

AP Chemistry
Test 1. Fall 2011

Name _____ (first 30 questions are 2 pts each)

- _____ 1. The volume of water in a graduated cylinder is read as 28.5 mL. When an insoluble solid object is added, the volume is read as 33.5 mL. The solid object was found to have a mass of 40.00 grams. The density of the object, to the correct number of significant figures is
A) 5 g/mL B) 5.0 g/mL C) 8 g/mL D) 8.0 g/mL E) 8.00 g/mL
- _____ 2. When the measurement 0.050 grams is correctly expressed in scientific notation, with the correct number of sig. figs., it should be
A) 5×10^2 B) 5.0×10^2 C) 5×10^{-2} D) 5.0×10^{-2} E) 5.0×10^{-3}
- _____ 3. Thomson's "cathode ray" experiments established
A) the charge of a proton B) the existence of the proton
C) the mass of an electron D) the existence of an electron
E) the nuclear structure of the atom
- _____ 4. The Roman numeral "III" must appear in the correct chemical name of the compound A) FePO_4 B) $\text{Al}(\text{NO}_3)_3$ C) CuNO_3
D) NiSO_4 E) SO_3
- _____ 5. Based on the symbol ${}^{60}_{28}\text{Ni}^{2+}$, the particle contains
A) 28 protons, 26 neutrons, and 28 electrons
B) 28 protons, 32 neutrons, and 30 electrons
C) 32 protons, 28 neutrons and 30 electrons
D) 28 protons, 28 neutrons, and 26 electrons
E) 28 protons, 32 neutrons, and 26 electrons.
- _____ 6. The atomic number of an ion is equivalent to its
A) number of neutrons B) number of electrons
C) nuclear charge D) atomic mass E) mass number

Write the correct chemical formula for each of the following:

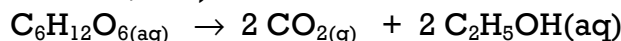
- _____ 7. Aluminum sulfate
- _____ 8. Cobalt (II) carbonate
- _____ 9. Dinitrogen trisulfide

- _____ 10. The compound with the formula Cu_2SO_3 would be called
A) copper (I) sulfite B) copper (I) sulfate
C) copper (II) sulfite D) copper (II) sulfate
E) copper (III) sulfate
- _____ 11. How many nanometers, nm, are there in one millimeter, mm?
A) 1×10^3 B) 1×10^{-3} C) 1×10^6 D) 1×10^{-6} E) 1×10^9
- _____ 12. What is the mass in grams of 3.01×10^{22} molecules of SO_2 ?
A) 3.2 grams B) 32 grams C) 12.8 grams D) 128 grams
E) 16 grams
- _____ 13. What quantity of water contains the same number of moles as
11.0 grams of CO_2 ? A) 7.2 grams B) 4.5 grams C) 72 grams
D) 0.25 grams E) 0.75 grams
- _____ 14. What quantity of water contains the same number of **oxygen
atoms** as 44.0 grams of CO_2 ? A) 18.0 grams B) 9.0 grams
C) 36.0 grams D) 44.0 grams E) 88.0 grams
- _____ 15. Which salt is least soluble in water?
A) KCl B) PbCl_2 C) AgNO_3 D) Na_2SO_4 E) NH_4Br
- _____ 16. What is the symbol for a particle that contains 16 protons, 17
neutrons, and 18 electrons? A) S^{2+} B) S^- C) S^{2-} D) Cl^- E) Ar
- _____ 17. Which of the following substances is the strongest electrolyte?
A) HNO_3 B) NH_3 C) $\text{C}_6\text{H}_{12}\text{O}_6$ D) $\text{HC}_2\text{H}_3\text{O}_2$ E) HF
- _____ 18. The % carbon by mass in acetic acid is
A) 36 % B) 40. % C) 53 % D) 19 % E) 42 %
- _____ 19. A substance that has the empirical formula CH *might* have a
molar mass of A) 6.5 B) 21 C) 72 D) 78 E) 100.
- _____ 20. When the equation $\text{C}_4\text{H}_{10} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ is correctly
balanced using the smallest possible whole number coefficients, the
coefficient before the O_2 is A) 3 B) 4 C) 7 D) 13 E) 16
- _____ 21. The reaction shown in question 20 is best described as
A) synthesis B) decomposition C) single replacement
D) metathesis E) combustion
- _____ 22. How many moles of NH_3 can be formed from 6.0 moles of H_2 gas in
excess N_2 ? A) 2.0 B) 3.0 C) 4.0 D) 6.0 E) 8.0

- _____ 23. In the reaction $2 \text{Al} + 6 \text{HCl} \rightarrow 2 \text{AlCl}_3 + 3 \text{H}_2$
If 2.7 grams of aluminum react completely with excess HCl, how many grams of hydrogen gas are formed?
A) 0.15 B) 0.30 C) 4.1 D) 0.20 E) 0.40
- _____ 24. A sample of a hydrocarbon is found upon analysis to contain 2.8 grams of carbon and 0.35 grams of hydrogen. What is the empirical formula for the hydrocarbon?
A) CH_2 B) C_2H_3 C) C_2H_5 D) C_8H E) CH_3
- _____ 25. What is the mass in grams of 6.33 mol of NaHCO_3 ?
A) 13.3 B) 126 C) 532 D) 1120 E) 1420
- _____ 26. In Mendeleev's Periodic Table, elements were placed in the same vertical columns on the basis of
A) number of valence electrons
B) similar chemical properties C) similar boiling points
D) atomic numbers
- _____ 27. Which two substances have exactly the same % compositions?
A) C_2H_6 and C_2H_4 B) H_2O and H_2S C) C_2H_2 and C_6H_6
D) N_2O_3 and NO_2 E) $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ and $\text{C}_6\text{H}_{12}\text{O}_6$
- _____ 28. How many grams of pure sulfuric acid (MM=98) must be dissolved to in water to produce a 2.00 molar solution of the acid in a volume of 250 mL? A) 49 grams B) 196 grams C) 24.5 grams
D) 4900 grams E) 245 grams
- _____ 29. How many mL of 2.00 molar HNO_3 are required to completely neutralize a solution containing 3.70 grams of $\text{Ca}(\text{OH})_2$? (MM=74.0)
A) 50.0 mL B) 100. mL C) 25.0 mL D) 250 mL. E) 500. mL
- _____ 30. When 100. mL of 1.00 M $\text{Ba}(\text{NO}_3)_2$ is mixed with 200. mL of 1.00 M KNO_3 , what is the concentration of nitrate ion in the resulting mixture? A) 1.00 M B) 1.33 M C) 2.00 M D) 2.50 M E) 3.00 M

Problems: (show work for part credit) Answer all remaining questions in the essay booklets provided.

- I. Ethanol is produced in a fermentation reaction, (MM of glucose is 180, ethanol ,46.0)



If the fermentation of 18.0 grams of glucose produces just a 10.0% yield of $\text{C}_2\text{H}_5\text{OH}(\text{aq})$, how many grams of ethanol are produced? (5pts)

- II. Aldehydes are compounds that contain only C, H, and O.
A certain aldehyde has a molar mass of 72.0

When 2.00 grams of this aldehyde is burned completely, the products are 4.89 grams of CO_2 and 2.00 grams of H_2O .

- A. What is the empirical formula of the aldehyde? (6 pts)
B. What is the actual molecular formula of the aldehyde? (2 pts)

- III. Sodium hydroxide reacts with iron(III) chloride, forming a red precipitate.

A. What is the formula of the precipitate? (3 pts)

B. Write a balanced equation for the reaction. (4 pts)

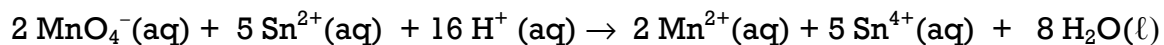
C. The molar mass of NaOH is 40.0, while that of Iron (III) chloride is 162. A solution containing 4.00 grams of NaOH is reacted with one containing 8.10 gram of FeCl_3 .

1. Which reactant is the limiting factor? Show work. (3)
2. How many **moles** of the precipitate are formed? (3)
3. How many moles of the non-limiting reactant remain unreacted? (3)

- IV. In the following reaction: $2 \text{CH}_3\text{OH} \rightarrow (\text{CH}_3)_2\text{O} + \text{H}_2\text{O}$

10.0 grams of CH_3OH reacts to yield 6.20 grams of $(\text{CH}_3)_2\text{O}$, what is the % yield? (4)

V. In an analysis for tin (II) ion, a solution containing some of the ion is reacted with permanganate. The net ionic equation for the reaction is



40.00 mL of 0.200 molar KMnO_4 (the K^+ is a spectator) are needed to completely react with all of the Sn^{2+} ions present in the solution.

- A. How many moles of permanganate ion reacted with the tin (II) ions? (3)
- B. How many moles of tin (II) ions were present in the solution? (3)
- C. What mass of tin, in grams, was present in the tested solution? (3)

Extra Credit:



How many pounds of potassium chlorate are needed in order to produce 100.0 pounds of O_2 ? (Molar mass of KClO_3 is 123_)