Final Exam notes:

The final is 100 points. Thursday, March 22, 11-1pm, ST101 (lecture room). The exam is 50 multiple choice questions only. Each is worth 2 points. It is not scantron.

You will receive a periodic table, and any necessary conversion factors and constants you might need. You only need a calculator and a pencil.

I suggest marking your answers on the actual questions first, then when you are all done, go back and transfer them to the answer sheet. It is a lot faster than flipping back and forth.

Practice Final Exam notes

There are 109 questions on this practice exam. All are multiple choice. The answers are listed at the end of the practice exam.

The types of questions you see on this practice exam are the types of questions you will see on the final. There are just more questions on the practice exam to give you more practice! You will see essentially the same questions, just changed a little. The concepts tested will be the same.

The best way to work through this is to sit down and try to take the test first without looking at the answers. Then grade your exam. Check the ones you have wrong and go back to the book or class notes to find the answer.

Don’t forget-your last problem set is due at the final if you haven’t already turned it in.

You grades will probably be available sometime later on Friday or on Monday. I have to wait for the lab scores to come in.

GOOD LUCK!
1. Consider a mixture consisting of sand in salt water. This mixture could be separated into its three components (sand, salt, and water) by first _____________ the mixture and then _____________ the remaining mixture.
   a) distilling, distilling
   b) distilling, filtering
   c) filtering, distilling
   d) filtering, filtering
   e) evaporating, grinding

2. Which one of the following is often easily separated into its components by simple techniques such as filtering or decanting?
   a) heterogeneous mixture
   b) compounds
   c) homogeneous mixture
   d) elements
   e) solutions

3. The symbol for the element phosphorous is _____.
   a) K
   b) P
   c) Po
   d) Ag
   e) Ph

4. If matter is uniform throughout, cannot be separated into other substances by physical processes, but can be decomposed into other substances by chemical processes, it is _______.
   a) a heterogeneous mixture
   b) an element
   c) a homogeneous mixture
   d) a compound
   e) a mixture of elements

5. If matter is uniform throughout, cannot be separated into other substances by physical processes, and cannot be decomposed into other substances by chemical processes, it is _______.
   a) an element
   b) a compound
   c) a homogeneous mixture
   d) a heterogeneous mixture
   e) a mixture of compounds

6. An element can not _______.
   a) be part of a heterogeneous mixture
   b) be part of a homogeneous mixture
   c) be separated into other substances by chemical means
   d) interact with other elements to form compounds
   e) be a pure substance
7. In the following list, only ________ is not an example of a chemical reaction.
   a) dissolution of a penny in nitric acid
   b) the condensation of water vapor
   c) a burning candle
   d) the formation of polyethylene from ethylene
   e) the explosive reaction of hydrogen with oxygen, which produces water

8. Of the following, only ________ is a chemical reaction.
   a) melting of lead
   b) dissolving sugar in water
   c) tarnishing of silver
   d) crushing of stone
   e) dropping a penny into a glass of water

9. Which of the following are chemical processes?
   1. rusting of a nail
   2. freezing of water
   3. decomposition of water into hydrogen and oxygen gases
   4. compression of oxygen gas

   a) 2, 3, & 4
   b) 1, 3, & 4
   c) 1 & 3
   d) 1 & 2
   e) 1 & 4

10. Which of the following is a physical property of sodium chloride?
    a) It is a solid at room temperature.
    b) It dissolves in water.
    c) It melts at a very high temperature.
    d) It is not significantly compressible.
    e) All of these are physical properties of sodium chloride.

11. Which of the following is not a physical property of water?
    a) It is a liquid at room temperature.
    b) It can be decomposed into oxygen and hydrogen gases.
    c) It boils at 100°C.
    d) It melts at 0°C.
    e) These are all physical properties of water.

12. 1 milligram = _____ micrograms
    a) 0.001
    b) 1,000
    c) 0.01
    d) 0.1
    e) 10
13. \[ 1.035 \times 10^{-4} \text{ L} = \text{ mL} \]
   a) \(1.035 \times 10^7\)
   b) \(1.035 \times 10^{-7}\)
   c) 0.1035
   d) 1.035
   e) 0.01035

14. What is the density (in g/cm³) of a gold nugget that has a volume of 1.68 cm³ and a mass of 32.4 g?
   a) 0.0519
   b) 19.3
   c) 54.4
   d) 0.0184
   e) 32.4

15. The density of silver is 10.5 g/cm³. What volume (cm³) would be occupied by a piece of silver with a mass of 61.3 g?
   a) 0.171
   b) 644
   c) 10.5
   d) 0.00155
   e) 5.84

16. Accuracy refers to _______.
   a) how close a measured number is to zero
   b) how close a measured number is to the calculated value
   c) how close a measured number is to other measured numbers
   d) how close a measured number is to the true value
   e) how close a measured number is to infinity

17. Which of the following has the same number of significant figures as the number 1.00310?
   a) \(1 \times 10^6\)
   b) 199.791
   c) 8.66
   d) 5.119
   e) 100

18. How many significant figures should there be in the answer to the following?
   \((3.15 \times 1.06) + (21 \times 1.773) = \)_____
   a) 1
   b) 2
   c) 3
   d) 4
   e) 5
19. One side of a cube measures 1.55 m. What is the volume of this cube in cm$^3$?
   a) 2.40 x 10$^4$
   b) 3.72 x 10$^6$
   c) 2.40
   d) 3.72
   e) 155

20. 45 m/s = _____ km/hr?
   a) 2.7
   b) 0.045
   c) 1.6 x 10$^2$
   d) 2.7 x 10$^3$
   e) 1.6 x 10$^5$

21. Which one of the following is not one of the postulates of Dalton's atomic theory?
   a) Each element is composed of tiny, indivisible particles called atoms.
   b) All atoms of a given element are identical to each other and different from those of other elements.
   c) During a chemical reaction, atoms are changed into atoms of different elements.
   d) Compounds are formed when atoms of different elements combine.
   e) Atoms of an element are not changed into different types of atoms by chemical reactions.

22. Of the following, the smallest and lightest subatomic particle is the __________.
   a) neutron
   b) proton
   c) electron
   d) nucleus
   e) alpha particle

23. An atom of the most common isotope of gold, $^{197}$Au, has _____ protons, _____ neutrons, and _____ electrons.
   a) 197, 79, 118
   b) 118, 79, 39
   c) 79, 197, 197
   d) 79, 118, 118
   e) 79, 118, 79

24. Which isotope has 36 electrons in an atom?
   a) $^{36}$Kr
   b) $^{35}$Br
   c) $^{34}$Se
25. The nucleus of an atom contains _______.
   a) electrons
   b) protons, neutrons, and electrons
   c) protons and neutrons
   d) protons and electrons
   e) protons

26. All atoms of a particular element contain the same number of _______.
   a) neutrons
   b) protons
   c) protons and neutrons
   d) protons, neutrons, and electrons
   e) subatomic particles

27. Different isotopes of a particular element contain the same number of _______.
   a) protons
   b) neutrons
   c) protons and neutrons
   d) protons, neutrons, and electrons
   e) subatomic particles

28. In the symbol shown below, x = _____.
   \[ ^{12}_{6}\text{C} \]
   x
   a) 7
   b) 13
   c) 12
   d) 6
   e) not enough information to determine

29. In the symbol below, x = _____.
   \[ ^{19}_{6}\text{C} \]
   a) 19
   b) 13
   c) 6
   d) 7
   e) not enough information to determine
30. In the symbol below, x is _____.
\[ ^{13}\text{C} \]
\[ \text{x} \]

a) the atomic number  
b) the mass number  
c) the isotope number  
d) the number of neutrons  
e) the elemental symbol

31. In the symbol below, x is _____.
\[ ^6\text{C} \]
\[ \text{x} \]

a) the number of neutrons  
b) the atomic number  
c) the mass number  
d) the isotope number  
e) the elemental symbol

32. In the periodic table, the elements are arranged in _________.
a) alphabetical order  
b) order of increasing atomic number  
c) order of increasing metallic properties  
d) order of increasing neutron content  
e) reverse alphabetical order

33. Which one of the following is a nonmetal?
a) W  
b) Sr  
c) Os  
d) Ir  
e) Br

34. Of the following, only ________ is not a metalloid.
a) B  
b) Al  
c) Si  
d) Ge  
e) As

35. The elements in groups 1A, 6A, and 7A are called, _________, respectively.
a) alkaline earth metals, halogens, and chalcogens  
b) alkali metals, chalcogens, and halogens  
c) alkali metals, halogens, and noble gases  
d) alkaline earth metals, transition metals, and halogens  
e) halogens, transition metals, and alkali metals
36. An element that appears in the lower left corner of the periodic table is __________.
   a) either a metal or metalloid
   b) definitely a metal
   c) either a metalloid or a non-metal
   d) definitely a non-metal
   e) definitely a metalloid

38. Horizontal rows of the periodic table are known as _______.
   a) periods
   b) groups
   c) metalloids
   d) metals
   e) nonmetals

39. Vertical columns of the periodic table are known as _______.
   a) metals
   b) periods
   c) nonmetals
   d) groups
   e) metalloids

40. Elements in Group 8A are known as the _______.
   a) halogens
   b) alkali metals
   c) alkaline earth metals
   d) chalcogens
   e) noble gases

41. __________ and __________ are isotopes of the same element.
   a) \( ^{116}X \), \( ^{119}X \)
   b) \( ^{92}X \), \( ^{89}X \)
   c) \( ^{45}X \), \( ^{92}X \)
   d) \( ^{99}X \), \( ^{92}X \)
   e) \( ^{11}X \), \( ^{38}X \)

42. There are _____ electrons, _____ protons, and _____ neutrons in the ion \( ^{35}X^- \).
   a) 38, 35, 42
   b) 77, 32, 77
   c) 32, 80, 35
   d) 77, 77, 35
   e) 35, 35, 42
43. Which one of the following is most likely to lose electrons when forming an ion?
   a) F
   b) P
   c) Rh
   d) S
   e) N

44. What is the formula of the compound formed between strontium ions and nitrogen ions?
   a) SrN
   b) Sr$_3$N$_2$
   c) Sr$_2$N$_3$
   d) SrN$_2$
   e) SrN$_3$

45. There are _____ protons, _____ neutrons, and _____ electrons in $^{131}_{53}$I$^-$.
   a) 131, 53, and 54
   b) 131, 53, and 52
   c) 53, 78, and 54
   d) 53, 131, and 52
   e) 78, 53, and 72

46. Which species is an isotope of $^{39}$Cl?
   a) $^{40}$Ar$^-$
   b) $^{34}$Sc$^-$
   c) $^{36}$Cl$^-$
   d) $^{80}$Br
   e) $^{39}$Ar

47. Magnesium reacts with a certain element to form a compound with the general formula MgX. What would the most likely formula be for the compound formed between potassium and element X?
   a) K$_2$X
   b) KX$_2$
   c) K$_2$X$_3$
   d) K$_2$X$_2$
   e) KX

50. Predict the empirical formula of the ionic compound that forms from aluminum and oxygen.
   a) AlO
   b) Al$_3$O$_2$
   c) Al$_2$O$_3$
   d) AlO$_2$
   e) Al$_2$O
51. Which species below is the sulfite ion?
   a) $\text{SO}_2^-$
   b) $\text{SO}_3^-$
   c) $\text{S}^{2-}$
   d) $\text{H}_2\text{SO}_4$
   e) $\text{H}_2\text{S}$

52. The correct name for SrO is _______.
   a) strontium oxide
   b) strontium hydroxide
   c) strontium peroxide
   d) strontium monoxide
   e) strontium dioxide

53. The correct name for K$_2$S is _______.
   a) potassium sulfate
   b) potassium disulfide
   c) potassium bisulfide
   d) potassium sulfide
   e) dipotassium sulfate

54. The correct name for SO is _______.
   a) sulfur oxide
   b) sulfur monoxide
   c) sulfoxide
   d) sulfate
   e) sulfite

55. The correct name for CCl$_4$ is _______.
   a) carbon chloride
   b) carbon tetrachlorate
   c) carbon perchlorate
   d) carbon tetrachloride
   e) carbon chlorate

56. The correct name for H$_2$SO$_3$ is _______.
   a) sulfuric acid
   b) sulfurous acid
   c) hydrosulfuric acid
   d) hydrosulfic acid
   e) sulfur hydroxide

57. Magnesium and sulfur form an ionic compound with the formula _________.
   a) MgS
   b) Mg$_2$S
   c) MgS$_2$
   d) Mg$_2$S$_2$
   e) Mg$_2$S$_3$
58. Which one of the following compounds is chromium(III) oxide?
   a) \( \text{Cr}_2\text{O}_3 \)
   b) \( \text{CrO}_3 \)
   c) \( \text{Cr}_3\text{O}_2 \)
   d) \( \text{Cr}_3\text{O}_0 \)
   e) \( \text{Cr}_2\text{O}_4 \)

59. Which one of the following compounds is copper(I) chloride?
   a) \( \text{CuCl} \)
   b) \( \text{CuCl}_2 \)
   c) \( \text{Cu}_2\text{Cl} \)
   d) \( \text{Cu}_3\text{Cl}_3 \)
   e) \( \text{Cu}_3\text{Cl}_2 \)

60. The formula of ammonium carbonate is ________.
   a) \( (\text{NH}_4)_2\text{CO} \)
   b) \( \text{NH}_4\text{CO}_2 \)
   c) \( (\text{NH}_3)_2\text{CO}_4 \)
   d) \( (\text{NH}_3)_2\text{CO}_3 \)
   e) \( \text{N}_2(\text{CO}_3)_3 \)

61. When the reaction below is balanced, the coefficients are ________.
   \[
   \text{NH}_3 + \text{O}_2 \rightarrow \text{NO}_2 + \text{H}_2\text{O}
   \]
   a) 1,1,1,1
   b) 4,7,4,6
   c) 2,3,2,3
   d) 1,3,1,2
   e) none of these

62. What is the coefficient of \( \text{H}_2\text{O} \) when the following equation is balanced?
   \[
   \text{Ca(s)} + \text{H}_2\text{O}(l) \rightarrow \text{Ca(OH)}_2(\text{aq}) + \text{H}_2(\text{g})
   \]
   a) 1
   b) 2
   c) 3
   d) 5
   e) 4
63. What is the coefficient of $\text{Al}_2\text{O}_3$ when the following equation is balanced?

$$\text{Al}_2\text{O}_3(s) + C(s) + \text{Cl}_2(g) \rightarrow \text{AlCl}_3(s) + \text{CO}(g)$$

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

64. What is the coefficient of $\text{Fe}_3\text{O}_4$ when the following equation is balanced?

$$\text{Al} + \text{Fe}_3\text{O}_4 \rightarrow \text{Al}_2\text{O}_3 + \text{Fe}$$

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

65. What is the coefficient of $\text{H}_2\text{SO}_4$ when the following equation is balanced?

$$\text{H}_2\text{SO}_4(aq) + \text{NaOH}(aq) \rightarrow \text{Na}_2\text{SO}_4(aq) + \text{H}_2\text{O}(l)$$

a) 1  
 b) 2  
 c) 3  
 d) 4  
 e) 0.5

66. Complete and balance the following combination reaction.

$$\text{Li} + \text{F}_2 \rightarrow \text{__________}$$

67. Element X has three naturally occurring isotopes. The mass (amu) and % abundance of the isotopes are: 37.919 (5.07%), 39.017 (15.35%), and 42.111 (79.58%). What is the average atomic mass (amu) of element X?

a) 41.42  
 b) 39.68  
 c) 39.07  
 d) 38.64  
 e) 33.33

68. A certain element has three isotopes. The isotopic masses (amu) and abundances are: 159.37 (30.60%), 162.79 (15.79%), and 163.92 (53.61%). What is the average atomic weight (amu) of the element?

a) 161.75  
 b) 162.03  
 c) 162.35  
 d) 163.15  
 e) 33.33
69. What is the average atomic weight of an element if the two known isotopes of the element have the following characteristics?

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Mass (amu)</th>
<th>% Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31.163</td>
<td>35.16</td>
</tr>
<tr>
<td>2</td>
<td>34.296</td>
<td>64.84</td>
</tr>
</tbody>
</table>

a) 30.197  
b) 33.194  
c) 34.016  
d) 35.221  
e) 32.730

70. The formula weight (amu) of potassium dichromate, \( \text{K}_2\text{Cr}_2\text{O}_7 \), is __________.

a) 107.09  
b) 255.08  
c) 242.18  
d) 294.18  
e) 333.08

71. How many sulfur atoms are there in 25 molecules of \( \text{C}_4\text{H}_4\text{S}_2 \)?

a) \( 1.5 \times 10^2 \)  
b) \( 4.8 \times 10^2 \)  
c) \( 3.0 \times 10^2 \)  
d) 50  
e) \( 6.02 \times 10^2 \)

72. A sample of \( \text{C}_3\text{H}_3\text{O} \) consisting of 200 molecules will yield __________ carbon atoms.

a) 600  
b) 200  
c) \( 3.61 \times 10^2 \)  
d) \( 1.20 \times 10^2 \)  
e) \( 4.01 \times 10^2 \)

73. How many grams of oxygen are in 65 g of \( \text{C}_2\text{H}_2\text{O}_2 \)?

a) 18  
b) 29  
c) 9.0  
d) 36  
e) 130

74. How many atoms of nitrogen are in 10 g of \( \text{NH}_4\text{NO}_3 \)?

a) 3.5  
b) \( 1.5 \times 10^2 \)  
c) \( 3.0 \times 10^2 \)  
d) 1.8  
e) 2
75. How many sulfur dioxide molecules are there in 0.180 mol of sulfur dioxide?
   a) $1.80 \times 10^3$
   b) $6.02 \times 10^4$
   c) $6.02 \times 10^3$
   d) $1.08 \times 10^4$
   e) $1.08 \times 10^3$

76. How many carbon atoms are there in 52.06 g of carbon dioxide?
   a) $5.206 \times 10^4$
   b) $3.134 \times 10^5$
   c) $7.122 \times 10^3$
   d) $8.648 \times 10^4$
   e) $1.424 \times 10^4$

77. What color of visible light has the highest energy?
   a) violet
   b) blue
   c) red
   d) green
   e) yellow

78. A spectrum containing only specific wavelengths is called a ______ spectrum.
   a) line
   b) continuous
   c) visible
   d) Balmer
   e) invariant

79. There are ____ orbitals in the second shell.
   a) 1
   b) 2
   c) 4
   d) 8
   e) 9

80. The n = 1 shell contains ___ p orbitals. All the other shells contain ___ p orbitals.
   a) 3, 6-9
   b) 0,3
   c) 6,2
   d) 3,3
   e) 2,6

81. The lowest energy shell that contains f orbitals is the shell with n = ____.
   a) 3
   b) 2
   c) 4
   d) 1
   e) 5
82. Which one of the following is an incorrect orbital notation?
   a) 2s
   b) 3py
   c) 3f
   d) 4dxy
   e) 4s

83. How many p-orbitals are there in a Ne atom?
   a) 0
   b) 1
   c) 6
   d) 3
   e) 2

84. Each p-orbital can accommodate a maximum of _____ electrons.
   a) 5
   b) 6
   c) 1
   d) 3
   e) 2

85. Each p-subshell can accommodate a maximum of _____ electrons.
   a) 6
   b) 2
   c) 10
   d) 3
   e) 5

86. The electron configuration of a ground-state Ag atom is _____.
   a) [Ar]4s^2 4d^10
   b) [Kr]5s^1 4d^10
   c) [Kr]5s^2 3d^9
   d) [Ar]4s^1 4d^10
   e) [Kr]5s^2 4d^10

87. The ground-state electron configuration of the element _________ is [Kr]5s^1 4d^1.
   a) Nb
   b) Mo
   c) Cr
   d) Mn
   e) Tc

88. The ground state electron configuration for Zn is _________.
   a) [Kr]4s^2 3d^10
   b) [Ar]4s^2 3d^10
   c) [Ar]4s^1 3d^10
   d) [Ar]3s^2 3d^10
   e) [Kr]3s^2 3d^10
89. Elements in group ____ have a np^6 electron configuration in the outer shell.
   a) 4A
   b) 6A
   c) 7A
   d) 8A
   e) 5A

91. Which group in the periodic table contains elements with the valence electron configuration of ns^-np^-?
   a) 1A
   b) 2A
   c) 3A
   d) 4A
   e) 8A

92. The valence electron configuration of the halogens is __________.
   a) ns^-np^6
   b) ns^1
   c) ns^2
   d) ns^-np^5
   e) ns^-np^3

93. Of the ions below, only ____ has a noble gas electron configuration.
   a) S^3-
   b) O^2+
   c) I^-
   d) K^-
   e) Cl^-

94. The electron configuration of the phosphide ion (P^3-) is __________.
   a) [Ne]3s^2
   b) [Ne]3s^2 3p^1
   c) [Ne]3s^2 3p^3
   d) [Ne]3p^2
   e) [Ar]

95. Which of the following would have to gain two electrons in order to achieve a noble gas electron configuration?
   O     Sr     Na     Se     Br
   a) Br
   b) Sr
   c) Na
   d) O & Se
   e) Sr, O, & Se
96. Elements from opposite sides of the periodic table tend to form __________.
   a) covalent compounds
   b) ionic compounds
   c) compounds that are gaseous at room temperature
   d) homonuclear diatomic compounds
   e) covalent compounds that are gaseous at room temperature

97. Which of the following sets contains species that are isoelectronic?
   a) F, Ne, Na
   b) P\(^3^-\), S\(^2^-\), Ar\(^-\)
   c) P\(^3+\), S\(^2^-\), Ar
   d) Cl, Ar, K
   e) F\(^-\), Ne, Na\(^+\)

98. Which of the following sets contains species that are isoelectronic?
   a) O, F, Ne
   b) C\(^4+\), N\(^3-\), O\(^-\)
   c) P\(^3^-\), S\(^2^-\), Ar
   d) Na, Mg, Al
   e) C\(^4-\), N\(^3+\), Ne

99. _____ is isoelectronic with argon and _____ is isoelectronic with neon.
   a) Cl\(^-\), F
   b) Cl\(^-\), Cl\(^+\)
   c) F\(^-\), F
   d) Ne\(^-\), Kr\(^-\)
   e) Ne\(^+\), Ar\(^+\)

100. The type of compound that is most likely to contain a covalent bond is ________.
    a) one that is composed of a metal from the far left of the periodic table and a nonmetal from the far right of the periodic table
    b) a solid metal
    c) one that is composed of only nonmetals
    d) held together by the electrostatic forces between oppositely charged ions
    e) There is no general rule to predict covalency in bonds.

101. How many hydrogen atoms must bond to silicon to give it an octet of valence electrons?
    a) 1
    b) 2
    c) 3
    d) 4
    e) 5
102. What is the maximum number of double bonds that a hydrogen atom can form?
   a) 0
   b) 1
   c) 2
   d) 3
   e) 4

103. The Lewis structure of the \( \text{CO}_3^{2-} \) ion is ____________.
   a) 
   
   b) 
   
   c)
104. According to VSEPR theory, if there are 4 pairs of electrons in the valence shell of an atom, they will be arranged in a(n) ________ geometry.
   a) octahedral  
   b) linear  
   c) tetrahedral  
   d) trigonal planar  
   e) trigonal bipyramidal

105. The molecular geometry of the $\text{H}_2\text{O}^+$ ion is ________.
   a) linear  
   b) tetrahedral  
   c) bent  
   d) trigonal pyramidal  
   e) octahedral

106. The molecular geometry of the $\text{CS}_2$ molecule is ________.
   a) linear  
   b) bent  
   c) tetrahedral  
   d) trigonal planar

107. The molecular geometry of the $\text{CHCl}_3$ molecule is ________.
   a) bent  
   b) trigonal planar  
   c) trigonal pyramidal  
   d) tetrahedral

108. The molecular geometry of the right-most carbon in the molecule below is ________.

```
    H  O
   " " "
H-C-C-O-H
   " "
   H
```

   a) trigonal planar  
   b) trigonal bipyramidal  
   c) tetrahedral  
   d) octahedral  
   e) T-shaped
109. An electron domain consists of ____________.
   a) a central atom
   b) one electron pair
   c) a central atom and n peripheral atoms
   d) two electron pairs
   e) one, two, or three electron pairs

**ANSWER KEY FOR Practice Final Exam**

1. c
2. a
3. b
4. d
5. a
6. c
7. b
8. c
9. c
10. e
11. b
12. b
13. c
14. b
15. e
16. d
17. b
18. b
19. b
20. c
21. c
22. c
23. e
51. a
52. a
53. d
54. b
55. d
56. b
57. a
58. a
59. a
60. a
61. b
62. b
63. a
64. b
65. a
66. $2\text{Li} + \text{F}_2 \rightarrow 2\text{LiF}$
67. a
68. c
69. b
70. d
71. d
72. a
73. d
74. b
75. e
76. c
77. a
105. d
106. a
107*. d
108. a
109. e