Chemistry Test 3: Moles, Stoichiometry, Balancing, Percent Composition, Empirical & Molecular Formulas

1. What is the percent by mass of hydrogen in NH_3 (formula mass = 17.0)?
   A) 17.6% C) 5.9%
   B) 82.4% D) 21.4%

2. Given the reaction:

   $$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

   The total number of grams of O_2 needed to produce 54 grams of water is
   A) 36 C) 75
   B) 61 D) 48

3. Given the unbalanced equation:

   $$\_\_Al_2(SO_4)_3 + \_\_Ca(OH)_2 \rightarrow \_\_Al(OH)_3 + \_\_CaSO_4$$

   When the equation is completely balanced using the smallest whole number coefficients the sum of the coefficients is
   A) 5 C) 3
   B) 9 D) 4

4. Compared to an atom of $^{12}_{6}C$, an atom of $^{14}_{6}C$ has
   A) more protons C) fewer protons
   B) more neutrons D) fewer neutrons

5. Given the reaction:

   $$C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$$

   At STP, what is the total number of liters of CO_2 produced when 5.0 liters of $C_3H_8(g)$ burns completely?
   A) 1.0 L C) 3.0 L
   B) 5.0 L D) 15 L

6. Which is a property of network solids but *not* molecular solids?
   A) water soluble C) high melting points
   B) high malleability D) electrical insulators

7. Which equation is correctly balanced?
   A) $Cu + H_2SO_4 \rightarrow CuSO_4 + H_2O + SO_2$
   B) $NH_3 + 2O_2 \rightarrow HNO_3 + H_2O$
   C) $Ca(OH)_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 3H_2O$
   D) $CaO + 2H_2O \rightarrow Ca(OH)_2$

8. $$Mg(s) + 2\ HCl(aq) \leftrightarrow MgCl_2(aq) + H_2(g)$$

   What type of reaction is shown above?
   A) single replacement C) double replacement
   B) synthesis D) decomposition

9. Which substance will conduct electricity in both the solid phase and the liquid phase?
   A) Ag C) HCl
   B) AgCl D) H_2

10. One atomic mass unit (1 amu) is equal to the mass of a carbon-12 atom multiplied by the quantity
    A) $\frac{1}{12}$
    B) 1836
    C) 12
    D) $\frac{1}{1836}$

11. A 4.4 gram sample of a hydrate was heated until the water of hydration was driven off. The anhydrous compound remaining had a mass of 3.3 grams. What is the percentage by mass of water in the hydrate?
    A) 67% C) 25%
    B) 75% D) 33%

12. Which sample of O_2 contains a total of 3.01×10^{23} molecules at STP?
    A) 1.00 mole C) 16.0 grams
    B) 2.00 moles D) 32.0 grams

13. An 8.24-gram sample of a hydrated salt is heated until it has a constant mass of 6.20 grams. What was the percent by mass of water contained in the original sample?
    A) 14.1% C) 32.9%
    B) 75.2% D) 24.8%

14. What is the mass number of an atom that contains 19 protons, 19 electrons, and 20 neutrons?
    A) 19 C) 58
    B) 39 D) 20

15. The electrons in a bond between two iodine atoms (I_2) are shared
    A) equally, and the resulting bond is nonpolar
    B) unequally, and the resulting bond is nonpolar
    C) unequally, and the resulting bond is polar
    D) equally, and the resulting bond is polar

16. When a sodium atom becomes an ion, the size of the atom
    A) increases by losing an electron
    B) decreases by gaining an electron
    C) increases by gaining an electron
    D) decreases by losing an electron

17. Given the balanced equation:

    $NaOH + HCl \rightarrow NaCl + H_2O$

    What is the total number of grams of H_2O produced when 116 grams of the product, NaCl, is formed?
    A) 54 g C) 36 g
    B) 18 g D) 9.0 g

18. Given the reaction

    $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$

    How many liters of ammonia, measured at STP, are produced when 28.0 grams of nitrogen is completely consumed?
    A) 11.2 C) 5.60
    B) 44.8 D) 22.4

19. A compound has a molecular mass of 54 and an empirical formula of C_2H_3. What is the molecular formula of the compound?
    A) C_6H_{10} C) C_2H_3
    B) C_5H_8 D) C_4H_6

20. In the reaction

    $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$,

    what is the total number of moles of CO used to produce 112 grams of iron?
    A) 1.0 C) 3.0
    B) 2.0 D) 4.0

21. $N_2(g) + 3\ H_2(g) \leftrightarrow 2\ NH_3(g)$

    What type of reaction is shown above?
    A) double replacement C) synthesis
    B) decomposition D) single replacement

22. A compound contains 40% calcium, 12% carbon, and 48% oxygen by mass. What is the empirical formula of this compound?
    A) $CaCO_2$ C) $CaCO_3$
    B) CaC_3O_6 D) CaC_2O_4

23. What is the gram formula mass of $(NH_4)_2SO_4$?
    A) 132 g C) 94.0 g
    B) 66.0 g D) 114 g

24. Which atom has the strongest attraction for electrons?
    A) F C) Cl
    B) Br D) I

25. Given the reaction:

    $2\ KClO_3(s) \rightarrow 2\ KCl(s) + 3\ O_2(g)$

    What is the total number of moles of $KClO_3(s)$ needed to produce 6 moles of $O_2(g)$?
    A) 1 C) 3
    B) 2 D) 4

26. What is the empirical formula of a compound with the molecular formula $C_6H_{12}O_6$?
    A) $C_4H_8O_4$ C) $C_2H_4O_2$
    B) CH_2O D) $C_3H_6O_3$

27. Which sample contains the same number of atoms as 24 grams of carbon?
    A) 80. g Ar C) 24 g Mg
    B) 10. g Ne D) 4.0 g He

28. Given the unbalanced equation:

$$\_\_C_3H_8(g) + \_\_O_2(g) \rightarrow \_\_H_2O(g) + \_\_CO_2(g)$$

When the equation is completely balanced using smallest whole numbers, the coefficient of O_2 is

A) 5 C) 3

B) 2 D) 10

29. What is the gram formula mass of $Na_2CO_3 \cdot 10H_2O$?

A) 266 g C) 106 g

B) 286 g D) 142 g

30. When the equation

$$\_\_Al(s) + \_\_O_2(g) \rightarrow \_\_Al_2O_3(s)$$

is correctly balanced using the smallest whole numbers, the coefficient of Al(s) is

A) 1 C) 3

B) 2 D) 4

31. Given the reaction:

$$Mg + 2\ HCl \rightarrow MgCl_2 + H_2$$

What is the total number of grams of Mg consumed when 0.50 mole of H_2 is produced?

A) 6.0 g C) 3.0 g

B) 12 g D) 24 g

32. The percent by mass of oxygen in $H_2C_2O_4$ is equal to

A) $\frac{8}{90} \times 100$ C) $\frac{4}{8} \times 100$

B) $\frac{64}{90} \times 100$ D) $\frac{90}{64} \times 100$

33. Given the reaction:

$$2\ Al + 3\ H_2SO_4 \rightarrow 3\ H_2 + Al_2(SO_4)_3$$

The total number of moles of H_2SO_4 needed to react completely with 5.0 moles of Al is

A) 5.0 moles C) 7.5 moles

B) 9.0 moles D) 2.5 moles

34. What type of bonding is found in the molecule HBr?

A) polar covalent C) nonpolar covalent

B) metallic D) ionic

35. When the equation

$$\_\_ C_2H_4 + \_\_ O_2 \rightarrow \_\_ CO_2 + \_\_ H_2O$$

is balanced using smallest whole numbers, what is the coefficient of the O_2?

A) 1 C) 3

B) 2 D) 4

36. What is the total number of moles of atoms represented by the formula $Al(C_2H_3O_2)_3$?

A) 22 C) 8

B) 11 D) 4

37. A compound whose empirical formula is NO_2 could have a molecular mass of

A) 39 C) 120

B) 23 D) 92

38. Which element forms a diatomic molecule containing a triple covalent bond?

A) Cl_2 C) N_2

B) O_3 D) H_2

39. Which quantity is equivalent to 39 grams of LiF?

A) 1.0 mole C) 0.50 mole

B) 2.0 moles D) 1.5 moles

40. Given the reaction:

$$Mg(s) + 2\ AgNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + 2\ Ag(s)$$

Which type of reaction is represented?

A) double replacement C) single replacement

B) synthesis D) decomposition

41. A substance was found to be a soft, non-conducting solid at room temperature. The substance is most likely

A) an ionic solid
C) a network solid
B) a metallic solid
D) a molecular solid

42. What is the total mass in grams of 0.75 mole of SO_2?

A) 16 g
C) 32 g
B) 24 g
D) 48 g

43. $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow 2\ NaNO_3(aq) + BaSO_4(s)$

What type of reaction is shown above?

A) synthesis
C) single replacement
B) double replacement
D) decomposition

44. Which is the formula for the compound that forms when magnesium bonds with phosphorus?

A) Mg_2P
C) Mg_2P_3
B) MgP_2
D) Mg_3P_2

45. Given the unbalanced equation:

$\_\_Al_2(SO_4)_3 + \_\_Ca(OH)_2 \rightarrow \_\_Al(OH)_3 + \_\_CaSO_4$

What is the coefficient in front of the $CaSO_4$ when the equation is completely balanced with the smallest whole-number coefficients?

A) 1
C) 3
B) 2
D) 4

46. The percent by mass of aluminum in Al_2O_3 is approximately

A) 47.1
C) 18.9
B) 52.9
D) 35.4

47. A compound consists of 25.9% nitrogen and 74.1% oxygen by mass. What is the empirical formula of the compound?

A) N_2O_5
C) NO_2
B) NO
D) N_2O

48. An atom that contains 8 protons, 8 electrons, and 9 neutrons has

A) an atomic number of 16
B) an atomic number of 9
C) a mass number of 17
D) a mass number of 25

49. A compound consists of 40.% sulfur and 60.% oxygen by mass. What is the empirical formula of this compound?

A) SO
C) SO_3
B) SO_2
D) SO_4

50. Which compound has the empirical formula CH?

A) C_6H_6
C) C_3H_8
B) CH_4
D) C_2H_4

51. A compound contains 53% Al and 47% O by mass. What is the empirical formula of this compound?

A) Al_2O_3
C) AlO_2
B) AlO
D) Al_3O_2

52. Which type of bonding involves positive ions immersed in a sea of mobile electrons?

A) ionic
C) nonpolar covalent
B) polar covalent
D) metallic

53. Which sequence of elements is arranged in order of decreasing atomic radii?

A) Li, Na, K
C) Al, Si, P
B) N, C, B
D) Cl, Br, I

54. What is the empirical formula of a compound that contains 28% iron, 24% sulfur, and 48% oxygen by mass?

A) $FeSO_3$
C) $Fe_2(SO_4)_3$
B) $FeSO_4$
D) $Fe_2(SO_3)_3$

55. Which formula represents a substance that contains covalent bonds?

A) CO_2
C) $LiCl$
B) $CaCl_2$
D) K_2O

56. Which equation illustrates conservation of mass?

A) $H_2 + O_2 \rightarrow H_2O$
C) $H_2 + Cl_2 \rightarrow 2\ HCl$
B) $H_2 + Cl_2 \rightarrow HCl$
D) $H_2 + O_2 \rightarrow 2\ H_2O$

57. What is the percent by mass of sulfur in sulfur dioxide?

A) 32
C) 67
B) 33
D) 50

58. A sample of a compound contains 24 grams of carbon and 64 grams of oxygen. What is the empirical formula of this compound?

A) CO_2 C) CO

B) C_2O_2 D) C_2O_4

59. $2\ SO_3(g) \leftrightarrow 2\ SO_2(g) + O_2(g)$

What type of reaction is shown above?

A) synthesis C) double replacement

B) decomposition D) single replacement

60. What is the mass of 3.0×10^{23} atoms of neon?

A) 0.50 g C) 10. g

B) 20. g D) 1.0 g

61. The Group 17 element with the highest electronegativity is

A) fluorine C) iodine

B) bromine D) chlorine

Answer Key
Chem T3 mole, stoi, balan [Apr 02, 2014]

1. A
2. D
3. B
4. B
5. D
6. C
7. B
8. A
9. A
10. A
11. C
12. C
13. D
14. B
15. A
16. D
17. C
18. B
19. D
20. C
21. C
22. C
23. A
24. A
25. D
26. B
27. A
28. A
29. B
30. D
31. B
32. B
33. C
34. A
35. C
36. A
37. D
38. C
39. D
40. C
41. D
42. D
43. B
44. D
45. C
46. B
47. A
48. C
49. C
50. A
51. A
52. D
53. C
54. C
55. A
56. C
57. D
58. A
59. B
60. C
61. A

Version A