Chemistry 115 – Exam 2 Study Guide

Study the multiple choice questions in mastering chemistry.

Know the definitions/meaning of mole, aqueous, Avogadro’s number, molecule, formula unit. Know your nomenclature.

Know how to convert from grams to moles to molecules/formula units/ atoms and back.

Know how to determine empirical formulas and molecular formulas from percent composition and molar mass data.

Know how to balance chemical equations and identify the type of chemical reaction.

Know how to do stoichiometry from moles to moles, from gram to gram, from particle to particle, or any combination of the above. Be able to determine the limiting reagent and the amount of product produced when known quantities of two substances react. Be able to calculate a percent yield. Know how to calculate the heat absorbed or evolved from a reaction using stoichiometry.

Below are some problems that may be similar to some of the problems on the exam.

1. Name the following compounds
   1. Na2BO3
   2. NCl3
   3. BeCO3
   4. Li2O
   5. TiF3
   6. IBr2
   7. K3PO3
   8. MgSO4
   9. CuClO4
   10. PBr5
   11. Zn(IO3)2
   12. Ba3(PO4)2
   13. MnSO3
   14. SO2
   15. V(BrO2)3
   16. XeF6
   17. SeS3
   18. Al(ClO)3
   19. NaCN
   20. Cd3N2
   21. CO
2. Write formulas for the following compounds
   1. Cesium phosphate
   2. Iron(II) fluoride
   3. Lithium carbonate
   4. Cobalt(III) sulfate
   5. Carbon tetraiodide
   6. Sodium perchlorate
   7. Barium iodite
   8. Potassium phosphate
   9. Nickel(III) borate
   10. Cadmium nitrate
   11. Sodium acetate
   12. Dibromine octoxide
   13. Silver hypobromite
   14. Aluminum sulfide
   15. Chromium(II) nitrite
   16. Cuprous sulfite
   17. Ammonium hydroxide
   18. Sodium chromate
   19. Potassium permanganate
3. Name the following hydrocarbons
   1. CH4
   2. C4H10
   3. C6H14
   4. C3H8
4. Calculate the mass of 3.64 moles of zirconium.
5. How many moles of vanadium are there in 7.53 g of vanadium?
6. How many atoms of titanium are there in 5.24 moles of titanium?
7. How many moles of magnesium are there in 5.29 x 1021 atoms of magnesium?
8. What is the mass of 8.21 x 1025 atoms of sulfur?
9. How many atoms are in 7.22 g of xenon?
10. Calculate the molar mass of vanillin, C8H8O3.
11. Calculate the mass of 5.28 moles of vanillin
12. Calculate the number of molecules of vanillin in 82.9 moles of vanillin
13. Calculate the number of atoms of carbon in 35 molecules of vanillin
14. Calculate the number of molecules of vanillin in a bottle of vanilla containing 65.0 mg of vanillin.
15. Calculate the molar mass of naphthalene, C10H8.
16. Calculate the moles of naphthalene containing 6.29 x 1024 molecules of naphthalene
17. Calculate the mass of one molecule of naphthalene.
18. Calculate the mass of naphthalene containing 6.08 moles of carbon
19. Determine the empirical formula of ethyl butyrate, the principle component of pineapple oil. It is composed of 62.04% C, 10.41% H and 27.55% O
20. Determine the empirical formula of methyl butyrate, the principle component of apple flavor. It is composed of 58.80% C, 9.87% H, and 31.33% O
21. Determine the empirical formula of benzyl acetate, the scent of jasmine. It is composed of 71.98%C, 6.71%H, 21.31%O
22. Determine the empirical formula of acetaminophen, the active ingredient in Tylenol. It is composed of 63.56%C, 6.00%H, 9.27%N, and 21.17%O.
23. Determine the empirical formula of naproxen, the active ingredient in Aleve. It is composed of 73.03%C, 6.13%H, and 20.84%O.
24. Nicotine, a stimulant found in tobacco, has the following mass percent composition: 74.10%C, 8.70%H, 17.27%N. The molar mass of nicotine is 162.23 g/mol. Find the molecular formula of nicotine.
25. The following are molar masses and empirical formulas of several compounds containing carbon and other elements. Find the molecular formula of each compound.
    1. 163.26 g/mol, C11H17N
    2. 186.24 g/mol, C6H7N
    3. 312.29 g/mol, C3H2N
    4. 284.77 g/mol, CCl
    5. 131.39 g/mol, C2HCl3
    6. 181.44 g/mol, C2HCl
26. Write balanced chemical equations for each of the following:
    1. Solid copper reacts with solid sulfur (S8) to form solid copper(I) sulfide (Cu2S).
    2. Sulfur dioxide gas(SO2) reacts with oxygen gas (O2) to form sulfur trioxide gas (SO3)
    3. Aqueous hydrochloric acid (HCl) reacts with solid manganese(IV) oxide (MnO2) to form aqueous manganese(II) chloride (MnCl2), liquid water, and chlorine gas.
    4. Liquid benzene (C6H6) reacts with gaseous oxygen (O2) to form carbon dioxide (CO2) and liquid water (H2O).
    5. Solid magnesium reacts with aqueous copper(I) nitrate to form aqueous magnesium nitrate and solid copper.
    6. Gaseous dinitrogen pentoxide decomposes to form nitrogen dioxide and oxygen gas.
    7. Solid calcium reacts with aqueous nitric acid to form aqueous calcium nitrate and hydrogen gas.
27. Balance the following chemical equations
    1. Na2S (aq) + Cu(NO3)2 (aq) 🡪 NaNO3 (aq) + CuS (s)
    2. HCl (aq) + O2 (g) 🡪 H2O (l) + Cl2 (g)
    3. H2 (g) + O2 (g) 🡪 H2O (l)
    4. FeS (s) + HCl (aq) 🡪 FeCl2 (aq) + H2S (g)
    5. BaO2 (aq) + H2SO4 (aq) 🡪 BaSO4 (s) + H2O2 (aq)
    6. Co(NO3)3 (aq) + (NH4)2S (aq) 🡪 Co2S3 (s) + NH4NO3 (aq)
    7. Li2O (aq) + H2O (l) 🡪 LiOH (aq)
    8. Hg2(C2H3O2)2 (aq) + KCl (aq) 🡪 Hg2Cl2 (s) + KC2H3O2 (aq)
    9. C6H14 (l) + O2 (g) 🡪 CO2 (g) + H2O (g)
    10. C3H8 (g) + O2 (g) 🡪 CO2 (g) + H2O (g)
    11. C8H18 (l) + O2 (g) 🡪 CO2 (g) + H2O (g)

Consider the following balanced equation and use it to answer questions 28-37

2 N2H4 (g) + N2O4 (g) 🡪 3 N2 (g) + 4 H2O (g)

1. How many molecules of N2 will be produced by the reaction of 16 molecules of N2H4 with excess N2O4?
2. How many moles of N2O4 are required to react with 5.34 moles of N2H4?
3. How many grams of water will be formed by the reaction of 9.35 g of N2O4 with excess N2H4?
4. How many moles of N2 will be produced from the reaction of 3.43 x 1025 molecules of N2H4 with excess N2O4?
5. How many molecules of water will be produced from the reaction of 15.0 grams of N2H4 with excess N2O4?
6. How many moles of N2 will be formed from the reaction of 4.36 moles of N2H4 with 3.62 moles of N2O4?
7. If 35.6 grams of water are formed from the reaction of 72.4 grams of N2H4 and 62.6 grams of N2O4, what is the percent yield?
8. How many L of water at 3.50 atm and 25oC will be formed from the reaction of 36.4 grams of N2O4 with excess N2H4?
9. How many L of N2 will be formed from the reaction of 7.25 L of N2H4 with excess N2O4, if the temperature and pressure are held constant?
10. If this reaction is exothermic, is heat a reactant or a product?