group that contains the most active metals.
Explain how these elements lose or gain electrons when forming a compound.

6. Explain why the elements in Group 17, always exhibit a -1 oxidation state when combining with metals.

7. Given the following metals: Ca, Fe, Ga, Na
- a. Identify which metal will form more than one binary compound with chlorine.
- b. Explain why.

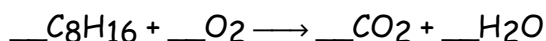
FORMULAS AND EQUATIONS REVIEW

(Naming, Formula Writing, Types of Reactions and Balancing)

___ 1) Which chemical equation *best* represents a decomposition reaction?

- A) $2\text{Al}(s) + 3\text{Cl}_2(g) \longrightarrow 2\text{AlCl}_3(s)$
 B) $\text{Cl}_2(g) + 2\text{KI}(aq) \longrightarrow 2\text{KCl}(aq) + \text{I}_2(aq)$
 C) $\text{H}_2\text{CO}_3(aq) \longrightarrow \text{H}_2\text{O}(l) + \text{CO}_2(g)$
 D) $\text{KCl}(aq) + \text{AgNO}_3(aq) \longrightarrow \text{KNO}_3(aq) + \text{AgCl}(s)$

___ 2) When the equation

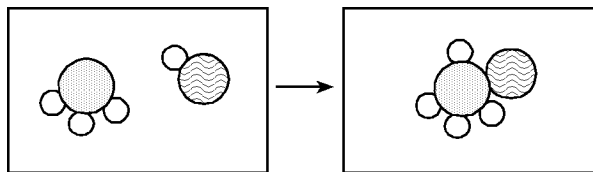
is correctly balanced using the *smallest* whole number coefficients, the coefficient of O_2 is

- A) 12 B) 16 C) 1 D) 8

___ 3) An example of an empirical formula is

- A) C_2Cl_2 B) H_2O_2 C) C_2H_2 D) CaCl_2

___ 4) What general type of chemical reaction is illustrated in the particle diagram below?



- A) synthesis C) single replacement
 B) double replacement D) decomposition

___ 5) What is the name of the compound whose formula is H_2SO_4 ?

- A) hydrosulfuric acid C) sulfurous acid
 B) sulfuric acid D) hydrosulfurous acid

___ 6) What is the total number of atoms of oxygen in the formula $\text{Al}(\text{ClO}_3)_3 \cdot 6\text{H}_2\text{O}$?

- A) 10 B) 6 C) 15 D) 9

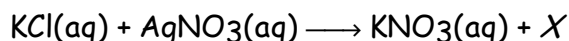
___ 7) When the equation $\text{H}_2 + \text{N}_2 \longrightarrow \text{NH}_3$ is completely balanced using the *smallest* whole numbers, the sum of *all* the coefficients will be

- A) 7 B) 12 C) 6 D) 3

- ___ 8) The chemical reaction $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu(s)}$ is *best* described as a
- A) synthesis reaction
B) combustion reaction
C) single replacement reaction
D) double replacement reaction

- ___ 9) What is the name of the compound whose formula is N_2O_5 ?
- A) nitrogen (IV) oxide
B) nitrogen (III) oxide
C) nitrogen (II) oxide
D) nitrogen (V) oxide

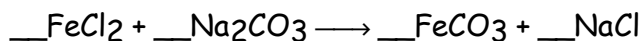
- ___ 10) Given the balanced equation:



What is the correct formula for the product represented by the letter X ?

- A) $\text{AgCl}_2(\text{s})$
B) $\text{K}_2\text{Cl}(\text{aq})$
C) $\text{AgCl}(\text{s})$
D) $\text{KCl}_2(\text{aq})$
- ___ 11) What is the correct chemical formula for iron (III) oxide?
- A) FeO_3
B) Fe_3O
C) Fe_2O_3
D) Fe_3O_2
- ___ 12) What is the empirical formula of a compound with the molecular formula $\text{C}_6\text{H}_{12}\text{O}_6$?
- A) $\text{C}_2\text{H}_4\text{O}_2$
B) $\text{C}_3\text{H}_6\text{O}_2$
C) $\text{C}_4\text{H}_8\text{O}_4$
D) CH_2O
- ___ 13) What is the formula for sodium oxalate?
- A) $\text{NaC}_2\text{H}_3\text{O}_2$
B) NaClO
C) $\text{Na}_2\text{C}_2\text{O}_4$
D) Na_2O
- ___ 14) What is the formula for nitrogen (IV) oxide?
- A) NO_4
B) NO
C) NO_2
D) NO_3
- ___ 15) When C_3H_8 burns completely in an excess of oxygen, the products formed are
- A) CO_2 and H_2
B) CO and H_2O
C) CO_2 and H_2O
D) CO and H_2
- ___ 16) What is the formula for potassium hydride?
- A) KH
B) KH_2
C) $\text{K}(\text{OH})_2$
D) KOH

___ 17) Given the equation:



When the equation is correctly balanced using the *smallest* whole numbers, the coefficient of NaCl is

- A) 6 B) 2 C) 3 D) 4

___ 18) Which of the following is the formula of a binary compound?




- A) $\text{Mg}(\text{ClO})_2$ C) MgCl_2
 B) BiPO_4 D) BaSO_4

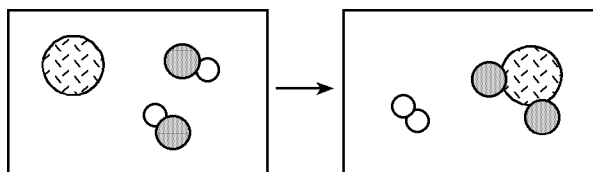
___ 19) In the compound Al_2O_3 , the ratio of aluminum to oxygen is

- A) 2 grams of aluminum to 3 grams of oxygen
 B) 3 moles of aluminum to 2 moles of oxygen
 C) 2 moles of aluminum to 3 moles of oxygen
 D) 3 grams of aluminum to 2 grams of oxygen

___ 20) Which formula correctly represents the compound calcium hydroxide?

- A) $\text{Ca}(\text{OH})_2$ C) CaOH_2
 B) Ca_2OH D) CaOH

___ 21) In the particle diagram below,  represents an atom of element A,  represents an atom of element B, and  represents an atom of element C.



What general type of reaction is illustrated in the diagram?

- A) decomposition C) single replacement
 B) double replacement D) synthesis

___ 22) What is the formula for lead (II) oxide?

- A) Pb_2O_3 B) PbO C) Pb_2O D) PbO_2

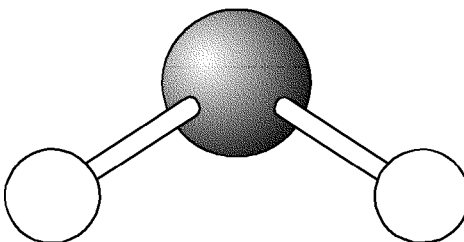
___ 23) What is the correct name for the compound with the formula CrPO_4 ?

- A) chromium (III) phosphide C) chromium (II) phosphate
 B) chromium (II) phosphide D) chromium (III) phosphate

- ___ 24) What is the chemical formula for nitrogen (I) oxide?
A) NO_2 B) N_2O_4 C) N_2O D) NO
- ___ 25) In a sample of solid $\text{Ba}(\text{NO}_3)_2$, the ratio of barium ions to nitrate ions is
A) 1:2 B) 1:6 C) 1:3 D) 1:1

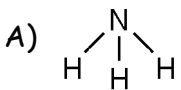
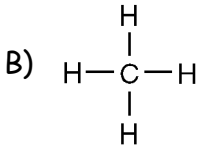
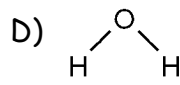
BONDING MIDTERM REVIEW

- ___ 1) Which substance contains positive ions immersed in a sea of mobile electrons?
 A) $O_2(s)$ B) $Cu(s)$ C) $CuO(s)$ D) $SiO_2(s)$
- ___ 2) The bond between hydrogen and oxygen in a water molecule is classified as
 A) covalent and nonpolar C) covalent and polar
 B) ionic and polar D) ionic and nonpolar
- ___ 3) The diagram below represents a water molecule.



This molecule is *best* described as

- A) nonpolar with nonpolar covalent bonds
 B) polar with polar covalent bonds
 C) nonpolar with polar covalent bonds
 D) polar with nonpolar covalent bonds
- ___ 4) Which compound contains *both* ionic and covalent bonds?
 A) $NaOH$ B) CBr_4 C) HBr D) $NaBr$
- ___ 5) At $25^\circ C$, F_2 is a gas but I_2 is a solid. This is *most* likely due to the fact that
 A) F_2 molecules have stronger intermolecular attractions
 B) I_2 is a dipole, but F_2 is not
 C) I_2 molecules have stronger intermolecular attractions
 D) F_2 is a dipole, but I_2 is not
- ___ 6) A chemical bond between two atoms results from a simultaneous
 A) repulsion by the protons in the two nuclei
 B) repulsion by the valence electrons of the atoms
 C) attraction by the protons for the neutrons
 D) attraction by the two nuclei for the electrons
- ___ 7) When sodium reacts with chlorine to form sodium chloride, electrons are lost by
 A) sodium, only C) neither sodium nor chlorine
 B) chlorine, only D) both sodium and chlorine

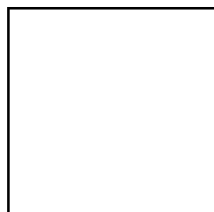
- ___ 8) When $\text{NaCl}(s)$ is dissolved in $\text{H}_2\text{O}(l)$, the sodium ion is attracted to the water molecule's
- A) positive end, which is oxygen
 B) negative end, which is oxygen
 C) negative end, which is hydrogen
 D) positive end, which is hydrogen
- ___ 9) Which substance is made up of molecules that are dipoles?
- A) H_2O
 B) N_2
 C) CO_2
 D) CH_4
- ___ 10) Compared to the boiling point of H_2S , the boiling point of H_2O is relatively high. Which type of bonding causes this difference?
- A) covalent
 B) network
 C) hydrogen
 D) ionic
- ___ 11) The *strongest* hydrogen bonds are formed between molecules in which hydrogen is covalently bonded to an element with
- A) high electronegativity and small atomic radius
 B) high electronegativity and large atomic radius
 C) low electronegativity and small atomic radius
 D) low electronegativity and large atomic radius
- ___ 12) The attraction which exists between carbon dioxide molecules in solid carbon dioxide is due to
- A) hydrogen bonds
 B) molecule-ion forces
 C) weak intermolecular forces
 D) ionic bonds
- ___ 13) Which structural formula represents a nonpolar symmetrical molecule?
- A) 
- B) 
- C) $\text{H}-\text{F}$
- D) 
- ___ 14) Intermolecular forces of attraction between nonpolar molecules *always* decrease with
- A) decreasing molecular size and increasing distance between the molecules
 B) increasing molecular size and increasing distance between the molecules
 C) decreasing molecular size and decreasing distance between the molecules
 D) increasing molecular size and decreasing distance between the molecules

- ___ 15) Element M has an electronegativity of less than 1.2 and reacts with bromine to form the compound MBr_2 . Element M could be
A) Al B) Na C) Ca D) K
- ___ 16) Which particles may be gained, lost, or shared by an atom when it forms a chemical bond?
A) nucleons C) electrons
B) neutrons D) protons
- ___ 17) The electrical conductivity of $KI(aq)$ is *greater* than the electrical conductivity of H_2O because the $KI(aq)$ contains mobile
A) ions from KI C) molecules of KI
B) ions from H_2O D) molecules of H_2O
- ___ 18) Two atoms with an electronegativity difference of 0.4 form a bond that is
A) covalent, because electrons are shared
B) covalent, because electrons are transferred
C) ionic, because electrons are shared
D) ionic, because electrons are transferred
- ___ 19) The electronegativity value of an element is a measure of the atoms
A) degree of conductivity C) ability to attract electrons
B) degree of stability D) ability to attract protons
- ___ 20) Which compound is an example of a network solid?
A) $SO_2(s)$ B) $CO_2(s)$ C) $H_2O(s)$ D) $SiO_2(s)$
- ___ 21) Which molecule is polar and contains polar bonds?
A) CO_2 B) N_2 C) NH_3 D) CCl_4
- ___ 22) What type of bond exists between the carbon atoms in diamonds?
A) hydrogen C) covalent
B) ionic D) metallic
- ___ 23) Which noble gas has the *lowest* normal boiling point?
A) Ne B) Ar C) Xe D) Kr
- ___ 24) Which compound has the *least* ionic character?
A) MgS B) NO C) HCl D) KI
- ___ 25) Which substance will conduct electricity in *both* the solid phase and the liquid phase?
A) Ag B) $AgCl$ C) HCl D) H_2

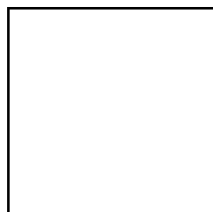
- ___ 26) In a nonpolar covalent bond, electrons are
- shared unequally by two atoms
 - located in a mobile "sea" shared by many ions
 - shared equally by two atoms
 - transferred from one atom to another
- ___ 27) What type of bonds are formed when two non-metal atoms combine?
- network bonds
 - covalent bonds
 - metallic bonds
 - ionic bonds
- ___ 28) A substance that has a melting point of 1,074 K conducts electricity when dissolved in water, but does *not* conduct electricity in the solid phase. The substance is *most* likely
- an ionic solid
 - a molecular solid
 - a network solid
 - a metallic solid
- ___ 29) Which species contains a coordinate covalent bond?
- $\left[\begin{array}{c} \text{H} \cdot \text{O} \cdot \text{H} \\ \cdot \quad \cdot \\ \text{H} \end{array} \right]^+$
 - $\left[\cdot \text{Hg} \cdot \text{Hg} \cdot \right]^{2+}$
 - $\begin{array}{c} \cdot \cdot \\ \text{H} \cdot \text{N} \cdot \text{H} \\ \cdot \cdot \\ \text{H} \end{array}$
 - $\text{H} \cdot \text{H}$
- ___ 30) Which electron-dot diagram represents a molecule that has a polar covalent bond?
- $\text{K}^+ \left[\begin{array}{c} \cdot \cdot \\ \cdot \text{Cl} \cdot \\ \cdot \cdot \end{array} \right]^-$
 - $\text{Li}^+ \left[\begin{array}{c} \cdot \cdot \\ \cdot \text{Cl} \cdot \\ \cdot \cdot \end{array} \right]^-$
 - $\text{H} \cdot \text{Cl} \cdot$
 - $\begin{array}{c} \cdot \cdot \\ \cdot \text{Cl} \cdot \text{Cl} \cdot \\ \cdot \cdot \end{array}$
- ___ 31) A characteristic of ionic solids is that they
- are noncrystalline
 - conduct electricity
 - have high melting points
 - have low boiling points
- ___ 32) Which of the following is a property of network solids, but *not* of molecular solids?
- water soluble
 - high malleability
 - high melting points
 - electrical insulators
- ___ 33) In which compound have electrons been transferred to the oxygen atom?
- CO_2
 - NO_2
 - Na_2O
 - N_2O

- ___ 34) Which formula represents a tetrahedral molecule?
A) CH_4 B) Br_2 C) HBr D) CaCl_2
- ___ 35) What type of bonds are formed when calcium atoms react with oxygen atoms?
A) coordinate covalent C) ionic
B) hydrogen D) polar covalent
- ___ 36) Which formula represents a molecular substance?
A) Li_2O B) Al_2O_3 C) CO D) CaO
- ___ 37) A substance was found to be a soft, nonconducting solid at room temperature. The substance is *most* likely
A) an ionic solid C) a network solid
B) a metallic solid D) a molecular solid
- ___ 38) The total number of pairs of shared electrons in a nitrogen molecule is
A) 1 B) 2 C) 3 D) 4
- ___ 39) Generally, how many valence electrons are needed for atoms to be *most* stable?
A) 8 B) 6 C) 32 D) 18
- ___ 40) Describe the role of valence electrons in:
(1) an ionic bond
(2) a covalent bond
(3) a metallic bond

- ___ 41) In the boxes below, draw a correct Lewis electron-dot structure for:
- (1) an atom of carbon
 - (2) an atom of oxygen
 - (3) a molecule of carbon dioxide (CO_2)



(1) carbon



(2) oxygen



(3) carbon dioxide

Questions 42 through 46 refer to the following:

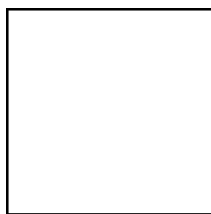
Given the binary compound formed from magnesium and chlorine:

- ___ 42) Write the correct IUPAC name for this compound.
- ___ 43) What type of bond forms between magnesium and chlorine? [*Give one reason to support your answer.*]
- ___ 44) In the box below, draw the Lewis electron-dot structure for the compound formed from magnesium and chlorine. [*Include any charges or partial charges.*]

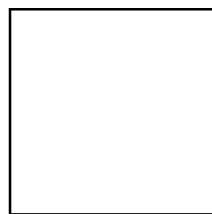


___ 45) Write the correct chemical formula for this compound.

___ 46) In the boxes below, draw the Lewis electron-dot diagrams for the elements Mg and Cl.



magnesium



chlorine

___ 47) In the box below, draw a Lewis electron-dot structure for a molecule of oxygen.



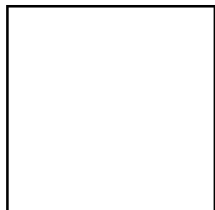
oxygen

___ 48) In the box below, draw a Lewis electron-dot structure for a molecule of nitrogen.

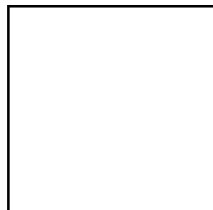


nitrogen

- ___ 49) In the boxes below, draw a correct Lewis electron-dot structure for:
- (1) an atom of carbon
 - (2) an atom of chlorine
 - (3) a molecule of carbon tetrachloride (CCl_4)



(1) carbon



(2) chlorine



(3) carbon tetrachloride

Answer each of the questions below using your knowledge of chemistry and the NYS Physical Setting Chemistry Reference Tables.

Use the compounds below to answer questions the following questions. Each molecule can be used once, more than once or not at all.

Some questions have more than one answer - indicate all compounds that apply.

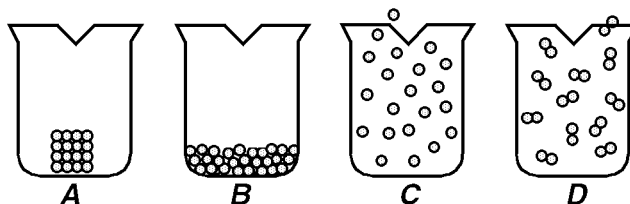
A) N_2	E) $CuSO_4$	I) CH_4
B) HBr	F) H_2O	J) NH_3
C) CH_3Cl	G) He	K) CO_2
D) $CaCl_2$	H) Al	

- 1) Molecule containing only ionic bonds.
- 2) Molecule containing nonpolar covalent bonds.
- 3) Molecule with a bent shape.
- 4) Pyramidal molecule.
- 5) Molecule containing both ionic and covalent bonds.
- 6) A nonpolar molecule with polar bonds.
- 7) Tetrahedral molecule.
- 8) Molecules held together by dispersion forces.
- 9) Molecules held together by dipole-dipole attractions.
- 10) Molecules held together by hydrogen bonds.
- 11) Contain a "sea of mobile electrons".
- 12) Molecule containing a double bond.
- 13) Molecule containing a triple bond.

STATES OF MATTER AND PHASE CHANGES MIDTERM REVIEW

- ___ 1) As the temperature of a gas is increased, the average kinetic energy of its molecules
 A) remains the same B) increases C) decreases

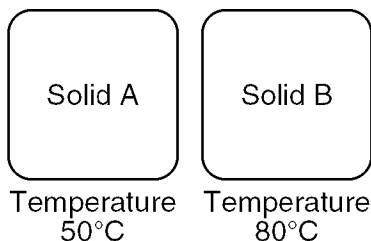
- ___ 2) The particle diagrams below represent elements at STP.



Which particle diagram *best* represents a substance in the liquid state?

- A) *A* B) *B* C) *C* D) *D*
- ___ 3) Which of the following is an example of a physical change?
 A) Acid rain causes the decomposition of a marble statue.
 B) Hydrochloric acid is neutralized by a base to produce a salt and water.
 C) Concentrated hydrochloric acid is diluted with water.
 D) Zinc metal is added to hydrochloric acid and a gas is released.
- ___ 4) Which would be considered a chemical change?
 A) decomposition of water to $H_2(g)$ and $O_2(g)$
 B) crushing ice
 C) dissolving NaCl in water
 D) evaporation of rainwater
- ___ 5) Which substance is made of particles with the *highest* average kinetic energy?
 A) $Br_2(l)$ at $20^\circ C$ C) $Fe(s)$ at $35^\circ C$
 B) $CO_2(g)$ at $25^\circ C$ D) $H_2O(l)$ at $30^\circ C$
- ___ 6) Ductility and malleability are examples of
 A) physical properties C) properties of nonmetals
 B) properties of all matter D) chemical properties

- ___ 7) The diagrams below represent two solids and the temperature of each.

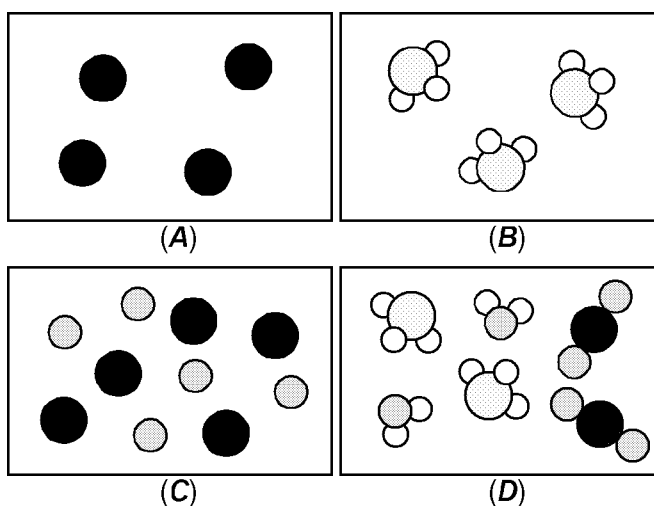


What occurs when the two solids are placed in contact with each other?

- A) Heat energy flows from solid *B* to solid *A*. Solid *B* increases in temperature.
 B) Heat energy flows from solid *A* to solid *B*. Solid *A* increases in temperature.
 C) Heat energy flows from solid *A* to solid *B*. Solid *A* decreases in temperature.
 D) Heat energy flows from solid *B* to solid *A*. Solid *B* decreases in temperature.
- ___ 8) What process is used to separate a mixture of liquids based on a difference in boiling point?
 A) filtration
 B) distillation
 C) chromatography
 D) titration
- ___ 9) What Kelvin temperature is equal to -33°C ?
 A) 306 K
 B) -33 K
 C) 240 K
 D) 33 K
- ___ 10) Which substance can *not* be decomposed by a chemical change?
 A) carbon (C)
 B) carbon monoxide (CO)
 C) methane (CH₄)
 D) carbon dioxide (CO₂)
- ___ 11) An example of a mixture is
 A) gold
 B) salt water
 C) pure water
 D) silver
- ___ 12) Matter is defined as anything that occupies space and has
 A) mass
 B) odor
 C) a definite shape
 D) color
- ___ 13) Element *A* and element *B* become chemically bonded together to form substance *C*. Substance *C* must be
 A) a solution
 B) a mixture
 C) a compound
 D) an element
- ___ 14) A true solution is *best* described as a
 A) heterogeneous mixture
 B) homogeneous compound
 C) homogeneous mixture
 D) heterogeneous compound

- ___ 15) Which of the following is *not* a diatomic gas?
 A) nitrogen
 B) hydrogen
 C) neon
 D) chlorine
- ___ 16) Which of the following statements is an identifying characteristic of a mixture?
 A) A mixture must be homogeneous.
 B) A mixture must have a definite composition by weight.
 C) A mixture can consist of a single element.
 D) A mixture can be separated by physical means.

Questions 17 through 20 refer to the following:

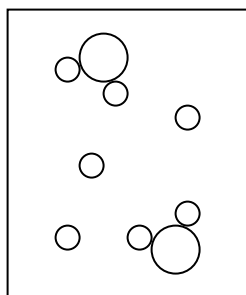


- ___ 17) Which particle diagram above *best* represents a single element?
 A) *A* B) *B* C) *C* D) *D*
- ___ 18) Which particle diagram above *best* represents a heterogeneous sample of matter?
 A) *A* B) *B* C) *C* D) *D*
- ___ 19) Which particle diagram above *best* represents a single compound?
 A) *A* B) *B* C) *C* D) *D*
- ___ 20) Which particle diagram above *best* represents a mixture of elements?
 A) *A* B) *B* C) *C* D) *D*
- ___ 21) Which pair is classified as a substance?
 A) elements and solutions
 B) elements and mixtures
 C) compounds and mixtures
 D) elements and compounds

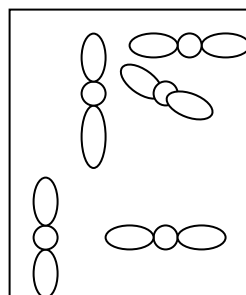
- ___ 22) A solid is dissolved in a beaker of water. Which observation suggests that the process is endothermic?
- A) The solution gives off a gas.
 - B) The temperature of the solution increases.
 - C) The temperature of the solution decreases.
 - D) The solution changes color.
- ___ 23) The temperature 30. K expressed in degrees Celsius is
- A) 243°C
 - B) -303°C
 - C) -243°C
 - D) 303°C
- ___ 24) Which of the following statements describes a chemical property of the element iodine?
- A) It vaporizes into a violet-colored gas.
 - B) Its crystals are a metallic gray.
 - C) It dissolves in alcohol.
 - D) It reacts with hydrogen to form a gas.
- ___ 25) Which set of properties does a substance such as $\text{CO}_2(\text{g})$ have?
- A) no definite shape but definite volume
 - B) definite shape and definite volume
 - C) no definite shape and no definite volume
 - D) definite shape but no definite volume

1. Mixtures are composed of two or more substances that can be separated by physical means. Describe the procedure you would use to separate the three components of a solution of sodium chloride NaCl (aq) and insoluble sand (SiO₂).

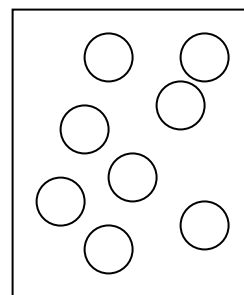
2. Given the following diagrams, identify each as consisting of an element, a compound, or a mixture. Also explain why you choose your answer for each.



(A)



(B)



(C)

A.

B.

C.

3. All mixtures are homogeneous. Is this statement true or false? Explain and give examples.