Chapter: Chemical Bonding

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

1. The charge on an ion is
   a. always positive.
   b. always negative.
   c. either positive or negative.
   d. zero.

2. According to the octet rule, a calcium atom has a tendency to
   a. lose one electron.
   b. lose two electrons.
   c. gain one electron.
   d. gain two electrons.

3. If a compound forms by ionic bonding, which is not true?
   a. A positively charged atom or group of atoms attracts a negatively charged atom or group of atoms.
   b. The net charge of the compound is zero.
   c. The compound contains just two atoms, each of opposite charge.
   d. Several ions group together in a tightly packed structure.

4. The only property listed that is not characteristic of ionic compounds is
   a. high melting point.
   b. hardness.
   c. lack of crystal structure.
   d. brittleness.

5. Which formula listed below represents a polyatomic ion?
   a. HCO$_3^-$
   b. H$_2$SO$_4$
   c. Cl$^-$
   d. Na$^+$

6. The crystal structure of an ionic compound depends on the
   a. sizes of the cations and anions.
   b. ratio of cations to anions.
   c. masses of the cation and anion.
   d. Both (a) and (b)
7. The melting points of ionic compounds are higher than the melting points of molecular compounds because
   a. ionic substances tend to vaporize at room temperature.
   b. ionic substances are brittle.
   c. attractive forces between ions are greater than the attractive forces between molecules.
   d. the numbers of positive and negative charges are equal in an ionic compound.

8. A covalent bond is formed when two atoms
   a. share an electron with each other.
   b. share one or more pairs of electrons with each other.
   c. gain electrons.
   d. gain and lose electrons.

9. The molecule described by the figure above has an average bond length of
   a. –70 kJ/mol.
   b. –347 kJ/mol.
   c. 154 pm.
   d. 290 pm.

10. The bond energy for the molecule described by the figure above is
    a. 70 kJ/mol.
    b. 347 kJ/mol.
    c. 154 pm.
    d. 290 pm.
11. Two atoms will likely form a polar covalent bond if the
electronegativity difference is
   a. 0.1.
   b. 1.0.
   c. 2.5.
   d. 4.0.

12. In which of these compounds is the bond between the atoms not a
    nonpolar covalent bond?
    a. Cl₂
    b. H₂
    c. HCl
    d. O₂

13. Bonding in molecules or ions that cannot be represented adequately by
    a single Lewis structure is represented by
    a. resonance structures.
    b. covalent bonding.
    c. overlapping orbitals.
    d. double bonding.

14. As the electronegativity difference between bonded atoms decreases,
    the bond becomes more
    a. covalent.
    b. ionic.
    c. metallic.
    d. Both (b) and (c)

15. The boiling point of water, H₂O, is higher than the boiling point of
    hydrogen sulfide, H₂S, because water molecules are
    a. less polar and form hydrogen bonds.
    b. more covalent and form hydrogen bonds.
    c. ionic and form hydrogen bonds.
    d. more polar and form hydrogen bonds.

16. Even though the following molecules contain polar bonds, the only
    polar molecule is
    a. CCl₄.
    b. CO₂.
    c. NH₃.
    d. CH₄.
17. As atoms bond with each other, they
   a. increase their potential energy, thus creating less stable arrangements of matter.
   b. decrease their potential energy, thus creating less stable arrangements of matter.
   c. increase their potential energy, thus creating more stable arrangements of matter.
   d. decrease their potential energy, thus creating more stable arrangements of matter.

18. In which of the following compounds has the central atom *not* formed \( sp^3 \) hybrid orbitals?
   a. CCl\(_4\)
   b. CO\(_2\)
   c. PCl\(_3\)
   d. NH\(_3\)

19. When a carbon atom’s 2s and 2p orbitals hybridize, which orbitals do they form?
   a. four \( sp^3 \)
   b. two \( sp^3 \)
   c. four \( sp \)
   d. two \( sp \)

20. Which is the correct Lewis structure for SiF\(_4\)?
   a. \( \text{F} = \text{Si} - \text{F} \)
   b. \( \text{F} = \text{F} - \text{Si} \)
   c. \( \text{F} - \text{Si} - \text{F} \)
   d. \( \text{F} = \text{F} = \text{F} - \text{Si} \)

21. Which is the correct Lewis structure for C\(_2\)H\(_4\)?
   a. \( \text{C} - \text{C} - \text{H} \)
   b. \( \text{H} - \text{H} - \text{H} \)
   c. \( \text{C} - \text{C} = \text{H} \)
   d. \( \text{C} = \text{H} = \text{C} \)
22. Which type of hybrid orbitals do oxygen atoms form in water molecules?
   a. sp\(^4\)
   b. sp\(^3\)
   c. sp\(^2\)
   d. sp

23. Which type of bonding is characterized by overlapping orbitals that allow outer electrons of atoms to move about freely throughout the entire lattice?
   a. ionic
   b. covalent
   c. metallic
   d. multiple

24. According to VSEPR theory, what is the shape of a molecule of CS\(_2\)?
   a. linear
   b. bent
   c. trigonal-planar
   d. tetrahedral

25. According to VSEPR theory, what is the shape of a molecule of NBr\(_3\)?
   a. bent
   b. trigonal-planar
   c. tetrahedral
   d. trigonal-pyramidal