Basics of General Organic and Biological Chemistry 2nd edition Bal Test Bank

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Chapter 2
Ionic Bonding and Simple Ionic Compounds

True/False

1. Atoms are especially stable if they have eight electrons in their outermost shell.
   True; Easy

2. CCl_4 is an example of an ionic compound.
   False; Easy

3. Chlorine would react with oxygen rather than sodium.
   False; Easy

4. The charge on a barium ion is 1^+.
   False; Easy

5. Metal ions are more likely to be cations.
   True; Easy

6. All nonmetal ions are anionic.
   False; Easy

7. Lewis diagrams depict all the electrons in an atom.
   False; Easy

8. The atoms belonging to the same row in the periodic table will for ions with the same charge.
   False; Moderate

9. NH_4^+ is an example of a nonmetallic cation.
   True; Easy

10. If two atoms X and Y form ions with the same charge, they probably belong to the same group in the periodic table.
    True; Moderate

11. The charge of the iron ion in $FeCl_2$ is 2+.
    True; Moderate

12. $CuSO_4$ is called copper(III) sulfate according to the stock system.
    False; Moderate

13. $PbNO_3$ has a polyatomic anion.
    True; Easy

14. The formula mass of hydrogen sulfide is 18.
    False; Moderate

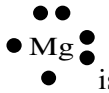
15. All elements including hydrogen and helium follow the octet rule of shell filling.
    False; Easy

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16. The formula unit for calcium chloride is CaCl.
False; Moderate

17. Boron and carbon belong to the same group in the periodic table and their ions have a charge of 3^-.
False; Moderate

18. Chlorine requires a single electron to satisfy the octet rule.
True; Moderate

19.  is the Lewis diagram for magnesium.
False; Moderate

20. Potassium dichromate has a polyatomic cation.
False; Moderate

Multiple Choice Questions

21. Which of the following rules states that an atom with eight electrons in its outermost shell is stable?
    a. Outermost shell rule
    b. The *d* subshell rule
    c. The valence electron rule
    d. Dalton's rule
    e. The octet rule
    e; Easy

22. The bond formed between two atoms after there is a transfer of electrons between them is called a(n) _____.
    a. covalent bond
    b. atomic bond
    c. hydrogen bond
    d. ionic bond
    e. elemental bond
    d; Easy

23. The group of elements that have eight electrons in their outer shell are called _____.
    a. ionic elements
    b. covalent gases
    c. neutron gases
    d. electronegative elements
    e. noble gases
    e; Easy

24. Which of the following electronic configurations is most likely to form an ionic bond?
    a. $1s^2$
    b. $1s^2 2s^2$

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c. $1s^2 2s^2 2p^1$
d. $1s^2 2s^2 2p^3$
e. $1s^2 2s^2 2p^6$
c; Moderate

25. Sodium, $1s^2 2s^2 2p^6 3s^1$, will mostly bond with _____.
a. sodium
b. chlorine
c. argon
d. zinc
e. tin
b; Moderate

26. The electronic configuration of magnesium is $1s^2 2s^2 2p^6 3s^2$. It will _____ while bonding.
a. lose an electron
b. gain an electron
c. lose two electrons
d. gain two electrons
e. gain six electrons
c; Easy

27. How is a sodium ion represented?
a. Na^{2-}
b. Na^{2+}
c. Na^{2+}
d. Na^{-}
e. Na^{+}
e; Moderate

28. What is the charge on an oxide ion?
a. 1–
b. 1+
c. 2–
d. 2+
e. 0
c; Easy

29. What is the charge on a molecule of NaCl?
a. 1+
b. 1–
c. 0
d. 2+
e. 2–
c; Easy

30. What is the name of the substance with a chemical formula 'NaCl?'
a. Sodium chlorine
b. Sodide chlorine
c. Sodium chloride
d. Sodide chloride
e. Sodium chlorate

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c; Easy

31. Why do atoms of the same group form ions of the same charge?
    a. They have the same number of neutrons
    b. They have the same number of protons
    c. They have the same number of electrons
    d. They have the same number of valence electrons
    e. They have the same number of valence neutrons
    d; Moderate

32. The group headed by nitrogen has _____ valence electrons.
    a. one
    b. two
    c. three
    d. four
    e. five
    e; Moderate

33. What is the Lewis diagram for gallium?
    a. 

    b. 

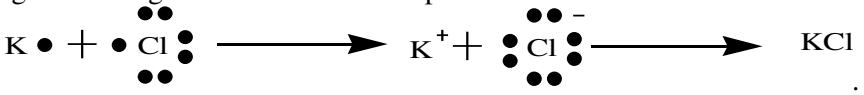
    c. 

    d. 

    e. 

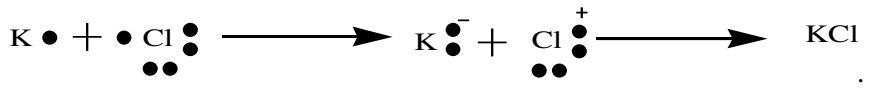
    a; Easy

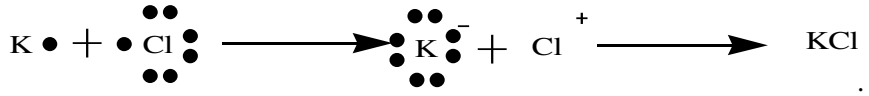
34. What is the formula for magnesium chloride?
    a. Mg_2Cl_3
    b. $MgCl_3$
    c. $MgCl_2$
    d. Mg_2Cl
    e. Mg_2Cl_2
    c; Easy

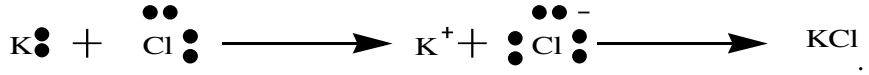
35. Using Lewis diagrams the formation of potassium iodide is shown as:
    a. 

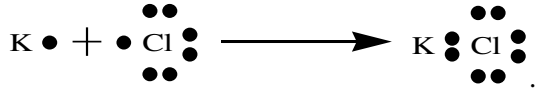
    .

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b. 

c. 

d. 

e. 

a; Moderate

36. What is the charge on a strontium ion?
    a. +1
    b. –1
    c. +2
    d. –2
    e. 0
    c; Moderate

37. What is the charge on hydrogen sulfide (H_2S)?
    a. +1
    b. –1
    c. +2
    d. –2
    e. 0
    e; Moderate

38. What is the chemical formula of potassium chloride?
    a. K_2Cl
    b. K_2Cl_2
    c. Cl_2K
    d. ClK_2
    e. KCl
    e; Moderate

39. The formula for sodium sulfate is _____.
    a. $NaNaSO_4$
    b. SO_4NaNa
    c. $NaSO_4$
    d. SO_4Na_2
    e. Na_2SO_4
    e; Easy

40. What is the chemical formula of barium chloride?
    a. BaCl
    b. Ba_2Cl

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c. $BaCl_3$
d. Ba_2Cl_3
e. $BaCl_2$
e; Moderate

41. What is the formula for aluminum fluoride?
a. FAl_3
b. Al_3F
c. F_3Al
d. Al_2F_6
e. AlF_3
e; Easy

42. Which of the following is a polyatomic ion?
a. hydrogen sulfide
b. carbon dioxide
c. chloride
d. hydrogen dioxide
e. ammonium
e; Moderate

43. What is the polyatomic ion in H_2SO_4?
a. H_2S^{2-}
b. H_2^{2-}
c. SO_4^{2-}
d. SO^{2-}
e. O_4^{2-}
c; Easy

44. What is the formula for calcium hydroxide?
a. CaOH
b. Ca_2OH
c. $(Ca)_2OH$
d. $CaOH_3$
e. $Ca(OH)_2$
e; Moderate

45. What is the charge of a bicarbonate ion?
a. 1–
b. 2–
c. 3–
d. 4–
e. 0
a; Moderate

46. Which of the following is an ionic compound?
a. CCl_4
b. PCl_5
c. CO_2
d. H_2SO_4
e. $Si(CH_3)_4$

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d; Easy

47. Write the compound formed by oxygen and aluminum ions.
    a. Al_2O_3
    b. Al_3O_2
    c. AlO_2
    d. AlO
    e. $(AlO)_2$
    a; Moderate

48. In the common system of naming cations, the name of the Sn^{4+} ion is called _____.
    a. tin (+4)
    b. stannic ion
    c. tin (IV))
    d. plumbic ion
    e. stannouos ion
    b; Moderate

49. FeS is known as _____.
    a. ferrous sulfide
    b. iron sulphide
    c. ferrate sulphur
    d. ferric sulphide
    e. iron sulphate
    a; Moderate

50. PO_4^{3-} is known as the _____ ion.
    a. phosphate
    b. potassium
    c. pentoxide
    d. phosphide
    e. phosphorous
    a; Moderate

51. The formula for the sulfide ion is _____.
    a. SO_4^{2-}
    b. SO_3^{3-}
    c. SO_2^{4-}
    d. SO^{5-}
    e. S^{2-}
    e; Easy

52. The formula for the bromide ion is _____.
    a. B^+
    b. Bo^+
    c. Be^{2-}
    d. Br^-
    e. Ba^{2+}
    d; Easy

53. What is $MgCl_2$known as?

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a. Manganous chlorine
b. Mono magnesium chlorinide
c. Dichlorine magnesium
d. Chloromagnesium
e. Magnesium chloride
e; Moderate

54. What is the formula mass for potassium iodide?
a. 126.90 u
b. 39.098 u
c. 15.6 u
d. 166.00 u
e. 4961.54 u
d; Moderate

55. What is the formula mass for calcium carbonate?
a. 100.0869 u
b. 40.078
c. 68.0881
d. 48.663
e. 124.772
a; Moderate

Essay

56. Explain the octet rule and discuss the inertness of noble gases.
The octet rule is the concept that atoms tend to have eight electrons in their valence electron shell. Helium, neon, argon, krypton, xenon, and radon do not form compounds very easily, which suggests that they are especially stable as lone atoms. Except for helium, they all have eight valence electrons. Chemists have concluded that atoms are especially stable if they have eight electrons in their outermost shell. This useful rule of thumb is called the octet rule.
Easy

57. Explain the formation of an ionic bond.
One way for atoms to obtain an octet is the transfer of electrons. There is the transfer of electrons between two atoms until all atoms have octets. Because some atoms will lose electrons and some atoms will gain electrons, there is no overall change in the number of electrons, but individual atoms acquire a nonzero electric charge. Those that lose electrons become positively charged, and those that gain electrons become negatively charged. Charged atoms are called ions. Because opposite charges attract (while like charges repel), these oppositely charged ions attract each other, forming ionic bonds.
Easy

58. Explain how the periodic table helps predict the charge on ions.
In many cases, elements that belong to the same group (column) on the periodic table form ions with the same charge because they have the same number of valence electrons. Thus, the periodic table becomes a tool for remembering the charges on many ions. For example, all ions made from alkali metals, the first column on the periodic table, have a 1+ charge. Ions made from alkaline earth metals, the second group on the periodic table,

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have a 2+ charge. On the other side of the periodic table, the next-to-last column, the halogens, form ions having a 1− charge.
Easy

59. Explain the advantage of Lewis diagrams over electron shell diagrams.
Lewis diagrams have two advantages over the electron shell diagrams. First, they show only valence electrons. Second, instead of having a circle around the chemical symbol to represent the electron shell, they have up to eight dots around the symbol; each dot represents a valence electron. These dots are arranged to the right and left and above and below the symbol, with no more than two dots on a side.
Easy

60. Explain the conventions followed for the formula of an ionic compound.
The formula for an ionic compound follows several conventions. First, the cation is written before the anion. Because most metals form cations and most nonmetals form anions, formulas typically list the metal first and then the nonmetal. Second, charges are not written in a formula. Remember that in an ionic compound, the component species are ions, not neutral atoms, even though the formula does not contain charges. Finally, the proper formula for an ionic compound always obeys the following rule: the total positive charge must equal the total negative charge.
Easy

61. What are polyatomic ions? Explain with an example.
Some ions consist of groups of atoms bonded together and have an overall electric charge. Because these ions contain more than one atom, they are called polyatomic ions. Polyatomic ions have characteristic formulas, names, and charges that should be memorized. For example, NO_3^- is the nitrate ion; it has one nitrogen atom and three oxygen atoms and an overall 1− charge.
Moderate

62. Explain how ionic bonds are formed.
Ionic bonds are formed when one atom loses electrons, becoming positive, from losing the negatively charged electrons. The atom that acquires electrons becomes negative for the same reason. The resultant positive/negative charges, causes the atoms to be drawn to each other, forming the bond.
Moderate

63. Explain the Stock system of naming ions.
In the Stock system an ion's positive charge is indicated by a Roman numeral in parentheses after the element name, followed by the word ion. Thus, Fe^{2+} is called the iron(II) ion, while Fe^{3+} is called the iron(III) ion. This system is used only for elements that form more than one common positive ion.
Moderate

64. Explain the common system of naming ions.
The second system, called the common system, is not conventional but still prevalent and used in the health sciences. This system recognizes that many metals have two common cations. The common system uses two suffixes (-ic and -ous) that are appended to the stem of the element name. The -ic suffix represents the greater of the two cation charges, and the -ous suffix represents the lower one. In many cases, the stem of the element name comes from the Latin name of the element.

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Moderate

65. Explain the calculation of formula mass of a compound.
The formula mass is obtained by adding the masses of each individual atom in the formula of the compound. Because a proper formula is electrically neutral (with no net electrons gained or lost), the ions can be considered atoms for the purpose of calculating the formula mass.
Moderate

Fill in the Blanks

66. The _____ rule says that stable atoms tend to have eight electrons in their outermost, or valence, shell.
octet; Easy

67. Positively charged ions are called _____.
cations; Easy

68. The two types of chemical bonds are ionic bonds and _____ bonds.
covalent; Easy

69. _____ are simple diagrams to show an atom's valence electrons and how they transfer.
Lewis diagrams; Easy

70. _____ are three dimensional, regular arrays of alternating positive and negative ions.
Crystals; Easy

71. In ionic compounds, the rule for the formula has the anion written _____ cation
after; Easy

72. Ions that contain more than one atom are called _____.
polyatomic ions; Easy

73. In the common system, the -ic suffix represents the _____ of the two cation charges.
greater; Moderate

74. The formula for cuprous sulfate is _____.
Cu_2SO_4; Easy

75. The formula mass for NaCl is _____.
58.44u; Easy

76. One atomic mass unit is equal to _____ the mass of a single carbon atom.
$\frac{1}{12}$; Easy

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