HIGH SCHOOL CORE CLASSES

INTEGRATED/COORDINATED SCIENCE 2 AB
Annual Course—Grade 10-12
Prerequisite: Integrated/Coordinated Science 1AB. Concurrent enrollment in Geometry AB is recommended.

36-01-23 INT/COOR SCI 2A
36-01-24 INT/COOR SCI 2B

Type of Credential
Life Science, or Science: Biological Science, **and** Physical Science, or Science: Chemistry, or Science: Physics, or Science: Geoscience. For further information please call Certificated Credentials and Contract Services Unit at 213-241-6520.

Course Description
Integrated/Coordinated Science 2AB is a laboratory-based, college preparatory course that builds and expands upon the concepts of biology, chemistry, physics, and earth sciences introduced in Integrated/Coordinated Science 1AB. The students use knowledge and skills obtained in year one as a foundation to broaden their abilities while experiencing both new and more advanced material. This course differs from the year one in having a more quantitative and project-based approach. This laboratory course allocates at least 40 percent of class time on student-centered laboratory activities and field study. In addition, 20 percent of the students' time should be in small-group activities related to team projects and research. The Integrated/Coordinated Science curriculum is used at a variety of sites that vary in calendar configuration, student population, and teaching resources. The curriculum follows a spiral approach, connected by common concepts that are matched to the State Standards. After taking two years of Integrated/Coordinated Science, students may elect to take a third year of Integrated/Coordinated Science or any other advanced science class to meet the second-year laboratory requirement for the University of California. Because each year of Integrated/Coordinated Science builds upon the previous year's instruction, all of the State Standards expected of all students are addressed within the three years of Integrated/Coordinated Science.
Integrated/Coordinated Science 2AB meets one year of the University of California '*d*' entrance requirement for laboratory science, and fulfills the life science requirement for graduation.

COURSE SYLLABUS

INSTRUCTIONAL UNITS	***SUGGESTED WEEKS**	
Cell Biology, Genetics	8	10
Conservation of Matter, Stochiometry, Solutions		
Organic Chemistry, Biochemisty,	8	9
Earth's Place in the Universe, Energy in the Earth System	8	9
Force and Motion, Conservation of Energy, Momentum,		
Electric and Magnetic Phenomena	8-	10
Total	***32**	***38**
	year-round	**traditional**

* Suggested weeks are to be used as an estimate only. Integration of units and standards is highly recommended. Pacing will depend on how State Content Standards and the Literacy and Mathematics Initiatives are embedded.

Biology Standards Covered

1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:

1.a. *Students know* that cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.

1.c. *Students know* that prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.

1.d. *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.

1.e. *Students know* the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins.

1.h. *Students know* that most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

1.j. **Students know* how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both.

Genetics

2. Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept:

2.a. *Students know* meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.

2.b. *Students know* only certain cells in a multicellular organism undergo meiosis.

2.c. *Students know* how random chromosome segregation explains the probability that a particular allele will be in a gamete.

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

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

2.f. *Students know* the role of chromosomes in determining an individual's sex.

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

3. A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. As a basis for understanding this concept:

3.a. *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 sex-linked, dominant or recessive).

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

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

3.d. **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.

4. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:

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

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

5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:

5.a. *Students know* the general structures and functions of DNA, RNA, and protein.

5.b. *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.

Chemistry Standards Covered

3. The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. As a basis for understanding this concept:
3.a. *Students know* how to describe chemical reactions by writing balanced equations.
6. Solutions are homogenous mixtures of two or more substances. As a basis for understanding this concept:
6.a. *Students know* the definitions of *solute* and *solvent.*
6.b. *Students know* how to describe the dissolving process at the molecular level by using the concept of random molecular motion.
6.c. *Students know* that temperature, pressure, and surface area affect the dissolving process.
6.f. **Students know* how molecules in a solution are separated or purified by the methods of chromatography and distillation.
Organic Chemistry and Biochemistry
10. The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life. As a basis for understanding this concept:
10.a. *Students know* large molecules(polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of simple subunits.
10.b. *Students know* the bonding characteristics of carbon that result in the formation of a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.
10.c. *Students know* amino acids are the building blocks of proteins.
10.d. **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.*
10.e. **Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, aldehydes, and organic acids.**
10.f. **Students know the R-group structure of amino acids and know how they combine to form the polypeptide backbone structure of proteins.*

Earth Science Standards Covered

Earth's Place in the Universe
1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept:
1.a. *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.
1.b. *Students know* that evidence from Earth and moon rock indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.
1.c. *Students know* that evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.
1.d. *Students know* that evidence indicates that the planets are much closer to Earth than the stars are.
1.e. *Students know* that the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.
1.f. *Students know* the evidence for the dramatic effects that that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.
1.g. **Students know the evidence for the existence of planets orbiting other stars.*
Energy in the Earth System

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:
4.a. *Students know* the relative amount of incoming solar energy compared with Earth's internal energy and energy used by society.
4.b. *Students know* the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.
5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept:
5.a. *Students know* differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
5.b. *Students know* the relationship between the rotation of the Earth and the circular motions of ocean currents and air in pressure centers.
5.c. *Students know* the origin and effects of temperature inversions.
5.d. *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.
5.e. *Students know* rain forests and deserts on Earth are distributed in bands at specific latitudes.
5.f. **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.*
5.g. **Students know features of the ENSO (El Nino Southern Oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle.*
6. Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:
6.a. *Students know* weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
6.b. *Students know* the effects of latitude, elevation, topography, and proximity to large bodies of water, and cold or warm ocean currents on climate.
6.c. *Students know* how the 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.
6.d. **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.*

Physics Standards Covered
Motion and Forces
1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:
1.a. *Students know* how to solve problems that involve constant speed and average speed.
1.b. *Students know* that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).
1.c. *Students know* how to apply the law, $F = ma$, to solve one-dimensional motion problems that involve constant forces (Newton's second law).
1.d. *Students know* when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).
1.e. *Students know* the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth.
1.f. *Students know* that applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (e.g., Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).
1.h. **Students know* that Newton's laws are not exact but provide very good approximations unless an object is moving close to the speed of light or is small enough that quantum effects are important.

1.l. **Students know* how to solve problems in circular motion by using the formula for centripetal acceleration in the following form: $a = v^2/r$.
Conservation of Energy and Momentum
2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:
2.a. *Students know* how to calculate kinetic energy by using the formula, $E = (1/2)mv^2$.
2.b. *Students know* how to calculate changes in gravitational potential energy near Earth by using the formula, (change in potential energy) = mgh (h is the change the elevation).
2.c. *Students know* how to solve problems involving conservation of energy in simple systems, such as falling objects.
2.d. *Students know* how to calculate momentum as the product of mv.

Representative Performance Outcomes and Skills
In accordance with their individual capacity, students will grow in the ability to:

- Demonstrate process skills of scientific thinking: observing, communicating, comparing, ordering, categorizing, relating, inferring, and applying.
- Demonstrate skills in the areas of speaking, listening, writing, reading, graphing, mapping skills, and mathematics.
- Handle safely the equipment and materials common to chemistry laboratory.
- Evaluate the contributions of science and technology and their relevance to improving our daily lives in preparation for the future.
- Establish the relevance of science and its applications to careers and real-life situations.
- Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests collect data, analyze relationships, and display data.*
- Identify and communicate sources of unavoidable experimental error.*
- Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.*
- Formulate explanations by using logic and evidence.*
- Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.*
- Distinguish between hypothesis and theory as scientific terms.*
- Recognize the usefulness and limitations of models and theories as scientific representations of reality.*
- Read and interpret topographic and geologic maps.*
- Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).*
- Recognize the issues of statistical variability and the need for controlled tests.*
- Recognize the cumulative nature of scientific evidence.*
- Analyze situations and solve problems that require combining and applying concepts from more than one area of science.*
- Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.*
- Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).*

- Investigate a societal issue by researching literature, analyzing data and communicating findings and discuss possible future outcomes.
- Demonstrate interconnections between the many disciplines of science.
- Demonstrate the interdisciplinary connections between science and other curricular fields.

Assessments

Instruction in our district is assessment-driven. The Framework states "that effective science programs include continual assessment of student's knowledge and understanding, with appropriate adjustments being made during the academic year (p.11)."[1] Assessments can be on demand or over a long period of time. The District Periodic Assessments and STAR State Testing play a significant role in Student Assessments.

The chart below, adapted from *A Guide for Teaching and Learning*, NRC (2000), gives some examples of on demand and over time assessment.

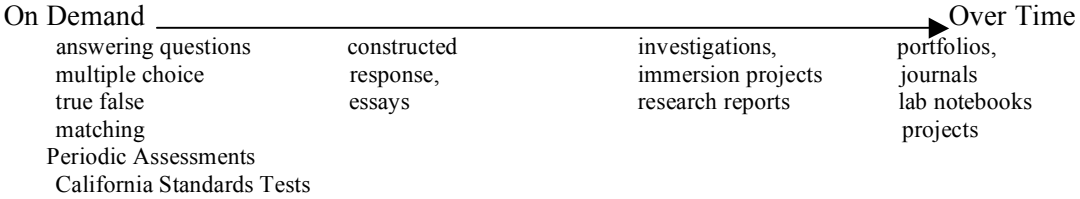

Chart 1 - Assessment Examples

Texts/Materials

- *Science Framework for California Public Schools*
- District Authorized Textbooks and ancillary materials:
  - Its About Time, *Integrated Coordinated Science for the 21st Century* Smith, et al. 2004
  - Its About Time, *Earth Comm*. American Geological Institute 2000
- *Science Safety Handbook for California Public Schools*
- Appropriate science laboratory materials