AP chemistry test 1. Chapters 1 to 4. Multiple choice questions go on the Scantron sheet.

Multiple choice are 2.5 points each

1. Given the following compounds and their molar masses:

|  |  |
| --- | --- |
| Compound | Molar mass |
| Al2O3 | 102 |
| BeO | 25 |
| Na2O | 62 |
| K2O2 | 110 |

A 1.00 gram sample of which of these compounds contains the greatest mass of oxygen?

A) Al2O3 B) BeO C) Na2O D) K2O2

2. What is the chemical formula of iron (III) sulfate?

A) FeSO4 B) FeSO3 C) Fe(SO4)3 D) Fe2(SO4)3

3 - 4. An experiment is done to determine the density of copper. A sample of copper is weighed, and has a mass of 36.10 grams. The sample is added to a graduated cylinder which contains water with a volume of 25.4 mL. Upon addition of the copper, the total volume increases to 29.7 mL. (The graduated cylinder has a capacity of 50.0 mL)

3. What is the density of copper based on this data, to the correct number of significant figures?

A) 8 g/mL B) 8.4 g/mL C) 8.40 g/mL D) 8.395 g/mL

4. The experiment is repeated with the same graduated cylinder, with the same initial volume of water. This time the mass of the copper is 110 grams. How would this larger sample affect the results? A) The graduated cylinder would overflow. B) The resulting density would have more significant figures than there were in the first experiment C) The calculated density would be larger than it was in the first experiment D) The results and the number of significant figures would be the same as in the first experiment.

5. The molar mass of AgCl is 143 g/mol. An unknown soluble metal chloride, MCl, is reacted with excess AgNO3 solution, causing AgCl to precipitate. The mass of the metal chloride was 1.21 grams. The mass of the AgCl precipitate was 1.43 grams. Which of the following is the most probable formula for the metal chloride?

A) KCl B) NaCl C) RbCl D) CsCl

6. 14 H+ + Cr2O72–  + 3 Sn2+ ➞ 3 Sn4+ + 2 Cr3+ + 7 H2O

In the reaction shown above, the number of Sn2+ ions that react must be equal to

A) the number of Cr3+ ions that form. B) three fourteenths the number of H+ ions

that react C) one third the number of Cr2O72– ions that react

D) one half the number of Sn4+ ions that form.

7. C2H6 + 6 F2 ➞ 6 HF + C2F6

A 4.00 mole sample of C2H6 and a 20.0 mole sample of F2 are placed in an empty container, where they react, using up one of the reactants. How many moles of HF are produced? A) 4.00 mol B) 14.0 mol C) 20.0 mol D) 24.0 mol

8. When aqueous solutions of barium nitrate and sodium sulfate are mixed, a white precipitate forms. What is the net ionic equation for the reaction?

A) Ba2+(aq) + SO42-(aq) ➞ BaSO4(s)

B) Na+(aq) + NO3– (aq) ➞ NaNO3(s)

C) NaSO4(aq) + BaNO3(aq) ➞ BaSO4(s) + NaNO3(s)

D) 2 Na+ (aq) + SO42– (aq) + Ba2+(aq) + 2 NO3–  (aq) ➞ 2 NaNO3(s) + BaSO4(s)

9. Given the equation H2SO4 + 2 KOH ➞ 2 H2O + K2SO4, how many mL of

0.60 molar KOH would be needed to react completely with 24.0 mL of 1.20 molar

H2SO4? A) 12.0 mL B) 24.0 mL C) 48.0 mL D) 96.0 mL

10. 10.0 mL of 2.00 molar NaCl is mixed with 40.0 mL of 3.00 molar CaCl2. What is the concentration of Cl- ion in the resulting mixture? (assume volumes are additive)

A) 5.20 molar B) 2.80 molar C) 2.50 molar D) 7.80 molar

11. When the reaction Al + H2O ➞ Al(OH)3 + H2 is balanced using the smallest possible whole number coefficients, the coefficient of the Al is A) 1 B) 2 C) 4 D) 6

12. Assume that the reaction C2H2 + 2 Cl2 ➞ C2H2Cl4 has an 80 % yield of product.

How many grams of C2H2Cl4 (MM = 168) would be pruduced when

1.00 mole of Cl2 reacts with excess C2H2? A) 67 g B) 134 g C) 105 g D) 210 g

13. In the reaction of hydrogen with oxygen to form water, how many grams of oxygen combine with each gram of hydrogen? A) .50 B) 8.0 C) 16.0 D) 32.0

14. How many grams of NaOH are needed to produce a 0.400 molar solution in a volume of

250 mL ? A) 0.100g B) 4.00 g C) 0.400 g D) 4.00 x 103 g

15. Osmium has a density of 22.6 g/cm3. What volume (in cm3) would be occupied by a 21.8 sample of osmium? A) 0.965 B) 1.04 C) 493 D) 2.03 × 10-3

16. Which atom has the largest number of neutrons?

A) calcium-40 B) chlorine-37 C) potassium-39 D) argon-40

17. The formula weight of aluminum sulfate (Al2(SO4)3) is \_\_\_\_\_\_\_\_\_\_ amu.

A) 342.15 B) 123.04 C) 59.04 D) 150.14

18. The combustion of ammonia in the presence of excess oxygen yields NO2 and H2O:

4 NH3 (g) + 7 O2 (g) → 4 NO2 (g) + 6 H2O (g)

The combustion of 43.9 g of ammonia produces \_\_\_\_\_\_\_\_\_\_ g of NO2.

A) 2.58 B) 178 C) 119 D) 0.954

19. What are the respective concentrations (M) of Fe3+ and I- afforded by dissolving 0.200 mol FeI3 in water and diluting to 725 mL?

A) 0.276 and 0.828 B) 0.828 and 0.276 C) 0.276 and 0.276 D) 0.145 and 0.435

20. When solutions of Ca(NO3)2 and Na3PO4 are mixed, they form a precipitate of Ca3(PO4)2. 30.0 mL of 0.10 M Ca(NO3)2 and 15.0 mL of 0.20 M Na3PO4 are mixed, and the precipitate forms. Once the reaction is complete, which ion is present IN THE SOLUTION in lowest concentration? A) Ca2+ B) Na+ C) NO3–  D) PO43-

21. What is the % NITROGEN by mass in the compound Al(NO3)3?

A) 6.57% B) 19.7 % C) 15.7 % D) 46.1 %

22. Oxalic acid is 2.22 % hydrogen, 26.67% carbon, and 71.11 % oxygen by mass. Oxalic acid

is also known to be a **diprotic** acid. The most probable formula for oxalic acid is

A) HCO2 B) H2C2O4 C) H2 C2O3 D) H2CO4

23. Which of the following would produce the smallest mass of CO2 if burned completely in excess oxygen? A) 10.0 g CH4 B) 10.0 g CH3OH C) 10.0 g C2H6

D) 10.0 g C4H10

24. C3H8(g) + 5 O2(g) ➞ 3 CO2 (g) + 4 H2O(ℓ)

In the reaction above, what is the TOTAL number of moles of reactants consumed when

2.00 mole of CO2(g) is produced? A) 0.67 mole B) 3.33 mole C) 4.00 mole

D) 12.0 mole

25. H2 + F2 ➞ 2 HF. In this reaction, what mass of HF is produced by the reaction of

1.5 x 1023 molecules of H2 with excess F2? A) 5.0g B) 10. g C) 20 g D) 40 g

26. 2 K(s) + Cl2(g) ➞ 2 KCl(s) Equal masses of K and Cl2 are reacted in a container until

either one or both of them are used up. What remains in the vessel?

A) KCl only B) K and KCl C) Cl2 and KCl D) Cl2 only

27. When a certain amount of a certain hydrocarbon is burned it produces 440 grams of CO2

and 72.0 grams of H2O. What is the empirical formula of the hydrocarbon?

A) C10H4 B) C5H2 C) C5H4 D) C10H8

Problems: ( 10 points, 16 points, 13 points. Total test points 106 )

I. Ketones are compounds that contain only carbon, oxygen, and hydrogen.

7.2 grams of a ketone are burned, and the only products are 7.2 grams of water

and 17.6 grams of CO2

A. Find the empirical formula of the ketone.

B. When two moles of this ketone are burned, 8. moles of water are formed.

What is the molecular formula of the ketone?

II. In order to produce hydrogen, Al metal can be reacted with sulfuric acid

Al(s) + H2SO4(aq) ➞ Al2(SO4)3(aq) + H2(g)

A. Balance the equation for this reaction.

B. 5.60 grams of Al are reacted with 50.0 mL of 4.00 molar H2SO4.

1. Identify the limiting factor. Show work.

2. Find the mass of hydrogen gas that is produced in this reaction.

3. Find the number of moles of **unreacted** reactant.

III. 6 Fe2+ + 14 H+ + Cr2O72– ➞ 2 Cr3+  + 6 Fe3+ + 7 H2O

A solid sample containing some Fe2+ was dissolved, and then analyzed using excess nitric acid to supply the H+ ions, and 50.0 mL of 0.500 molar Cr2O72– to exactly use up the iron (II) ions.

A. How many moles, and how many grams of Fe2+ were contained in the sample?

B. If the nitric acid was 4.00 molar, what is the minumum volume of the acid that was needed in this analysis?

C. The reference table lists the atomic mass of iron **atoms**. Why is it permissible to use this mass to find the grams of Fe(II) **ions** in part B?