

Name _____

AP Chemistry

HW Due: 11/9/2015

This is an old AP Chemistry Exam from 10/3/2006. Part I (Multiple Choice): 45 Questions, 45 minutes, No Calculator Allowed. That year the results were:

2006-2007	
Top Score	36/45 80%
Average Score	24/45 53%
Lowest Score	8/45 18%

You can use extra time and a calculator if you want but use this assignment to self-assess where you are at. You will turn this assignment in on Monday 11/9 and it will be graded on correctness so do your best.

Bubble the correct answer on the blue side of your scantron for each of the following.

- Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?
 - H₂O and H₂O₂
 - HCl and HClO₃
 - KBr and KCl
 - NH₃ and NH₄Cl
 - AgNO₃ and Ag₂SO₃
- A pure sample of KClO₃ is found to contain 71 grams of chlorine atoms. What is the mass of the sample?
 - 122 grams
 - 170 grams
 - 209 grams
 - 245 grams
 - 293 grams
- Estimate the mass of CaCl₂ (molar mass = 110.0) required to prepare 75.00 mL of a 2.000 M solution of this salt.
 - 150 g
 - 16.65 g
 - 8.325 g
 - 1.65 x 10⁴ g
 - 222 g
- When the following half reaction is balanced with the smallest whole number coefficients, it will contain: NO₃⁻ → NO
 - 2e⁻ on the right side
 - 4e⁻ on the left side
 - 2H₂O on the right side
 - 2H⁺ on the left side
 - a coefficient of 2 for NO
- How many grams of lead(II) nitrate [Pb(NO₃)₂] must be weighed in order to have exactly 3.00 grams of lead atoms? The molar mass of lead nitrate is 331.
 - 4.80 g
 - 0.626 g
 - 130 g
 - 3.90 g
 - 48.0 g
- 2MnO₄⁻ + 5SO₃²⁻ + 6H⁺ → 2Mn²⁺ + 5SO₄²⁻ + 3H₂O
Which of the following statements is true regarding the reaction given above?
 - MnO₄⁻ acts as the reducing agent
 - H⁺ acts as the oxidizing agent
 - SO₃²⁻ acts as the reducing agent
 - MnO₄⁻ is oxidized
 - SO₃²⁻ is reduced
- A student examined 2.0 moles of an unknown carbon compound and found that the compound contained 48 grams of carbon, 64 grams of oxygen and 8 grams of hydrogen. Which of the following could be the molecular of the compound?
 - CH₂O
 - CH₂OH
 - CH₃COOH
 - CH₃CO
 - C₂H₅OH
- How much water must be added to a 50.0 mL solution of 0.60 M HNO₃ to produce a 0.40M solution of HNO₃?
 - 25 mL
 - 33 mL
 - 50 mL
 - 67 mL
 - 75 mL
- Al₂(CO₃)₃ + 6HCl → 2AlCl₃ + 3H₂O + 3CO₂
When 5.00 mL of 6.00 M hydrochloric acid is added to 468 mg of aluminum carbonate (formula mass = 234) according to the above balanced reaction, what is the maximum number of millimoles of CO₂ gas that will be evolved?
 - 15
 - 5.0
 - 23.0
 - 6.0
 - 1.7
- The molecular formula for the hydrated ferric oxide is generally written as Fe₂O₃ * x H₂O because the water content in rust can vary. If a 1-molar sample of hydrated ferric oxide is found to contain 108 g of H₂O, what is the molecular formula of the compound?
 - Fe₂O₃ * H₂O
 - Fe₂O₃ * 3H₂O
 - Fe₂O₃ * 6H₂O
 - Fe₂O₃ * 10H₂O
 - Fe₂O₃ * 12H₂O
- Which of the following elements forms a polyatomic anion where it has an oxidation number of +6?
 - Ca
 - S
 - Fe
 - N
 - Cs
- 2 ZnS(s) + 3 O₂(g) → 2 ZnO(s) + 2 SO₂(g)
If the reaction above took place at standard temperature and pressure, what was the volume of O₂(g) required to produce 40.0 grams of ZnO(s)?
 - $\frac{(40.0)(2)}{(81.4)(3)(22.4)} L$
 - $\frac{(40.0)(3)}{(81.4)(2)(22.4)} L$
 - $\frac{(40.0)(2)(22.4)}{81.4(3)} L$
 - $\frac{(40.0)(3)(22.4)}{(81.4)(2)} L$
 - $\frac{(81.4)(2)(22.4)}{(40.0)(3)} L$

13. The net ionic equation for the reaction of sodium sulfate with iron(II) chloride is:

- a. $\text{SO}_4^{2-}(\text{aq}) + \text{Fe}^{2+}(\text{aq}) \rightarrow \text{FeSO}_4(\text{s})$ b. $\text{Cl}^-(\text{aq}) + \text{Si}(\text{aq}) \rightarrow \text{SiCl}(\text{s})$
c. $\text{SO}_3^{2-}(\text{aq}) + \text{Fe}^{2+}(\text{aq}) \rightarrow \text{FeSO}_3(\text{s})$ d. $\text{Na}_2\text{SO}_4(\text{s}) + \text{Fe}^{2+}(\text{aq}) \rightarrow \text{FeSO}_4(\text{s}) + 2\text{Na}^+(\text{aq})$
e. $\text{SO}_3^{2-}(\text{aq}) + \text{FeCl}_3(\text{s}) \rightarrow \text{Fe}_2(\text{SO}_3)_2(\text{aq}) + 3\text{Cl}^-(\text{aq})$

14. Balance the following half-reaction for an acid solution using the smallest possible whole number coefficients and entering the proper number of electrons when needed. $\text{MnO}_4^{2-} \rightarrow \text{Mn}^{2+}$

In the balanced half reaction:

- a. there should be 4 electrons on the left side b. there should be 3 electrons on the right side
c. there should be 2 electrons on the right side d. there should be 2 electrons on the left side
e. this is not a half-reaction; no electrons are needed

15. Balance the following half-reaction for an acid solution using the smallest possible whole number coefficients and entering the proper number of electrons when needed. $\text{MnO}_4^{2-} \rightarrow \text{Mn}^{2+}$

In the balanced half reaction the hydrogen ions appear as:

- a. 2 on the right side b. 4 on the left side c. 3 on the left side
d. 4 on the right side e. 8 on the left side

16. $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 3\text{Sn}^{2+}(\text{aq}) + 14\text{H}^+(\text{aq}) \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 3\text{Sn}^{4+}(\text{aq}) + 7\text{H}_2\text{O}$

Which of the following statements about this reaction is true?

- a. dichromate ions are oxidized by Sn(II) ions b. hydrogen ions are reduced to H_2O
c. oxygen is reduced from -2 to 0 d. the oxidation state of chromium does not change
e. chromium is reduced from the +6 to the +3 oxidation state

17. $\text{IO}_3^-(\text{aq}) + \text{H}^+(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$

When the above half-reaction is balanced by entering the electrons where needed and using the smallest whole-number coefficients possible, there will be:

- a. 5 electrons on the left-hand side b. no electrons c. 8 electrons on the right-hand side
d. 3 electrons on the right-hand side e. 10 electrons on the left hand side

18. The compound that contains 10.4% oxygen is:

- a. NaOH b. CaO c. Al_2O_3 d. BaO e. $\text{Ca}(\text{OH})_2$

19. A halogen, X, and an alkaline earth metal, M, can form a compound with the formula:

- a. MX b. MX_2 c. MX_3 d. M_2X_3 e. M_3X_2

20. Which of the following cannot be a reducing agent?

- a. Ag b. I⁻ c. Fe^{3+} d. Cr^{3+} e. Cl^-

21. $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

If 16 grams of CH_4 reacts with 16 grams of O_2 in the reaction shown above, which of the following will be true?

- a. The mass of H_2O formed will be twice the mass of CO_2 formed.
b. Equal masses of H_2O and CO_2 will be formed.
c. Equal numbers of moles of H_2O and CO_2 will be formed.
d. The limiting reagent will be CH_4 .
e. The limiting reagent will be O_2 .

22. How many grams of NaOH (molar mass = 40.0 g/mol) are contained in 5.00×10^2 mL of a 0.80 M sodium hydroxide solution?

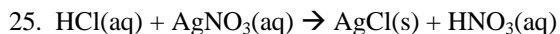
- a. 16 g b. 80. g c. 20. g d. 64 g. e. none of these

23. A beaker contains 150.0 mL of a 0.20 M $\text{Pb}(\text{NO}_3)_2$ solution. If 50.0 mL of a 0.20 M solution of MgCl_2 is added to the beaker, what will be the final concentration of Pb^{2+} ions in solution?

- a. 0.20 M b. 0.10 M c. 0.050 M d. 0.025 M e. 0.012 M

24. An unknown substance dissolves readily in water but not in benzene (a nonpolar solvent). Molecules of what type are present in the substance?

- a. neither polar nor nonpolar b. polar c. either polar or nonpolar
d. nonpolar e. none of these



One half liter of a 0.20 molar HCl solution is mixed with one-half liter of a 0.40 molar solution of AgNO₃. A reaction occurs forming a precipitate as shown above. If the reaction goes to completion, what is the mass of AgCl produced?

- a. 14 grams b. 28 grams c. 42 grams d. 70 grams e. 84 grams

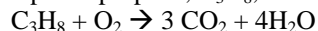
26. What is the mass ratio of boron to fluorine in a boron trifluoride molecule?

- a. 1.8 to 1 b. 3.0 to 1 c. 3.5 to 1 d. 5.3 to 1 e. 6.0 to 1

27. An ion containing only oxygen and chlorine is 31% oxygen by mass. What is the empirical formula?

- a. ClO^- b. ClO_2^- c. ClO_3^- d. ClO_4^- e. Cl_2O^-

28. A sample of propane, C₃H₈, was completely burned in air at STP. The reaction occurred as shown below:



If 67 liters of CO₂ were produced and all of the carbon in the CO₂ came from the propane, what was the mass of propane in the sample?

- a. 11 grams b. 22 grams c. 33 grams d. 44 grams e. 55 grams

29. What is the percent composition by mass of the elements in the compound NaNO₃?

- a. Na 20%, N 20%, O 60% b. Na 23%, N 14%, O 48%
c. Na 23%, N 14%, O 63% d. Na 27%, N 16%, O 57%
e. Na 36%, N 28%, O 36%

30. When excess hydroxide ions were added to 1.0 liter of CaCl₂ solution, Ca(OH)₂ precipitate was formed. If all the calcium ions in the solution were precipitated in 7.4 grams of Ca(OH)₂, what was the initial concentration of the CaCl₂ solution?

- a. 0.05 molar b. 0.10 molar c. 0.15 molar d. 0.20 molar e. 0.30 molar

31. How many micron are in a meter?

- a. 10⁶ b. 10⁻⁶ c. 10⁹ d. 10⁻⁹ e. none of these answers

32. How many significant figures are there in 0.0054020?

- a. 3 b. 4 c. 5 d. 7 e. 8

33. When a solution of KMnO₄ was mixed with a solution of HCl, Cl₂ gas bubbles formed and Mn²⁺ ions appeared in the solution. Which of the following has occurred?

- a. K⁺ has been oxidized by Cl⁻ b. K⁺ has been oxidized by H⁺
c. Cl⁻ has been oxidized by K⁺ d. Cl⁻ has been oxidized by MnO₄⁻
e. MnO₄⁻ has been oxidized by Cl⁻

34. Which of the following scientists is referred to as the Father of Modern Chemistry?

- a. Lavoisier b. Dalton c. Aristotle d. Boyle e. Priestly

35. How many electrons does a calcium ion have?

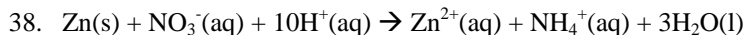
- a. 18 b. 20 c. 22 d. 21 e. 40

36. Titanium metal is prepared by heating rutile, an oxide of titanium, along with carbon and chlorine gas. By mass, rutile is 60% titanium and 40% oxygen. What is the empirical formula of rutile?

- a. TiO b. Ti₂O c. Ti₂O₃ d. TiO₂ e. Ti₃O₂

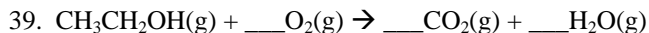
37. How many grams of carbon are present in 270. grams of glucose, C₆H₁₂O₆?

- a. 12.0 grams b. 18.0 grams c. 67.5 grams d. 72.0 grams e. 108 grams



Which of the following statements regarding the reaction shown above is correct?

- a. The oxidation number of hydrogen changes from +1 to 0.
b. The oxidation number of nitrogen changes from +5 to -3.
c. The oxidation number of hydrogen changes from +1 to -1.
d. The oxidation number of nitrogen changes from +5 to +3.
e. The oxidation number of nitrogen changes from +6 to +4.



The reaction above represents the oxidation of ethanol. How many moles of O₂ are needed to oxidize 1 mole of CH₃CH₂OH?

- a. 3/2 moles b. 5/2 moles c. 3 moles d. 7/2 moles e. 4 moles

40. What is the weight of NaNO_3 (molecular weight 85.0) present in 100. mL of a 4.00 molar solution?
a. 8.50 grams b. 17.0 grams c. 25.5 grams d. 34.0 grams e. 51.0 grams
41. The following data were gathered in an experiment to determine the density of a sample of an unknown substance.
Mass of the sample = 7.50 grams
Volume of the sample = 2.5 milliliters
The density of the sample should be reported as:
a. 3.00 g/mL b. 3.0 g/mL c. 3 g/mL d. 0.3 g/mL e. 0.33 g/mL
42. A method of separation where a mobile phase is passed through a stationary phase is called:
a. distillation b. decanting c. filtration d. electrolysis e. chromatography
43. $\text{Be}_2\text{C} + \text{H}_2\text{O} \rightarrow \text{Be}(\text{OH})_2 + \text{CH}_4$
When the equation above is balanced with the lowest whole-number coefficients for H_2O will be:
a. 1 b. 2 c. 3 d. 4 e. 5
44. If the actual scientific value is 1.57 grams/mL, which of the following sets of results shows poor accuracy, good precision and high systematic error?
a. 1.68 g/mL, 1.68 g/mL, 1.68 g/mL b. 1.57 g/mL, 1.57 g/mL, 1.57 g/mL
c. 1.68 g/mL, 1.57 g/mL, 1.49 g/mL d. 1.58 g/mL, 1.57 g/mL, 1.56 g/mL
e. none of these answers
45. The density values for 5 substances are given: Benzene (0.880 g/mL), Ethanol (0.789 g/mL), Water (0.9982 g/mL), Mercury (13.6 g/mL) and Hydrochloric acid (1.19 g/mL). If you had 10.0 mL of each substance, which would have the smallest mass?
a. ethanol b. benzene c. mercury d. water e. hydrochloric acid