

**GENERAL CHEMISTRY I**

**CHEM 1411**

**FINAL EXAM**

1. A sample that cannot be separated into two or more substances by physical means is
2. a heterogeneous mixture
3. a compound
4. either a compound or an element
5. an element
6. The enthalpy of combustion of benzoic acid is -26.4 kJ/g. What is the enthalpy of combustion expressed in joules per kilogram?
7. -2.64 x 103 J/kg
8. -2.64 x 104 J/kg
9. -2.64 x 109 J/kg
10. -2.64 x 107 J/kg
11. Write the result of the following calculation in scientific notation: 0.0263 cm2 ÷ 88.2 cm
12. 2.98 x 105 cm
13. 2.98 x 104 cm
14. 2.98 x 10-3 cm
15. 2.98 x 10-4 cm
16. The oxidation number of barium in BaO is
17. +1
18. +4
19. -1/2
20. +2
21. How many moles of a gas are in a gas sample occupying 0.738 L at 135 mmHg and 30oC?
22. 190 mol
23. 4.01 mol
24. 40.5 mol
25. 0.00527 mol
26. The nucleus of a 208Pb nuclide contains
27. 208 neutrons and 290 electrons
28. 82 protons and 208 neutrons
29. 208 protons and 126 electrons
30. 82 protons and 126 neutrons
31. Which of the following properties, in general, increases from left to right across a period in the periodic table?
32. ionic charge
33. atomic radius
34. density
35. ionization potential
36. Identify the molecule/ion that has central atom with SP3 hybridization
37. H2O
38. SO3
39. CH2=CH2
40. NH4+
41. A bond in which an electron pair is unequally shared by two atoms is
42. polar covalent
43. coordinate covalent
44. ionic
45. nonpolar covalent
46. Which of the following electron configuration is impossible, according to the Pauli exclusion principle?
47. 1s22s22p6
48. 1s22s22p3
49. 1s22s3
50. 1s22s22p63s1
51. How many atoms of carbon atoms are there in 0.51 mole of procaine, C13H20N2O2, a “pain killer” used by dentists?
52. 6.6 x 1023
53. 4.3 x 1024
54. 4.0 x 1024
55. 6.1 x 1023
56. What is the mass in grams of 0.699 mol of glucose, C6H12O6
57. 0.00388 g
58. 67.1 g
59. 126 g
60. 21.0 g
61. Calculate the number of moles of bromine present in 14.5 mL of Br2(l), whose density is 3.12 g/mL.
62. 3.53 mol
63. 0.181 mol
64. 0.566 mol
65. 0.283 mol
66. An ore sample is found to contain 24.1 g of mercury and 50.7 g of waste rock (gaugue). What is the percent by mass of mercury in the ore?
67. 32.2 %
68. 47.4 %
69. 0.322 %
70. 0.474 %
71. 2KHCO3(s) → K2CO3(s) + CO2(g) + H2O(l)

Based on the above equation, how many moles of potassium carbonate will be produced if 454 g of potassium hydrogen carbonate are heated?

1. 2.27 mol
2. 3.29 mol
3. 11.4 mol
4. 227 mol
5. What hybrid orbitals of sulfur are involved in the bonding in sulfur trioxide?
6. sp2
7. sp2d
8. sp3
9. sp3d2
10. Which of the following statements is true concerning the two nuclides 3He and 4He?
11. they have the same number of neutrons
12. they are isotopes
13. they have the same relative atomic mass.
14. they have the same mass number.
15. If q = -101 KJ for a certain process, that process
16. requires a catalyst
17. is exothermic
18. occurs rapidly
19. is endothermic
20. Which of the following molecules is polar?
21. SF6
22. CCl4
23. BF3
24. NO2
25. Which of the following is an exothermic process?
26. work is done by the system on the surroundings
27. heat energy flows from the system to the surroundings
28. work is done on the system by the surroundings
29. heat energy is absorbed or released by the system
30. Which of the following aqueous solutions would be expected to be the best conductor of electricity?
31. 0.10 *M* CH3COOH
32. 0.10 *M* HCl
33. 0.10 *M* Na2SO4
34. 0.10 *M* NaCl
35. The melting point of nitrogen is 63 K. What is the temperature in degrees Celsius?
36. 63oC
37. -336oC
38. -63oC
39. -210oC
40. Which molecule or ion has a trigonal pyramidal molecular geometry?
41. BF3
42. C2H4
43. SO3
44. SO32-
45. Sodium and potassium have similar chemical and physical properties. This is best explained by the fact that both elements
46. have the same ground-state valence-electron configuration.
47. have low relative atomic masses
48. are in period 1 of the periodic table.
49. have relatively low first ionization energies.
50. Calculate the mass of gold that occupies the same volume as 62.9 g of cobalt. The density of cobalt is 8.90 g/mL and the density of gold is 19.30 g/mL
51. 2.73 g
52. 136 g
53. 1.08 x 104 g
54. 0.0345 g
55. Which set of ions are isoelectronic in their ground-state electron configuration?
56. N3-, O2-, Mg2+, Al3+
57. Na+, K+, Rb+, Cs+
58. F-, Cl-, Br-, I-
59. Mg2+, Ca2+, Sr2+, Ba2+
60. How many electrons does the ion 3517Cl- have?
61. 16
62. 36
63. 18
64. 34
65. In general, atomic radii
66. decrease from left to right in a period and increase down a group.
67. increase from left to right in a period and decrease down a group.
68. do not change across a period or a group.
69. decrease from left to right and decrease down a group.
70. What is the ground state electron configuration of of 34Se?
71. [Ar]3d104p6
72. [Ar]4s23d104p4
73. [Kr]4s23d104p4
74. [Ar]4s24d104p4
75. What is the molecular geometry around an atom in a molecule or ion which is surrounded by zero lone pairs of electrons and four single covalent bonds?
76. tetrahedral
77. linear
78. bent
79. trigonal pyramidal
80. A 22.4 L sample of nitrogen at 3.65 atm and 22oC is simultaneously expanded to 57.4 L and heated to 38oC. What is the new pressure of the gas?
81. 2.46 atm
82. 1.50 atm
83. 204 atm
84. 334 atm
85. Which of the following indicates the existence of strong intermolecular forces of attraction in a liquid?
86. a very low critical temperature
87. a very low boiling point
88. a very low vapor pressure
89. a very low viscosity
90. The specific heat capacity of Lead is 0.13 J/g.oC. How much heat (in Joules) is required to raise the temperature of 15 g of Lead from 22 oC to 37 oC?
91. 29 J
92. 0.13 J
93. -0.13 J
94. 2.0 J
95. Consider the following reaction:

2Na3PO4(aq) + 3Ba(NO3)2(aq) → Ba3(PO4)2(s) + 6NaNO3(aq)

Suppose a solution containing 3.50 g of Na3PO4 is mixed with a solution containing 6.40 g Ba(NO3)2. How many grams of Ba3(PO4)2 can be formed?

1. Ethanol, C2H5OH, is made industrially by the reaction of water with ethylene, C2H4. Calculate the value of ΔHo for the reaction

C2H4(*g*) + H2O(*l*) → C2H5OH(*l*)

given the following thermochemical equations:

C2H4(*g*) + 3O2(*g*) → 2CO2(*g*) + 2H2O(*l*) ΔHo = -1411.1 kJ

C2H5OH(*l*) + 3O2(*g*) → 2CO2(*g*) + 3H2O(*l*) ΔHo = -1367.1 kJ

1. Ethylene glycol, the substance used in automobile antifreeze, is composed of 38.7% C, 9.7% H, and 51.6% O by mass. Its molar mass is 62.1 g/mol. Determine both the empirical and molecular formulae of ethylene glycol.
2. A sample of blood completely fills an 8.20 cm3 vial.

The empty vial has a mass of 10.30 g. The vial has a mass of 18.91 g after being filled with blood. What is the density of blood?

1. Balance the following formula equation and then write its net ionic equation.

Pb(NO3)2(*aq*) + Fe2(SO4)3(*aq*) → PbSO4(*s*) + Fe(NO3)3(*aq*)

1. An important chemical reaction in the manufacture of Portland cement is the high temperature decomposition of calcium carbonate to give calcium oxide and carbon dioxide.

CaCO3(*s*) → CO2(*g*) + CaO(*s*)

Suppose a 1.25 g sample of CaCO3 is decomposed by heating. How many milliliters of CO2 gas will be evolved if the volume will be measured at 745 torr and 25 oC?

1. What is the wavelength (in nanometers) of a photon emitted during a transition from ni = 6 to nf = 4 state in the H atom?
2. A sample of 15g carbon dioxide was kept under 500 mmHg pressure and 35 oC temperature. If the pressure is reduced to 420 mmHg and temperature is increased to 54 oC what will the change in volume?