

## AP CHEMISTRY SUMMER ASSIGNMENT

Intro: AP Chemistry covers the same material to the same depth as a typical college introductory chemistry course, like those offered at a UC school. It includes about 5 topics not covered in regular High School Chemistry, and covers all other topics in much greater detail. Very few students have been successful in AP Chemistry without first taking, and doing very well in, a regular High School Chemistry course. This provides a solid foundation, for the much greater detail in the AP Curriculum. In order for the material to be covered before the AP test in May, there is a mandatory summer assignment for all AP Chemistry students. One should remember that a strong independent study ethic should be developed before attempting college level courses, as this is required for success at this level.

Assignment: I require students to independently cover Chapters 1-3 in Zumdahl Chemistry. These chapters are a review of the regular High School Chemistry course, although some material is treated to a greater depth. When we start up in August you will be turning in several assignments. We will then take a week to go over this work, and you will be tested on this material in the second week

Schedule:

### ASSIGNMENTS

July

Read Ch. 1 (Fundamental mathematical skills for chemistry)

Do problems: 34,74,76,78

Complete Ch. 1 test

Read Ch. 2 (Fundamental structure in chemistry)

Do problems: 50 and 56-68 even

Memorize polyatomic ions (10 ion quizzes during the year, first one, first week)

Complete Ch. 2 test

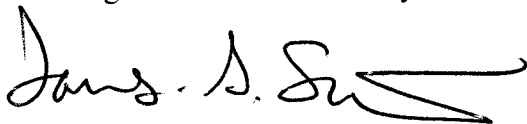
August

Read Ch. 3 (Stoichiometry)

Do problems: 28,34,36,40,48,62,68,70,78,82,84,86,89,92,104,AP problem 1982B

Complete Ch. 3 Test

Have a great summer. I'll see you at the beach!



James G. Smith

CHAPTER 1 TEST (100 POINTS)  
MULTIPLE CHOICE

1. Convert 16.8 lb to g. (1 lb = 453.6 g)
  - a. 7621 g
  - b. 76.2 g
  - c.  $3.70 \times 10^4$  g
  - d. 762.0 g
  - e. 7620 g
2. The melting point of lead is  $327^\circ\text{C}$ . What is this on the Fahrenheit scale?  
( $T_F = T_C \times (9^\circ\text{F}/5^\circ\text{C}) + 32^\circ\text{F}$ )
  - a.  $621^\circ\text{F}$
  - b.  $895^\circ\text{F}$
  - c.  $600^\circ\text{F}$
  - d.  $620.6^\circ\text{F}$
  - e.  $547^\circ\text{F}$
3. A titration was performed to find the concentration of hydrochloric acid with the following results:

Trial	Molarity
1	$1.25 \pm 0.01$
2	$1.24 \pm 0.01$
3	$1.26 \pm 0.01$

The actual concentration of HCl was determined to be 1.000 M; the results of the titration are:

- a. both accurate and precise.
  - b. accurate but imprecise.
  - c. precise but inaccurate.
  - d. both inaccurate and imprecise.
  - e. accuracy and precision are impossible to determine with the available information.
4. Using the rules of significant figures, calculate the following:  $4.0021 - 0.004$ 
  - a. 4.00
  - b. 3.9981
  - c. 4.0
  - d. 3.998
  - e. 4
5. A method of separation that employs a system with two phases of matter, a mobile phase and a stationary phase, is called
  - a. vaporization.
  - b. distillation.
  - c. homogenization.
  - d. filtration.
  - e. chromatography.
6. The melting point of indium is  $156.2^\circ\text{C}$ . At  $323^\circ\text{F}$ , what is the physical state of indium?
  - a. not enough information
  - b. gas
  - c. At  $323^\circ\text{F}$ , the indium is partially solid and partially liquid; there is an equilibrium between the two states.
  - d. solid
  - e. liquid

7. Express the volume  $159 \text{ dm}^3$  in liters.
- 15.9 L
  - 0.159 L
  - 1.59 L
  - 159 L
  - 159000 L
8. The statement "The total mass of materials is not affected by a chemical change in those materials" is called a(n)
- theory.
  - observation.
  - measurement.
  - natural law.
  - experiment.
9. Convert  $62^\circ\text{F}$  to K. ( $T_F = T_C \times (9^\circ\text{F}/5^\circ\text{C}) + 32^\circ\text{F}$ )
- 289.8 K
  - 290 K
  - 340 K
  - 260 K
  - 243 K
10. Manganese makes up  $1.3 \times 10^{-4}$  percent by mass of the elements found in a normal healthy body. How many grams of manganese would be found in the body of a person weighing 183 lb? ( $2.2 \text{ lb} = 1.0 \text{ kg}$ )
- 11 g
  - 1100 g
  - 0.11 g
  - 0.24 g
  - none of these is correct
11. Which of the following is *not* a unit in the SI system?
- Kelvin
  - ampere
  - candela
  - meter
  - calorie
12. A metric unit for mass is
- ton.
  - pound.
  - kilogram.
  - ounce.
  - meter.
13. Express 784000000 in exponential notation.
- $78.4 \times 10^7$
  - $7.84 \times 10^6$
  - $7.84 \times 10^8$
  - $784 \times 10^6$
  - $784 \times 10^7$

14. A freighter carrying a cargo of uranium hexafluoride sank in the English Channel in late August 1984. The cargo of uranium hexafluoride weighed  $2.25 \times 10^8$  kg and was contained in 30 drums, each having a volume of  $1.62 \times 10^6$  L. What is the density (g/mL) of uranium hexafluoride?
- ~~a. 1.39 g/mL~~
  - b. 1.39 g/mL
  - c. 4.63 g/mL
  - d. 46.3 g/mL
  - e. 41.7 g/mL
15. How many significant figures are there in the number 0.0322?
- a. 4
  - b. 3
  - c. 5
  - d. 2
  - e. 0
16. One meter contains this many decimeters:
- a. 10
  - b. 100
  - c. 1000
  - d. 1/10
  - e. 1/100
17. A quantitative observation
- a. always makes a comparison.
  - b. contains a number and a unit.
  - c. does not contain a number.
  - d. must be obtained through experimentation.
  - e. none of these
18. In 1928, 1.0 g of a new element was isolated from 660 kg of the ore molybdenite. The percent by mass of this element in the ore was:
- a.  $1.5 \times 10^{-4}\%$
  - b. 1.5%
  - c. 1.0%
  - d. 6.6%
  - e.  $3.5 \times 10^{-3}\%$
19. How many significant figures are there in the number 0.0006042?
- a. 4
  - b. 7
  - c. 8
  - d. 3
  - e. 0
20. An example of a pure substance is
- a. carbon dioxide.
  - b. elements.
  - c. pure water.
  - d. compounds.
  - e. all of these
21. How many significant figures are there in the number 1008500?
- a. 0
  - b. 13
  - c. 7
  - d. 5
  - e. 4

22. A solution is also called a
- compound.
  - homogeneous mixture.
  - pure mixture.
  - heterogeneous mixture.
  - distilled mixture.
23. In a recent accident, some drums of uranium hexafluoride were lost in the English Channel, which is known for its cold water (about  $17^{\circ}\text{C}$ ). The melting point of uranium hexafluoride is  $148^{\circ}\text{F}$ . In what physical state is the uranium hexafluoride in these drums?
- a mixture of solid and liquid
  - solid
  - gas
  - liquid
  - not enough information
24. The amount of uncertainty in a measured quantity is determined by:
- the skill of the observer only.
  - both the skill of the observer and the limitations of the measuring instrument.
  - the limitations of the measuring instrument only.
  - neither the skill of the observer nor the limitations of the measuring instrument.
25. Which of the following is an example of a qualitative observation?
- The temperature of the liquid is  $60^{\circ}\text{C}$ .
  - A piece of wood is 5.3 cm long.
  - The volume of liquid in beaker A is 4.3 mL
  - Solution 1 is much darker than solution 2.
  - none of these
26. \_\_\_\_\_ are substances with constant composition that can be broken down into elements by chemical processes.
- Quarks
  - Solutions
  - Compounds
  - Mixtures
  - Heterogeneous mixtures
27. The state of matter for an object that has both definite volume and definite shape is
- elemental state.
  - solid state.
  - gaseous state.
  - liquid state.
  - mixed state.
28. Measured quantities, such as length, mass, or time, can best be described as:
- sometimes certain.
  - always uncertain.
  - always certain.
  - sometimes uncertain.
29. Convert 974036 mm to km.
- 9744036 km
  - 974036000 km
  - 974.036 km
  - 0.974036 km
  - 0.000974036 km

30. 100 seconds contain this many nanoseconds.
- $1 \times 10^7$
  - $1 \times 10^{10}$
  - $1 \times 10^{11}$
  - $1 \times 10^8$
  - $1 \times 10^{12}$
31. A set of tested hypotheses that gives an overall explanation of some natural phenomenon is called a(n)
- observation.
  - theory.
  - measurement.
  - experiment.
  - natural law.
32. Which of the following metric relationships is incorrect?
- 1 microliter =  $10^{-6}$  liters
  - 1 millimeter =  $10^3$  meters
  - 1 megagram =  $10^6$  grams
  - 100 centimeters = 1 meter
  - 1 kilogram =  $10^3$  grams
33. A scientist obtains the number 1250.37986 on a calculator. If this number actually has four (4) significant figures, how should it be written?
- 1251
  - 1250.4
  - 1250.3799
  - $1.250 \times 10^{-3}$
  - $1.250 \times 10^3$
34. Convert 6.0 kg to lb. (1 kg = 2.205 lb)
- 13 lbs
  - 2.7 lbs
  - 1.3 lbs
  - 13.23 lbs
  10. lbs
35. The term used to describe how consistently several measurements of some quantity give the same result is:
- exactness.
  - uncertainty.
  - accuracy.
  - significance.
  - precision.
36. A piece of indium with a mass of 16.6 g is submerged in 46.3 cm<sup>3</sup> of water in a graduated cylinder. The water level increases to 48.6 cm<sup>3</sup>. The correct value for the density of indium from these data is:
- 7.217 g/cm<sup>3</sup>
  - 0.14 g/cm<sup>3</sup>
  - 7.2 g/cm<sup>3</sup>
  - more than 0.1 g/cm<sup>3</sup> away from any of these values.
  - 0.138 g/cm<sup>3</sup>

37. Convert 761 mi to km. (1 m = 1.094 yds, 1 mi = 1760 yds)

- a. 832 km
- b.  $1.22 \times 10^9$  km
- c. 1470 km
- d. 1220 km
- e. 696 km

TRUE/FALSE

38. All physical changes are accompanied by chemical changes.

MULTIPLE CHOICE

39. The density of gasoline is 0.7025 g/mL at 20°C. When gasoline is added to water:

- a. it will mix so you can't see it.
- b. it will float on top.
- c. it will sink to the bottom.
- d. the mixture will improve the running of the motor.
- e. none of these things will happen.

40. Convert 0.7891 L to cL.

- a. 7.891 cL
- b. 78.91 cL
- c. 0.007891 cL
- d. 789.1 cL
- e. 0.07891 cL

41. The volume of 65 L equals

- a. 65 dm<sup>3</sup> and 65000 cm<sup>3</sup>
- b. 650 dm<sup>3</sup>
- c. 65 dm<sup>3</sup>
- d. 65000 cm<sup>3</sup>
- e. 650 cm<sup>3</sup>

42. Convert 4301 mL to qts. (1 L = 1.06 qt)

- a. 4.559 qts
- b.  $4058 \times 10^{-3}$  qts
- c. 4559 qts
- d. 4.058 qts
- e. 4058 qts

43. Convert 0.092 ft<sup>3</sup> to L. (2.54 cm = 1 in., 1 L = 1 dm<sup>3</sup>)

- a. 0.40 L
- b.  $3.2 \times 10^{-3}$  L
- c. 26 L
- d. 2.6 L
- e. 1.8 L

44. The state of matter for an object that has a definite volume but not a definite shape is

- a. mixed state.
- b. gaseous state.
- c. solid state.
- d. liquid state.
- e. elemental state.

45. The boiling of water is a

- a. chemical and physical damage.
- b. chemical change because heat is needed for the process to occur.
- c. physical change because the water merely disappears.
- d. physical change because the gaseous water is chemically the same as the liquid.
- e. chemical change because a gas (steam) is given off.

46. Using the rules of significant figures, calculate the following:

$$\frac{6.167 + 83}{5.10}$$

5.10

- a. 17.48
- b. 17
- c. 17.5
- d. 18
- e. 20

47. The degree of agreement among several measurements of the same quantity is called \_\_\_\_\_. It reflects the reproducibility of a given type of measurement.

- a. certainty
- b. precision
- c. accuracy
- d. error
- e. significance

48. One second contains this many picoseconds.

- a.  $1 \times 10^{-9}$
- b.  $1 \times 10^{-12}$
- c.  $1 \times 10^{15}$
- d.  $1 \times 10^9$
- e.  $1 \times 10^{12}$

49. The agreement of a particular value with the true value is called

- a. precision.
- b. error.
- c. certainty.
- d. significance.
- e. accuracy.

50. Express 0.000543 in exponential notation.

- a.  $54.3 \times 10^{-5}$
- b.  $5.43 \times 10^{-6}$
- c.  $543 \times 10^{-3}$
- d.  $54.3 \times 10^{-3}$
- e.  $5.43 \times 10^{-4}$



# MR. SMITH'S TOTALLY AWESOME POLYATOMIC SHEET (YIPPEE!)

## Positive Ions

Aluminum $\text{Al}^{3+}$	Lithium $\text{Li}^+$
Ammonium $\text{NH}_4^+$	Magnesium $\text{Mg}^{2+}$
Antimony $\text{Sb}^{3+}$	Manganese (IV) $\text{Mn}^{4+}$
Barium $\text{Ba}^{2+}$	Manganese (II) $\text{Mn}^{2+}$
Beryllium $\text{Be}^{2+}$	Mercury (II) $\text{Hg}^{2+}$
Bismuth $\text{Bi}^{3+}$	Mercury (I) $\text{Hg}_2^{2+}$
Cadmium $\text{Cd}^{2+}$	Nickel (II) $\text{Ni}^{2+}$
Calcium $\text{Ca}^{2+}$	Nickel (III) $\text{Ni}^{3+}$
Cerium (IV) $\text{Ce}^{4+}$	Platinum (IV) $\text{Pt}^{4+}$
Cerium (III) $\text{Ce}^{3+}$	Platinum (II) $\text{Pt}^{2+}$
Cesium $\text{Cs}^+$	Potassium $\text{K}^+$
Chromium (III) $\text{Cr}^{3+}$	Rubidium $\text{Rb}^+$
Chromium (II) $\text{Cr}^{2+}$	Silver $\text{Ag}^+$
Cobalt (III) $\text{Co}^{3+}$	Sodium $\text{Na}^+$
Cobalt (II) $\text{Co}^{2+}$	Strontium $\text{Sr}^{2+}$
Copper (II) $\text{Cu}^{2+}$	Thallium (III) $\text{Tl}^{3+}$
Copper (I) $\text{Cu}^+$	Thallium (I) $\text{Tl}^+$
Gallium $\text{Ga}^{3+}$	Tin (IV) $\text{Sn}^{4+}$
Germanium $\text{Ge}^{4+}$	Tin (II) $\text{Sn}^{2+}$
Hydrogen $\text{H}^+$	Titanium (IV) $\text{Ti}^{4+}$
Iron (III) $\text{Fe}^{3+}$	Titanium (III) $\text{Ti}^{3+}$
Iron (II) $\text{Fe}^{2+}$	Vanadium $\text{V}^{3+}$
Lead (II) $\text{Pb}^{2+}$	Zinc $\text{Zn}^{2+}$
Lead (IV) $\text{Pb}^{4+}$	

## Negative Ions

Acetate $\text{C}_2\text{H}_3\text{O}_2^-$	Hydrogen phthalate [biphthalate] $\text{HC}_8\text{H}_4\text{O}_4^-$
Arsenide $\text{As}^{3-}$	Hydrogen sulfate [bisulfate] $\text{HSO}_4^-$
Arsenate $\text{AsO}_4^{3-}$	Hydrogen sulfide [bisulfide] $\text{HS}^-$
Arsenite $\text{AsO}_3^{3-}$	Hydrogen sulfite [bisulfite] $\text{HSO}_3^-$
Benzoate $\text{C}_7\text{H}_6\text{O}_2^{2-}$	Hydroxide $\text{OH}^-$
Borate $\text{BO}_3^{3-}$	Hypochlorite $\text{ClO}^-$
Bromate $\text{BrO}_3^-$	Iodate $\text{IO}_3^-$
Bromide $\text{Br}^-$	Iodide $\text{I}^-$
Carbide $\text{C}^{4-}$	Nitrate $\text{NO}_3^-$
Carbonate $\text{CO}_3^{2-}$	Nitride $\text{N}^{3-}$
Chlorate $\text{ClO}_3^-$	Nitrite $\text{NO}_2^-$
Chloride $\text{Cl}^-$	Orthosilicate $\text{SiO}_4^{4-}$
Chlorite $\text{ClO}_2^-$	Oxalate $\text{C}_2\text{O}_4^{2-}$
Chromate $\text{CrO}_4^{2-}$	Oxide $\text{O}^{2-}$
Cyanate $\text{CNO}^-$	Perchlorate $\text{ClO}_4^-$
Cyanide $\text{CN}^-$	Periodate $\text{IO}_4^-$
Dichromate $\text{Cr}_2\text{O}_7^{2-}$	Permanganate $\text{MnO}_4^-$
Dihydrogen phosphate $\text{H}_2\text{PO}_4^{2-}$	Peroxide $\text{O}_2^{2-}$
Diphosphate $\text{P}_2\text{O}_7^{4-}$	Phosphate $\text{PO}_4^{3-}$
Fluoride $\text{F}^-$	Phosphide $\text{P}^{3-}$
Hexacyanoferrate (III) [ferricyanide] $\text{Fe}(\text{CN})_6^{3-}$	Pyrophosphate $\text{P}_2\text{O}_7^{4-}$
Hexacyanoferrate (IV) [ferrocyanide] $\text{Fe}(\text{CN})_6^{4-}$	Silicate $\text{SiO}_3^{2-}$
Hydride $\text{H}^-$	Sulfate $\text{SO}_4^{2-}$
Hydrogen Carbonate [bicarbonate] $\text{HCO}_3^-$	Sulfide $\text{S}^{2-}$
Hydrogen oxalate [bioxalate] $\text{HC}_2\text{O}_4^-$	Sulfite $\text{SO}_3^{2-}$
Hydrogen phosphate [monohydrogen phosphate] $\text{HPO}_4^{2-}$	Thiocyanate $\text{SCN}^-$
Hydrogen phosphite [monohydrogen phosphite] $\text{HPO}_3^{2-}$	Thiosulfate $\text{S}_2\text{O}_3^{2-}$

### Positive Ions

$\text{Ag}^+$ Silver	$\text{Li}^+$ Lithium
$\text{Al}^{3+}$ Aluminum	$\text{Mg}^{2+}$ Magnesium
$\text{Ba}^{2+}$ Barium	$\text{Mn}^{2+}$ Manganese (II)
$\text{Be}^{2+}$ Beryllium	$\text{Mn}^{4+}$ Manganese (IV)
$\text{Bi}^{3+}$ Bismuth	$\text{Na}^+$ Sodium
$\text{Ca}^{2+}$ Calcium	$\text{NH}_4^+$ Ammonium
$\text{Cd}^{2+}$ Cadmium	$\text{Ni}^{2+}$ Nickel (II)
$\text{Ce}^{3+}$ Cerium (III)	$\text{Ni}^{3+}$ Nickel (III)
$\text{Ce}^{4+}$ Cerium (IV)	$\text{Pb}^{2+}$ Lead (II)
$\text{Co}^{2+}$ Cobalt (II)	$\text{Pb}^{4+}$ Lead (IV)
$\text{Co}^{3+}$ Cobalt(III)	$\text{Pt}^{2+}$ Platinum (II)
$\text{Cr}^{2+}$ Chromium (II)	$\text{Pt}^{4+}$ Platinum (IV)
$\text{Cr}^{3+}$ Chromium (III)	$\text{Rb}^+$ Rubidium
$\text{Cs}^+$ Cesium	$\text{Sb}^{3+}$ Antimony
$\text{Cu}^+$ Copper (I)	$\text{Sn}^{2+}$ Tin (II)
$\text{Cu}^{2+}$ Copper (II)	$\text{Sn}^{4+}$ Tin (IV)
$\text{Fe}^{2+}$ Iron (II)	$\text{Sr}^{2+}$ Strontium
$\text{Fe}^{3+}$ Iron (III)	$\text{Ti}^{3+}$ Titanium (III)
$\text{Ga}^{3+}$ Gallium	$\text{Ti}^{4+}$ Titanium (IV)
$\text{Ge}^{4+}$ Germanium	$\text{Tl}^+$ Thallium (I)
$\text{H}^+$ Hydrogen	$\text{Tl}^{3+}$ Thallium (III)
$\text{Hg}^{2+}$ Mercury (II)	$\text{V}^{3+}$ Vanadium
$\text{Hg}_2^{2+}$ Mercury (I)	$\text{Zn}^{2+}$ Zinc
$\text{K}^+$ Potassium	

### Negative Ions

$\text{As}^{3-}$ Arsenide	$\text{HCO}_3^-$ Hydrogen carbonate [bicarbonate]
$\text{AsO}_3^{3-}$ Arsenite	$\text{HPO}_3^{2-}$ Hydrogen phosphite [monohydrogen phosphite]
$\text{AsO}_4^{3-}$ Arsenate	$\text{HPO}_4^{2-}$ Hydrogen phosphate [monohydrogen phosphate]
$\text{BO}_3^{3-}$ Borate	$\text{HS}^-$ Hydrogen sulfide [bisulfide]
$\text{Br}^-$ Bromide	$\text{HSO}_3^-$ Hydrogen sulfite [bisulfite]
$\text{BrO}_3^-$ Bromate	$\text{HSO}_4^-$ Hydrogen sulfate [bisulfate]
$\text{C}_2\text{H}_3\text{O}_2^-$ Acetate	$\text{I}^-$ Iodide
$\text{C}_2\text{O}_4^{2-}$ Oxalate	$\text{IO}_3^-$ Iodate
$\text{C}^{4-}$ Carbide	$\text{IO}_4^-$ Periodate
$\text{C}_7\text{H}_6\text{O}_2^{2-}$ Benzoate	$\text{MnO}_4^-$ Permanganate
$\text{Cl}^-$ Chloride	$\text{N}^{3-}$ Nitride
$\text{ClO}^-$ Hypochlorite	$\text{NO}_2^-$ Nitrite
$\text{ClO}_2^-$ Chlorite	$\text{NO}_3^-$ Nitrate
$\text{ClO}_3^-$ Chlorate	$\text{O}^{2-}$ Oxide
$\text{ClO}_4^-$ Perchlorate	$\text{O}_2^{2-}$ Peroxide
$\text{CN}^-$ Cyanide	$\text{OH}^-$ Hydroxide
$\text{CNO}^-$ Cyanate	$\text{P}_2\text{O}_7^{4-}$ Diphosphate
$\text{CO}_3^{2-}$ Carbonate	$\text{P}_2\text{O}_7^{4-}$ Pyrophosphate
$\text{Cr}_2\text{O}_7^{2-}$ Dichromate	$\text{P}^{3-}$ Phosphide
$\text{CrO}_4^{2-}$ Chromate	$\text{PO}_4^{3-}$ Phosphate
$\text{F}^-$ Fluoride	$\text{S}^{2-}$ Sulfide
$\text{Fe}(\text{CN})_6^{3-}$ Hexacyanoferrate (III) [ferricyanide]	$\text{S}_2\text{O}_3^{2-}$ Thiosulfate
$\text{Fe}(\text{CN})_6^{4-}$ Hexacyanoferrate (IV) [ferrocyanide]	$\text{SCN}^-$ Thiocyanate
$\text{H}^-$ Hydride	$\text{SiO}_3^{2-}$ Silicate
$\text{H}_2\text{PO}_4^{2-}$ Dihydrogen phosphate	$\text{SiO}_4^{4-}$ Orthosilicate
$\text{HC}_2\text{O}_4^-$ Hydrogen oxalate [bioxalate]	$\text{SO}_3^{2-}$ Sulfite
$\text{HC}_8\text{H}_4\text{O}_4^-$ Hydrogen phthalate [bipthalate]	$\text{SO}_4^{2-}$ Sulfate

## MULTIPLE CHOICE

1. According to the law of definite proportions:
  - a. it is not possible for the same two elements to form more than one compound.
  - b. the ratio of the masses of the elements in a compound is always the same.
  - c. if the same two elements form two different compounds, they do so in the same ratio.
  - d. the total mass after a chemical change is the same as before the change.
2. Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?
  - a.  $\text{NH}_4$  and  $\text{NH}_4\text{Cl}$
  - b.  $\text{ZnO}_2$  and  $\text{ZnCl}_2$
  - c.  $\text{H}_2\text{O}$  and  $\text{HCl}$
  - d.  $\text{NO}$  and  $\text{NO}_2$
  - e.  $\text{CH}_4$  and  $\text{CO}_2$
3. Many classic experiments have given us indirect evidence of the nature of the atom. Which of the experiments listed below did not give the results described?
  - a. The Rutherford experiment was useful in determining the nuclear charge on the atom.
  - b. Millikan's oil-drop experiment showed that the charge on any particle was a simple multiple of the charge on the electron.
  - c. The Rutherford experiment proved the Thomson "plum-pudding" model of the atom to be essentially correct.
  - d. The electric discharge tube proved that electrons have a negative charge.
4. Which of the following statements from Dalton's atomic theory is no longer true, according to modern atomic theory?
  - a. Elements are made up of tiny particles called atoms.
  - b. Atoms are not created or destroyed in chemical reactions.
  - c. All atoms of a given element are identical.
  - d. Atoms are indivisible in chemical reactions.
  - e. All of these statements are true according to modern atomic theory.
5. The first people to attempt to explain why chemical changes occur were
  - a. metallurgists.
  - b. the Greeks.
  - c. physicians.
  - d. alchemists.
  - e. physicists.
6. The Greeks proposed that matter consisted of four fundamental substances:
  - a. fire, metal, water, air
  - b. atoms, metal, fire, air
  - c. earth, metal, water, air
  - d. fire, earth, water, air
  - e. atoms, fire, water, air

7. The first chemist to perform truly quantitative experiments was
- Paracelsus.
  - Bauer.
  - Priestly.
  - Lavoisier.
  - Boyle.
8. The scientist who discovered the law of conservation of mass and is also called the father of modern chemistry is
- Proust.
  - Bauer.
  - Priestly.
  - Lavoisier.
  - Boyle.
9. Which of the following pairs can be used to illustrate the law of multiple proportions?
- $\text{SO}$  and  $\text{SO}_2$
  - $\text{CO}$  and  $\text{CaCO}_3$
  - $\text{H}_2\text{O}$  and  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
  - $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{S}$
  - $\text{KCl}$  and  $\text{KClO}_2$
10. The chemist credited for inventing a set of symbols for writing elements and a system for writing the formulas of compounds (and for discovering selenium, silicon, and thorium) is
- Boyle.
  - Berzelius.
  - Priestly.
  - Dalton.
  - Lavoisier.
11. What element (in trace amounts) has been shown to help in protecting against heart disease and cancer?
- silicon
  - copper
  - selenium
  - potassium
  - oxygen
12. The first scientist to show that atoms emit any negative particles was
- J. J. Thomson.
  - William Thomson.
  - Ernest Rutherford.
  - John Dalton.
  - Lord Kelvin.

13. The scientist whose alpha-particle scattering experiment led him to conclude that the nucleus of an atom contains a dense center of positive charge is
- J. J. Thomson.
  - William Thomson.
  - Ernest Rutherford.
  - John Dalton.
  - Lord Kelvin.
14. Which one of the following statements about atomic structure is false?
- The electrons occupy a very large volume compared to the nucleus.
  - The number of protons and neutrons is always the same in the neutral atom.
  - The protons and neutrons in the nucleus are very tightly packed.
  - Almost all of the mass of the atom is concentrated in the nucleus.
15. If the Thomson model of the atom had been correct, Rutherford would have observed
- alpha particles going through the foil with little or no deflection.
  - positive particles formed in the foil.
  - alpha particles bouncing off the foil.
  - alpha particles greatly deflected by the metal foil.
  - None of these observations is consistent with the Thomson model of the atom.
16. Rutherford's experiment was important because it showed that:
- radioactive elements give off alpha particles.
  - the mass of the atom is uniformly distributed throughout the atom.
  - a zinc sulfide screen scintillates when struck by a charged particle.
  - an atom is mostly empty space.
  - gold foil can be made to be only a few atoms thick.
17. Which of the following is(are) correct?
- sulfide  $S^{2-}$
  - ammonium chloride  $NH_4Cl$
  - acetic acid  $HC_2H_3O_2$
  - barium oxide  $BaO$
- all
  - 3, 4
  - 1, 2
  - 1, 3, 4
  - none
18. Which of the following atomic symbols is incorrect?
- $^{32}_{15}P$
  - $^{14}_8N$
  - $^{14}_6C$
  - $^{37}_{17}Cl$

19. The element rhenium (Re) exists as two stable isotopes and 18 unstable isotopes. Rhenium-185 has in its nucleus
- 130 protons, 75 neutrons.
  - not enough information is given.
  - 75 protons, 75 neutrons.
  - 75 protons, 130 neutrons.
  - 75 protons, 110 neutrons.
20. Which statement is *not* correct?
- Three types of radioactive emission are gamma rays, beta ~~protons~~, and alpha particles.
  - There are only three types of radioactivity known to scientists today.
  - The mass of an alpha particle is 7300 times that of the electron.
  - An alpha particle has a 2+ charge.
  - A gamma ray is high-energy "light."
21.  $^{40}_{20}\text{C}^{2+}$  has
- 20 protons, 22 neutrons, and 18 electrons.
  - 20 protons, 20 neutrons, and 22 electrons.
  - 20 protons, 20 neutrons, and 18 electrons.
  - 22 protons, 20 neutrons, and 20 electrons.
  - 22 protons, 18 neutrons, and 18 electrons.
22. Which of the following has 45 neutrons, 35 protons, and 36 electrons?
- $^{80}_{35}\text{Br}^{-}$
  - $^{81}_{35}\text{Tl}^{-}$
  - $^{80}_{35}\text{Hg}$
  - $^{103}_{35}\text{Rh}^{-}$
23. The numbers of protons, neutrons, and electrons in  $^{127}_{53}\text{I}^{-}$  are:
- 53 p, 127 n, 52 e
  - 53 p, 74 n, 52 e
  - 52 p, 128 n, 53 e
  - 53 p, 127 n, 54 e
  - 53 p, 74 n, 54 e
24. All of the following are true *except*:
- Ions are formed by removing electrons from a neutral atom.
  - Metals tend to form positive ions.
  - Ions are formed by adding electrons to a neutral atom.
  - Ions are formed by changing the number of protons in an atom's nucleus.
  - An ion has a positive or negative charge.

25. Which of the following statements is (are) true?

- a.  $^{18}_{8}\text{O}$  and  $^{19}_{9}\text{F}$  have the same number of neutrons.
- b.  $^{14}_{6}\text{C}$  and  $^{14}_{7}\text{N}$  are isotopes of each other because their mass numbers are the same.
- c.  $^{18}_{8}\text{O}^{2-}$  has the same number of electrons as  $^{20}_{10}\text{Ne}$ .
- d.  $^{18}_{8}\text{O}$  and  $^{19}_{9}\text{F}$  have the same number of neutrons and  $^{14}_{6}\text{C}$  and  $^{14}_{7}\text{N}$  are isotopes of each other because their mass numbers are the same.
- e.  $^{18}_{8}\text{O}$  and  $^{19}_{9}\text{F}$  have the same number of neutrons and  $^{18}_{8}\text{O}^{2-}$  has the same number of electrons as  $^{20}_{10}\text{Ne}$ .

26. By knowing the number of protons a neutral element has, you should be able to determine

- a. the name of the element.
- b. the number of neutrons in the neutral element.
- c. the number of electrons in the neutral element.
- d. two of these.
- e. none of these

TRUE/FALSE

27. The number of neutrons in an element is the same for all neutral atoms of that element.

MULTIPLE CHOICE

28. The average mass of a carbon atom is 12.011. Assuming you were able to pick up only one carbon unit, the chances that you would randomly get one with a mass of 12.011 is

- a. about 12%.
- b. 0%.
- c. greater than 50%.
- d. 0.011%.
- e. 12.011%.

TRUE/FALSE

29. The number of electrons in an element is the same for all neutral atoms of that element.

MULTIPLE CHOICE

30. An ion is formed

- a. by either adding or subtracting neutrons from the atom.
- b. by either adding or subtracting protons from the atom.
- c. Two of these are true.
- d. by either adding or subtracting electrons from the atom.
- e. All of these are true.

31. Which of the following statements are *true* of uranium-238?

- I. Its chemical properties will be exactly like those of uranium-238.
  - II. Its mass will be slightly different from that of an atom of uranium-238.
  - III. It will contain a different number of protons than an atom of uranium-238.
  - IV. It is more plentiful in nature than uranium-238.
- a. I, II, IV
  - b. III, IV
  - c. I, II, III
  - d. II, III, IV
  - e. all of these

32. An isotope,  $X$ , of a particular element has an atomic number of 7 and a mass number of 15. Therefore,

- a.  $X$  is an isotope of nitrogen.
- b.  $X$  has 8 neutrons per atom.
- c.  $X$  has an atomic mass of 14.0067.
- d.  $X$  is an isotope of nitrogen and  $X$  has 8 neutrons per atom.
- e.  $X$  is an isotope of nitrogen,  $X$  has 8 neutrons per atom, and  $X$  has an atomic mass of 14.0067.

SHORT ANSWER

33. Write the symbol for each of the following elements.

- a. magnesium \_\_\_\_\_
- b. potassium \_\_\_\_\_
- c. iron \_\_\_\_\_
- d. sodium \_\_\_\_\_

MULTIPLE CHOICE

34. How many oxygen atoms are there in one formula unit of  $\text{Ca}_3(\text{PO}_4)_2$ ?

- a. 2
- b. 4
- c. 6
- d. 8
- e. none of these

35. The formula of water,  $\text{H}_2\text{O}$ , suggests

- a. there is twice as much mass of hydrogen as oxygen in each molecule.
- b. there are two hydrogen atoms and one oxygen atom per water molecule.
- c. there is twice as much mass of oxygen as hydrogen in each molecule.
- d. there are two oxygen atoms and one hydrogen atom per water molecule.
- e. none of these



36. Which of the following are incorrectly paired?
- Na, alkali metal
  - Sn, transition metal
  - Mg, alkaline earth metal
  - Br, halogen
  - Ar, noble gas
37. Which of the following are incorrectly paired?
- Copper, Co
  - Sodium, Na
  - Silver, Ag
  - Iron, Fe
  - Lead, Pb
38. All of the following are characteristics of metals *except*:
- good conductors of heat
  - tend to gain electrons in chemical reactions
  - malleable
  - ductile
  - often lustrous
39. All of the following are characteristics of nonmetals *except*:
- poor conductors of electricity
  - do not have a shiny (lustrous) appearance
  - often bond to each other by forming covalent bonds
  - tend to form negative ions in chemical reactions with metals
  - appear in the upper left-hand corner of the periodic table
40. What are the forms of elemental carbon?
- graphite and diamond
  - graphite, diamond, and buckminsterfullerene
  - graphite and buckminsterfullerene
  - diamond and buckminsterfullerene
  - diamond, graphite, and carbonite
41. Which metals form cations with varying positive charges?
- transition metals
  - metalloids
  - Group 1 metals
  - Group 2 metals
  - Group 3 metals
42. A species with 12 protons and 10 electrons is
- $\text{Ne}^{2+}$
  - $\text{Ne}^{2-}$
  - $\text{Ti}^{2+}$
  - $\text{Mg}^{2+}$
  - Mg
43. The correct name for NaBr is
- monosodium monobromide
  - monosodium bromide
  - sodium bromide
  - sodium monobromide
  - sodium(I) bromide

44. The correct name for  $\text{Hg}_2^{2+}$  is

- a. mercury ion
- b. mercury(I) ion
- c. hydrogen(II) ion
- d. mercury(II) ion
- e. hydrogen ion

45. The correct name for  $\text{SnO}_2$  is

- a. tin(IV) oxide
- b. tin(II) oxide
- c. silicon(IV) oxide
- d. tin oxide
- e. silicon(II) oxide

46. The formula for calcium bisulfate is

- a.  $\text{Ca}(\text{SO}_4)_2$
- b.  $\text{CaS}_2$
- c.  $\text{Ca}(\text{HSO}_4)_2$
- d.  $\text{Ca}_2\text{HSO}_4$
- e.  $\text{Ca}_2\text{S}$

47. Which of the following is incorrectly named?

- a.  $\text{Pb}(\text{NO}_3)_2$ , lead(II) nitrate
- b.  $\text{NH}_4\text{ClO}_4$ , ammonium perchlorate
- c.  $\text{PO}_4^{3-}$ , phosphate ion
- d.  $\text{Mg}(\text{OH})_2$ , magnesium hydroxide
- e.  $\text{NO}_3^-$ , nitrite ion

48. All of the following are in aqueous solution. Which is incorrectly named?

- a.  $\text{H}_2\text{SO}_4$ , sulfuric acid
- b.  $\text{H}_2\text{CO}_3$ , carbonic acid
- c.  $\text{H}_3\text{PO}_4$ , phosphoric acid
- d.  $\text{HCN}$ , cyanic acid
- e.  $\text{HCl}$ , hydrochloric acid

49. All of the following are in aqueous solution. Which is incorrectly named?

a.  $\text{HC}_2\text{H}_3\text{O}_2$ , acetic acid

b.  $\text{HBr}$ , bromic acid

c.  $\text{H}_2\text{SO}_3$ , sulfurous acid

d.  $\text{HNO}_2$ , nitrous acid

e.  $\text{HClO}_3$ , chloric acid

50. Which of the following pairs is incorrect?

a.  $\text{NH}_4\text{Br}$ , ammonium bromide

b.  $\text{K}_2\text{CO}_3$ , potassium carbonate

c.  $\text{BaPO}_4$ , barium phosphate

d.  $\text{CuCl}$ , copper(I) chloride

e.  $\text{MnO}_2$ , manganese (IV) oxide

## AP Problem

1982 B

Water is added to 4.267 grams of  $\text{UF}_6$ . The only products are 3.730 grams of a solid containing only uranium, oxygen and fluorine and 0.970 gram of a gas. The gas is 95.0% fluorine, and the remainder is hydrogen.

- From these data, determine the empirical formula of the gas.
- What fraction of the fluorine of the original compound is in the solid and what fraction in the gas after the reaction?
- What is the formula of the solid product?
- Write a balanced equation for the reaction between  $\text{UF}_6$  and  $\text{H}_2\text{O}$ . Assume that the empirical formula of the gas is the true formula.

## MULTIPLE CHOICE

1. Suppose the reaction  $\text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{SO}_4 \rightarrow 3\text{CaSO}_4 + 2\text{H}_3\text{PO}_4$  is carried out starting with 103 g of  $\text{Ca}_3(\text{PO}_4)_2$  and 75.0 g of  $\text{H}_2\text{SO}_4$ .

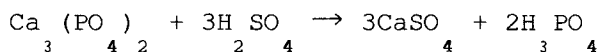
How much phosphoric acid will be produced?

- 50.0 g
  - 112 g
  - 74.9 g
  - 32.5 g
  - 97.6 g
2. Consider the following reaction:
- $$\text{CH}_4(\text{g}) + 4\text{Cl}_2(\text{g}) \rightarrow \text{CCl}_4(\text{g}) + 4\text{HCl}(\text{g})$$
- What mass of  $\text{CCl}_4$  is formed by the reaction of 8.00 g of methane with an excess of chlorine?
- 1.42 g
  - 7.10 g
  - 14.2 g
  - 76.7 g
  - none of these
3. Vitamin C contains the elements C, H, and O. It is known to contain 40.9% C and 4.58% H by mass. The molar mass of vitamin C has been found to be about 180. The molecular formula for vitamin C is:

- $\text{C}_3\text{H}_4\text{O}_3$
- $\text{C}_4\text{H}_6\text{O}_4$
- $\text{C}_2\text{H}_3\text{O}_2$
- $\text{C}_6\text{H}_8\text{O}_6$

Use the following information to answer the question(s) below:

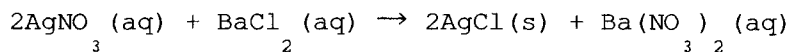
Phosphoric acid can be prepared by reaction of sulfuric acid with "phosphate rock" according to the equation:



4. What is the molar mass of  $\text{Ca}_3(\text{PO}_4)_2$ ?

- 87.05 g/mol
- 135.05 g/mol
- 310.18 g/mol
- 118.02 g/mol
- 166.02 g/mol

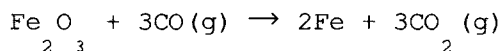
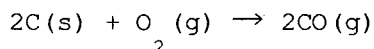
5. A 5.95-g sample of  $\text{AgNO}_3$  is reacted with  $\text{BaCl}_2$  according to the equation



to give 4.00 g of  $\text{AgCl}$ . What is the percent yield of  $\text{AgCl}$ ?

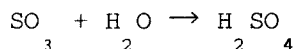
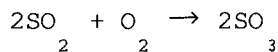
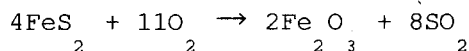
- a. 67.2%
  - b. 93.5%
  - c. 21.4%
  - d. 79.7%
  - e. 39.8%
6. The reaction of 11.9 g of  $\text{CHCl}_3$  with excess chlorine produced 12.6 g of  $\text{CCl}_4$ , carbon tetrachloride:
- $$2\text{CHCl}_3 + 2\text{Cl}_2 \rightarrow 2\text{CCl}_4 + 2\text{HCl}$$
- What is the percent yield?
- a. 82.2%
  - b. 46.2%
  - c. 100%
  - d. 113%
  - e. 27.4%
7. The limiting reactant in a reaction
- a. has the lowest ratio of moles available/coefficient in the balanced equation.
  - b. has the lowest coefficient in a balanced equation.
  - c. has the lowest ratio of coefficient in the balanced equation/moles available.
  - d. is the reactant for which you have the fewest number of moles.
  - e. none of these
8. Bromine exists naturally as a mixture of bromine-79 and bromine-81 isotopes. An atom of bromine-79 contains
- a. 44 protons, 44 electrons, and 35 neutrons.
  - b. 79 protons, 79 electrons, and 35 neutrons.
  - c. 35 protons, 44 neutrons, 35 electrons.
  - d. 35 protons, 79 neutrons, and 35 electrons.
  - e. 34 protons and 35 electrons, only.
9. A sample of aluminum contains  $5.83 \times 10^{20}$  atoms. How many grams are present in this sample?
- a. 27.0 g
  - b.  $1.57 \times 10^{22}$  g
  - c. 0.0261 g
  - d. 0.854 g
  - e. 0.000963 g
10. When 20.0 g  $\text{C}_2\text{H}_6$  and 60.0 g  $\text{O}_2$  react to form  $\text{CO}_2$  and  $\text{H}_2\text{O}$ , how many grams of water are formed?
- a. 58.0 g
  - b. 14.5 g
  - c. 20.0 g
  - d. 18.0 g
  - e. none of these

11. A 0.4647-g sample of a compound known to contain only carbon, hydrogen, and oxygen was burned in oxygen to yield 0.8635 g of  $\text{CO}_2$  and 0.1767 g of  $\text{H}_2\text{O}$ . What is the empirical formula of the compound?
- CHO
  - $\text{C}_2\text{H}_2\text{O}$
  - $\text{C}_3\text{H}_3\text{O}_2$
  - $\text{C}_6\text{H}_3\text{O}_2$
  - $\text{C}_3\text{H}_6\text{O}_2$
12. Which of the following compounds has the same percent composition by mass as styrene,  $\text{C}_8\text{H}_8$ ?
- cyclobutadiene,  $\text{C}_4\text{H}_4$
  - acetylene,  $\text{C}_2\text{H}_2$
  - $\alpha$ -ethyl naphthalene,  $\text{C}_{12}\text{H}_{12}$
  - benzene  $\text{C}_6\text{H}_6$
13. The following two reactions are important in the blast furnace production of iron metal from iron ore ( $\text{Fe}_2\text{O}_3$ ):



Using these balanced reactions, how many moles of  $\text{O}_2$  are required for the production of 5.00 kg of Fe?

- 67.1 moles
  - 29.8 moles
  - 7.46 moles
  - 89.5 moles
  - 16.8 moles
14. Sulfuric acid may be produced by the following process:



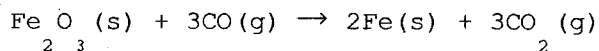
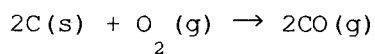
How many moles of  $\text{H}_2\text{SO}_4$  will be produced from 5.00 moles of  $\text{FeS}_2$ ?

- 6.11
- 5.00
- 10.00
- 12.22
- 20.00

15. For which compound does 0.256 mole weigh 12.8 g?
- $\text{CH}_3\text{Cl}$
  - $\text{C}_2\text{H}_4\text{O}$
  - $\text{CO}$
16. Nitric acid contains what percent hydrogen by mass?
- 4.50%
  - 20.0%
  - 10.0%
  - 1.60%
  - 3.45%
17. Ammonium carbonate contains what percent nitrogen by mass?
- 29.2%
  - 14.6%
  - 17.9%
  - none of these
18. A 2.00-g sample of an oxide of bromine is converted to 2.936 g of AgBr. Calculate the empirical formula of the oxide. (molar mass for AgBr = 187.78)
- $\text{BrO}_3$
  - $\text{BrO}_2$
  - $\text{BrO}$
  - $\text{Br}_2\text{O}$
  - none of these
19. When 125.0 g of ethylene ( $\text{C}_2\text{H}_4$ ) burns in oxygen to give carbon dioxide and water, how many grams of  $\text{CO}_2$  are formed?
- 57.50 g
  - 392.2 g
  - 250.0 g
  - 425.6 g
  - 327.0 g
20. Given the equation  $3A + B \rightarrow C + E$ , you react 2 moles of A with 1 mole of B. Which of the following is true?
- A is the limiting reactant because of its higher molar mass.
  - A is the limiting reactant because you need 3 moles of A and have 2.
  - B is the limiting reactant because you have fewer moles of B than A.
  - B is the limiting reactant because 3 A molecules react with 1 B molecule.
  - Neither reactant is limiting.
21. What is the coefficient for oxygen when the following equation is balanced?
- $$\text{NH}_3(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$$
- 7
  - 3
  - 6
  - 12
  - 14



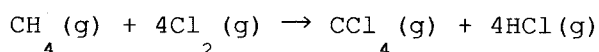
22. Iron is produced from its ore by the reactions:



How many moles of  $\text{O}_2\text{(g)}$  are needed to produce 1 mole of  $\text{Fe(s)}$ ?

- a. 1 mole  $\text{O}_2$
- b. 0.5 mole  $\text{O}_2$
- c. 0.75 mole  $\text{O}_2$
- d. 1.5 mole  $\text{O}_2$

23. Consider the following reaction:



What mass of  $\text{CCl}_4$  will be formed if 1.20 moles of methane react with 1.60 moles of chlorine?

- a. 229 g
- b. 171 g
- c. 114 g
- d. 61.5 g
- e. 17.1 g

24.  $\text{NaHCO}_3$  is the active ingredient in baking soda. How many grams of oxygen are in 0.35 g of  $\text{NaHCO}_3$ ?

- a. 0.20 g
- b. 0.012 g
- c. 0.067 g
- d. 0.15 g
- e. 0.022 g

25. Cortisone consists of molecules, each of which contains 21 atoms of carbon (plus other atoms). The mass percentage of carbon in cortisone is 69.98%. What is the molar mass of cortisone?

- a. 360.4 g/mol
- b. 176.5 g/mol
- c. 287.6 g/mol
- d. 312.8 g/mol
- e. 252.2 g/mol

**A.P. Chemistry Reading List:**

<b>Unit</b>		<b>Zumdahl Text</b>	<b>P.R. Guide</b>
1.	Summer Assignment	1, 2, 3	5
2.	Solution Stoichiometry	4.1-4.7	5
3.	Atomic Structure and P-Table	7 <del>8.1</del>	3
4.	Bonding	8, 10.1-10.4	4
5.	Gases	5	6
6.	Phase Changes	10.8-9	7
7.	Thermodynamics	6.1-6.4, 16.1-16.9	8
8.	Solutions	11, 15.6-7	9
9.	Equilibrium	13	10
10.	Acids and Bases	4.8, 14, 15.1-15.5	15
11.	Kinetics	12	12
12.	Redox and Electrochemistry	4.9-10, 17	13
13.	Nuclear Decay	21.1-3	14
14.	Lab	none	15
15.	Organic Chemistry	22.1-3	16
16.	Descriptive Chemistry	none	17