College Prep Chemistry Midterm Exam Review

1. Which of the following are quantitative observations and which are qualitative observations?
   a. My waist size is 31 inches
   b. My eyes are blue
   c. My right index finger is 1/4 inch longer than my left
   d. The leaves of most trees are green in summer
   e. An apple consists of over 95% water
   f. Chemistry is an easy subject
   g. I got 90% on my last chemistry exam
2. When 0.0021 is written in scientific notation, the exponent is (positive/negative), whereas when 4540 is written in scientific notation, the exponent is (positive/negative).
3. Express each of these in "regular notation":
   a. 4.215e3
   b. 7.228e-5
   c. 9.012e-2
   d. 7.091e-7
   e. 6.921e2
4. Express each of the following numbers in scientific notation:
   a. 12,500
   b. 37,400,000
   c. 0.1550
   d. 0.0000104
   e. 375
5. Indicate the meaning (as a power of 10) for each of the following metric prefixes:
   a. Kilo
   b. Centi
   c. Milli
   d. Deci
   e. Nano
   f. Micro
6. Round off each of the following numbers to three significant figures.
   a. 1,566,311
   b. 2.7651e-3
   c. 84,592
   d. 0.0011672
   e. 0.07759
7. Evaluate each of the following, and write the answer to the correct number of significant figures.
   a. 97.381 + 4.2502 + 0.99195
   b. (0.102)(0.0821)(273)(1.01)
   c. (2.0944 + 0.0003233 + 12.22)/(7.001)
8. Perform each of the following conversions, being sure to set up clearly the appropriate conversion factor in each case:
   a. 62.5cm to inches
   b. 4.95 m to yards
   c. 2.45 mi to km
9. The radius of an atom is on the order of 10^{-10} m. What is this radius in centimeters? In inches? In nanometers?
10. Carry out the following indicated temperature conversions:
    a. –40 °C to °F
    b. –40 °F to °C
    c. 232 K to °C
    d. 232 K to °F
11. A gas cylinder having a volume of 10.5 L contains 36.8 g of gas. What is the density of the gas in g/mL?
12. A sample containing 33.42 g of metal pellets is poured into a graduated cylinder initially containing 12.7 mL of water, causing the water level in the cylinder to rise to 21.6 mL. Calculate the density of the metal.
13. Acetone, a solvent widely used in industry, boils at 65°C. This is an example of a (physical/chemical) property of acetone.

14. Acetone is highly flammable because it reacts easily with oxygen gas in the atmosphere; this is an example of a (physical/chemical) property of acetone.

15. Classify the following as physical or chemical changes:
    a. Mothballs gradually vaporize in a closet

    b. A French chef making a sauce with brandy is able to burn off the alcohol from the brandy, leaving just the brandy flavoring

    c. Hydrofluoric acid attacks glass, and is used to etch calibration marks on glass laboratory utensils.

    d. Calcium chloride lowers the temperature at which water freezes, and can be used to melt ice on city sidewalks and roadways.

    e. An antacid tablet fizzes and releases carbon dioxide gas when it comes in contact with hydrochloric acid in the stomach.

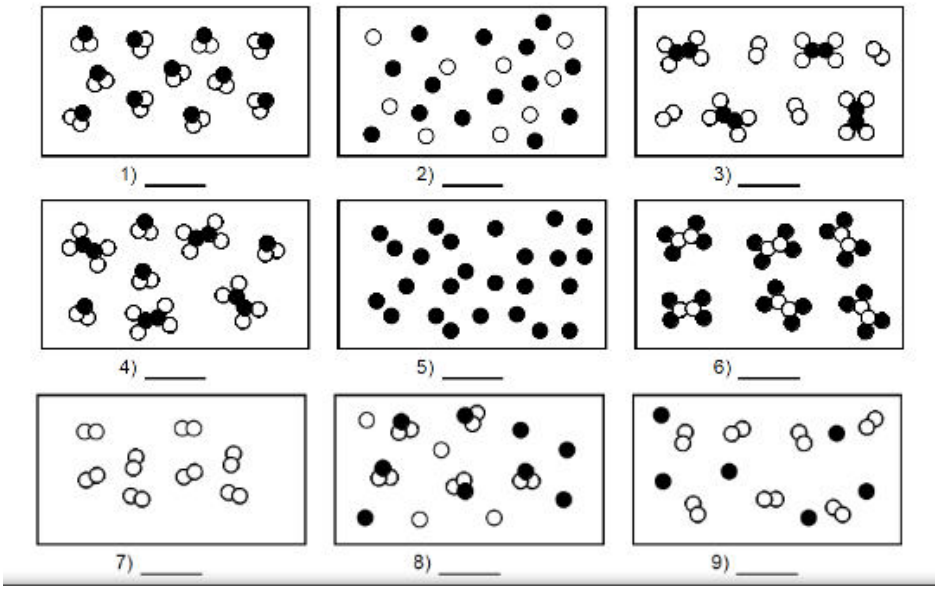
    f. A flashlight battery corrodes and leaks on prolonged storage.

16. Classify the following as elements, compounds, or mixtures:
    a. A white cotton handkerchief
    b. Distilled water
    c. Water scooped from a pond
    d. The mercury used in a thermometer

17. Classify the following mixtures as heterogeneous or homogeneous:
    a. A bag of various colored marbles
    b. Beach sand
    c. A sample of sodium chloride dissolved in water
    d. A sample of air

18. Label each as element (E), molecule (M), compound (C), heterogeneous mixture (HT), or homogeneous mixture (HM).

Each circle represents an atom and each different color represents a different kind of atom. If two atoms are touching then they are bonded together.



19. The proton and the (electron/neutron) have almost equal masses. The proton and the (electron/neutron) have charges that are equal in magnitude but opposite in nature.

20. Write the atomic symbol ($^{A}_{Z}X$) for each of the isotopes described below:
    a. Atomic number=8, number of neutrons = 9

    b. The isotope of chlorine in which mass number = 37

c. Atomic number=27, mass number=60

21. Given the data in the table below, calculate the average atomic mass of the element argon:

Isotope	Abundance	Mass (amu)
Argon-36	0.337%	35.978
Argon-38	0.063%	37.963
Argon-40	99.600%	39.962

22. Write the name of the family (group) to which each of the following elements belongs:
    a. Cs c. Rn e. Sr g. Rb
    b. Ra d. Cl f. Xe

23. Write the charge and number of valence electrons for each of the following elements:
    a. Cs c. Rn e. Sr g. Rb
    b. Ra d. Cl f. Xe

24. Positive ions are called _____, whereas negative ions are called _____.

25. Ions are formed when an atom gains or loses ____; they never involve a change in the atom's nucleus.

26. What is the difference between the atomic number and the mass number of an element? Can atoms of two different elements have the same atomic number? Could they have the same mass number? Why or why not?

27. How did Rutherford contribute to the theory of atomic structure?

28. Where are electrons found in the Bohr model of the atom?

29. Calculate the number of protons, neutrons, and electrons in a neutral atom of Mg-25.

30. Write the reaction for each nuclear decay process:
    ^{140}La undergoes beta decay ^{135}Cs releases an alpha particle C-14 undergoes positron emission

31. Radioactive isotope X has a half-life of 2 days. How much of isotope X will remain after 2 weeks if you begin with 35 g of X?

32. Calculate the number of electrons in an ion of O^{2-}.

33. Define isotope.

34. Determine the identity of the element that has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^5$.

35. Write the noble gas electron configuration for the element titanium.

36. Draw an orbital diagram for the element nitrogen.

37. What do the following rules concerning electron configuration state? Pauli exclusion principle, Hund's rule, the aufbau principle.

38. Why are the noble gases stable?

39. Define and give the periodic trend for the following properties:
    a. electronegativity
    b. ionization energy
    c. shielding
    d. atomic radius

40. Are elements most similar to each other in the same column or the same row? What do these elements have in common that cause them to be similar?

41. List the following atoms in terms of increasing atomic radius, decreasing ionization energy, and increasing electronegativity:
    Al, Si, P, S, Cl

42. Fill in the following chart

Group #	1	2	3-12	13	14	15	16	17	18
Group Name				None	None	None	None		
# of Val electrons			varies						
Charge			varies						

43. Give the name of each of the following simple binary ionic compounds:
    a. Na_2O
    b. K_2S
    c. $MgCl_2$
    d. $CaBr_2$

44. Give the name of each of the following ionic substances:
    a. $SnBr_2$
    b. $SnBr_4$
    c. CrO
    d. Cr_2O_3

45. Name each of the following binary compounds:
    a. CBr_4
    b. N_2O_3
    c. PCl_3
    d. ICl
    e. SiF_4

46. Name each of the following:
    a. $Fe(NO_3)_3$
    b. $Co_3(PO_4)_2$
    c. $Cr(CN)_3$
    d. $Al_2(SO_4)_3$

47. Name each of the following acids:
    a. HCl
    b. H_2SO_4
    c. HNO_3
    d. HI
    e. HNO_2

48. Write the formula for each of the following compounds:
    a. Lithium bromide
    b. Sodium iodide
    c. Silver (I) sulfide
    d. Cesium oxide
    e. Beryllium iodide
    f. Barium hydride
    g. Aluminum fluoride
    h. Potassium oxide

49. Write the formula for each of the following compounds:
    a. phosphorus triiodide
    b. silicon tetrachloride
    c. dinitrogen pentaoxide
    d. diboron trioxide
    e. dinitrogen pentafluoride
    f. diphosphorus pentoxide

50. Write the formula for each of the following compounds:
    a. Tin (IV) acetate
    b. Sodium oxide
    c. Ammonium nitrite
    d. Potassium sulfite

51. Write the formula for each of the following:
    a. Calcium phosphate
    b. Ammonium nitrate
    c. Aluminum acetate
    d. Barium sulfate
    e. Iron (III) nitrate
    f. Copper (I) hydroxide

52. Draw Lewis diagrams for each of the following molecules. Then assign molecular geometry and bond angles to each diagram.
    a. CH_4
    b. PH_3
    c. H_2O
    d. CO_2

53. Determine which of the molecules given in #57 are polar and which are nonpolar.

54. List some possible signs that a chemical reaction has occurred.

55. In a chemical equation for a reaction, the notation "(aq)" after a substance's formula means that the substance is dissolved in ___.

56. Balance the following equations:
    a. ___C_3H_8 + ___O_2 → ___CO_2 + ___H_2O
    b. ___SO_2 + ___O_2 → ___SO_3
    c. ___$Ba(NO_3)_2$ + ___Na_2SO_4 → ___$NaNO_3$ + ___$BaSO_4$

57. Fill in the chart below:

Reactants	Type of Reaction	Balanced Equation
Hydrochloric acid reacts with sodium hydroxide		
magnesium reacts with iron (II) fluoride		
calcium reacts with nitrogen		
lithium phosphide reacts with lead (II) nitrate		
LiCl		
butane (C_4H_{10}) reacts with oxygen		