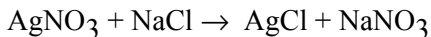


- ___ 9. Liquid nitrogen is used by physicians to burn moles off of skin. Liquid nitrogen boils at boils at 77 K. What is its boiling point in °C ?
- a. 350°C b. -350°C c. -196°C d. -56°C
- ___ 10. Atoms consist principally of what three fundamental particles?
- a. electrons, protons, and molecules c. elements, positrons, and neutrons
b. electrons, protons, and neutrons d. elements, protons, and neutrons
- ___ 11. What is the correct classification for NH_4^+ ?
- a. monatomic cation c. monatomic anion
b. polyatomic cation d. polyatomic anion
- ___ 12. Calculate the number of moles of oxygen atoms in 32.0 grams of oxygen gas (O_2).
- a. 2.00 moles b. 2.42 moles c. 0.50 moles d. 3.57 moles
- ___ 13. Glucose has a molecular weight of 180.2 g and an empirical formula CH_2O . What is its molecular formula?
- a. $\text{C}_8\text{H}_4\text{O}_5$ b. $\text{C}_6\text{H}_{12}\text{O}_6$ c. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ d. $\text{C}_{10}\text{H}_{12}\text{O}_3$
- ___ 14. What mass of iron is contained in 86.6 grams of FeSO_4 ?
- a. 31.8 g b. 19.2 g c. 47.3 g d. 80.6 g
- ___ 15. Balancing a chemical equation so that it obeys the law of conservation of matter requires:
- a. Adjusting the coefficients in front of the formulas so there are the same number and type of atom on both sides of the equation.
b. Making sure the reactants and products are in the same phase.
c. Keeping the total charge the same on both sides of the equation.
d. Changing the formulas of the products and reactants.
- ___ 16. How many moles of O_2 are required to react with 5.2 moles of methanol, CH_3OH ?
- $$2\text{CH}_3\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 4\text{H}_2\text{O}$$
- a. 3.5 b. 7.8 c. 1.8 d. 4.0
- ___ 17. How many liters of O_2 at STP would be needed to react with 4.8 grams of CH_4 ?
- $$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$$
- a. 0.15 b. 0.60 c. 6.6 d. 13.4
- ___ 18. What is the molarity of 2850. mL of a solution containing 46.2 grams of NaBr ?
- a. 0.695 M b. 0.306 M c. 0.516 M d. 0.157 M
- ___ 19. What volume of 0.2500 M KOH solution contains 16.31 grams of KOH ?

- a. 872 mL b. 8.72 mL c. 1165 mL d. 165 mL

_____ 20. Silver nitrate, AgNO_3 , reacts with NaCl as indicated by the following equation. What mass of NaCl would be required to react with 400. mL of 0.200 M AgNO_3 solution?



- a. 0.117 g b. 1.17 g c. 4.68 g d. 2.34 g

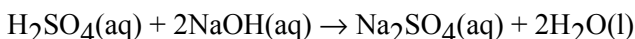
_____ 21. Which one of the following is an alkaline earth metal?

- a. potassium, K c. iron, Fe
b. magnesium, Mg d. tin, Sn

_____ 22. Which of the following is a halogen?

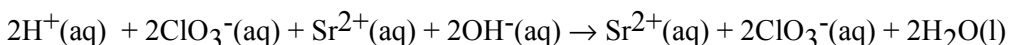
- a. argon, Ar c. bromine, Br
b. copper, Cu d. calcium, Ca

_____ 23. What is the **total ionic** equation for the following molecular equation?



- a. $[\text{2H}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})] + [\text{2Na}^+(\text{aq}) + \text{2OH}^-(\text{aq})] \rightarrow [\text{2Na}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})] + [\text{4H}^+(\text{l}) + \text{2O}^{2-}(\text{l})]$
b. $[\text{2H}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})] + [\text{2Na}^+(\text{aq}) + \text{2OH}^-(\text{aq})] \rightarrow [\text{2Na}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})] + \text{2H}_2\text{O}(\text{l})$
c. $\text{H}_2\text{SO}_4(\text{aq}) + [\text{2Na}^+(\text{aq}) + \text{2OH}^-(\text{aq})] \rightarrow [\text{2Na}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})] + \text{2H}_2\text{O}(\text{l})$
d. $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow [\text{2Na}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})] + \text{2H}_2\text{O}(\text{l})$

_____ 24. What is (are) the spectator ion(s) in the following reaction?

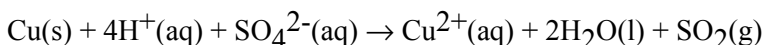


- a. H^+ , OH^- c. Sr^{2+} , ClO_3^-
b. H^+ d. Sr^{2+} , OH^-

_____ 25. Which of the following statements best describes an oxidizing agent?

- a. A substance that is reduced and causes oxidation of another substance.
b. A substance that increases the number of oxygen atoms bonded.
c. A substance that is oxidized and causes reduction of another substance.
d. A substance that reacts with oxygen.

_____ 26. What compound or ion is the reducing agent in the following reaction?



- a. Cu b. H⁺ c. SO₄²⁻ d. Cu²⁺

____ 27. Which one of the following equations accurately represents the **dissociation** of Mg(NO₃)₂?

- a. Mg(NO₃)₂(aq) + 3H₂O(l) → Mg(OH)₂(aq) + 2HNO₃(aq)
 b. Mg(NO₃)₂(aq) → Mg²⁺(aq) + 2N(aq) + O₃⁻(aq) +
 c. Mg(NO₃)₂(aq) → Mg²⁺(aq) + 2NO₃⁻(aq)
 d. 2NO₃⁻(aq) + Mg²⁺(aq) → Mg(NO₃)₂(aq)

____ 28. Of the following, which one is the precipitation reaction?

- a. AgNO₃(aq) + NaBr(aq) → AgBr(s) + NaNO₃(aq)
 b. N₂O₅(s) + H₂O(l) → 2HNO₃(aq)
 c. S(s) + O₂(g) → SO₂(g)
 d. H₂O(g) + CO(g) → H₂(g) + CO₂(g)

____ 29. Which of the following is true?

- a. As energy of a photon increases, both the frequency and wavelength increase.
 b. As energy of a photon increases, both the frequency and wavelength decrease.
 c. As energy of a photon increases, the frequency increases and wavelength decreases.
 d. There is no correlation between the energy, frequency and wavelength of photons.

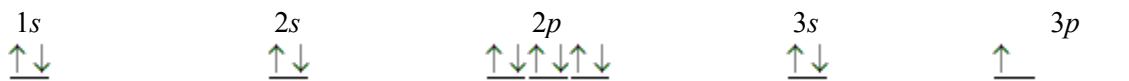
____ 30. Which quantum number is often designated by the letters *s*, *p*, *d* and *f*?

- a. Principle quantum number, *n* c. Magnetic quantum number, *m_l*
 b. Angular momentum quantum number, *l* d. Spin quantum number, *m_s*

____ 31. The electron configuration 1s²2s²2p⁶3s²3p⁶ represents the element _____.

- a. He b. Kr c. Ar d. Ne

____ 32. Which element has the following orbital diagram?



- a. Na b. Mg c. P d. Al

____ 33. The number of electrons present in the *s* orbitals in the outermost electron shell of the alkaline earth (Group IIA) metals is _____.

- a. one b. two c. three d. four

____ 34. _____ is a d-transition metal.

- a. Cr b. Ga c. Al d. Sb

- _____ 35. Which element has the **largest** atomic radius? (*Refer to the Periodic Table for a clue.*)
a. Rb b. K c. Na d. Li
- _____ 36. The minimum energy required to remove the outermost electron from an element is
a. first ionization energy. c. potential energy
b. orbital energy d. kinetic energy
- _____ 37. Which element has the **largest** atomic radius? (*Refer to the Periodic Table for a clue.*)
a. Na b. Mg c. Si d. S
- _____ 38. Which one of the following species has the same number of electrons (isoelectronic) as Na^+ ?
a. Ca^{2+} b. K^+ c. S^{2-} d. F^-
- _____ 39. An atom of which element below has the most unpaired electrons?
a. Na b. Ca c. P d. F
- _____ 40. A chemical bond formed by two atoms sharing one or more pairs of electrons is called a (or an) _____
bond.
a. ionic b. covalent c. coordinated d. resonance
- _____ 41. Which molecule has the **most** polar bond (shares the electrons least equally)? *Be sure to consult the Periodic Table with electronegativity values.*
a. IBr b. HCl c. N_2 d. HBr
- _____ 42. The hydrogen (H) atom can achieve a complete outer shell by
a. gaining one electron to form H^+ .
b. losing one electron to form H^- .
c. sharing a bonding pair of electrons with another atom.
d. all of the above.
- _____ 43. Which one of the following molecules has a net dipole moment?
a. Cl_2 b. H_2 c. I_2 d. BrCl
- _____ 44. In which of the following molecules are the bonding electrons shared **most** equally in the bonds between the atoms? *Be sure to consult the Periodic Table with electronegativity values.*
a. NH_3 b. IBr c. IF d. NaF
- _____ 45. The *valence electrons* are in
a. the highest main energy level occupied by electrons.
b. the set of orbitals used to make triple bonds.
c. the orbitals belonging to the entire molecule.
d. the lowest energy level occupied by electrons.
- _____ 46. A covalent bond is formed when two atoms
a. share one or more bonding electron pairs.

- b. share no bonding electron pairs
- c. have no non-bonding electron pairs.
- d. are dissociated in aqueous solutions.

- ___ 47. The central atom in a molecule is bonded to 3 other atoms and has 2 lone pairs. What type of hybrid orbitals are formed by the central atom?
- a. sp
 - b. sp^2
 - c. sp^3
 - d. sp^3d
- ___ 48. The central atom in a molecule is sharing a total of 12 electrons (6 electron pairs). What type of hybrid orbitals are formed by the central atom?
- a. sp^2
 - b. sp^3
 - c. sp^3d
 - d. sp^3d^2
- ___ 49. Electronegativity is the measure
- a. of how effectively an element attracts electrons to itself when bonded to another element.
 - b. of how easily an element gives up an electron.
 - c. of how quickly an element dissociates from another element.
 - d. of how isoelectronic an element is.
- ___ 50. What kind of hybrid orbitals are utilized by the carbon atom in CCl_4 molecules?
- a. sp
 - b. sp^2
 - c. sp^3
 - d. sp^3d
- ___ 51. According to VSEPR theory, how many **total** electron groups are there around the oxygen (O) atom in H_2O ?
- a. 1
 - b. 2
 - c. 3
 - d. 4
- ___ 52. The net dipole moment for a molecule is equal to
- a. the strongest dipole of all the bonds in the molecule.
 - b. the net sum of all the dipoles of all the bonds in the molecule.
 - c. the largest electronegativity value of all the atoms in the molecule.
 - d. the net sum of all the electronegativity values for all the atoms in the molecule.
- ___ 53. The aluminum (Al) atom in $AlCl_3$ has three pair of bonding electrons and no non-bonding electron pairs. What is its molecular geometry?
- a. trigonal pyramid
 - b. trigonal planar
 - c. tetrahedral
 - d. square-based pyramid
- ___ 54. According to Boyle's Law, if the volume of a sample of Cl_2 gas is tripled while the temperature is held constant, what happens to the pressure?
- a. It remains constant.
 - b. It decreases by 1/3.
 - c. It triples.
 - d. It increases nine-fold.
- ___ 55. According to Charles' Law, if the volume of a sample of Cl_2 gas is tripled while pressure is held constant, what happens to the absolute temperature?
- a. It remains constant.
 - b. It decreases by 1/3.
 - c. It triples.
 - d. It increases nine-fold.
- ___ 56. By international agreement the standard temperature and pressure (STP) for gases is

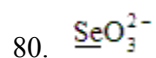
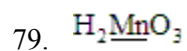
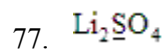
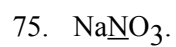
- c. Al_2S_3
- d. $\text{Fe}_2(\text{SO}_4)_3$
- e. Mg_2CO_3

- h. Cu_3PO_4
- i. AgSO_3
- j. KOH

- ___ 65. sodium oxide
- ___ 66. aluminum sulfide
- ___ 67. calcium nitrate
- ___ 68. copper(I) phosphate
- ___ 69. zinc(II) chloride
- ___ 70. magnesium carbonate
- ___ 71. ammonium bromide
- ___ 72. iron(III) sulfate
- ___ 73. potassium hydroxide
- ___ 74. silver sulfite

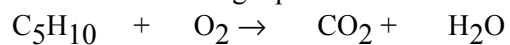
Short Answer

Give the oxidation number of each element which is underlined.

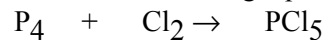


Problem

81. Balance the following equation.



82. Balance the following equation.



83. What is the percent by mass of sulfur in $\text{Al}_2(\text{SO}_4)_3$?

84. What is the electron configuration of chlorine, Cl?

85. Draw the energy diagram and orbital diagram for silicon, Si.

State the number of valence electrons for each of the following.

86. Carbon (C)

87. Magnesium (Mg)

88. Phosphorus (P)

89. Fluorine (F)

90. Hydrogen (H)

Draw the Lewis Structures for each of the following.

91. CCl_4

92. NH_3

93. NH_4^+

94. H_2O

Chemistry Final Exam Review Questions

Answer Section

MULTIPLE CHOICE

1. ANS: B TOP: States of Matter
2. ANS: D TOP: Chemical and Physical Properties
3. ANS: B TOP: Chemical and Physical Properties
4. ANS: A TOP: Use of Numbers
5. ANS: B TOP: Use of Numbers
6. ANS: A TOP: Use of Numbers
7. ANS: D TOP: The Unit Factor Method (Dimensional Analysis)
8. ANS: C TOP: Density and Specific Gravity
9. ANS: C TOP: Heat and Temperature
10. ANS: B TOP: Atoms and Molecules
11. ANS: B TOP: Ions and Ionic Compounds
12. ANS: A TOP: The Mole
13. ANS: B TOP: Determination of Molecular Formulas
14. ANS: A TOP: Some Other Interpretations of Chemical Formulas
15. ANS: A TOP: Chemical Equations
16. ANS: B TOP: Calculations Based on Chemical Equations
17. ANS: D TOP: Calculations Based on Chemical Equations
18. ANS: D TOP: Concentrations of Solutions
19. ANS: C TOP: Concentrations of Solutions
20. ANS: C TOP: Using Solutions in Chemical Reactions
21. ANS: B TOP: The Periodic Table: Metals, Nonmetals, and Metalloids
22. ANS: C TOP: The Periodic Table: Metals, Nonmetals, and Metalloids
23. ANS: B TOP: Reactions in Aqueous Solutions
24. ANS: C TOP: Reactions in Aqueous Solutions
25. ANS: A TOP: Oxidation-Reduction Reactions-An Introduction
26. ANS: A TOP: Oxidation-Reduction Reactions-An Introduction
27. ANS: C TOP: Metathesis (Acid-Base) Reactions
28. ANS: A TOP: Metathesis (Acid-Base) Reactions
29. ANS: C TOP: Electromagnetic Radiation
30. ANS: B TOP: Quantum Numbers
31. ANS: C TOP: Electron Configurations
32. ANS: D TOP: Electron Configurations
33. ANS: B TOP: The Periodic Table and Electron Configurations
34. ANS: A TOP: More About the Periodic Table
35. ANS: A TOP: Atomic Radii
36. ANS: A TOP: Ionization Energy
37. ANS: A TOP: Ionization Energy
38. ANS: D TOP: Ionic Radii
39. ANS: C TOP: Lewis Dot Formulas of Atoms
40. ANS: B TOP: Formation of Covalent Bonds
41. ANS: B TOP: Polar and Nonpolar Covalent Bonds

42. ANS: D TOP: Dipole Moments
43. ANS: D TOP: Dipole Moments
44. ANS: B TOP: The Continuous Range of Bonding Types
45. ANS: A TOP: Valence Shell Electron Pair Repulsion (VSEPR) Theory
46. ANS: A TOP: Polar Molecules: The Influence of Molecular Geometry
47. ANS: D TOP: Valence Bond (VB) Theory
48. ANS: D TOP: Valence Bond (VB) Theory
49. ANS: A TOP: Linear Electronic Geometry
50. ANS: C TOP: Tetrahedral Electronic Geometry (AB₄)
51. ANS: D TOP: Tetrahedral Electronic Geometry (AB₄)
52. ANS: B TOP: Trigonal Bipyramidal Electronic Geometry
53. ANS: B TOP: Octahedral Electronic Geometry
54. ANS: B TOP: Charles's Law; the Absolute Temperature Scale
55. ANS: C TOP: Charles's Law; the Absolute Temperature Scale
56. ANS: B TOP: Standard Temperature and Pressure
57. ANS: D
58. ANS: A
59. ANS: A
60. ANS: C TOP: Valence Shell Electron Pair Repulsion (VSEPR) Theory
61. ANS: A TOP: Valence Shell Electron Pair Repulsion (VSEPR) Theory
62. ANS: C
63. ANS: B
64. ANS: B

MATCHING

65. ANS: F
66. ANS: C
67. ANS: B
68. ANS: H
69. ANS: A
70. ANS: E
71. ANS: G
72. ANS: D
73. ANS: J
74. ANS: I

SHORT ANSWER

75. ANS:
+5
76. ANS:
-3
77. ANS:
+6
78. ANS:

- +2
79. ANS:
+4
80. ANS:
+4

PROBLEM

81. ANS:
 $2\text{C}_5\text{H}_{10} + 15\text{O}_2 \rightarrow 10\text{CO}_2 + 10\text{H}_2\text{O}$
82. ANS:
 $\text{P}_4 + 10\text{Cl}_2 \rightarrow 4\text{PCl}_5$
83. ANS:
28.1%
84. ANS:
 $1s^2 2s^2 2p^6 3s^2 3p^5$
85. ANS:
blah blah blah
86. ANS:
4
87. ANS:
2
88. ANS:
5
89. ANS:
7
90. ANS:
1
91. ANS:
ddd
92. ANS:
ddd
93. ANS:
ddd
94. ANS:
ddd