Multiple Choice – 2 pts. each

1) Which of the following bonds exhibits the greatest ionic character?
   a) H - F  b) H - I  c) H - Br  d) H - Cl

2) Generally, how many valence electrons are needed for atoms to be most stable?
   a) 8  b) 6  c) 32  d) 18

3) Which type of bonding is characteristic of a substance that has a high melting point and electrical conductivity only in the liquid phase?
   a) ionic  b) metallic  c) nonpolar covalent  d) polar covalent

4) Which compound is ionic?
   a) CaCl$_2$  b) N$_2$O  c) HCl  d) SO$_2$

5) In which compound do the atoms have the greatest difference in electronegativity?
   a) AlCl$_3$  b) NaBr  c) KF  d) LiI

6) What type of bonds are present in a strip of magnesium ribbon?
   a) metallic  b) covalent  c) ionic  d) London dispersion

7) Which particles may be gained, lost, or shared by an atom when it forms a chemical bond?
   a) nucleons  b) neutrons  c) protons  d) electrons

8) Two atoms with an electronegativity difference of 0.4 form a bond that is
   a) ionic, because electrons are transferred
   b) covalent, because electrons are shared
   c) ionic, because electrons are shared
   d) covalent, because electrons are transferred

9) Which type of bonds are formed when calcium atoms react with oxygen atoms?
   a) hydrogen  b) coordinate covalent  c) polar covalent  d) ionic

10) Which type of bond is formed by the transfer of electrons from one atom to another?
    a) an ionic bond
    b) a hydrogen bond
    c) a covalent bond
    d) a coordinate covalent bond

11) Which atoms are most likely to form covalent bonds?
    a) nonmetal atoms that share electrons
b) metal atoms that share protons
c) nonmetal atoms that share protons
d) metal atoms that share electrons

12) Which compound contains both covalent and ionic bonds?
   a) CCl₄   b) KCl   c) MgCl₂   d) NH₄Cl

13) Oxygen, nitrogen, and fluorine bond with hydrogen to form molecules. These molecules are attracted to each other by
   a) coordinate covalent bonds   c) ionic bonds
   b) electrovalent bonds   d) hydrogen bonds

14) The bond between hydrogen and oxygen in a water molecule is classified as
   a) covalent and nonpolar   c) ionic and polar
   b) ionic and nonpolar   d) covalent and polar

15) Which is a nonpolar molecule containing a nonpolar covalent bond?
   a) I₂   b) CO₂   c) NH₃   d) H₂O

16) Which diagram best represents a polar covalent molecule?
   a) HCl   b) NaCl   c) Cl₂   d) H₂

17) Which molecule is nonpolar due to a symmetrical distribution of charge?
   a) CO₂   b) NH₃   c) HCl   d) H₂O

18) The unusually high boiling point of water is due to the
   a) network bonds between the molecules
   b) nonpolar character of the molecules
   c) hydrogen bonds between the molecules
   d) linear structure of the molecules

19) Which substance will conduct electricity in both the solid phase and the liquid phase?
   a) AgCl   b) HCl   c) Ag   d) H₂

20) Which formula represents a molecular substance?
   a) Al₂O₃   b) CO   c) CaO   d) Li₂O

21) Which molecule contains a polar covalent bond?

\[
\begin{align*}
\text{H} & \quad \text{N} \quad \text{H} \\
\text{H} & \quad \text{H} \quad \text{O} \quad \text{O} \\
\end{align*}
\]
22) The electrons in a bond between two iodine atoms (I₂) are shared
   a) unequally, and the resulting bond is polar
   b) equally, and the resulting bond is polar
   c) unequally, and the resulting bond is nonpolar
   d) equally, and the resulting bond is nonpolar

23) Which of the following solid substances contains positive ions immersed in a sea of mobile electrons?
   a) O₂                   b) Cu                   c) CuO                   d) SiO₂

**Short Answer Questions:**

24) In the boxes below, draw a correct Lewis electron-dot structure for: (3 pts.)
   (1) an atom of hydrogen
   (2) an atom of oxygen
   (3) a molecule of water (H₂O)
   
   (1) hydrogen          (2) oxygen          (3) water

25) \[ \text{H} \quad \text{Cl} \quad \text{Br} \quad \text{Br} \]
    \[ \text{Bond A} \quad \text{Bond B} \]

   a) State *one* way in which bond A and bond B (above) are the same and
      *one* way in which they are different. (2 pts.)

   b) Draw the Lewis electron-dot diagrams for the two molecules above.
      Label any partial charges. (2 pts.)
c) Is HCl a polar or nonpolar molecule? [Explain why.] (2 pts.)

26) Write the correct IUPAC chemical formula for the following compounds (1 pt. each)

1) barium chloride

2) iron (III) bromide

3) dihydrogen monoxide

4) magnesium nitrate

5) sodium bromide

27) Write the correct IUPAC chemical names for the following compounds (1 pt. each)

1) CF₄

2) N₂S₃

3) MgO

4) NaOH

28) Metals like copper are often used in electrical wiring.

a) Name two properties of metals that makes them useful in electrical wiring (2 pts.)

b) Explain how metallic bonding between copper atoms can account for each of these properties (1 pt.)

29) Describe the role of valence electrons in: (1 pt. each)
1) an ionic bond

2) a covalent bond

3) a metallic bond

30) In the laboratory, a student compares the properties of two unknown solids. The results of his experiment are reported in the data table below.

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Predict the type of bonding in substance A. (1 pt.)

31) Given the binary compound formed from magnesium and chlorine:

a) Write the correct IUPAC name for this compound (1 pt.)

b) Write the correct chemical formula for this compound (1 pt.)

c) What type of bond forms between magnesium and chlorine? [Give one reason to support your answer.] (2 pts.)

d) In the boxes below, draw the Lewis electron-dot structures for the elements Mg and Cl. (2 pts.)
e) In the box below, draw the Lewis electron-dot structure for the compound formed from magnesium and chlorine. *[Include any charges or partial charges.]* (1 pt.)

32) Explain, in terms of electronegativity, why an H-F bond is expected to be more polar than an H-I bond. (2 pts.)

**BONUS Questions – 1 pt. each**

33) Given the reaction: \( \text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl} \)

Which statement best describes the energy change as bonds are formed and broken in this reaction?

a) The forming of the H-Cl bond releases energy  
b) The forming of the H-Cl bond absorbs energy  
c) The breaking of the H-H bond releases energy  
d) The breaking of the Cl-Cl bond releases energy

34) When phosphorus and chlorine atoms combine to form a molecule of PCl\(_3\), 6 electrons will be

a) shared equally  
b) shared unequally  
c) lost  
d) gained
35) In the box below, draw a Lewis electron-dot structure for a molecule of hydrogen.
24) In the boxes below, draw a correct Lewis electron-dot structure for: (3 pts.)

1. an atom of hydrogen
2. an atom of oxygen
3. a molecule of water (H₂O)

(1) hydrogen
(2) oxygen
(3) water

25) H ---- Cl
     Bond A

25) Br ---- Br
     Bond B

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b) Draw the Lewis electron-dot diagrams for the two molecules above. Label any partial charges. (2 pts.)

26) Write the correct IUPAC chemical formula for the following compounds (1 pt. each)

1) barium chloride
2) iron (III) bromide
3) dihydrogen monoxide
4) magnesium nitrate
5) sodium bromide
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2) $\text{N}_2\text{S}_3$  
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a) Name two properties of metals that makes them useful in electrical wiring (2 pts.)

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b) Write the correct chemical formula for this compound (1 pt.)

c) What type of bond forms between magnesium and chlorine? [Give one reason to support your answer.] (2 pts.)

d) In the boxes below, draw the Lewis electron-dot structures for the elements Mg and Cl. (2 pts.)

magnesium

chlorine

32) Explain, in terms of electronegativity, why an H-F bond is expected to be more polar than an H-I bond. (2 pts.)
BONUS Questions - 1 pt. each

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(1) an atom of hydrogen
(2) an atom of oxygen
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![Lewis dot structures for hydrogen, oxygen, and water](image)

25) H ——— Cl

Br ——— Br

Bond A
Bond B

a) State one way in which bond A and bond B (above) are the same and one way in which they are different. (2 pts.)

Both covalent

H – Cl = polar bond
Br – Br = nonpolar bond

b) Draw the Lewis electron-dot diagrams for the two molecules above. Label any partial charges. (2 pts.)

![Lewis dot structure for HCl and Br₂](image)

c) Is HCl a polar or nonpolar molecule? [Explain why.] (2 pts.)

Polar, because H and Cl have different electronegativities

26) Write the correct IUPAC chemical formula for the following compounds (1 pt. each.)

1) barium chloride
   \[ \text{BaCl}_2 \]

2) iron (III) bromide
   \[ \text{FeBr}_3 \]

3) dihydrogen monoxide
   \[ \text{H}_2\text{O} \]

4) magnesium nitrate
   \[ \text{Mg(NO}_3\text{)}_2 \]

5) sodium bromide
   \[ \text{NaBr} \]
27) Write the correct IUPAC chemical names for the following compounds (1 pt. each)

1) \( \text{CF}_4 \)  
   Carbon tetrachloride

2) \( \text{Na}_2\text{S}_2 \)  
   Diniórogen tri sulfide

3) \( \text{MgO} \)  
   Magnesium oxide

4) \( \text{NaOH} \)  
   Sodium hydroxide

28) Metals like copper are often used in electrical wiring.

   a) Name two properties of metals that makes them useful in electrical wiring (2 pts.)
      
      * Malleable, ductile, good conductors
   

   b) Explain how metallic bonding between copper atoms can account for each of these properties (1 pt.)
      
      Conductor = sea of mobile valence e⁻
      Malleable/ductile = no rigid crystal structure

29) Describe the role of valence electrons in ______ (1 pt. each)

   1) an ionic bond
      
      Transferred from one atom to another

   2) a covalent bond
      
      Shared between atoms

   3) a metallic bond
      
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   Covalent
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a) Write the correct IUPAC name for this compound (1 pt.) \( \text{MgCl}_2 \)

b) Write the correct chemical formula for this compound (1 pt.) Magnesium chloride

c) What type of bond forms between magnesium and chlorine? [Give one reason to support your answer.] (2 pts.) Ionic b/c an electron transferred from Mg to Cl

d) In the boxes below, draw the Lewis electron-dot structures for the elements Mg and Cl. (2 pts.)

- Mg:
- Cl:

   magnesium           chlorine

32) Explain, in terms of electronegativity, why an H-F bond is expected to be more polar than an H-I bond. (2 pts.)

Greater electronegativity difference between H-F than between H-I
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