

10th Grade Chemistry Objectives (2015-2016)

These are the objective that you will be assessed on this year in chemistry. Each objective will be assessed multiple times throughout the year to determine your overall understanding of concepts and application of skills. For each unit you should be able to identify these objectives and use them to guide your studying.

Matter

- Distinguish between the physical properties and chemical properties of matter.
- Explain solid, liquid, and gas states in terms of kinetic particle theory.
- Interpret phase change diagrams.
- Describe the differences between elements, mixtures and compounds
- Explain the interconversion between states of matter in terms of the kinetic particle theory
- Describe evidence for the movement of particles in gases and liquids
- Differentiate between volume and mass and calculate the density of large and small quantities of a variety of substances (e.g., aluminum foil, water, copper, clay, rock)
- Explain the law of conservation of matter
- Distinguish between pure substances, heterogeneous, and homogeneous, giving examples of each
- Demonstrate how mixtures can be separated by using the properties of the substances from which they are made, such as particle size, density, solubility and boiling point.
- Define the terms solute, solvent, and solution
- List and explain three factors that affect the rate at which a solid solute dissolves in a liquid solvent.
- Investigate factors affecting dissolution rates.

Atomic Structure

- Describe the development of the model of atomic structure (include Dalton, Thompson, Rutherford, Bohr models)
- State the relative charges, location in an atom, and approximate relative masses of protons, neutrons and electrons
- Describe the composition of an atom including the forces acting within the atom (nuclear, electrostatic)
- Define the terms atomic number, mass number, valence electrons, isotopes, relative atomic mass (A_r), relative molecular mass (M_r), mole, Avogadro's constant
- Draw Bohr models of atoms, isotopes, and ions up to atomic number 20
- Draw Lewis structures of atoms and ions up to atomic number 20
- Distinguish the number of protons, neutrons, and electrons in atoms, ions and isotopes
- Describe the build-up of electrons in 'shells' and understand the significance of the noble gas electronic structures and of valence electrons (the ideas of the distribution of electrons in s and p orbitals and in d block elements are not required.)
- Interpret chemical formulas
- Calculate the molecular mass given any compound

- Use molecular mass to convert between mass in grams and amount in moles of a chemical compound.
- Solve problems involving mass in grams, amount in moles, and number of atoms in an element.

Periodic Table

- Define the terms group and period
- Describe the arrangement of elements on the periodic table
- Relate the properties of the main-group elements to their electron arrangements.
- Describe and explain the properties of metals and non-metals
- Predict how an atom's electron arrangement influences its ability to transfer or share electrons and is related its position on the periodic table.
- Deduce the electron configuration of an atom from the element's position on the periodic table, and vice versa.
- Explain periodic trends across periods and down groups including; atomic number, atomic radii, reactivity, ionization energy, and electronegativity.
- Relate trends in the periodic table to the atomic structures of elements.
- Explain why noble gases are unreactive.

Chemical Bonding & Formulas

- Give examples that show how substances can react chemically with other substances to form new substances, known as compounds, and that in such recombination's the properties of the new substances may be very different from those of the old.
- Distinguish between ionic, covalent, and metallic bonds.
- Explain why most atoms form chemical bonds.
- Describe the formation of ions and ionic bonds
- Define the terms molecule, molecular formula and empirical formula
- State the octet rule
- Describe how bonds are created by sharing electrons.
- Draw Lewis structures to showing covalent bonding involving single and multiple bonds.
- Describe the differences in volatility, solubility and electrical conductivity between ionic and covalent compounds
- Describe metallic bonding
- Describe and explain the general physical and chemical properties of metals
- Write chemical formulas for ionic compounds
- Name ionic compounds given a formula
- List the formulas for the following polyatomic ions; ammonium, hydrogen carbonate (bicarbonate), hydrogen sulfate, hydroxide, nitrate, carbonate, sulfate, phosphate
- Using prefixes, name a binary molecular compound from its formula (covalent naming)
- Write the formula of a binary molecular compound given its name. (covalent formulas)
- Calculate the number of molecules, formula units, or ions in a given molar amount of a chemical compound
- Calculate the percent composition of a given chemical compound.

Chemical Equations and Reactions & Stoichiometry

- Write a word equation and a formula equation for a given chemical equation.
- Balance chemical equations.
- Apply the use of state symbols (s), (l), (g) and (aq) in equations.
- Describe the relationship between the law of conservation of matter and balancing chemical equations.
- List observations that would indicate that a chemical reaction has taken place.
- Define and give general equations for synthesis, decomposition, single-displacement, and double displacement reactions.
- Classify reactions as synthesis, decomposition, single-displacement, double-displacement, or combustion reactions
- Predict products of simple reactions given the reactants.
- Use an activity series to predict whether a given reaction will occur and what the products will be.
- Describe the importance of the mole ratio in stoichiometric calculations
- Write a mole ratio relating two substances in a chemical equation.
- Use mole ratios to calculate the amount of reactants or products in a reaction (calculate moles and/or grams) given the mass or moles of a different reactant or product.
- Explain how non-spontaneous reactions can occur.
- Distinguish between exothermic and endothermic reactions.

Acid-Base Reactions

- Define acid and base according to Bronsted-Lowry theory
- List the general characteristics of acids and bases.
- Name common binary acids and oxyacids given their chemical formulas
- Predict the products and balance chemical equations for the reactions with acids involving; reactive metals, metal oxides, metal hydroxides, hydrogen carbonates, and carbonates
- Explain the process and write balanced equations of neutralization reactions
- Explain and use the pH scale
- Use a pH meter and universal indicators to determine the acidity or alkalinity of a substance
- Define the terms solute, solvent, solution, solubility and molarity
- Calculate molarity
- Solve problems involving pH and $[H^+]$
- Describe how acid rain is formed and the effects of acid rain on humans and ecosystems

Measurement and Data Processing

- Use appropriate safety procedures when conducting investigations.
- Name appropriate apparatus for the measurement of time, temperature, mass, volume,
- List the SI units for length, mass, time, volume, density and pressure
- Use appropriate tools and technology to collect precise and accurate data.
- Distinguish between mass and weight

- Calculate density from given data or data collected in experiments
- Use dimensional analysis to perform calculations
- Determine the number of significant figures in measurements.
- Perform mathematical calculations involving significant figures.
- Calculate and use percentage error to determine the accuracy of measurements.
- Distinguish between accuracy and precision.
- Apply qualitative and quantitative measures to analyze data and draw conclusions that are free of bias.
- Communicate and defend scientific findings.

Gases (If Time)

- Define pressure and describe how it is measured
- State the standard conditions of temperature and pressure
- Convert between units of pressure
- Apply Dalton's law of partial pressure to calculate partial and total pressures
- Use the kinetic-molecular theory to explain the relationships between gas volume, temperature and pressure
- Use Boyle's law to calculate volume-pressure changes at constant temperature
- Use Charles's law to calculate volume-temperature changes at constant pressure
- Use Gay-Lussac's law to calculate pressure-temperature changes at constant volume
- Use the combined gas law to calculate volume-temperature-pressure changes
- Define standard molar volume of a gas and use it to calculate gas masses and volumes
- State the ideal gas law
- State and explain the significance of Avogadro's law
- Use the ideal gas law to calculate pressure, volume, temperature, or amount of gas when the other three quantities are known.
- Describe the process of diffusion.
- Relate the kinetic-molecular theory to the properties of an ideal gas.
- Relate verbally, mathematically, or graphically the behavior of the parameters that describe the physical behavior of gases.
- List the conditions under which gases deviate from ideal behavior.