

California Learning Resource Network listing for *Principles of Alchemy (Chemistry)*

Standards that all students are expected to achieve in the course of their studies are unmarked. Standards that all students should have the opportunity to learn are marked with an asterisk (*).

Introduces and Provides for Systematic Development for Grade 9

Strand: Physical Sciences

Substrand: **Heat and Thermodynamics**

3c Students know the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object. *alchemy/wat1d2.htm#states*

3d Students know that most processes tend to decrease the order of a system over time and that energy levels are eventually distributed uniformly. *alchemy/fir1d2.htm#entropy*

3e Students know that entropy is a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system. *alchemy/fir1d2.htm#entropy*

3f *Students know the statement "Entropy tends to increase" is a law of statistical probability that governs all closed systems (second law of thermodynamics). *alchemy/fir1d2.htm#entropy*

Strand: Chemistry

Substrand: **Atomic and Molecular Structure**

1a Students know how to relate the position of an element in the periodic table to its atomic number and atomic mass. *alchemy/ear1d.htm#introtable*

1b Students know how to use the periodic table to identify metals, semimetals, nonmetals, and halogens. *alchemy/ear1d2.htm#alkali*

1c Students know how to use the periodic table to identify alkali metals, alkaline earth metals and transition metals, trends in ionization energy, electronegativity, and the relative sizes of ions and atoms. *alchemy/ear1d.htm*

1d Students know how to use the periodic table to determine the number of electrons available for bonding. *alchemy/ear1d.htm*

1e Students know the nucleus of the atom is much smaller than the atom yet contains most of its mass. *alchemy/air1d.htm#dalton*

1f *Students know how to use the periodic table to identify the lanthanide, actinide, and transactinide elements and know that the transuranium elements were synthesized and identified in laboratory experiments through the use of nuclear accelerators. *alchemy/ear1d2.htm#transition*

1g *Students know how to relate the position of an element in the periodic table to its quantum electron configuration and to its reactivity with other elements in the table. *alchemy/air1d.htm#electronshells* *alchemy/ear1d.htm#atomsizes*



Substrand: **Chemical Bonds**

2a Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.

alchemy/wat1d.htm#lewishell

2b Students know chemical bonds between atoms in molecules such as H_2 , CH_4 , NH_3 , H_2CCH_2 , N_2 , Cl_2 , and many large biological molecules are covalent.

alchemy/wat1d.htm#lewishell

2c Students know salt crystals, such as $NaCl$, are repeating patterns of positive and negative ions held together by electrostatic attraction. *alchemy/wat1d2.htm#simple*

2d Students know the atoms and molecules in liquids move in a random pattern relative to one another because the intermolecular forces are too weak to hold the atoms or molecules in a solid form. *alchemy/wat1d2.htm#weakbonds*

2e Students know how to draw Lewis dot structures. *alchemy/wat1d.htm#lewis*

2f *Students know how to predict the shape of simple molecules and their polarity from Lewis dot structures. *alchemy/wat1d2.htm#molestrc*

2g *Students know how electronegativity and ionization energy relate to bond formation. *alchemy/ear1d.htm#eleneg* *alchemy/ear1d.htm#ionization*

2h *Students know how to identify solids and liquids held together by Van der Waals forces or hydrogen bonding and relate these forces to volatility and boiling/melting point temperatures. *alchemy/wat1d2.htm#weakbonds*

Substrand: **Conservation of Matter and Stoichiometry**

3a Students know how to describe chemical reactions by writing balanced equations.

alchemy/fir1d.htm#balance

3g *Students know how to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions. *alchemy/fir1d.htm#redox*

Substrand: **Acids and Bases**

5a Students know the observable properties of acids, bases, and salt solutions.

alchemy/fir1x.htm#ph

5b Students know acids are hydrogen-ion-donating and bases are hydrogen-ion-accepting substances. *alchemy/fir1qa.htm#a27*

5c Students know strong acids and bases fully dissociate and weak acids and bases partially dissociate. *alchemy/wat1d.htm#elbonds*

Substrand: **Solutions**

6b Students know how to describe the dissolving process at the molecular level by using the concept of random molecular motion. *alchemy/wat1d2.htm#weakbonds*

Substrand: **Chemical Thermodynamics**

7b Students know chemical processes can either release (exothermic) or absorb (endothermic) thermal energy. *alchemy/fir1d.htm#reactions*

7c Students know energy is released when a material condenses or freezes and is absorbed when a material evaporates or melts. *alchemy/fir1d2.htm#gibbs*

7e *Students know how to apply Hess's law to calculate enthalpy change in a reaction. *alchemy/fir1d2.htm#enthalpy*



7f *Students know how to use the Gibbs free energy equation to determine whether a reaction would be spontaneous. [alchemy/fir1d2.htm#gibbs](#)

Substrand: Reaction Rates

8a Students know the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time. [alchemy/fir1d2.htm#rates](#)

8b Students know how reaction rates depend on such factors as concentration, temperature, and pressure. [alchemy/fir1d2.htm#rates](#)

8c Students know the role a catalyst plays in increasing the reaction rate. [alchemy/fir1d2.htm#rates](#)

8d *Students know the definition and role of activation energy in a chemical reaction. [alchemy/fir1d2.htm#rates](#)

Substrand: Chemical Equilibrium

9a Students know how to use Le Chatelier's principle to predict the effect of changes in concentration, temperature, and pressure. [alchemy/fir1d2.htm#equilb](#)

9b Students know equilibrium is established when forward and reverse reaction rates are equal. [alchemy/fir1d2.htm#equilb](#)

Substrand: Nuclear Processes

11a Students know protons and neutrons in the nucleus are held together by nuclear forces that overcome the electromagnetic repulsion between the protons. [alchemy/air1d.htm](#)

11c Students know some naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions. [alchemy/air1d.htm#isotopes](#) and [alchemy/air1d.htm#radiation](#)

11d Students know the three most common forms of radioactive decay (alpha, beta, and gamma) and know how the nucleus changes in each type of decay. [alchemy/air1d.htm#radiation](#)

11e Students know alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and have different penetrations. [alchemy/air1d.htm#radiation](#)

11f *Students know how to calculate the amount of a radioactive substance remaining after an integral number of half lives have passed. [alchemy/air1d.htm#radiation](#)



Principles of Alchemy (Chemistry)
by Dr Jamie Love from Merlin Science
www.synapses.co.uk/alchemy