1. How many significant figures are there in each of the following numbers? 5, 5, 5, 4, 2, 3, 4, 8

10.203; 100.00; 120.30; 9.0020; 0.7030; 0.96; 0.00803; 340100; 80.000000

2. Write each of the numbers above in scientific notation.

3.0203 \times 10^2; 1.0000 \times 10^0; 1.2030 \times 10^2; 9.0020 \times 10^0; 7.030 \times 10^{-1}; 9.6 \times 10^{-1}; 8.03 \times 10^{-3}; 3.401 \times 10^5; 8.000000 \times 10^1

3. Calculate answers using the correct significant figures:

1.02 + 107.3 = 108.3

14.273 - 0.12 = 14.15

32.4 + 9.5 \times 252.7 = 2400

1.02 - 107.3 + 14.273 + 0.12 = -91.9

0.2022 \times 5.62 = 5.13

2.137 \times 5.62

26.98

133.43

\frac{84700}{4.032} = 2.10 \times 10^4

4. Round each number to 3 digits.

8.03; 0.00761; 14.0; 12400; 24.0

5. 6.3 m^3 = 6300000 \text{ cm}^3; 1.5 \mu g = 1.5 \times 10^{-6} \text{ g}; 2.7 \text{ pL} = 0.0027 \text{ mL}

6. Compute the dosage of a patient in mg of aspirin per kg of body weight who receives exactly 2 aspirin which have a mass of 0.155 g each and the patient has a body weight of 151 lbs. (1 lb = 453.6 g) 310. mg/68.5 kg = 4.52 mg/kg

7. A 3.3 L automobile engine contains how many pints? (1L = 1.057 qts) 7.0 pints

8. How many seconds are there in exactly 3 weeks? 1,814,400 sec

9. What is the density of a 20.0 mL block of wood weighing 18.3 g? 0.915 g/mL

10. What is the volume of 83.7 g of copper if its density is 8.96 g/mL? 9.34 mL

11. The density of liquid bromine is 2.928 g/cm^3. What is the mass of 100.0 mL of bromine? 292.8 g

12. Calculate the density of a body that has a mass of 0.321 kg and a volume of 4.5 mL. Express your answer in g/mL. 7.1 g/mL

13. Convert -35 °F to Kelvin. °F — °C — K

236 K

14. Convert 114 °C to degrees Fahrenheit. 237°F

15. **Temperature** refers to the intensity of heat.

16. A(n) **atom** is the smallest particle of matter that can enter into a chemical combination.

17. **Physical properties** are characteristics that do not involve a change in the chemical identity of matter.

18. A **liquid** has a definite volume but variable shape.

19. **Elements** are pure substances that can not be decomposed by a chemical change.

20. **Chemistry** is the study of the composition, structure, properties, and reactions of matter.

21. Matter is anything that occupies **space** and has **mass**.

22. Pure substances that can be decomposed by chemical changes are called **compounds**.

23. A **hypothesis** is a tentative explanation of experimental data, but if further testing is still supportive it is called a **theory**.

24. **Mixtures** are composed of two or more kinds of matter that can be separated by a physical means.

25. **Gases** take both the shape and volume of their container.

26. **Kinetic** energy is energy that a body possesses when it is in motion.

27. What type of energy does a compressed spring possess? **potential**

28. Classify each of the following as a mixture, compound, or an element. a. air, **mixture**; b. C_6H_{12}O_6, **compound**; c. C_6H_{12}O_6 dissolved in water, **mixture**; d. iron, **element**; e. Cl_2, **element**

29. Classify each of the following as a chemical or physical change.

a. the dissolving of powder kool-aid in water, **physical change**; b. freezing of liquid water, **physical change**

30. Give the chemical symbol for each of the following chemical names. a. Hydrogen, **H**; b. Tin, **Sn**; c. Calcium, **Ca**; d. Sulfur, **S**

31. Give the chemical name for each of the following chemical symbols.

a. Na, **sodium**; b. He, **helium**; c. Hg, **mercury**; d. C, **carbon**

32. What law states that all samples of a pure compound contain the same elements in the same proportions by mass? **Law of Definite Composition**

33. amu is an abbreviation for **atomic mass units**.

34. A(n) **neutron** has a mass of 1 amu and no charge.

35. An electron has a mass of **0** amu and a **1** charge.

36. Atoms of a particular element that differ only in the number of neutrons in the nucleus are called **isotopes**.
37. Given the symbol $^{79}_{34}X^{2-}$, determine the a. # protons; b. # electrons; c. # neutrons; d. identity of the element.

34 protons; 36 electrons; 45 neutrons; selenium (Se)

38. An atom of Ag has 47 electrons and 61 neutrons. Determine the number of each of the following?
   a. atomic number = 47; b. protons = 47; c. mass number = 108

39. Describe the experiments that led to the discovery of the proton, neutron, electron, and the nuclear atom. See Textbook

40. Compare and contrast the Rutherford and Bohr models of the atom. Rutherford had one large region around the nucleus for all the electrons. Bohr had several regions, orbits, at different distances from the nucleus. Electrons in each orbit would have a specific amount (quantum) of energy.

41. Light that has a wavelength of 680 µm is red. a) What is the frequency of this light?

C = λν therefore $ν = \frac{C}{λ}$

$ν = \frac{3.00 \times 10^8 \text{ m/s}}{6.8 \times 10^{-7} \text{ m}} = 4.412 \times 10^{14} \text{ /s} = 4.4 \times 10^{14} \text{ Hz}$

b) What is the energy of a photon of this red light?

$ΔE = hν = (6.626 \times 10^{-34} \text{ J} \cdot \text{s})(4.4 \times 10^{14} \text{ /s}) = 2.9154 \times 10^{-19} = 2.9 \times 10^{-19} \text{ J}$

42. Name the quantum #s that correspond to shell, subshell, and orbital. What are the possible values?

| Principle QN (n) | energy level (shell) | 1, 2, 3, ...
| Angular Momentum QN (l) | orbital shape (subshell) | 0, 1, ..., (n-1)
| Magnetic QN (ml) | orbital orientation (specific orbital) | -l,...,0,...,+l

43. What are the maximum number of electrons per shell for n= 1-4? 2, 8, 18, 32

44. What are the max. number of electrons per subshell, shape of the orbital, and # of orbitals for l = 0-3?

| 2 | sphere | 1 |
| 6 | dumbell | 3 |
| 10 | 4 leaf clover | 5 |
| 14 | 8 lobe | 7 |

45. Which shell has the highest energy, n=3 or n=5?

46. Which type of electrons have the highest energy, 4d or 4f? (assuming in the same shell)

47. Name the three different orientations of the p orbitals. $p_x$, $p_y$, $p_z$

48. How many electrons does a 3p orbital hold? 2 How many electrons does a 3p subshell hold? 6

49. Identify the subshell in which electrons with the following quantum # are found. a) n=4, l=1 4p b) n=7, l=3 7f c) n=2, l=0 2s

50. Which of the following sets of quantum # describes the outermost or highest energy electron on a neutral Al atom? a) n=1, l=0, m=0, s=1/2; b) n=2, l=1, m=0, s= -1/2; c) n=3, l=0, m=0, s=1/2; d) n=3, l=1, m=1, s=-1/2; e) n=4, l=1, m=1, s=1/2

51. Provide the following info for each of the listed elements: a) group #, b) period, c) metal, nonmetal, or semi-metal.

| Ne | 8 | 2 | nonmetal |
| Ge | 4 | 4 | semimetal |
| Mo | 6B | 5 | metal |
| U | 7 | | metal |
| K | 1 | 4 | metal |
| Cl | 7 | 3 | nonmetal |
| Ba | 2 | 6 | metal |
| S | 6 | 3 | nonmetal |

52. Define the following terms: photoelectric effect, periodic law, Heisenberg Uncertainty Principle, quantized, ground state, excited state, quantum #, electromagnetic energy, orbital, and photon. Please see notes or text.

53. The electron configuration for antimony (Sb) is $1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 4s^2 \ 3d^{10} \ 4p^5 \ 5s^2 \ 4d^{10} \ 5p^3$. Answer the following questions without looking at the periodic table:

a) What is the outer shell of Sb? 5 What period is Sb in? 5

b) How many valence electrons are there? 5 What group (number and name) is Sb in? 5

c) What is the outermost subshell? p
54. Give the electron configurations of the following ions:
   Br\(^{-}\) 36 electrons 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 3d\(^2\) 4s\(^2\) 4p\(^6\) 4d\(^{10}\) 5p\(^6\) and Al\(^{3+}\) 10 electrons 1s\(^2\) 2s\(^2\) 2p\(^6\)

55. Name the four quantum #. What information is given by each? What are the possible values?
   
   | Principle QN (n) | energy level (shell) | 1, 2, 3,... |
   | Angular Momentum QN (l) | orbital shape (subshell) | 0, 1, 2, (n-1) |
   | Magnetic QN (m_l) | orbital orientation (specific orbital) | -l,...,0,...,+l |
   | Spin QN (m_s) | orbital spin | -1/2 or +1/2 |

56. What are the maximum number of electrons per shell for n= 1-4? 2, 8, 18, 32

57. What are the max. number of electrons per subshell, shape of the orbital, and # of orbitals for l = 0-3?
   
   | 2 | sphere | 1 |
   | 6 | dumbell | 3 |
   | 10 | 4 leaf clover | 5 |
   | 14 | 8 lobe | 7 |

58. How many electrons does a 3p orbital hold? 2
   How many electrons does a 3p subshell hold? 6

59. Identify the subshell in which electrons with the following quantum # are found.
   a) n=4, l=1 p
   b) n=7, l=3 f
   c) n=2, l=0 s

60. Which of the following sets of quantum # describes the outermost or highest energy electron on a neutral Al atom?
   a) n=1, l=0, m=0, s=1/2; b) n=2, l=1, m=0, s= -1/2; c) n=3, l=0,m=0, s=1/2; d) n=3, l=1, m=1, s=-1/2; e) n=4, l=1, m=1, s=1/2

61. Provide the electron configuration for each of the listed elements.
   
   | Ne | 1s\(^2\) 2s\(^2\) 2p\(^6\) |
   | Ge | 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 3d\(^{10}\) 4p\(^2\) |
   | Mo | 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 3d\(^{10}\) 4p\(^6\) 5s\(^2\) 4d\(^4\) |
   | U | 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 3d\(^{10}\) 4p\(^6\) 5s\(^2\) 4d\(^{10}\) 5p\(^6\) |
   | 6s\(^2\) 4f\(^{14}\) 5d\(^{10}\) 6p\(^6\) 7s\(^2\) 5f\(^4\) |
   | K | 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 4s\(^1\) |
   | Cl | 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^5\) |
   | Ba | 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 4s\(^2\) 3d\(^{10}\) 4p\(^6\) 5s\(^2\) 4d\(^{10}\) 5p\(^6\) 6s\(^2\) |
   | S | 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^4\) |

62. Which of the following has the larger ionic radius?
   a) P (fewer protons decreases attraction, more neg. increases repulsion) or S; b) S or Te (more electron shells, greater shielding by core electrons); c) Na (fewer protons decreases attraction) or Mg.

63. Which of the following has the larger atomic radius?
   a) P (fewer protons decreases attraction) or S; b) S or Te (more electron shells, greater shielding by core electrons)

64. Which element in each pair has an ionization energy that indicates that it is easier to remove its outermost electron?
   a) Na (electrons farther from nucleus ,same shell but bigger atom, have weaker attractions) or Cl;
   b) Na or Cs (electrons farther from nucleus ,higher shells, have weaker attractions).

65. Which element in each pair has a greater tendency to gain an electron according to its electron affinity value?
   a) Na or Cl (more protons and smaller atom); b) Cl (smaller atom/fewer shells) or I.

66. Define the following terms: isoelectronic, ionic radii, orbital, valence shell, valence electron, electron affinity, atomic radius, Pauli exclusion principle, and Hund's rule. Please see notes or text.

67. What type of elements are attracted to an magnetic field? paramagnetic

68. What is meant by the noble gas electron configuration? An electron configuration isoelectronic with one of the noble gases. pseudo noble gas electron configuration? A noble gas electron configuration plus 10 electrons in the outer d subshell.