

**Matter, Energy and Life**  
**Chapter 1**

Learning Goals	Homework
1. Be able to distinguish between chemical and physical properties.	10, 12, 14
2. Be able to classify a substance according to its physical state (solid, liquid, gas, mixture) or its chemical state (element or compound)	20, 22, 23, 24, 25, 26 55, 56
3. Be able to describe the properties of metals and nonmetals.	28, 37
4. Know and be able to use the correct format for chemical symbols for elements and compounds.	31, 32, 33, 34, 35, 38, 40, 42, 53
5. Understand the concept of energy. Be able to discuss and identify the differences between kinetic and potential energy.	46, 47
6. Be able to identify the reactants and the products of a chemical reaction.	Application: A Chemical Reaction 26
7. Table 1.3 lists 35 common elements and their symbols. Since the symbols will be used extensively throughout the quarter, you should learn them. Your progress will be evaluated on Quiz 1.	
8. Be familiar with the content of each Application and Interlude.	48, 49, 50
9. Be able to write a definition for each Key Term listed on page 14.	

**Measurements in Chemistry**  
Chapter 2

Learning Goals	Homework
1. Know the multiple or fraction represented by the prefixes mega, kilo, deci, centi, milli, micro, and nano, (Table 2.2) and know the symbol for each.	27, 28
2. Know the SI and metric units for mass, length, volume, and temperature.	24, 25, 26
3. Be able to interconvert among units expressed using the prefixes given in Table 2.2. (e.g., cm to km)	29, 30, 31
4. The skills and knowledge described in sections 2.4, 2.5, and 2.6 are essential for your success in chemistry. You will be expected to study these sections on your own to master the skills. We will spend very little time in lecture discussing them. Quiz 2 will evaluate your progress in learning these items.	32-39 as needed
5. Be able to convert a quantity from one unit to another. Conversion factors will be provided on the exam.	40, 41, 42, 44, 46, 50 52, 64, 65, 72, 78
6. Many of the homework problems in chapters 1-11 require numerical solutions. Therefore, Section 2.8 is very important to you. If you are not a proficient problem solver, the authors' discussion will be very helpful.	
7. Be able to convert a temperature from one unit to another. Try to develop a general feeling for the relationships among the three scales.	53
8. Be able to perform calculations relating to systems where energy flow has occurred.	56, 57, 58
9. Be able to do calculations using the density or specific gravity of a substance.	61, 63
10. Be able to use the information given in each Application and Interlude.	66, 67, 68
11. Be able to define conversion factor, density, specific gravity, heat, specific heat, mass, and temperature.	

**Atoms and the Periodic Table**  
Chapter 3

Learning Goals	Homework
1. Be able to describe the structure of the atom.	23, 24, 26
2. Be able to use the atomic number and the neutron or mass number to identify and name an isotope for an element.	29, 32, 33, 35, 38
3. Know how atomic weight is related to the isotopes of an element.	39
4. Know the differences among orbitals, subshells, and shells.	41, 42
5. Be able to write the electron configuration for elements with atomic numbers 1-20.	44, 45, 46, 47, 48
6. Understand the basis for the organization of the Periodic Table. Know the difference between periods and groups, and know the categories of elements in the Periodic Table.	49, 50, 52, 54, 59, 60 61, 81, 82, 83
7. Be able to use the periodic table to determine the number of valence electrons an element has and what the electron configuration for those valence electrons would be.	53, 55, 56, 58, 63, 84
8. Know the content of the Application and the Interlude.	65, 66
9. Be able to write a definition for atomic number, electron shell, electron subshell, group, period, isotope, mass number, orbital, and valence shell.	

**Ionic Compounds**

## Chapter 4

Learning Goals	Homework
1. Be able to write the ionic symbol and the electron-dot symbol for atoms and ions.	29, 30, 31, 32, 33
2. Know the general principles of ion formation and know the properties of ionic compounds.	34
3. Be able to apply the octet rule to forming ions.	35, 36, 38, 40, 41, 42
4. Be able to use the Periodic Table to predict the types of ions that will form and the charges on the ion.	46, 48, 49, 50
5. Know how ionization energy and electron affinity are related to ion formation.	44, 45
6. Know how and why the radius of an atom changes as it accepts a charge.	52, 54
7. Be able to name monoatomic ions.	55, 56
8. Be able to write the formula for an ion when given its name.	57
9. Be able to name a polyatomic ion when given its formula, or to write the formula when given a name.	58, 59
10. Be able to name a compound when given its formula, or to write its formula when given its name.	62, 65, 81, 82
11. Be able to write a correct chemical formula using the charges on the combining ions.	60, 64, 66
12. Be able to identify the characteristics of acids and bases, and be able to write the reaction equations for their dissolution in water.	67, 68, 69
13. Know the content of the Application and Interlude boxes.	70-75
14. Be able to write definitions for ionization energy, electron affinity and polyatomic ion.	

**Molecular Compounds**  
Chapter 5

Learning Goals	Homework
1. Be able to describe the covalent bond and compare it to the ionic bond.	24, 25
2. Be able to combine the correct number of atoms to form molecular compounds.	26, 28, 29, 30, 32, 36
3. Be able to distinguish among structural, molecular, and condensed formulas.	33, 34, 38, 40
4. Be able to draw the Lewis structure for a substance when given its molecular formula.	41, 43, 44, 46, 48, 49, 81
5. Be able to predict the geometry for molecules containing 2, 3, or 4 electron charge clouds.	51, 52, 53, 54
6. Be able to use electronegativity differences and molecular geometry to predict the polarity of bonds and molecules.	56, 58, 59, 60, 61
7. Be able to name binary molecular compounds when given a formula or write a formula when given the name.	62, 63, 64, 65, 66, 78
8. Know and be able to apply the information given in the Application and Interlude boxes.	67, 68, 69, 70, 71
9. Be able to write a definition for binary compound, electronegativity, covalent bond, and molecular compound.	

**Chemical Reactions: Classification and Mass Relationships**

## Chapter 6

Learning Goals	Homework
1. Be able to balance simple chemical reaction equations by inspection.	26, 27, 28, 29, 31
2. Be able to calculate the number of moles of a substance when given its mass and formula weight or when given the number of particles in the sample.	35, 36, 40, 42, 43, 44
3. Be able to use the mole relationships in a chemical equation	46, 48, 50
4. Be able to calculate the percent yield in a chemical reaction.	52
5. Be able to identify the three general classes of reactions described in the chapter.	
6. Be able to predict the products of precipitation reactions and to write the net ionic equation for the reaction. Table 6.1 gives rules to use for this process.	55, 56, 57, 58, 59, 60, 61
7. Be able to recognize inorganic and organic redox reactions and to assign an oxidation number to elements.	65, 66, 68, 70
8. Be able to identify reducing and oxidizing agents.	62, 64, 67
9. Understand and be able to use the information in the Applications and Interlude.	71, 72, 73
10. Be able to write a definition for molar mass, mole, oxidation, reduction, reducing agent, oxidizing agent, solubility, and spectator ion.	

**Chemical Reactions: Energy, Rates, and Equilibrium**  
Chapter 7

Learning Goals	Homework
1. Be able to state the law of conservation of mass and energy. Know how this law is related to the issue of the origin of the universe.	11, 12, 13
2. Be able to calculate the enthalpy change when a given set of reactants are converted to products.	16
3. Know the difference between enthalpy and entropy. Be able to use enthalpy and entropy changes to predict the spontaneity of a reaction.	17, 18, 19, 20, 21, 22, 24
4. Know how the activation energy affects a reaction and know the effect of temperature, concentration, and catalysts on reaction rates.	25, 26, 29, 30, 31, 32, 33, 34
5. Understand the principles of chemical equilibrium. Be able to write an equilibrium constant expression for a reaction and to do calculations for systems at equilibrium.	35, 36, 37, 38, 39, 40, 42, 44
6. Know and be able to use the content of the Application and Interlude boxes.	46, 47, 48, 49, 50, 51
7. Be able to write a definition for catalyst, endergonic process, endothermic process, endothermic, exergonic process, exothermic, and spontaneous process.	

**Gases, Liquids, and Solids**  
Chapter 8

Learning Goals	Homework
1. Know and be able to use the assumptions of the Kinetic Molecular Theory.	20, 21
2. Know and be able to use the different units for pressure.	17, 22
3. Be able to state and use each of the following gas laws:	
a. Dalton's Law	18, 19
b. Boyle's Law	25, 26, 30
c. Charles's Law	31, 32
d. Gay-Lussac's Law	35, 36
e. Combined Gas	38, 41, 42, 43
f. Avogadro's Law	46, 47, 48, 50
g. Universal (Ideal) Law	52, 54, 56, 58
4. Understand and be able to use the three major types of intermolecular forces to describe the properties of gases, liquids and solids.	59, 60, 61, 62, 64, 65 66, 67, 70, 72
5. Know and be able to use the information in the Application and Interlude boxes.	73, 74, 75, 76, 77
6. Be able to write a definition for amorphous solid, crystalline solid, heat of fusion, heat of vaporization, normal boiling point and standard temperature and pressure (STP).	

**Solutions**  
Chapter 9

Learning Goals	Homework
1. Be able to identify various types of mixtures and know the characteristics of a true solution.	25, 26, 30
2. Be able to predict how intermolecular forces, surface area, temperature, and pressure affect solubility.	27, 28, 31, 32
3. Know how saturated, unsaturated, and supersaturated solutions differ.	34
4. Be able to use the different concentration units described in the chapter.	35, 36, 37, 38, 41, 44, 48 51, 52, 54
5. Be able to perform stoichiometric calculations when the reactants and products are present in solution.	56, 58
6. Be able to use the relationship, $M_1V_1 = M_2V_2$ , when diluting a solution.	60
7. Know the differences between electrolytes and nonelectrolyte and be able to express the electrolyte concentration using equivalents or milliequivalents per liter.	61, 62, 64
8. Know the effect of a solute's concentration on the vapor pressure, boiling point, and freezing point of a solution.	66, 69
9. Be able to calculate the osmolarity of a solution.	73
10. Be able to predict the direction the solvent will flow when two solutions of different concentrations are brought into contact through an osmotic membrane.	70, 71, 72, 74
11. Know and be able to use the information in the Application and Interlude boxes.	75, 76, 77, 78, 79
12. Be able to write a definition for dialysis, isotonic, miscible, osmosis, saturated, and supersaturated.	

**Acids and Bases**  
Chapter 10

Learning Goals	Homework
1. <b>Be able to identify the particles present in solution when an acid or a base is dissolved in water.</b>	<b>29, 30, 31, 32, 35</b>
2. Table 10.1 contains a list of strong acids and bases. Know the name and formula for each of the substances.	
3. <b>Be able to identify the most common strong and weak acids and bases.</b>	<b>33, 34</b>
4. Be able to identify the conjugate acid/base pairs for a Bronsted-Lowery acid or base.	36, 37, 38, 39, 40
5. <b>Be able to predict the relative strength of the conjugate acids or bases.</b>	<b>41</b>
6. Be able to write the products for the reaction of an acid with hydroxide, bicarbonate and carbonate ions, and with ammonia.	44, 45
7. <b>Be able to use the value of the acid dissociation constant, <math>K_a</math>, to determine the strength of an acid.</b>	<b>46</b>
8. Know what the ion-product constant for water represents and know its value at 25°C.	47
9. <b>Be able to use the pH of a solution to determine whether it is acidic, basic, or neutral.</b>	<b>48</b>
10. Be able to calculate pH when given $[H_3O^+]$ or to calculate $[H_3O^+]$ when given pH.	50, 53, 56
11. <b>Be able to calculate <math>[OH^-]</math> when given pH or <math>[H_3O^+]</math>.</b>	<b>54, 57</b>
12. Be able to describe the composition of a buffer, to explain how it works to control pH, and what makes it a good or poor buffer.	58, 59, 60
13. <b>Be able to discuss how buffers work in the human body.</b>	<b>61</b>
14. Sections 10.14 and 10.15 discuss analysis of acid solutions. You should know the underlying principles of analysis by titration but you will not be tested on the material. Learning Goals	
15. <b>Be able to predict whether a salt will produce an acidic or a basic solution when dissolved in water.</b>	<b>26, 27</b>
16. Know and be able to use the information contained in the Application and Interlude boxes.	77, 78, 79, 80
17. <b>Be able to write a definition for amphoteric, buffer, buffer capacity, conjugate acid, conjugate base, and ion-product constant for water.</b>	

**Nuclear Chemistry**  
Chapter 11

Learning Goals	Homework
1. Be able to discuss the nature of radioactivity.	13, 14
2. Be able to describe $\alpha$ , $\beta$ , and $\gamma$ radiation and know how they differ.	15, 16, 17, 18, 22, 23
3. Be able to discuss ionizing radiation.	19, 20
4. Be able to define background radiation and know the main sources of it.	21
5. Know what the half-life of an isotope represents, why it is important and how it is used. Be able to perform calculations using the half-life concept.	24, 25, 37, 46
6. Know how radiation is detected and what units measure the radiation and its effects.	26, 27, 28, 29, 30, 50
7. Be able to complete and balance nuclear equations.	31, 32, 39, 40, 41, 42, 43
8. Know the differences between nuclear fission and nuclear fusion.	
9. Know and be able to apply the information in the Applications and Interlude boxes.	51, 52, 53, 54, 55
10. Be able to write a definition for chain reaction, critical mass, decay series, nucleon, radioisotope, and radio nuclide.	
11. Half-lives of radioisotopes are used as a tool in establishing the age of rock samples and carbon-containing samples of recent origin. Know what limits this method has.	

**Introduction to Organic Chemistry: Alkanes**  
Chapter 12

Learning Goals	Homework
1. Know the characteristics and properties of organic compounds. Reactivity in organic compounds is generally associated with functional groups. Learn them as they are discussed in class.	17, 18, 19, 20, 25 Section 12.7
2. Be able to draw structural and condensed structural formulas for organic compounds. Be able to draw all isomers for a simple compound.	26, 27, 29, 32, 33, 34, 36 37, 38
3. Be able to name an alkane or cycloalkane when given its structural or condensed structural formula.	39, 44, 45
4. Be able to draw a structural or condensed structural formula when given the name of an alkane or a cycloalkane.	40, 43
5. Although combustion is the most important reaction of alkanes, substitution of chlorine or bromine for hydrogen can also occur. Be able to predict the products for each of these reactions.	48, 50, 52
6. Know how primary ( $1^\circ$ ), secondary ( $2^\circ$ ), tertiary ( $3^\circ$ ), and quaternary ( $4^\circ$ ) carbon.	
7. Know and be able to apply the information given in the Application and Interlude boxes.	53, 54, 55, 56, 57, 58, 59
8. Be able to write a definition for alkane, alkyl group, conformation, constitutional isomers, hydrocarbon, isomers, and substituent.	

**Alkenes, Alkynes, and Aromatic Compounds**

## Chapter 13

<u>Learning Goals</u>	<u>Homework</u>
1. Know the properties of alkenes and alkynes.	Section 13.4 (p. 367)
2. Be able to name alkenes and alkynes when given a structural formula, or to draw a structure when given a name.	17, 18, 22, 23, 24, 30
3. Be able to draw and name <i>cis</i> - and <i>trans</i> - isomers for alkenes.	31, 33, 34, 37, 38
4. Be able to predict the products of the addition of hydrogen, chlorine, bromine, hydrogen bromide, hydrogen chloride, and water to an alkene or alkyne. You must also know the conditions under which the reactions occur.	39, 41, 42, 43, 44
5. Know how addition polymers form.	48
6. Know that aromatic compounds undergo substitution reactions rather than addition reactions. However, no specific reactions must be learned.	Section 13.10
7. Know the contents of the Application: The Chemistry of Vision.	56, 57

**Some Compounds with Oxygen, Sulfur, or a Halogen**  
Chapter 14

Learning Goals	Homework
1. Be able to identify (primary, secondary, and tertiary) alcohols, ethers and phenols.	15, 20
2. Know the properties of the alcohols discussed in Section 14.2	
3. Be able to name and draw structures of alcohols.	21, 22, 23, 24
4. Be able to predict the products for the oxidation and dehydration of alcohols.	28, 29, 30, 34, 36, 37
5. Be able to discuss the physical properties of alcohol, phenols, ethers, and alkyl halides.	26, 31, 32, 58, 64
6. Be able to name compounds containing halogen atoms.	59
7. Know and be able to apply the content of the Application and Interlude boxes.	44, 45, 46, 47, 48 49, 50, 51
8. Be able to identify an aldehyde, a ketone, a carbonyl group, an alkyl halide, a carboxylic acid, and a hydroxyl group.	

**Aldehydes and Ketones**

## Chapter 16

Learning Goals	Homework
1. Be able to identify aldehydes and ketones and understand the importance of the carbonyl group in these compounds.	14, 18, 20
2. Be able to name aldehydes and ketones.	15, 21, 22, 23, 24, 25
3. Know the properties of aldehydes and ketones.	Sections 16.3, 16.4
4. Be able to predict the products for the oxidation of an aldehyde, the reduction of an aldehyde or ketone, the addition of an alcohol to a ketone or aldehyde, and the hydrolysis of an acetal.	26, 27, 28, 31, 32, 33 34, 35, 36, 37, 39, 44
5. Know what Tollen's reagent and Benedict's reagent are used for.	30
6. Know and be able to apply the content of the Application and Interlude boxes.	53, 54, 55, 56, 57, 58

**Carboxylic Acids and Their Derivatives**

## Chapter 17

Learning Goals	Homework
1. Know the properties of carboxylic acids and their derivatives.	21, 22, 25 Sections 17.3, 17.6
2. Be able to name carboxylic acids, carboxylic acid salts, acid anhydrides, and carboxylic esters when given a structural formula, or to draw the structure when given the name.	26, 27, 28, 40, 41
3. Know the acidic properties of carboxylic acids.	31, 32, 38
4. Be able to predict the products of the reaction of a carboxylic acid with water, a base, or an alcohol.	34a, 47, 48
5. Be able to predict the products for the hydrolysis of an ester.	50
6. Be able to identify the general types of organic reactions described in section 17.10.	60, 61
7. No questions will be asked about amides.	
8. Know and be able to apply the content of the Application and Interlude boxes.	62, 63, 64, 65, 66