Governor Arnold Schwarzenegger
State Board of Education
California Department of Education

Free Digital Textbook Initiative Report

Reviews facilitated by the California Learning Resource Network

August 11, 2009

"From government to non-profit organizations, teachers to textbook publishers, we all have a role to play in leveraging 21st century technology to expand learning and better serve California's students, parents, teachers and schools. This initiative will ensure our schools know which digital textbooks stand up to California's academic content standards - so these cost-effective resources can be used in our schools to help ensure each and every student has access to a world-class education."

- Governor Arnold Schwarzenegger

ACKNOWLEDGEMENTS

Governor Arnold Schwarzenegger

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Introduction

California's Free Digital Textbook Initiative was created to provide students, teachers and parents access to free digital high school textbooks that meet California's rigorous academic content standards.

At Governor Arnold Schwarzenegger's request, Secretary of Education Glen Thomas, Superintendent of Public Instruction Jack O'Connell and State Board of Education President Theodore Mitchell invited content developers to submit materials for review so that schools would have access to standards-aligned digital math and science textbooks in time for the start of classes in fall 2009. The California Learning Resource Network (CLRN) coordinated resource acquisition and facilitated the reviews.

It is important to note that, while the digital textbooks in this report were reviewed for alignment with California's content standards (see http://www.cde.ca.gov/be/st/ss/index.asp*)*, social content review criteria were not applied during this phase. Thus, a textbook's inclusion in this report does not in any way constitute an endorsement by the State of California. Districts, schools and individuals planning to take advantage of these books are reminded to conduct their own reviews to determine whether these resources meet their needs.

Textbook reviews and links to each textbook download are available at CLRN's web site at http://www.clrn.org/fdti/.

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Note: Materials were not reviewed for alignment to California's social content review standards; inclusion in this report does not constitute endorsement by the State of California.

Algebra II

Publisher: Connexions

Title of Program: Advanced Algebra II

URL: http://cnx.org/content/m19435/1.4/Advanced_Algebra_2_20090615.pdf

Standards Met:
This program meets 26 of the 27 algebra II content standards.

Standards Not Addressed:
13.0: Students use the definition of logarithms to translate between logarithms in any base.

Standards Met with Comments:
4.0: Students factor polynomials representing the difference of squares, perfect square trinomials, and the sum and difference of two cubes.
Factoring the sum and difference of two cubes is not addressed.

5.0: Students demonstrate knowledge of how real and complex numbers are related both arithmetically and graphically. In particular, they can plot complex numbers as points in the plane.
How real and complex numbers are related graphically is not addressed. Plotting complex numbers as points in a plane is not addressed.

7.0: Students add, subtract, multiply, divide, reduce, and evaluate rational expressions with monomial and polynomial denominators and simplify complicated rational expressions, including those with negative exponents in the denominator.
Rational expressions with negative exponents in the denominator are not addressed.

10.0: Students graph quadratic functions and determine the maxima, minima, and zeros of the function.
In the Activities/Homework and Conceptual Explanations, zeros were only referred to as "roots." The term "zeros" was not used. "Zeros" was, however, used in the Teacher's Guide.

16.0: Students demonstrate and explain how the geometry of the graph of a conic section (*e.g.*, asymptotes, foci, eccentricity) depends on the coefficients of the quadratic equation representing it.
Use of the term "eccentricity" was not used. However, stretching upward, etc. was addressed.

20.0: Students know the binomial theorem and use it to expand binomial expressions that are raised to positive integer powers.
The term "binomial theorem" was not used. However, the ideas were presented as "3 formulae" and "algebraic generalizations."

22.0: Students find the general term and the sums of arithmetic series and of both finite and infinite geometric series.
Infinite geometric series were not addressed.

23.0: Students derive the summation formulas for arithmetic series and for both finite and infinite geometric series.
Infinite geometric series were not addressed.

24.0: Students solve problems involving functional concepts, such as composition, defining the inverse function and performing arithmetic operations on functions.
Problems involving performing arithmetic operations on functions were not in evidence.

25.0: Students use properties from number systems to justify steps in combining and simplifying functions.
Properties were used to simplify composite functions, but were not used to combine functions using arithmetic operations.

Calculus

Publisher: CK-12 Foundation

Title of Program: CK-12 Single Variable Calculus

URL: http://cafreetextbooks.ck12.org/math/CK12_Calculus.pdf

Standards Met:
This program meets all 32 calculus content standards.

Standards Not Addressed:
All standards are addressed.

Standards Met With Comments:
1.1: Students prove and use theorems evaluating the limits of sums, products, quotients, and composition of functions.
No proofs.

1.3: Students prove and use special limits, such as the limits of (sin(x))/x and (1-cos(x))/x as x tends to 0.
No proofs.

4.2: Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.
Very limited (three) applications in evidence.

6.0: Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.
No applications in evidence.

16.0: Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution, length of a curve, and work.
Velocity and acceleration problems were not addressed.

19.0: Students compute, by hand, the integrals of rational functions by combining the techniques in standard 17.0 with the algebraic techniques of partial fractions and completing the square.
Completing the square was not addressed.

Calculus

Publisher: H. Jerome Keisler, Ph.D.

Title of Program: Elementary Calculus: An Infinitesimal Approach

URL: http://www.math.wisc.edu/~keisler/calc.html

Standards Met:
This program meets all 32 calculus content standards.

Standards Not Addressed:
All standards are addressed.

Standards Met with Comments:
4.2: Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.
The text uses the term "infinitesimal" instead of "instantaneous." No chemistry problems are in evidence.

6.0: Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.
No chemistry or economics problems are in evidence.

7.0: Students compute derivatives of higher orders.
Second derivative only.

Calculus

Publisher: David Guichard, Ph.D.

Title of Program: Calculus

URL: http://whitman.mathematics.googlepages.com

Standards Met:
This program meets 31 of the 32 calculus content standards.

Standards Not Addressed:
1.2: Students use graphical calculators to verify and estimate limits.

Standards Met With Comments:
1.1: Students prove and use theorems evaluating the limits of sums, products, quotients, and composition of functions.
Composition of functions is not addressed.

4.2: Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.
Chemistry and economics problems are not in evidence.

6.0: Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.
No parametrically defined functions. Chemistry and economics problems are not in evidence.

13.0: Students know the definition of the definite integral by using Riemann sums. They use this definition to approximate integrals.
The term "Riemann sums" is not used.

15.0: Students demonstrate knowledge and proof of the fundamental theorem of calculus and use it to interpret integrals as antiderivatives.
No opportunity to demonstrate proof of the fundamental theorem of calculus.

21.0: Students understand the algorithms involved in Simpson's rule and Newton's method. They use calculators or computers or both to approximate integrals numerically.
Simpson's rule is not addressed.

Calculus

Publisher: Wellesley-Cambridge Press

Title of Program: Calculus

URL: http://ocw.mit.edu/ans7870/resources/Strang/strangtext.htm

Standards Met:
This program meets 31 of the 32 calculus content standards.

Standards Not Addressed:
25.0: Students differentiate and integrate the terms of a power series in order to form new series from known ones.
Examples only. No student problems.

Standards Met With Comments:
1.1: Students prove and use theorems evaluating the limits of sums, products, quotients, and composition of functions.
No compositions of functions, limited student work with evaluating, no proofs.

3.0: Students demonstrate an understanding and the application of the intermediate value theorem and the extreme value theorem.
The standard was discussed, but there was limited opportunity for student demonstration of understanding.

4.2: Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.
There was no opportunity for student demonstration, and there were few chemistry and economics problems.

5.0: Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.
Proof was not addressed.

6.0: Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.
No chemistry or economics problems were in evidence.

7.0: Students compute derivatives of higher orders.
Up to third derivatives was addressed.

9.0: Students use differentiation to sketch, by hand, graphs of functions. They can identify maxima, minima, inflection points, and intervals in which the function is increasing and decreasing.
There was limited graphing of functions.

Calculus

15.0: Students demonstrate knowledge and proof of the fundamental theorem of calculus and use it to interpret integrals as antiderivatives.
Limited opportunity to demonstrate proof.

16.0: Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution, length of a curve, and work.
There were few velocity and no acceleration problems.

26.0: Students calculate Taylor polynomials and Taylor series of basic functions, including the remainder term.
Taylor polynomials were not specifically addressed.

Geometry

Publisher: CK-12 Foundation

Title of Program: CK-12 Geometry

URL: http://cafreetextbooks.ck12.org/math/CK12_Geometry.pdf

Standards Met:
This program meets 21 of the 22 geometry content standards.

Standards Not Addressed:
19.0: Students use trigonometric functions to solve for an unknown length of a side of a right triangle, given an angle and a length of a side.

Standards Met With Comments:
1.0: Students demonstrate understanding by identifying and giving examples of undefined terms, axioms, theorems, and inductive and deductive reasoning.
The word postulate is used in place of axiom.

9.0: Students compute the volumes and surface areas of prisms, pyramids, cylinders, cones, and spheres; and students commit to memory the formulas for prisms, pyramids, and cylinders.
No opportunity to verify memorization without a teacher's supervision.

10.0: Students compute areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids.
No evidence of formula for scalene or equilateral triangles. Heron's formula is not in evidence. ½(bh) does not meet the intent of this standard.

16.0: Students perform basic constructions with a straightedge and compass, such as angle bisectors, perpendicular bisectors, and the line parallel to a given line through a point off the line.
No explicit instruction for most constructions.

17.0: Students prove theorems by using coordinate geometry, including the midpoint of a line segment, the distance formula, and various forms of equations of lines and circles.
Midpoint of a line segment is not addressed.

18.0: Students know the definitions of the basic trigonometric functions defined by the angles of a right triangle. They also know and are able to use elementary relationships between them. For example, $\tan(x) = \sin(x)/\cos(x)$, $(\sin(x))^2 + (\cos(x))^2 = 1$.
No opportunity to demonstrate use of relationships between the functions.

Trigonometry

Publisher: CK-12 Foundation

Title of Program: CK-12 Trigonometry

URL: http://cafreetextbooks.ck12.org/math/CK12_Trigonometry.pdf

Standards Met:
This program meets all 20 trigonometry content standards.

Standards Not Addressed:
All standards are addressed.

Standards Met With Comments:
4.0: Students graph functions of the form f(t) = A sin (Bt + C) or f(t) = A cos (Bt + C) and interpret A, B, and C in terms of amplitude, frequency, period, and phase shift.
A different notational format is used in the text.

7.0: Students know that the tangent of the angle that a line makes with the x-axis is equal to the slope of the line.
A weak connection is made between slope and tangent.

10.0: Students demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities.
The word "verify" is used more frequently than "prove."

Biology/Life Science

Publisher: CK-12 Foundation

Title of Program: CK-12 Biology

URL: http://cafreetextbooks.ck12.org/science/CK12_Biology.pdf

Standards Met:
This program meets 63 of the 67 biology/life science content standards.

Investigation and Experimentation Standards Met:
This program meets 3 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
3d: Students know how to use data on frequency of recombination at meiosis to estimate genetic distances between loci and to interpret genetic maps of chromosomes.

4b: Students know how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.

4f: Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.

6e: Students know a vital part of an ecosystem is the stability of its producers and decomposers.

Standards Met With Comments:
1a: Students know cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.
Terminology difference: selectively permeable is used instead of semipermeable.

1b: Students know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.
Addresses only that enzymes are proteins that catalyze biochemical reactions and the role of pH in the chyme leaving the stomach.

5d: Students know how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.
Transformation is not addressed.

6b: Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
Climate changes are not addressed.

6g: Students know how to distinguish between the accommodation of an individual organism to its environment and the gradual adaptation of a lineage of organisms through genetic change.
Standard is not clearly stated, but information is within text.

Biology/Life Science

Publisher: CK-12 Foundation

Title of Program: CK-12 Life Science

URL: http://cafreetextbooks.ck12.org/science/CK12_Life_Science.pdf

Standards Met:
This program meets 61 of the 67 biology/life science content standards.

Investigation and Experimentation Standards Met:
This program addresses 1 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
3d: Students know how to use data on frequency of recombination at meiosis to estimate genetic distances between loci and to interpret genetic maps of chromosomes.

7a: Students know why natural selection acts on the phenotype rather than the genotype of an organism.

8b: Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.

8e: Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.

9h: Students know the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2}, and ATP.

9i: Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms.

Standards Met With Comments:
1b: Students know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.
Does not address activities of enzymes.

2c: Students know how random chromosome segregation explains the probability that a particular allele will be in a gamete.
The term "factor" is used in the place of "allele."

4e: Students know proteins can differ from one another in the number and sequence of amino acids.
There is a general introduction to the concept, but there is insufficient detail relating amino acid sequence to protein structure.

4f: Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.
There is a general introduction to concept, but there is insufficient detail relating to amino acid sequence to protein structure and function.

5c: Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.
General introduction to concept.

5e: Students know how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.
General introduction to concept. Methods are briefly described but diagrams are needed to support the text.

7b: Students know why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.
General introduction to concept. A diagram or example would better develop this standard.

8a: Students know how natural selection determines the differential survival of groups of organisms.
General introduction to concept. Insufficient detail; more examples or diagrams are needed.

9a: Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.
General introduction to concept.

Biology/Life Science

Publisher: Pearson Education

Title of Program: Biology

URL: http://www.pearsonschool.com/onlinelearninginitiative

Standards Met:
This program meets 31 of the 67 biology/life science content standards.

Investigation and Experimentation Standards Met:
This program meets 4 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
1d: Students know the central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.

1g: Students know the role of the mitochondria in making stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.

2d: Students know new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).

2e: Students know why approximately half of an individual's DNA sequence comes from each parent.

2g: Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents.

3b: Students know the genetic basis for Mendel's laws of segregation and independent assortment.

3c: Students know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes.

3d: Students know how to use data on frequency of recombination at meiosis to estimate genetic distances between loci and to interpret genetic maps of chromosomes.

4a: Students know the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.

4b: Students know how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.

4e: Students know proteins can differ from one another in the number and sequence of amino acids.

4f: Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.

5c: Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.

6e: Students know a vital part of an ecosystem is the stability of its producers and decomposers.

6f: Students know at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.

7b: Students know why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.

7c: Students know new mutations are constantly being generated in a gene pool.

7e: Students know the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature.

7f : Students know how to solve the Hardy-Weinberg equation to predict the frequency of genotypes in a population, given the frequency of phenotypes.

8b: Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.

8c: Students know the effects of genetic drift on the diversity of organisms in a population.

8f: Students know how to use comparative embryology, DNA or protein sequence comparisons, and other independent sources of data to create a branching diagram (cladogram) that shows probable evolutionary relationships.

9a: Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

9b: Students know how the nervous system mediates communication between different parts of the body and the body's interactions with the environment.

9c: Students know how feedback loops in the nervous and endocrine systems regulate conditions in the body.

9d: Students know the functions of the nervous system and the role of neurons in transmitting electrochemical impulses.

9e: Students know the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.

9f: Students know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts.

9g: Students know the homeostatic role of the kidneys in the removal of nitrogenous wastes and the role of the liver in blood detoxification and glucose balance.

9h: Students know the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2}, and ATP.

9i: Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms.

10a: Students know the role of the skin in providing nonspecific defenses against infection.

10b: Students know the role of antibodies in the body's response to infection.

10c: Students know how vaccination protects an individual from infectious diseases.

10e: Students know why an individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign.

10f: Students know the roles of phagocytes, B-lymphocytes, and T-lymphocytes in the immune system.

Standards Met With Comments:
1a: Students know cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.
Explanation of the structure of the cell membrane is limited in depth.

1b: Students know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.
Conditions needed for enzyme functions are not addressed.

1c: Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.
Addressed in several different chapters of text.

1h: Students know most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.
The term "polysaccharide" is not used, but is referred to as carbohydrates.

1i: Students know how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production.
Mitochondria is not mentioned in ATP synthesis.

1j: Students know how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both.
Cell wall addressed, but cytoskeleton is briefly explained.

3a: Students know how to predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive).
Autosomal or X-linked is not addressed.

4c: Students know how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.
Mentions types of mutations, but does not explain whether or not the protein is changed.

4d: Students know specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.
Gene regulation is defined, but gene expression is not addressed.

5b: Students know how to apply base-pairing rules to explain precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA
"Semiconservative replication" is defined not just "replication." Weak emphasis on base-pairing rules in DNA and RNA.

6d: Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
All cycles are mentioned, but lack details of each (water, carbon, nitrogen). Abiotic resources and organic matter are not addressed. The oxygen cycle is thorough.

Chemistry

Publisher: CK-12 Foundation

Title of Program: CK-12 Chemistry

URL: http://cafreetextbooks.ck12.org/science/CK12_Chemistry.pdf

Standards Met:
This program meets all 73 chemistry content standards.

Investigation and Experimentation Standards Met:
This program meets 8 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
All standards are addressed.

Standards Met With Comments:
1e: Students know the nucleus of the atom is much smaller than the atom yet contains most of its mass.
Resource covers what is in the nucleus and masses of protons, neutrons, and electrons, but doesn't put these concepts together.

1h: Students know the experimental basis for Thomson's discovery of the electron, Rutherford's nuclear atom, Millikan's oil drop experiment, and Einstein's explanation of the photoelectric effect.
Resource does not address Millikan's oil drop experiment.

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.
Resource does not identify biological molecules as being specifically covalent compounds.

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.
The term "London dispersion forces" is used instead of "Van der Waals forces."

Chemistry

Publisher: Curriki

Title of Program: Open Source Chemistry Course

URL: http://www.curriki.org/xwiki/bin/view/Coll_Group_CLRN-OpenSourceChemistryCourse/OpenSourceChemsitryCourseGrades9-12?bc=;Coll_Group_CLRN-OpenSourceChemistryCourse.ELRSubmissionForOpenSourceChemstry

Standards Met:
This program meets 44 of the 73 chemistry content standards.

Investigation and Experimentation Standards Met:
This program meets 2 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
1a: Students know how to relate the position of an element in the periodic table to its atomic number and atomic mass.

1i: Students know the experimental basis for the development of the quantum theory of atomic structure and the historical importance of the Bohr model of the atom.

2c: Students know salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction.

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.

3b: Students know the quantity one mole is set by defining one mole of carbon 12 atoms to have a mass of exactly 12 grams.

4b: Students know the random motion of molecules explains the diffusion of gases.

4f: Students know there is no temperature lower than 0 Kelvin.

4g: Students know the kinetic theory of gases relates the absolute temperature of a gas to the average kinetic energy of its molecules or atoms.

4h: Students know how to solve problems by using the ideal gas law in the form PV = nRT.

5f: Students know how to calculate pH from the hydrogen-ion concentration.

5g: Students know buffers stabilize pH in acid-base reactions.

6b: Students know how to describe the dissolving process at the molecular level by using the concept of random molecular motion.

6c: Students know temperature, pressure, and surface area affect the dissolving process.

6e: Students know the relationship between the molality of solute in a solution and the solution's depressed freezing point or elevated boiling point.

6f: Students know how molecules in a solution are separated or purified by the methods of chromatography and distillation.

7e: Students know how to apply Hess's law to calculate enthalpy change in a reaction.

7f: Students know how to use the Gibbs free energy equation to determine whether a reaction would be spontaneous.

8a: Students know the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.

8b: Students know how reaction rates depend on such factors as concentration, temperature, and pressure.

8c: Students know the role a catalyst plays in increasing the reaction rate.

9c: Students know how to write and calculate an equilibrium constant expression for a reaction.

10a: Students know large molecules (polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of simple subunits.

10c: Students know amino acids are the building blocks of proteins.

10e: Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids.

10f: Students know the R-group structure of amino acids and know how they combine to form the polypeptide backbone structure of proteins.

11a: Students know protons and neutrons in the nucleus are held together by nuclear forces that overcome the electromagnetic repulsion between the protons.

11b: Students know the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions. The change in mass (calculated by $E = mc^2$) is small but significant in nuclear reactions.

11g: Students know protons and neutrons have substructures and consist of particles called quarks.

Standards Met With Comments:
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.
Transuranium elements are not addressed.

1h: Students know the experimental basis for Thomson's discovery of the electron, Rutherford's nuclear atom, Millikan's oil drop experiment, and Einstein's explanation of the photoelectric effect.
Photoelectric effect is not addressed.

1j: Students know that spectral lines are the result of transitions of electrons between energy levels and that these lines correspond to photons with a frequency related to the energy spacing between levels by using Planck's relationship (E = hv).
Planck's relationship is not addressed.

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.
That biological molecules are covalent compounds is not addressed.

3g: Students know how to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions.
How to balance oxidation-reduction reactions is not addressed.

4i: Students know how to apply Dalton's law of partial pressures to describe the composition of gases and Graham's law to predict diffusion of gases.
Graham's law is not addressed.

5a: Students know the observable properties of acids, bases, and salt solutions.
Observable properties of salt solutions are not addressed.

6d: Students know how to calculate the concentration of a solute in terms of grams per liter, molarity, parts per million, and percent composition.
Only molarity is addressed in calculations of solution concentration.

7a: Students know how to describe temperature and heat flow in terms of the motion of molecules (or atoms).
Heat flow in terms of the motion of molecules is not addressed.

7c: Students know energy is released when a material condenses or freezes and is absorbed when a material evaporates or melts.
Energy involved in condensation or freezing is not addressed.

Chemistry

9a: Students know how to use Le Chatelier's principle to predict the effect of changes in concentration, temperature, and pressure.
Resource does not address use of Le Chatelier's principle in predictions of equilibrium shifts.

10d: Students know the system for naming the ten simplest linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring.
Compounds with double and triple bonds are not addressed.

Earth Science

Publisher: CK-12 Foundation

Title of Program: CK-12 Earth Science

URL: http://cafreetextbooks.ck12.org/science/CK12_Earth_Science.pdf

Standards Met:
This program meets 38 of the 46 earth science content standards.

Investigation and Experimentation Standards Met:
This program meets 1 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
1d: Students know the evidence indicating that the planets are much closer to Earth than the stars are.

1g: Students know the evidence for the existence of planets orbiting other stars.

2d: Students know that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.

2e: Students know accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.

4a: Students know the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.

9a: Students know the resources of major economic importance in California and their relation to California's geology.

9b: Students know the principal natural hazards in different California regions and the geologic basis of those hazards.

9d: Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.

Standards Met With Comments:
1f: Students know the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.
The concept is introduced, but much more evidence could be offered.

2f: Students know the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.
Brief supporting evidence of concept.

4d: Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.
Conditions on Mars are not addressed.

6a: Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
Topics of weather and climate are addressed in separate areas of text.

7a: Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.
Nitrogen cycle not addressed.

8a: Students know the thermal structure and chemical composition of the atmosphere.
The term "thermal structure" is not used, though topic is covered.

9c: Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.
General information of concept. Origins of California's fresh water are not addressed.

Earth Science

Publisher: Curriki

Title of Program: Earth Systems, an Earth Science Course

URL: http://www.curriki.org/xwiki/bin/view/Coll_Group_CLRN-OpenSourceEarthScienceCourse/EarthSystemsAnEarthScienceCourse?viewer=info&bc=

Standards Met:
This program meets 3 of the 46 earth science content standards.

Investigation and Experimentation Standards Met:
This program addresses 3 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
1a: Students know how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.

1b: Students know the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.

1c: Students know the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.

1d: Students know the evidence indicating that the planets are much closer to Earth than the stars are.

1e: Students know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.

1f: Students know the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.

1g: Students know the evidence for the existence of planets orbiting other stars.

2a: Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.

2b: Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.

2c: Students know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.

2d: Students know that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.

2e: Students know accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.

2f: Students know the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.

2g: Students know how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years.

3a: Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.

3b: Students know the principal structures that form at the three different kinds of plate boundaries.

3c: Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.

3d: Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.

3e: Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.

3f: Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.

4c: Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.

4d: Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.

5b: Students know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.

5c: Students know the origin and effects of temperature inversions.

5d: Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.

5e: Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.

5f: Students know the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.

5g: Students know features of the ENSO (El Niño southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle.

6a: Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.

6b: Students know the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.

6c: Students know how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.

6d: Students know how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.

7a: Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.

7b: Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.

7c: Students know the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.

7d: Students know the relative residence times and flow characteristics of carbon in and out of its different reservoirs.

8a: Students know the thermal structure and chemical composition of the atmosphere.

8b: Students know how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.

8c: Students know the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

9a: Students know the resources of major economic importance in California and their relation to California's geology.

9b: Students know the principal natural hazards in different California regions and the geologic basis of those hazards.

9c: Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

9d: Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.

Standards Met With Comments:
5a: Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
Discusses basic atmospheric circulation but does not address oceans.

Earth Science

Publisher: Hugues Goosse, Ph.D.

Title of Program: Introduction to Climate Dynamics and Climate Modeling

URL: http://stratus.astr.ucl.ac.be/textbook/

Standards Met:
This program meets 13 of the 46 earth science content standards.

Investigation and Experimentation Standards Met:
This program does not address any Investigation and Experimentation standards.

Standards Not Addressed:
1a: Students know how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.

1b: Students know the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.

1c: Students know the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.

1d: Students know the evidence indicating that the planets are much closer to Earth than the stars are.

1e: Students know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.

1f: Students know the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.

1g: Students know the evidence for the existence of planets orbiting other stars.

2a: Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.

2b: Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.

2c: Students know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.

2d: Students know that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.

2e: Students know accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.

2f: Students know the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.

2g: Students know how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years.

3a: Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.

3b: Students know the principal structures that form at the three different kinds of plate boundaries.

3c: Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.

3d: Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.

3e: Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.

3f: Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.

4a: Students know the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.

4b: Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.

4c: Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.

4d: Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.

5c: Students know the origin and effects of temperature inversions.

5e: Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.

5f: Students know the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.

8c: Students know the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

9a: Students know the resources of major economic importance in California and their relation to California's geology.

9b: Students know the principal natural hazards in different California regions and the geologic basis of those hazards.

9c: Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

9d: Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.

Standards Met With Comments:
None

Physics

Publisher: Benjamin Crowell, Ph.D.

Title of Program: Light and Matter

URL: http://www.lightandmatter.com/books.html

Standards Met:
This program meets 43 of the 49 physics content standards.

Investigation and Experimentation Standards Met:
This program addresses 8 of the 14 Investigation and Experimentation standards.

Standards Not Addressed:
2h: Students know how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.

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.

4a: Students know waves carry energy from one place to another.

4b: Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).

4e: Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately $3*10^8$ m/s (186,000 miles/second).

5o: Students know how to apply the concepts of electrical and gravitational potential energy to solve problems involving conservation of energy.

Standards Met With Comments:
4d: Students know sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.
Longitudinal wave was not addressed.

5j: Students know electric and magnetic fields contain energy and act as vector force fields.
Vectors were not addressed.

Digital Textbook Review Parameters

What was submitted?

- Basic student instructional materials, commonly known as textbooks, intended to be the primary resource for a course of study.
- Mathematics materials aligned to standards in geometry, algebra II, trigonometry and calculus.
- Science materials aligned to standards in physics, chemistry, biology/life sciences and earth sciences, including investigation and experimentation standards.
- Textbooks in digital format available for download and print.
- Stable content for two years. Content changes are not allowed for two years, although formatting changes are permitted.

What were the criteria for review?

- State-adopted academic content standards for the course areas. *(See http://www.cde.ca.gov/be/st/ss/index.asp)*
- Materials were not reviewed for alignment to California social content review standards.

Who was responsible for performing the reviews?

- Expert teachers and content specialists in mathematics and science organized by CLRN, the entity responsible for reviewing supplemental electronic learning resources.
- CLRN, under contract with the California Department of Education (CDE), collaborated with the Office of the Secretary of Education and the Curriculum Frameworks and Instructional Resources Division to coordinate and conduct the reviews.

Who trained the reviewers?

- CLRN conducted training under CDE's guidance.
- Existing CLRN review processes, which have been approved by the State Board of Education, were used so training was minimal.

What task did the reviewers perform?

- The reviewers confirmed whether materials fully, partially, or did not meet state board-adopted content standards.
- When a standard was partially or not met, reviewers annotated those parts of the standards not addressed.
- This report states the number of standards met by each resource and details those standards that were partially or not met. No other ratings were used.

What was required of the content developers?

- Content developers were required to complete standards correlation documents with citations demonstrating the submitted digital textbook's standards alignment.
- CLRN notified content developers upon completion of the review and provided each developer seven days to edit their abstract or provide additional evidence for standards that were partially or not met.

California Learning Resource Network Review Process

The California Learning Resource Network (CLRN) is a State Educational Technology Service project of the California Department of Education that reviews supplemental electronic learning resources, free web information links and electronic learning assessment resources.

Resource Submission: Publishers Invitation to Submit
CLRN created individual content standards correlation documents, similar to standards maps frequently used by publishers and local education agencies, and posted these on a Free Digital Textbook Initiative page that also included initial guidance for content developers. Each document contained complete standards for each subject along with a column for publishers to insert page references where reviewers could find evidence of each standard.

On May 28, 2009, Governor Schwarzenegger issued a formal call to content developers to submit standards-aligned digital textbooks for geometry, algebra II, trigonometry, calculus, physics, chemistry, biology/life science and earth science courses. The formal deadline to complete submissions was June 15, 2009.

Publishers created a CLRN publisher account and entered information about the book(s) they submitted, including a description of each textbook and the resource URL. Publishers then indicated the specific standards met by their textbook and uploaded a completed standards correlation document that provided page references for each standard. CLRN staff worked individually with publishers during the acquisition phase.

Resource Review
For the purposes of the Free Digital Textbook Initiative, CLRN's objective was to determine whether each resource introduced or developed the applicable state-board adopted content standards. California's social content review criteria were not applied to these resources.

CLRN's mathematics review site at the Kings County Office of Education under the direction of Jim Shaver and CLRN's science review site at the Humboldt County Office of Education under the direction of Cathy Dickerson were responsible for conducting the reviews. The majority of reviewers have worked for CLRN for 10 years, and all have been trained in CLRN's review criteria. Reviewers have college majors in the subject they review and most have either completed the relevant training courses or are trainers themselves.

During the textbook reviews, teams of two reviewers used the standards correlation document for each book to search for and identify whether the publisher's citation provided sufficient evidence to confirm each standard was developed. When a standard was partially developed or if non-standard terms were used, reviewers annotated a citation next to each standard. Each textbook was reviewed by one of seven two-person teams at each review site.

Post Review
Once reviews were completed, review site coordinators confirmed the results and forwarded them to CLRN's program manager for follow-up. CLRN staff read through each review to note potential concerns and determine if clarifying questions needed to be asked or if a re-review needed to be conducted.

After the review was edited, publishers were notified of their review's impending publication. Publishers logged into their accounts to read the reviews (including reviewer comments for partially-met standards) and were given seven days to submit any comments, question the results or provide additional evidence for standards that were either partially or not met.