AP Chemistry. Fall 2019. Test 1.



1. The elements I and Te have similar average atomic masses. A sample that was believed to be a mixture of I and Te was run through a mass spectrometer, resulting in the data above. All of the following statements are true. Which one would be the best basis for concluding that the sample was pure Te?

(A) Te forms ions with a −2 charge, whereas I forms ions with a −1 charge

(B) Te is more abundant than I in the universe.

(C) I consists of only one naturally occurring isotope with 74 neutrons, whereas Te has more than one isotope.

(D)I has a higher first ionization energy than Te does.

2. A student obtains a sample of a pure solid compound. In addition to Avogadro’s number, which of the following must the student know in order to determine how many molecules are in the sample?

 (A) Mass of the sample, volume of the sample

 (B) Mass of the sample, density of the sample

(C) Molar mass of the compound, mass of the sample

(D) Molar mass of the compound, density of the sample

3. A sample of a compound that contains only the elements C, H, and N is completely burned in O2 to produce 44.0 g of CO2, 45.0 g of H2O, and some NO2 . A possible empirical formula of the compound is A) CH2N B) CH5N C) C2H5N D) C3H3N2

 4. A student has two samples of NaCl, each one from a different source. Assume that the only potential contaminant in each sample is KCl. The student runs an experiment to determine the percent by mass of chlorine in each sample. From the results of this experiment alone, which of the following questions is most likely to be answered?

 A) Which sample has the higher purity? B**)** Which sample has the higher density?

C) What is the source of the contaminants present in each of the samples?

D) Which sample came from a salt mine, and which sample came from the ocean?

5. When a 3.22 g sample of an unknown hydrate of sodium sulfate, Na2SO4 ⋅ x H2O(s), is heated, H2O (molar mass 18 g) is driven off. (“x” represents the number of moles of water per mole of Na2SO4 in the hydrate.) The mass of the anhydrous Na2SO4 (**s**) (molar mass 142 g) that remains is 1.42 g. The value of **x** in the hydrate is

 A) 0.013 B) 1.8 C)6.0 D)10. E) 20.

6. 10 HI + 2 KMnO4 + 3 H2SO4 → 5 I2 + 2 MnSO4 + K2SO4 + 8 H2O

According to the balanced equation above, how many moles of HI would be necessary to produce 2.5 mol of I2, starting with 4.0 mol of KMnO4 and 3.0 mol of H2SO4 ?

A) 2.5 B) 5.0 C) 8.0 D) 10.

7. 2 H2O(**l**) + 4 MnO -(**aq**) + 3 ClO -(**aq**) → 4 MnO (**s**) + 3 ClO -(**aq**) + 4 OH-(**aq**)

 According to the balanced equation above, how many moles of ClO2-(aq) are needed to react completely with 20. mL of 0.20 M KMnO4 solution?

 A) 0.0030 mol B) 0.0053 mol C) 0.0075 mol D) 0.030 mol

8.2 KClO3(**s**) → 2 KCl(**s**) + 3 O2(**g**)

 What is the percentage yield of O2 if 12.3 g of KClO3 (molar mass 123 g) is decomposed to produce 3.2 g of O2 (molar mass 32 g) according to the equation above?

1. 10 % B) 33 % C) 67 % D) 80.%

9. 2 N2H4(**g**) + N2O4(**g**) → 3 N2(**g**) + 4 H2O(**g**)

When 8.0 g of N2H4 (32 g mol-1) and 92 g of N2O4 (92 g mol-1) are mixed together and react according to the equation above, what is the maximum mass of H2O that can be produced? A) 9.0 g B) 18 g C) 36 g D) 72 g

10. 3 Ag**(s)** + 4 HNO3 → 3 AgNO3 + NO**(g)** + 2 H2O

The reaction of silver metal and dilute nitric acid proceeds according to the equation above. If 0.10 mole of powdered silver is added to 10. milliliters of 6.0–molar nitric acid, the number of moles of NO gas that can be formed is

A) 0.015 mol B) 0.020 mol C) 0.030 mol D) 0.045 mol E) 0.090 mol

11. A 1.0 L sample of an aqueous solution contains 0.20 mol of NaCl and 0.10 mol of CaCl2. What is the minimum number of moles of AgNO3 that must be added to the solution in order to precipitate all of the Cl- as AgCl(s) ? (Assume that AgCl is insoluble.)

 A) 0.10 mol B) 0.20 mol C) 0.30 mol D) 0.40 mol

12. C3H8(**g**) + 5 O2(**g**) → 3 CO2(**g**) + 4 H2O(**l**)

In the reaction represented above, what is the total number of moles of reactants consumed when 2.00 mole of CO2(g) is produced?

A) 0.66 mol B) 2.66 mol C) 4.00 mol D) 12 mol

13. MgCl2(aq) + 2 NaOH(aq) (aq) 🠆 Mg(OH)2(s) + 2 NaCl(aq)

 A 100 mL sample of 0.1 M MgCl2 and a 100. mL sample of 0.2 M NaOH were combined, and Mg(OH)2 precipitated, as shown by the equation above. If the experiment is repeated using solutions of the same molarity, which of the following changes in volume will double the amount of Mg(OH)2 produced?

 A) Using the same volume of MgCl2 with twice the volume of NaOH

 B) Using the twice the volume of MgCl2 with the same volume of NaOH

 C) Using twice the volume of MgCl2 with half the volume of NaOH

 D) Using twice the volume of MgCl2 and twice the volume of NaOH

14. H2 + F2 → 2 HF

In the reaction represented above, what mass of HF is produced by the reaction of

 1.5 x 1023 molecules of H2 with excess F2 ? (Assume the reaction goes to completion.) A) 0.50 g B) 2.0 g C) 5.0 g D) 10.0 g E) 20.0 g

15. MnO4 − + 5 Fe2+ + 8 H+ → Mn2+ + 5 Fe3+ + 4 H2O

In the reaction represented above, the number of MnO4- ions that react must be equal to which of the following?

A) 5 times the number of Fe2+ ions that react

B) one fourth the number of water molecules that are formed.

C) 8 times the number of H+ ions that react.

D) Half the number of Mn2+ ions that are formed.

 16. If the density of Cu is 8.3 g/mL, what mass of Cu will occupy a volume of 2.00 liters?

 A) 16.6 grams B) 16.6 kilograms C) 4.15 grams D) 241 grams.

 Questions 17 - 20 are based on the following formulas:

 A) Al2(SO4)3 B) PCl5 C) CsI D) FePO4

17. The name of this compound contains a numerical prefix

18. The name of this substance contains a roman numeral

19. Of these substances, the one with the highest formula mass.

20. Of these substances, the one with the highest % of metal ions, by mass.

21. How many oxygen atoms are contained in 2.74 g of Al2(SO4)3? (mm=342)

A) 12 B) 6.02 × 1023 C) 7.22 × 1024 D) 5.79 × 1022

22. Which salt is least soluble in water ? A) NaBr B) Zn(NO3)2 C) NH4Cl D) AgI

Problems: Show work!

1. Silver chromate, Ag2CrO4, can be precipitated using the reaction

AgNO3(aq) + K2CrO4(aq) → Ag2CrO4(s) + KNO3(aq)

1. Balance the given equation.
2. Write a net ionic equation for this reaction.
3. If 100. mL of 2.00 M AgNO3 is mixed with 200. mL of 1.00 M K2CrO4,
4. Find the number of moles of each reactant added
5. Identify the limiting factor.
6. How many moles of Ag2CrO4 are produced
7. How many GRAMS of the excess reactant are left over?

( M of AgNO3 is 170., K2CrO4 is 194 )

1. What is the molarity of KNO3 in the solution after the reaction occurs?

II. 2352 grams of FeS2 is allowed to react with 1408 grams of O2 according to the following equation. (MM of FeS2 is 120, O2 is 32, Fe2O3 is 160 )

 FeS2 + O2 → Fe2O3 + SO2

 A. Balance the equation.

 B. Determine the limiting factor in the reaction. (show work)

C. How many grams of Fe2O3 would be produced in this reaction, if there is an 80% yield?

III. Combustion of 8.80 grams of an organic compound containing only C , H, and O produces 17.60 grams of CO2 and 7.20 grams of H2O.

A. What is the empirical formula of the compound?

B. If the compound has a molar mass of 88, what is the molecular formula of the compound?

C. How many grams of CO2 would be produced in the combustion of 8.00 moles of this substance?