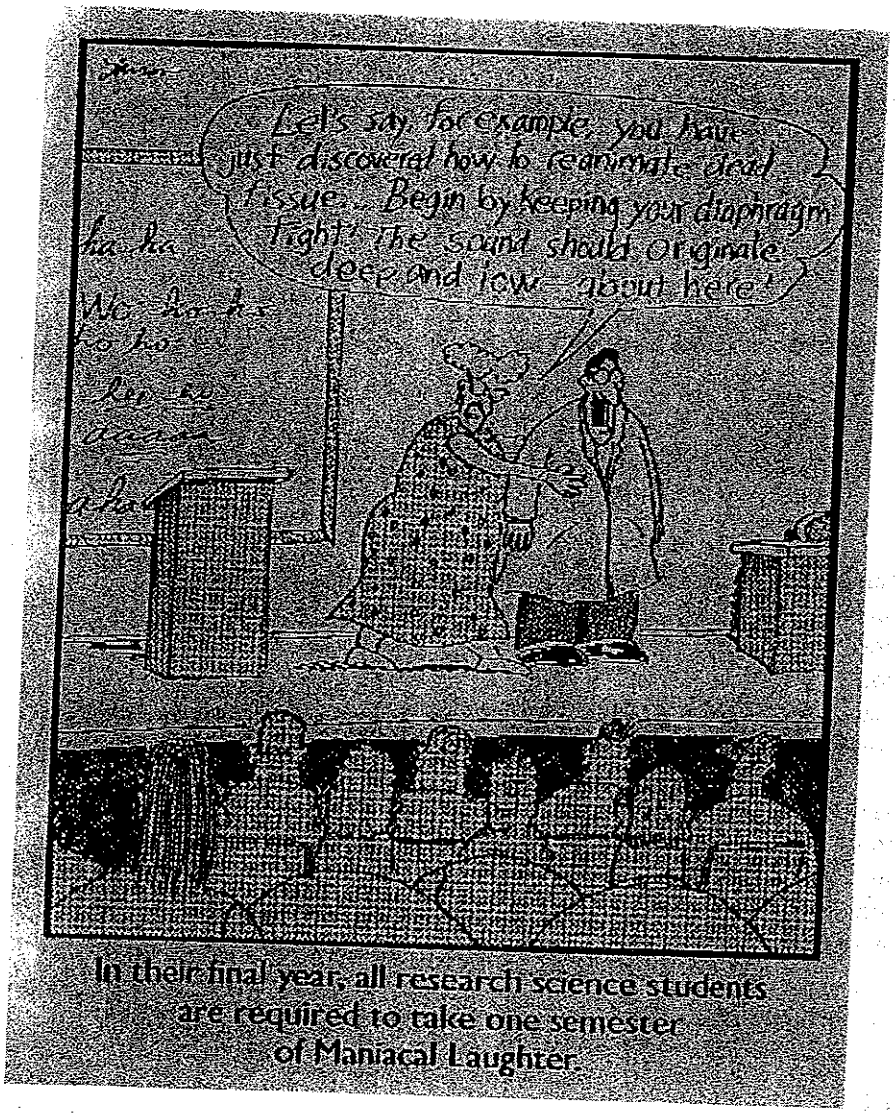
Semester Final

REVIEW



In their final year, all research science students are required to take one semester of Maniacal Laughter.

DO NOT WRITE ON THIS SHEET!!! USE YOUR BUBBLE SHEET OR THE EXTRA PAPER PROVIDED.

Relax! This is stuff you already know. Take your time, do your best and make sure that you watch the time, as there are a lot of problems here.

Choose the BEST answer for each of the following. Mark that answer on your bubble sheet. **GOOD LUCK!**

1. **How many hydrogen atoms are indicated in the formula $(NH_4)_2C_8H_4O_2$?**
   a. 8
   b. 12
   c. 20
   d. 24
   e. none of these

2. **The total number of atoms indicated by the formula $Ca_3(PO_4)_3$ is**
   a. 6
   b. 10
   c. 16
   d. 18
   e. 7

3. **Which atomic particle determines the chemical behavior of an atom?**
   a. proton
   b. electron
   c. neutron
   d. nucleus
   e. none of these

4. **Which particle has the smallest mass?**
   a. neutron
   b. proton
   c. electron
   d. helium nucleus

5. **How many protons, electrons, and neutrons respectively does ^{127}I have?**
   a. 53, 127, 74
   b. 53, 74, 53
   c. 53, 53, 127
   d. 74, 53, 127
   e. 53, 53, 74

6. Which of the following statements are true?

I. The number of protons in an element is the same for all neutral atoms of that element.

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

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

a. I, II and III are all true.
b. Only I and II are true.
c. Only II and III are true.
d. ~~Only I and II are true.~~
e. I, II and III are all false.

7. An element's most stable ion forms an ionic compound with chlorine having the formula XCl_2. If the ion of element X has a mass of 89 and 36 electrons, what is the identity of the element, and how many neutrons does it have?

a. Kr, 53 neutrons
b. Kr, 55 neutrons
c. Se, 55 neutrons
d. Sr, 51 neutrons
e. Rb, 52 neutrons

8. The number of neutrons in one atom of $^{206}_{82}Hg$ is

a. 82
b. 206
c. 124
d. 288
e. none of these

9. The average mass of a boron atom is 10.81. Assuming you were able to isolate only one boron atom, the chance that you would randomly get one with a mass of 10.81 is

a. 0%
b. 0.81%
c. about 11%
d. 10.81%
e. greater than 50%

10. Atoms of the same element having the same atomic number but different mass numbers are called

a. isomers
b. orbitals
c. neutrons
d. isotopes
e. nuclei

11. The number of protons in the nucleus of an atom is called its

a. mass number
b. valence
c. isotope number
d. atomic number
e. none of these

12. **Which of the following is a nonmetal?**
    a. cerium
    b. cesium
    c. carbon
    d. calcium
    e. copper

13. **Which of the following elements is an alkali metal?**
    a. Ca
    b. Cu
    c. Fe
    d. Na
    e. Sc

14. **Which of the following elements is an alkaline earth metal?**
    a. Ca
    b. Cu
    c. Fe
    d. Na
    e. Sc

15. **Which of the following is a noble gas?**
    a. Ar
    b. N_2
    c. H_2
    d. O_2
    e. CO_2

16. **Which of the following elements is most similar to chlorine?**
    a. H
    b. He
    c. Na
    d. Hg
    e. Br

17. **The state of matter for an object that has both definite volume and definite shape is**
    a. solid
    b. liquid
    c. gaseous
    d. elemental
    e. mixed

18. **Which of the following involves a chemical change?**
    a. boiling water
    b. melting ice
    c. chopping wood
    d. cooking an egg
    e. none of these

19. Which of the following is a physical change?
    a. burning gasoline
    b. cooking an egg
    c. decomposing meat
    d. evaporating water
    e. rusting iron

20. Which of these is a chemical property?
    a. Ice melts at 0°C.
    b. Oxygen is a gas.
    c. Helium is very nonreactive.
    d. Sodium is a soft, shiny metal.
    e. Water has a high specific heat.

21. In a chemical change,
    a. a phase change must occur
    b. the original material can never be regenerated
    c. a phase change never occurs
    d. the products are different substances from the starting materials

22. How many of the following are compounds: table salt, carbon, copper, water, mercury?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

23. An element contains only one kind of
    a. isotope
    b. mixture
    c. atom
    d. pure substance
    e. none of these

24. Sand on the beach is an example of
    a. a homogeneous mixture
    b. a heterogeneous mixture
    c. a compound
    d. an element

25. The substance ClO_3^- is best described as
    a. a molecule
    b. a polyatomic ion
    c. a polyatomic molecule
    d. a mixture

26. The correct name for Cu_2O is
    a. copper oxide
    b. copper(I) oxide
    c. copper(II) oxide
    d. dicopper oxide
    e. dicopper monoxide

27. **The correct formula for ammonium sulfate is**
    a. NH_4SO_3
    b. NH_4SO_4
    c. $(NH_4)_2SO_3$
    d. $(NH_4)_2SO_4$
    e. $(NH_3)_2SO_3$

28. **Which of the following formulas is *incorrect*?**
    a. $Ba(OH)_2$
    b. LiH
    c. CaCl
    d. $KMnO_4$
    e. K_2O

29. **Compounds containing only two chemical elements are called**
    a. mixtures
    b. binary compounds
    c. ternary compounds
    d. heterogeneous substances
    e. none of these

30. **An empty graduated cylinder weighs 55.26 g. When filled with 50.0 mL of an unknown liquid, it weighs 92.39 g. The density of the unknown liquid is**
    a. 37.11 g/mL
    b. 50.0 g/mL
    c. 0.743 g/mL
    d. 1.67 g/mL
    e. 0.592 g/mL

31. **Water has a density of 1.0 g/mL. Which of the objects will float in water?**
    Object I: mass - 50.0 g; volume = 60.8 mL
    Object II: mass = 65.2 g; volume = 42.1 mL
    Object III: mass = 100.0 g; volume = 20.0 mL
    a. I
    b. I, III
    c. II
    d. II, III
    e. III

32. **Density is an example of a**
    a. chemical property
    b. physical property
    c. qualitative property
    d. chemical change
    e. physical change

33. **Convert 761 mi to kilometers (1 m = 1.094 yd; 1 mi = 1760 yd).**
   a. 4.70×10^{-4} km
   b. 1470 km
   c. 832 km
   d. 696 km
   e. 1220 km

34. **The result of the following calculation has how many significant figures?**
(0.4333 J/g °C) (33.12°C – 31.12°C)(412.1 g)
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5

35. **How many significant figures are in the number 6.022×10^{32}?**
   a. 27
   b. 23
   c. 3
   d. 4
   e. 1

36. **Using the rules of significant figures, calculate the following:**
6.167 + 70 =
   a. 76
   b. 80
   c. 76.167
   d. 77
   e. 76.17

37. **Express 549000000 in scientific notation.**
   a. 5.49×10^{-8}
   b. 5.49×10^{8}
   c. 54.9×10^{-7}
   d. 549×10^{8}
   e. 549×10^{6}

38. **A compound is analyzed and found to contain 12.1% carbon, 16.2% oxygen, and 71.7% chlorine (by mass). Calculate the empirical formula of this compound.**
   a. COCl
   b. $COCl_2$
   c. CO_2Cl
   d. CO_2Cl_2
   e. $COCl_4$

39. **The mass percent of oxygen in CaO is**
   a. 28.5%
   b. 50%
   c. 72.4%
   d. 25.0%
   e. Cannot be determined from the information given

40. **The mass in grams of 6.0 mol of hydrogen gas (contains H_2) is**
   a. 6×10^{23} g
   b. 12 g
   c. 6.0 g
   d. 12×10^{23} g
   e. none of these

41. **How many atoms of calcium are present in 80.0 g of calcium?**
   a. 2
   b. 3.32×10^{-24}
   c. 6.02×10^{23}
   d. ~~1.20×10^{24}~~
   e. none of these

42. **One mole of oxygen atoms represents**
   a. 32.0 g
   b. 1.00 g
   c. 6.02×10^{23} atoms
   d. ~~16 atoms~~
   e. none of these

43. **When the equation $Si(s) + HF(aq) \rightarrow SiF_4(g) + H_2(g)$ is balanced, what is the coefficient for HF?**
   a. 0
   b. 1
   c. 2
   d. 3
   e. 4

When the following equations are balanced using the smallest possible integers, what is the number in front of the underlined substance in each case?

44. $C_3H_8(g) + \underline{O_2(g)} \rightarrow CO_2(g) + H_2O(g)$

a. 2
b. 3
c. 4
d. 5
e. 6

45. $Mg(s) + HCl(aq) \rightarrow \underline{MgCl_2(aq)} + H_2(g)$

a. 1
b. 2
c. 3
d. 4
e. 5

46. $\underline{H_3PO_4(aq)} + Ca(OH)_2(aq) \rightarrow Ca_3(PO_4)_2(aq) + H_2O(l)$

a. 2
b. 3
c. 4
d. 5
e. 6

47. **In the reaction**
$Al_2S_3(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2S(g)$
how many moles of HCl are used for each mole of $AlCl_3$ formed?

a. 0
b. 1
c. 1.5
d. 2
e. 3

48. **All the following are clues that a chemical reaction has taken place *except***

a. a color change
b. a solid forms
c. the reactant is smaller
d. bubbles form
e. a flame occurs

Use the following choices:

a. **single replacement**
b. **combustion**
c. **synthesis**
d. **decomposition**
e. **more than one type**

to classify each of the following reactions (more than one choice may apply).

49. $2HgO(s) \rightarrow 2Hg(l) + O_2(g)$

50. $2Na(s) + H_2(g) \rightarrow 2NaH(s)$

51. $C(s) + O_2(g) \rightarrow CO_2(g)$

52. **Which of the following statements is *not* true?**
a. When a metal reacts with a nonmetal, an ionic compound is formed.
b. A metal-nonmetal reaction can always be assumed to be an oxidation-reduction reaction.
c. Two nonmetals can undergo an oxidation-reduction reaction.
d. When two nonmetals react, the compound formed is ionic.
e. A metal-nonmetal reaction involves electron transfer.

53. **The reaction $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$ is a(n) _____ reaction.**
a. metathesis
b. acid-base
c. oxidation-reduction
d. none of these
e. single-replacement

54. **When an acid reacts with a base, which product always forms?**
a. hydrogen
b. carbon dioxide
c. water
d. hydrogen and carbon dioxide
e. none of these

55. **Which of the following is a salt?**
a. HCl
b. SO_3
c. HNO_2
d. $MgCl_2$
e. none of these

56. **Which of the following "hardens" tooth enamel?**
a. F_2
b. F^-
c. $Ca(OH)_2$
d. $FeCl_3$
e. Cl^-

57. The _____ **equation contains only those substances directly involved in reactions in aqueous solutions.**

a. molecular
b. complete ionic
c. net ionic
d. reduced ionic
e. ionic

Identify the solid product that forms when the following aqueous solutions are mixed:

58. $KNO_3(aq) + BaCl_2(aq) \rightarrow$

a. KCl
b. $Ba(NO_3)_2$
c. $BaNO_3$
d. KCl_2
e. None forms.

59. $AgNO_3(aq) + BaCl_2(aq) \rightarrow$

a. AgCl
b. $Ba(NO_3)_2$
c. AgBa
d. $ClNO_3$
e. None forms.

60. **The net ionic reaction for the reaction between aqueous lead nitrate and aqueous potassium iodide is**

a. $Pb(NO_3)_2(aq) + KI(aq) \rightarrow PbI_2(s) + KNO_3(aq)$
b. $Pb^{2+}(aq) + NO_3^-(aq) + K^+(aq) + I^-(aq) \rightarrow Pb^{2+}(aq) + I^-(aq) + K^+(aq) + NO_3^-(aq)$
c. $Pb^{2+}(aq) + 2NO_3^-(aq) + 2K^+(aq) + I^-(aq) \rightarrow PbI_2(s) + 2K^+(aq) + 2NO_3^-(aq)$
d. $Pb^{2+}(aq) + 2I^-(aq) \rightarrow PbI_2(s)$
e. none of these

61. **What is the correct balanced complete ionic equation for the reaction of lead(II) nitrate with potassium chloride?**

a. $Pb(NO_3)_2(aq) + KCl(aq) \rightarrow PbCl_2(s) + KNO_3(aq)$
b. $Pb^{2+}(aq) + 2NO_3^-(aq) + 2K^+(aq) + 2Cl^-(aq) \rightarrow Pb^{2+}(aq) + 2Cl^-(aq) + 2K^+(aq) + 2NO_3^-(aq)$
c. $Pb^{2+}(aq) + 2NO_3^-(aq) + 2K^+(aq) + 2Cl^-(aq) \rightarrow Pb^{2+}(aq) + 2Cl^-(aq) + 2KNO_3(s)$
d. $Pb^{2+}(aq) + 2NO_3^-(aq) + K^+(aq) + Cl^-(aq) \rightarrow PbCl_2(s) + K^+(aq) + NO_3^-(aq)$
e. $Pb^{2+}(aq) + 2NO_3^-(aq) + 2K^+(aq) + 2Cl^-(aq) \rightarrow PbCl_2(s) + 2K^+(aq) + 2NO_3^-(aq)$

62. **A substance that, when dissolved in water, produces a solution that conducts electric current very efficiently is called**

a. a strong electrolyte
b. a weak electrolyte
c. a strong ion
d. an electrical solute
e. none of these

63. **When a precipitation reaction occurs, the ions that do *not* form the precipitate**
   a. evaporate
   b. are cations only
   c. form a second insoluble compound in the solution
   d. are left dissolved in the solution
   e. none of these

64. **In the reaction between CO and Fe_3O_4, the theoretical yield in an experiment is calculated to be 47.2 g Fe. When a careless chemistry student carries out the experiment, the actual yield is 42.9 g Fe. Calculate the percentage yield.**
   a. 90.9%
   b. 77.5%
   c. 8.1%
   d. 110%
   e. 9.11 g Fe

65. **Calculate the theoretical yield of iron in the reaction of 254 g of iron(III) oxide with 25.0 g of carbon, according to the equation**

$2Fe_2O_3(s) + 3C(s) \rightarrow 4Fe(s) + 3CO_2(g)$

   a. 155 g Fe
   b. 77.5 g Fe
   c. 88.1 g Fe
   d. 122 g Fe
   e. 101 g Fe

66. **The limiting reactant is the reactant**
   a. for which you have the lowest mass in grams.
   b. that has the lowest coefficient in the balanced equation.
   c. that has the lowest molar mass.
   d. that is left over after the reaction has gone to completion.
   e. none of the above

67. **Consider the equation**

$2A + 3B \rightarrow C$

If 4.0 mol of A is reacted with 4.0 mol of B, which of the reactants is limiting?
   a. Neither is limiting because equal amounts (4.0 mol) of each reactant are reacted.
   b. A is limiting because 2 is smaller than 3 (the numbers refer to the coefficients in the balanced equation).
   c. A is limiting because there are 2 mol and 4.0 mol are needed.
   d. B is limiting because 3 is larger than 2 (the numbers refer to the coefficients in the balanced equation).
   e. B is limiting because there are 4.0 mol and 6.0 mol are needed.

68. **For the reaction of $C_2H_4(g)$ with $O_2(g)$ to form $CO_2(g)$ and $H_2O(g)$, what number of grams of CO_2 could be produced from 2.0 g of C_2H_4 and 5.0 g of O_2?**
   a. 5.5 g
   b. 4.6 g
   c. 7.6 g
   d. 6.3 g
   e. none of these

69. For the reaction
$2Cl_2(g) + 4NaOH(aq) \rightarrow 3NaCl(aq) + NaClO_2(aq) + 2H_2O(l)$
11.9 g Cl_2 is reacted with 12.0 g NaOH. Determine which is the limiting reactant.

a. Cl_2
b. NaOH
c. NaCl
d. $NaClO_2$
e. H_2O

70. Consider the reaction
$2Fe(s) + 3O_2(g) \rightarrow Fe_2O_3(s)$
If 12.5 g of iron(III) oxide (rust) is produced from 8.74 g of iron, how many grams of oxygen are needed for this reaction?
a. 12.5 g
b. 7.5 g
c. 8.74 g
d. 21.2 g
e. none of these

71. What mass of oxygen would be required to completely burn 6.75 g of propane in the following reaction?
$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$
a. 33.8 g O_2
b. 49.0 g O_2
c. 24.5 g O_2
d. 122 g O_2
e. 77.4 g O_2

Which of the following is *true* for a buffered solution?
a. The solution resists any change in its $[H^+]$.
b. The solution will not change its pH very much even if a concentrated acid is added.
c. The solution will not change its pH very much even if a strong base is added.
d. Any H^+ ions added will react with a conjugate base of a weak acid already in solution.
e. all of these

Consider the reaction $HNO_2(aq) + H_2O(l) \rightarrow H_3O^+(aq) + NO_2^-(aq)$. Which species is the conjugate base?
a. $HNO_2(aq)$
b. $H_2O(l)$
c. $H_3O^+(aq)$
d. $NO_2^-(aq)$
e. two of these

Identify the Bronsted acids and bases in the following equation (A = Bronsted acid, B = Bronsted base):

$HSO_3^- + CN^- \rightarrow HCN + SO_3^{2-}$

a.	B	A	B	A
b.	B	B	A	A
c.	A	B	A	B
d.	A	B	B	A
e.	B	A	A	B

Which of the following must be *true* if a solution is to be considered acidic?

a. $[H^+] > [OH^-]$
b. $[H^+] < [OH^-]$
c. $[H^+] = [OH^-]$
d. $K_w = [H^+]/[OH^-]$
e. two of these

A solution with a pH of 2 is how many times more acidic as a solution with a pH of 4?

a. 0.5
b. 2
c. 10
d. 100
e. 1000

The pH of a solution at 25°C in which $[OH^-] = 3.4 \times 10^{-5}$ *M* is

a. 4.47
b. 10.47
c. 9.53
d. 6.34
e. none of these

Solid calcium hydroxide is dissolved in water until the pH of the solution is 10.94. The hydroxide ion concentration $[OH^-]$ of the solution is

a. 1.1×10^{-11} *M*
b. 3.06 *M*
c. 8.7×10^{-4} *M*
d. 1.0×10^{-13} *M*
e. none of these

A solution has $[H^+] = 4.0 \times 10^{-8}$ *M*. The pOH of this solution is

a. 3.20
b. 6.60
c. 7.40
d. 10.80
e. none of these