General chemistry, work sheet

Chapter 1: Essential Ideas in Chemistry

Part-I: define the following terms

1. Chemistry	2. Substance	3. Mixture
4. Compound	5. Matter	6. Extensive properties
7. Intensive properties	8.Accuracy	9. Significant figure
10. Precision	11.Repeatability	12. Reproducibility
13. Gross error	14. Systematic (Determinate) error	15. Random (indeterminate) error

Part-II: give the correct answer according to the questions

1. what are the main part of chemistry
2. what are the classification of matter
3. give an example of physical and chemical; properties
4. show how Celsius scale and the Fahrenheit scale are related
5. Give the conversion factor of 100 cm and 1 m
6. give the repeatability conditions
7. The exact caffeine concentration of a given coffee is 10. 315 ppm. when student x determine, it become 10.320 ± 0.03 ppm and for the second student it was 10.513 ± 0.0006.
   a. Which one is more accurate?
   b. Which one is more precise and
   c. why?
8. How Systematical errors can be avoided or detected?
9. what is the purpose of Standard reference materials
10. determine the significance figure from the following measurements
    a. 23, b. 0.03 c. 2.03 d. 5.0600×10^4
11. give the result of the following equations according to the significance figure rule
    a. $25.2 + 1.34 =$ _____ c. $9.2 \times 6.8 \times 0.3744 =$ _____
    b. $3.10 \times 4.520 =$ _____ d. $2.33 \times 6.085 \times 2.1 =$ _____

Chapter 2: Atoms, Molecules and Ions

Part-I: define the following terms

1. Chemical symbol	2. Isotopes	3. atomic mass
4. fractional abundance	4. **Chemical formulas**	5.Atoms
5. proton,	6. electron	7. neutron
8. Nuclear structure	9. Nucleus	
10. atomic number	11. mass number	
12. Ionic bonding	13. Covalent bonding	14. molecular compounds
15. metallic bonds	16. Complex compound	17. coordinate covalent bond
18. diatomic molecules	19. polyatomic molecules.	20. Ionic Hydrates
21. Binary acids	22. Oxyacids	23. hydrated compound

Part-II: give the correct answer according to the questions

12. give about 10 elements symbol that derived from their Latin names.
13. give 10 element symbol that abbreviate from English names
14. What is the atomic mass of chlorine in amu by calculating from isotopic mass and fractional abundance.
15. Calculate the Average atomic mass of chlorine if the natural abundance of the isotope of Cl-35 has is 75.77% and Cl-37 has 0.2423 %.
16. calculate the atomic mass of boron (B), which has two isotopes: B-10 with 19.9% natural abundance, and B-11 with 80.1% abundance.
17. neon-20 has 19.992, abundance of 90.48%, neon-21 has 20.994, abundance of 0.27% and neon-22 has 21.991 amu, abundance of 9.25%. Determine Average a. m.
18. A compound has 2 Hydrogen, 1 Sulfur, and 4 Oxygen what is the possible acidic compound chemical formula.
19. explain the Dobereiner's Traineds.and what is the its limitation
20. explain Law of octaves what is the its limitation
21. explain Mendeleev periodic table and its limitation
22. explain modern periodic table and its limitation
23. give an example of ionic and covalent compound

Chapter 3: Composition of Substances and Solutions

I. Work the following questions

1. Define the term Substances and Solutions and explain what it means Mole and Molar Mass?
2. Write your Understanding about moles, molecules and Avogadro's number
3. What are the units of the mole? And describe the amount of mole and the related quantity Avogadro's number?
4. Write an equation to calculate moles and mass in a given chemical compounds?
5. Complete the following table:

No	Element	Relative atomic mass	Sample Mass (g)	No of moles in the sample
I	Hydrogen	1.01	1.01	
II	Magnesium		24.31	
III	Carbon	12.01		
IV	Chlorine	35.45	70.9	

6. Calculate the number of moles in each of the following samples:
   a. 21.62 g of boron (B) , c. 54.94 g of manganese (Mn),
   b. c. 100.3 g of mercury (Hg) d. 50 g of barium (Ba) e. 40 g of lead (Pb)
7. One of the amino acids is glycine, which has the molecular formula $C_2H_5O_2N$. How many moles of glycine molecules are contained in 28.35 g of glycine?
8. What is the mass of 0.443 mol of hydrazine, N_2H_4?
9. A prospector panning for gold in a river collects 15.00 g of pure gold. How many Au atoms are in this quantity of gold?
10. Explain the relation between mass, moles, and numbers of atoms or molecules, and perform calculations deriving these quantities from one another
11. If You have a 56 g sample of iron sulfide (FeS)
    a. How many moles of FeS are there in the sample?
    b. How many molecules of FeS are there in the sample?
    c. What is the difference between a mole and a molecule?
    d. Write down Avogadro's number without using scientific notation.
12. Calculate the molecular or formula mass of each of the following:
    (a) P_4 (b) H_2O (c) $Ca(NO_3)_2$ (d) CH_3CO_2H (acetic acid)
13. Is there any difference among Formula mass and molecular mass?

14. Write a sentence that describes how to determine the number of moles of a compound in a known mass of the compound if we know its molecular formula.
15. Compare 1 mole of H_2, 1 mole of O_2, and 1 mole of F_2. (a) Which has the largest number of molecules? Explain why. (b) Which has the greatest mass? Explain why
16. Which contains the greatest number of moles of oxygen atoms: 1 mol of ethanol (C_2H_5OH), 1 mol of formic acid (HCO_2H), or 1 mol of water (H_2O)? Explain why.
17. Explain what means by the Empirical and Molecular Formulas
18. Write the Steps to determine Empirical and Molecular Formulas
19. Write the formula to calculate Percent composition
20. Calculate the percentage that each element contributes to the overall mass of sulfuric acid (H_2SO_4) and Aspirin (C9H8O4).
21. Analysis of a 12.04g sample of a liquid compound composed of carbon, hydrogen, and nitrogen showed it to contain 7.34g C, 1.85g H, and 2.85g N. What is the percent composition of this compound?
22. Determine the percent water in $CuSO_4 \cdot 5H_2O$ to three significant figures.
23. A compound contains 52.2% carbon (C), 13.0% hydrogen (H) and 34.8% oxygen (O). Determine its empirical formula.
24. Vinegar, which is used in our homes, is a dilute form of acetic acid. A sample of acetic acid has the following percentage composition: 39.9% carbon, 6.7% hydrogen and 53.4% oxygen.
    i. Determine the empirical formula of acetic acid.
    ii. Determine the molecular formula of acetic acid if the molar mass of acetic acid is 60g/mol.
25. What is the empirical formula of a compound containing 40.0% C, 6.71% H, and 53.28% O?
26. What information do we need to determine the molecular formula of a compound from the empirical formula?
27. A chlorinated hydrocarbon compound when analysed, consisted of 24.24% carbon, 4.04% hydrogen, 71.72% chlorine. The molecular mass was found to be 99 from another experiment. Deduce the empirical and molecular formula.
28. A calcium mineral consisted of 29.4% calcium, 23.5% sulphur and 47.1% oxygen by mass. Calculate the empirical formula of the mineral.
29. Dichloroethane, a compound that is often used for dry cleaning, contains carbon, hydrogen, and chlorine. It has a molar mass of 99 g/mol. Analysis of a sample shows that it contains 24.3% carbon and 4.1% hydrogen. What is its molecular formula?

30. A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% of chlorine. Its molar mass is 98.96g. What are its empirical and molecular formulas?
31. Determine the empirical and molecular formula for chrysotile asbestos. Chrysotile has the following percent composition: 28.03% Mg, 21.60% Si, 1.16% H, and 49.21% O. The molar mass for chrysotile is 520.8 g/mol.
32. What mean by concentration units? And what are they?
33. Differentiate between molarity, molality, Normality and Molality.
34. Calculate the molarity of 6.52g of $CoCl_2$ (128.9 g/mol) dissolved in an aqueous solution with a total volume of 75.0 mL.
35. The concentration of acetic acid in white vinegar was determined to be 0.839 M. What volume of vinegar contains 75.6 g of acetic acid?
36. Determine the molarity of each of the following solutions:
    i. 1.457 mol KCl in 1.500 L of solution
    ii. 20.54 g of $Al(NO_3)_3$ in 1575 mL of solution
    iii. 0.515 g of H_2SO_4 in 1.00 L of solution
    iv. 2.76 kg of $CuSO_4 \cdot 5H_2O$ in 1.45 L of solution
37. Find the molarity of a 40.0% by mass aqueous solution of sulfuric acid, H_2SO_4, for which the density is 1.3057 g/mL.
38. Wine is approximately 12% ethanol (CH_3CH_2OH) by volume. Ethanol has a molar mass of 46.06g/mol and a density 0.789g/mL. How many moles of ethanol are present in a 750 mL bottle of wine?
39. A 50.0g sample of industrial wastewater was determined to contain 0.48 mg of mercury. Express the mercury concentration of the wastewater in ppm and ppb units.
40. If 0.1718 L of a 0.3556 *M* C_3H_7OH solution is diluted to a concentration of 0.1222 *M*, what is the volume of the resulting solution?
41. An experiment in a general chemistry laboratory calls for a 2.00*M* solution of HCl. How many mL of 11.9 *M* HCl would be required to make 250 mL of 2.00 *M* HCl?
42. The hardness of water (hardness count) is usually expressed in parts per million (by mass) of $CaCO_3CaCO_3$, which is equivalent to milligrams of $CaCO_3CaCO_3$ per liter of water. What is the molar concentration of Ca^{2+} ions in a water sample with a hardness count of 175 mg $CaCO_3$/L?
43. The level of mercury in a stream was suspected to be above the minimum considered safe (1 part per billion by weight). An analysis indicated that the concentration was 0.68 parts per billion. Assume a density of 1.0 g/mL and calculate the molarity of mercury in the stream.

44. Commercially available sulphuric acid contains 91% acid by mass and has a density of 1.83g/mL (i) Calculate the molarity of the solution (ii) volume of concentrated acid required to prepare 3.5L of 0.50 M H_2SO_4
45. Why molality is preferred over molarity in expressing the concentration of a solution?
46. Write the formula of Converting Moles to Number of Particles and Number of Particles to Moles.
47. A scientist analyzes a 50.0 g sample and founds that it contains 13.3 g of potassium, 17.7g of chromium, and another element. Later the scientist learns that the sample is potassium dichromate, $K_2Cr_2O_7$. What is the percentage composition of potassium dichromate?
48. The empirical formula of butane, the fuel used in disposable lighters, is C_2H_5 . In an experiment, the molar mass of butane was determined to be 58 g/mol. What is the molecular formula of butane?
49. A compound's molar mass is 240.28 g/mol. Its percentage composition is 75.0% carbon, 5.05% hydrogen, and 20.0% oxygen. What is the compound's molecular formula?
50. A 0.539 g sample of a compound that contained only carbon and hydrogen was subjected to combustion analysis. The combustion produced 1.64 g of carbon dioxide and 0.807 g of water. Calculate the percentage composition and the empirical formula of the sample.

Chapter 4: Stoichiometry of Chemical Reaction

1. Give definition of the following terms:
   a) Mole
   b) Balancing chemical equation
   c) Stoichiometry
   d) Oxidation
   e) Reducing agent
   f) Limiting reactant
   g) Excess reactant
   h) Titration
   i) Equivalence point
   j) Gravimetric analysis
2. Carbon tetrachloride (CCl_4) was prepared by reacting 100. g of carbon disulfide and 100. g of chlorine. If 65.0 g of CCl_4 were obtained from the reaction:

   $CS_2 + 3\ Cl_2 \rightarrow CCl_4 + S_2Cl_2$ then Calculate
   a) the percent yield
   b) Limiting reactant
   c) Excess reactant
3. Polychlorinated biphenyls (PCBs), which were formerly used in the manufacture of electrical transformers, are environmental and health hazards. They break down very slow in the environment. The decomposition of PCBs can be represented by the equation

   $2\ C_{12}H_4Cl_6 + 23\ O_2 + 2\ H_2O \rightarrow 24\ CO_2 + 12\ HCl$

   (a)How many moles of water are needed to react with 10.0 mol of O_2?

   (b) How many grams of HCl are produced when 15.2 mol react with H_2O?

   (c) How many moles of CO_2 are produced when 76.5 g HCl are produced?

   (d) How many grams of $C_{12}H_4Cl_6$ are reacted when 100.25 g CO_2 are produced?

   (e) How many grams of HCl are produced when 2.5 kg $C_{12}H_4Cl_6$ react?
4. Balance the following chemical reactions:
   a) $C_6H_6 + O_2 \rightarrow CO_2 + H_2O$
   b) $C_5H_{12}O + O_2 \rightarrow CO_2 + H_2O$
   c) $CH_3NH_2 + O_2 \rightarrow CO_2 + H_2O + N_2$

d) $Cr(OH)_3 + HClO_4 \rightarrow Cr(ClO_4)_3 + H_2O$

e) $MnO_4^-{}_{(aq)} + S^{2-}{}_{(aq)} \rightarrow MnS_{(s)} + S_{(s)}$ (basic solution)

5. In the following reactions, label the oxidizing agent and reducing agent.

a) $P_{4(s)} + 5O_{2(g)} \rightarrow P_4O_{10(s)}$

b) $Co_{(s)} + Cl_{2(g)} \rightarrow CoCl_{2(s)}$

c) $ZnO(s) + C(s) \rightarrow Zn(g) + CO(g)$

d) $8Fe(s) + S_8(s) \rightarrow 8FeS(s)$

6. Determine the oxidation number for each of the underlined elements:

a) $\underline{\underline{Cr}}_2O_7^{2-}$

b) $H_2\underline{\underline{S}}O_4$

c) $NaH_2\underline{\underline{P}}O4$

d) $\underline{\underline{C}}O_3^{2-}$

7. Determine whether each of the following half-reactions represents an oxidation or a reduction

a) $Cu^{2+} \rightarrow Cu^+$

b) $F_2 \rightarrow 2F^-$

c) $2IO4^- + 16H^+ \rightarrow I_2 + 8H_2O$

8. It takes 83 mL of a 0.45 M NaOH solution to neutralize 235 mL of an HCl solution. What is the concentration of the HCl solution?

9. A student prepares a solution of hydrochloric acid that is approximately 0.1 M and wants to determine its precise concentration. A 25.00 mL portion of the HCl solution is transferred to a fask, and after a few drops of indicator are added, the HCl solution is titrated with 0.0775 M NaOH solution. The titration requires exactly 37.46 mL of the standard NaOH solution to reach the end point. What is the molarity of the HCl solution?

10. Explain the difference between equivalence point and end point of titration.

Chapter 5: Electronic Structure and Periodic Properties of Elements

1. A dental hygienist uses x-rays (λ = 1 .00 Å) to take a series of dental radiographs while the patient listens to a radio station (λ = 325 cm) and looks out the window at the blue sky (λ= 473 nm). What is the frequency (in s^{-1}) of the electromagnetic radiation from each source? (Assume that the radiation travels at the speed of light, 3.00X l 0^8 m/s.)
2. A cook uses a microwave oven to heat a meal. The wavelength of the radiation is l .20 cm. What is the energy of one photon of this microwave radiation?
3. What values of the angular momentum (*l*) and magnetic (*m*,) quantum numbers are allowed for a principal quantum number (*n*) of 3? How many orbitals exist for *n* = 3?
4. Differentiate the Pauli Exclusion Principle and Aufbau principle.
5. Write the ground-state electron configurations for (a) sulfur (S) and (b) palladium (Pd), which is diamagnetic.
6. What is a wave? Explain the following terms associated with waves: wavelength, frequency, amplitude.
7. An electron in an atom is in the *n* = 3 quantum level. List the possible values of *l*and m_l that it can have.
8. What is the difference between a 2*px* and a 2*py* orbital?
9. Write the ground-state electron configurations for the following elements: Ge, Fe, Zn, Ni, W
10. An atom of a certain element has 15 electrons. Without consulting a periodic table, answer the following questions: (a) what is the ground-state electron configuration of the element? (b) How should the element be classified? (c) Is the element diamagnetic or paramagnetic?
11. Write ground-state electron configurations for these ions, which play important roles in biochemical processes in our bodies: (a) Na^+, (b) Mg^{+2}, (c) Cl^-, (d) K^+, (e) Ca^{+2} (g) Cu^{+2}, (h) Zn^{+2}.
12. Using condensed electron confiurations, write reactions for the formation of the common ions of the following elements:(a) Iodine (Z= 53) (b) Potassium (Z = 19) (c) Indium (Z = 49)
13. Use condensed electron configurations to write the reaction for the formation of each transition metal ion, and predict whether the ion is paramagnetic: (a) Mn^{2+} (Z = 25) (b) Cr^{3+} (Z = 24) (c) Hg^{2+} (Z = 80)
14. Draw an orbital diagram showing valence electrons, and write the condensed ground-state electron configuration for each: (a) Ti (b) CI (c) V

15. Define shielding and effective nuclear charge. What is the connection between the two?
16. Define the trends in three key atomic properties those Atomic Size, Ionization Energy, Electron Affinity.
17. Describe the different between paramagnetism and diamagnetism?
18. Why do successive IEs of a given element always increase? When the difference between successive IEs of a given element is exceptionally large (for example, between IE, and IE2 of K), what do we learn about its electron configuration?
19. Arrange each set in order of increasing atomic size: (a) Rb, K, Cs (b) C, O, Be (c) CI, K, S (d) Mg, K, Ca
20. Which element in each of the following sets would you expect to have the highest IE2? (a) Na, Mg, Al (b) Na, K, Fe (c) Sc, Be, Mg

Chapter 6: Chemical Bonding and Molecular Geometry

1. define the following terms

a. Bonding	i. Lattice energy	Q. Covalent Bonds
b. Bond multiplicity	j. Born-Haber cycle	R. Polar Covalent Bond
c. Bond length	K. Hess's law	S. Dipole moment
d. Bond angle	L. Lattice enthalpy	T. Formal charge
e. Bond polarity	M. Ionization Energy	U. Resonance structure
f. Bond energy	N. Electron Affinity	V. VSEPR theory
g. Ionic Bonds	O. Dissociation energy	W. Valence bond theory
h. Crystal lattice	P. Heat of formation	X. Isoelectronic

2. Show the Born-Haber cycle for $CaCl_2$
3. Use the following data to estimate H_f for KCl, U = -690 KJ/mol, IE for K = 419 KJ/mol, EA of Cl= -349 KJ/mol, BE of Cl2 = 239 KJ/mol, Hsub for K = 64 KJ/mol
4. Write Lewis structure of SO_4^{-2}
5. write the Lewis formula for CO_3^{2-} with formal charge
6. show Resonance structure for CO_3^{-2} and C_6H_6
7. explain Electron-Deficient Molecules and give molecular example with their dot structure
8. what are Odd-Electron Molecules and give an example
9. describe Expanded Valence Shells and give three example
10. arrange the following paired based on the repulsion Bonding Pair (BP)-BP, Lone Pair (LP)-LP and LP-BP.
11. give molecule that belongs to the following molecular geometry

a. linear	g. seesaw
b. V-shape	h. square pyramidal
c. trigonal pyramidal	i. tetrahedral
d. Square planar	j. T-shape
e. Trigonal planar	k. octahedral

12. write at least 4 limitation of VSEPRT
13. show the diagram for the H-H, overlapping; H-Cl, overlapping and Cl-Cl, overlapping

Chapter 7: Equilibrium constant and acid base equilibrium

21. CH_4 reacts with H_2S to form H2 and CS_2:

    CH_4 (g) + 2 H_2S (g) ⇄ CS_2 (g) + 4 H_2 (g) Determine the value of K_P for this reaction at 1000 K if the following equilibrium pressures were measured:

    P_{CH4} = 0.20 atm P_{H2S} = 0.25 atm

    P_{CS2} = 0.52 atm P_{H2} = 0.10 atm

22. SO_2 (g) + NO_2 (g) ⇄ SO_3 (g) + NO (g); K_C = 3.75

    1.24 mol SO_2 (g) and 0.750 mol NO_2 (g) are combined in a 2.50 L flask, and the reaction is allowed to reach equilibrium. Determine the concentration of each species present at equilibrium.

23. Write the equations for the conversion of K_c to K_P for each of the following reactions:

    (a) $C_2H_6(g) \rightleftharpoons C_2H4(g) + H_2(g)$

    (b) $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$

    (c) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

24. Explain how to recognize the conditions under which changes in pressure would affect systems at equilibrium.

25. What is the minimum mass of $CaCO_3$ required to establish equilibrium at a certain temperature in a 6.50-L container if the equilibrium constant (*Kc*) is 0.050 for the decomposition reaction of $CaCO_3$ at that temperature?

    $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

26. State LeChatelier's Principle. Which factors have an effect on a system at equilibrium? How does the presence of a catalyst affect a system at chemical equilibrium? Explain your answer.

27. What will be the effect of increasing the total pressure on the equilibrium conditions for (a) a chemical equation that has more moles of gaseous products than gaseous reactants, (b) a chemical equation that has more moles of gaseous reactants than gaseous products, (c) a chemical equation that has the same number of moles of gaseous reactants and gaseous products, and

    (d) A chemical equation in which all reactants and products are pure solids, pure liquids, or in an aqueous solution?

28. Distinguish between the term's static equilibrium and dynamic equilibrium. Which kind does a chemical equilibrium represent?

29. (a) A sample of milk is found to have a pH of 6.50. What are the concentrations of H_3O^+ and OH^- ions in this sample? (b) A sample of buttermilk has a pH of 4.50. Which sample is more acidic?

30. Calculate the pH of (a) a 1.5×10^{-4} M solution of $HClO_4$, a strong acid, at 25°C and (b) 1.5×10^{-8} M solution of HCl at 25°C.
31. What is the relationship between base strength and the value of Kb? What is the relationship between acid strength and the value of pKa?
32. Calculate the concentrations of the various species in a 0.100 M H_3AsO_4 solution. Compare the concentrations with those of the analogous species in 0.100 M H_3PO_4 solution.
33. Given the following reaction at equilibrium in a closed container at 500°C, predict the effect of each of the following changes on the amount of NH_3 present at equilibrium:

    (a) forcing more H_2 into the system; (b) removing some NH_3 from the system.

    $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$
34. Some nitrogen and hydrogen are placed in an empty 5.00-liter container at 500°C. When equilibrium is established, 3.01 mol of N_2, 2.10 mol of H_2, and 0.565 mol of NH_3 are present. Evaluate Kc for the following reaction at 500°C.

    $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$
35. We put 10.0 moles of N_2O into a 2.00-L container at some temperature, where it decomposes according to

    $2N_2O(g) + 2N_2(g) \Leftrightarrow O_2(g)$
36. For the following reaction, the equilibrium constant is 49.0 at a certain temperature. If 0.400 mol each of A and B are placed in a 2.00-liter container at that temperature, what concentrations of all species are present at equilibrium?

    $A + B \Leftrightarrow C + D$
37. . The reaction between nitrogen and oxygen to form NO(g) is represented by the chemical equation

    $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

    Equilibrium concentrations of the gases at 1500 K are 6.4×10^{-3} mol/L for N_2, 1.7×10^{-3} mol/L for O_2, and 1.1×10^{-5} mol/L for NO. Calculate the value of Kc at 1500 K from these data. Why are some aqueous solutions of salts of weak acids and weak bases neutral, whereas others are acidic and still others are basic?
38. . In the distant future, when hydrogen may be cheaper than coal, steel mills may make iron by the reaction $Fe_2O_3(s) + 3H_2(g) \Leftrightarrow 2Fe(s) + 3H_2O(g)$.

    For this reaction, $\Delta H^0 = 96$ kJ/mol and Kc = 8.11 at 1000. K. (a) what percentage of the H_2 remains unreacted after the reaction has come to equilibrium at 1000K? (b) Is this percentage greater or less if the temperature is decreased to below 1000K?

39. What kind of equilibrium constant can be calculated from a ΔG^0 value for a reaction involving only gases?
40. What must be true of the value of ΔG^0 for a reaction if (a) K >> 1; (b) K = 1; (c) K << 1?
41. In each of the following question parts write the names and formulas for three salts of a weak acid and a weak base that give (a) neutral, (b) acidic, and (c) basic aqueous solutions.

42. Of the following salts, which will produce an acidic solution? A neutral solution? A basic solution?

    Ammonium acetate (NH_4CH_3COO)

    Ammonium nitrate (NH_4NO_3)

    Ammonium sulfate [$(NH_4)_2SO_4$]

    Calcium sulfite ($CaSO_3$)

    Lithium hypochlorite (LiClO)

    Potassium chloride (KCl)

43. A sample of HI (g) is placed in a flask at a pressure of 0. 1 00 bar. After equilibrium is attained, the partial pressure of HI (g) is 0.050 bar. Evaluate K for the reaction

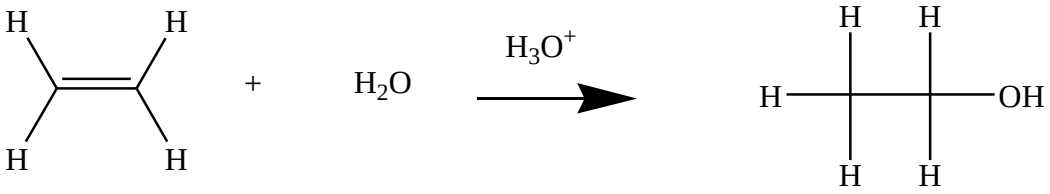
    $2HI\ (g) = H_2\ (g) + I_2\ (g)$

Set up an equilibrium table. In the initial system, line I, there are no products so some must form to reach equilibrium.

Chapter 8: Organic Chemistry

1) Discuss the following terms.
   a) vitalism
   b) hybridization
   c) isomerism
   d) esterification
   e) amidation
2) Describe saturated and unsaturated hydrocarbons and name the characteristic chemical reactions for each.
3) Identify aliphatic and aromatic hydrocarbons from the following compounds.
   a) Pentane
   b) Cyclohexene
   c) Toluene
   d) Xylene
4) Both cyclohexene and benzene are unsaturated hydrocarbons. However, benzene does not exhibit the characteristic reactions of cyclohexene. Explain.
5) Why are alkenes more reactive than alkanes?
6) What are heterocyclic compounds? Give one example of such compounds.
7) Classify the following compounds as either alkane or alkene.
   a) C_3H_8 b) C_5H_{10} c) C_6H_{14} d) C_6H_{12} e) C_5H_{12}
8) Draw skeletal structure for hexane, cyclohexane, cyclohexene, cyclohexanol and cyclohexanone.
9) Classify each of the organic compounds below as an alcohol, ether, aldehyde, ketone, carboxylic acid, ester, amine and amide.
   a) HCOOH
   b) CH_3COCH_3
   c) $CH_3CH_2CH_2CONHCH_3$
   d) $HCOOCH_3$
   e) $CH_3CH(OH)CH_2CH_2CH_3$
   f) CH_3CH_2CHO
   g) $(CH_3)_2CHCH_2OCH_2CH_3$
   h) $CH_3CH_2CH_2CH_2NHCH_3$

10) Identify the type of reaction and the role of the acid in the following transformation.



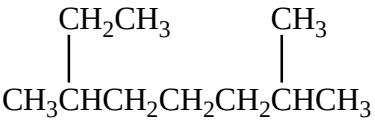
11) Give the IUPAC name for the following organic compounds:

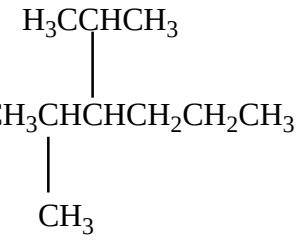
a. $(CH_3)_2C(OH)CH_2CH_2CH_3$

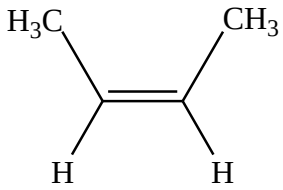
b) $CH_3OCH(CH_3)_2$

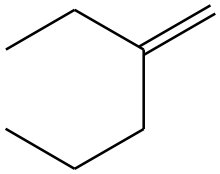
c) $CH_3CH_2CH_2CH(OH)CH_2CH(OH)CH_3$

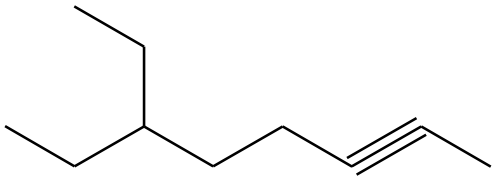
d) $(CH_3)_2CHCH_2CH_2CH{=}CHCH_2Cl$

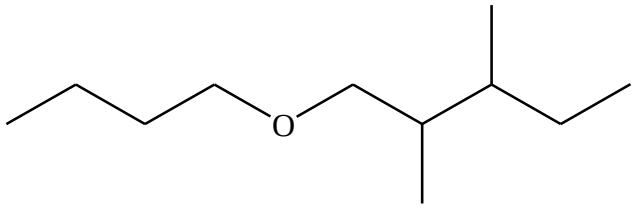
e) 

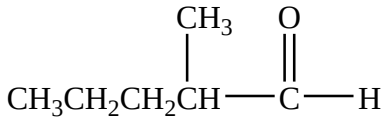
f) 

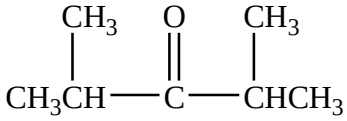
g) 

h) 

i) 

j) 

k) 

l) 

m) 

12) Draw the structures corresponding to the following IUPAC names:

a) 3,4-Dimethylnonane

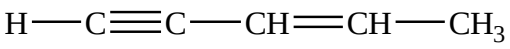
b) 3-Ethyl-4,4-dimethylheptane

c) 2,2-Dimethyl-4-propyloctane

d) 2,4,5-Trimethyl-4-(1-methylethyl)heptane

e) 2-Methyl-4-(2-methylpropyl)octane

13) Identify the geometry, hybridization and bond angles at the carbon atoms in the molecule shown below.



14) What kind of isomerism exists between the following pairs of compounds?

a) n-butane and 2-methylpropane

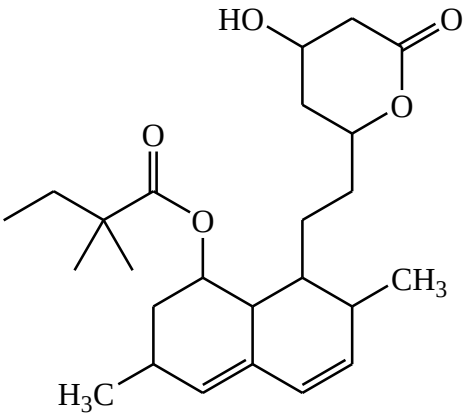
b) 1-butene and 2-butene

c) Cis-2-butene and trans-2-butene

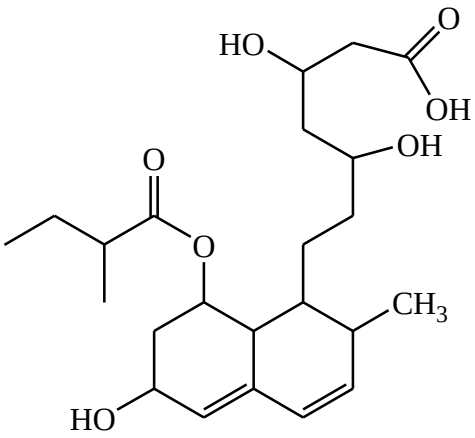
d) Isopentane and neopentane

e) Diethyl ether and n-butanol

15) The cholesterol-lowering agents called *statins*, such as simvastatin (Zocor) and pravastatin (Pravachol), are among the most widely prescribed drugs in the world, with annual sales estimated at approximately $15 billion. Identify the functional groups in both, and explain how the two substances differ.



Simvastatin (Zocor)



Pravastatin (Pravachol)

16) Arrange the following isomers of pentane in increasing order of boiling point. Explain why such difference occurs among these isomers?

a) n-pentane b) isopentane c) neopentane

17) On what basis hydrocarbons can be classified? Support your answer by listing the classes.

18) Discuss the importance of hydrocarbons and support your answer by giving example.

19) Carbon has ability to form long chains and this is the reason for the presence of the vast number of organic compounds in nature. What is the term that represents this unique property of carbon?

20) Discuss the similarities and differences between aldehydes and ketones.

21) In which one of the following molecules does carbon exhibit lowest and highest oxidation state?

a) CH_4 b) CH_3OH c) CH_2O d) CH_2O_2 e) CO_2

22) Why esters have lower vapor pressures than the alcohols and carboxylic acids from which they are derived?

23) Which one is more basic from amines and amides and why?

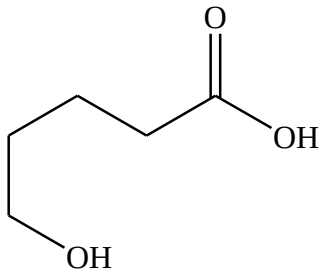
24) Name the products of the following reactions.

a) Oxidation of primary alcohol

b) Oxidation of secondary alcohol

c) Oxidation of aldehyde

25) It is possible for a molecule containing an alcohol and a carboxylic acid group to react with itself to form cyclic esters known as lactones. Give the structure of the product that would result from the reaction of 5-hydroxy pentanoic acid with itself?



26) Give the missing reactants and products in the following reactions and transformations. Put your answer in the given box.

