Biology 5 A B C- Syllabus Addendum for Prospective Teachers Campbell, N. A. & Reece, J. B. (2005). *Biology* 7th Edition. Pearson		
Chapter	**Subject Matter Requirements for Prospective Teachers General Science**	**Academic content standards for kindergarten through grade twelve, adopted by the California State Board of Education**
Ch 1-Exploring Life	7.1g Describe the levels of organization (e.g., cells, tissues, organs, systems, organisms) in plants and animals	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 5a Students know plants and animals have levels of organization for structure and function including cells, tissues, organs, organ systems; and the whole organism
Ch 2-The Chemical Context of Life	6.1a Demonstrate understanding that a small subset of elements (C, H, O, N, P, S) makes up most of the chemical compounds in living organisms by combining in many wa	Science Content Standards for California Public Schools, Grade 8: 6b Students know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur; 6c Students know that living organisms have many different kinds of molecules including small ones such as water and salt and very large ones such as carbohydrates, fats, proteins, and DNA
Ch 3-Water and the Fitness of the Environment	6.1a Demonstrate understanding that a small subset of elements (C, H, O, N, P, S) makes up most of the chemical compounds in living organisms by combining in many wa	Science Content Standards for California Public Schools, Grade 8: 6b Students know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur; 6c Students know that living organisms have many different kinds of molecules including small ones such as water and salt and very large ones such as carbohydrates, fats, proteins, and DNA
Ch 4-Carbon and the Molecular	6.1a Demonstrate understanding that a small subset of elements (C, H, O, N, P, S) makes up most of the chemical compounds in living organisms by combining in many wa	Science Content Standards for California Public Schools, Grade 8: 6b Students know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur; 6c Students know that living organisms have many different kinds of molecules including small ones such as water and salt and very large ones such as

		carbohydrates, fats, proteins, and DNA
Ch 5-The Structure and Function of Macromolecules	6.1a Demonstrate understanding that a small subset of elements (C, H, O, N, P, S) makes up most of the chemical compounds in living organisms by combining in many wa	Science Content Standards for California Public Schools, Grade 8: 6b Students know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur; 6c Students know that living organisms have many different kinds of molecules including small ones such as water and salt and very large ones such as carbohydrates, fats, proteins, and DNA
	6.1b Recognize and differentiate the structure and function of molecules in living organisms, including carbohydrates, lipids, proteins, and nucleic acids	Science Content Standards for California Public Schools, Grades 9-12 Biology: 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; 1h Students know most macromolecules (polysaccharides, nucleic acids, proteins, and lipids) in cells and organisms are synthesized from a small collection of simple precursors
Ch 6-A Tour of the Cell	7.1a Describe organelles and explain their function in the cell	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop, their cells differentiate.
	7.1b Relate the structure of organelles and cells to their functions	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop, their cells differentiate
	7.1c Identify and contrast animal and plant cells	Science Content Standards for California Public Schools, Grade 7: 1a Students know cells function similarly in all living organisms; 1b Students know the characteristics that distinguish plant cells from animal cells including chloroplasts and cell walls
Ch 9-Cellular Respiration: Harvesting Chemical Energy	6.1d Compare anaerobic and aerobic respiration	Science Content Standards for California Public Schools, Grade 5: 2g Students know plant and animal cells break down sugar to obtain energy a process resulting in carbon dioxide and water (respiration); Grades 9-12 Biology: 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
	7.1d Explain the conversion, flow, and storage of energy of the cell	Science Content Standards for California Public Schools, Grade 3: 1b Students know sources of stored energy take many forms such as food, Fuel, and batteries
Ch 10-Photosynthesis	6.1e Describe the process of photosynthesis	Science Content Standards for California Public Schools, Grade 5: 2f Students know plants use carbon dioxide and energy from sunlight to build molecules of sugar and release oxygen; Grade 6: 5a Students know energy entering ecosystems as sunlight is transferred by producers in Chemical energy through photosynthesis and them from organism to organism through food webs; Grades 9-12 Biology 1f Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide
	7.1d Explain the conversion, flow, and storage of energy of the cell	Science Content Standards for California Public Schools, Grade 3: 1b Students know sources of stored energy take many forms such as food, Fuel, and batteries
Ch 13- Meiosis and Sexual Life Cycles	5.1a Explain the inheritance of traits which are determined by one or more genes, including dominance, recessiveness, sex linkage, phenotypes, genotypes, and incomplete dominan	Science Content Standards for California Public Schools, Grade 7: 2b Students know sexual reproduction produces offspring that inherit half of their genes from each parent; 2c Students know an inherited trait can be determined by one or more genes; 3a Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms.
	5.1b Solve problems that illustrate monohybrid and dihybrid crosses	Science Content Standards for California Public Schools, Grade7: 2a Students know the differences between the life cycles and reproduction methods of sexual and asexual organisms
	5.1c Compare sexual and asexual reproduction	Science Content Standards for California Public Schools, Grade 7: 2a Students know the differences between the life cycles and reproduction methods of sexual and asexual organisms
	7.1e Identify the function and explain the importance	Science Content Standards for California Public Schools, Grade 7:

	of mitosis and meiosis as processes of cellular and organismal reproduction	1e Students know cells divide to increase their numbers through a process of mitosis which results in two daughter cells with identical sets of chromosomes
Ch 14-Mendel and the Gene Idea	5.1a Explain the inheritance of traits which are determined by one or more genes, including dominance, recessiveness, sex linkage, phenotypes, genotypes, and incomplete dominan	Science Content Standards for California Public Schools, Grade 7: 2b Students know sexual reproduction produces offspring that inherit half of their genes from each parent; 2c Students know an inherited trait can be determined by one or more genes; 3a Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms.
	5.1b Solve problems that illustrate monohybrid and dihybrid crosses	Science Content Standards for California Public Schools, Grade7: 2a Students know the differences between the life cycles and reproduction methods of sexual and asexual organisms
	5.1c Compare sexual and asexual reproduction	Science Content Standards for California Public Schools, Grade 7: 2a Students know the differences between the life cycles and reproduction methods of sexual and asexual organisms
	5.1g Describe evidence, past and present, that supports the theory of evolution, including diagramming relationships that demonstrate shared characteristics of fossil and living organisms	Science Content Standards for California Public Schools, Grade 7: 3c Students know how independent lines of evidence from geology, fossils, and comparative anatomy provide the bases for the theory of evolution; 3d Students know how to construct a simple branching diagram to classify living groups of organisms by shared derived characteristics and how to expand the diagram to include fossil organisms
	7.1e Identify the function and explain the importance of mitosis and meiosis as processes of cellular and organismal reproduction	Science Content Standards for California Public Schools, Grade 7: 1e Students know cells divide to increase their numbers through a process of mitosis which results in two daughter cells with identical sets of chromosomes
Ch 15-The Chromosomal Basis of Inheritance	5.1a Explain the inheritance of traits which are determined by one or more genes, including dominance, recessiveness, sex linkage, phenotypes, genotypes, and incomplete dominan	Science Content Standards for California Public Schools, Grade 7: 2b Students know sexual reproduction produces offspring that inherit half of their genes from each parent; 2c Students know an inherited trait can be determined by one or more genes; 3a Students know both genetic variation and

		environmental factors are causes of evolution and diversity of organisms.
	5.1b Solve problems that illustrate monohybrid and dihybrid crosses	Science Content Standards for California Public Schools, Grade7: 2a Students know the differences between the life cycles and reproduction methods of sexual and asexual organisms
	5.1c Compare sexual and asexual reproduction	Science Content Standards for California Public Schools, Grade 7: 2a Students know the differences between the life cycles and reproduction methods of sexual and asexual organisms
	7.1e Identify the function and explain the importance of mitosis and meiosis as processes of cellular and organismal reproduction	Science Content Standards for California Public Schools, Grade 7: 1e Students know cells divide to increase their numbers through a process of mitosis which results in two daughter cells with identical sets of chromosomes
Ch 16-The Molecular Basis of Inheritance	5.1f Explain the process of DNA replication	Science Content Standards for California Public Schools, Grades 9-12 Biology: 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
Ch 17-From Gene to Protein	5.1d Explain how the coding of DNA (deoxyribonucleic acid) controls the expression of traits by genes	Science Content Standards for California Public Schools, Grade 7: 2d Students know plant and animal cells contain many thousands of different genes and typically have two copies of every gene. The two copies or alleles of the gene may or may not be identical and one may be dominant in determining the phenotype while the other is recessive; 2e Students know DNA is the genetic material of living organisms and is located in the chromosomes of each cell
	5.1e Define mutations and explain their causes	Science Content Standards for California Public Schools, Grade 7: 3a Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms; Grades 9-12 Biology: 7c Students know new mutations are constantly being generated in a gene pool
	6.1c Describe the process of protein synthesis, including transcription and translation	Science Content Standards for California Public Schools, Grades 9-12 Biology 1d: Students know the

		central dogma of molecular biology outlines the flow of information from transcription of RNA in the nucleus to translation of proteins on ribosomes in the cytoplasm
Ch 22-The Descent with Modification: A Darwinian View of Life	5.1h Explain the theory of natural selection, including adaptation, speciation, and extinction	Science Content Standards for California Public Schools, Grade 7: 3b Students know the reasoning used by Charles Darwin in reaching his conclusion that natural selection is the mechanism of evolution.; 3e Students know that extinction of a species occurs when the environment changes and the adaptive charact3erisctis of a species are insufficient for its survival; Grades 9-12 Biology: 8a Students know how natural selection determines the differential survival of groups of organi
Ch 26-The Tree of Life: An Introduction to Biological Diversity	5.1i List major events that affected the evolution of life on Earth (e.g., climate changes, asteroid impacts)	Science Content Standards for California Public Schools, Grade 7: 3e Students know that extinction of a species occurs when the environment changes and the adaptive charact3erisctis of a species are insufficient for its survival
	7.1f Compare single-celled and multicellular organisms, noting the role of cell differentiation in the development of multicellular organisms	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop their cells differentiate; 5b students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.
Ch 27-Prokaryotes	7.1f Compare single-celled and multicellular organisms, noting the role of cell differentiation in the development of multicellular organisms	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop their cells differentiate; 5b students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.
Ch 28-Protists	7.1f Compare single-celled and multicellular organisms, noting the role of cell differentiation in the development of multicellular	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop their cells differentiate; 5b students know organ systems function because of the contributions of individual

	organisms	organs, tissues, and cells. The failure of any part can affect the entire system.
Ch 29-Plant Diversity I: How Plants Colonized Land	7.1i Explain the major structures and their functions in vascular and nonvascular plan	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; 5e Students know how sugar, water, and minerals are transported in a vascular plant
	7.1k Explain the reproductive processes in flowering plants	Science Content Standards for California Public Schools, Grade 7: 1c Students know the nucleus is the repository from genetic information in plant and animal cells; 5f Students know the structures and processes by which flowering plants generate pollen, ovules, seeds and fruit
Ch 30-Plant Diversity II: The Evolution of Seed Plants	7.1i Explain the major structures and their functions in vascular and nonvascular plan	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; 5e Students know how sugar, water, and minerals are transported in a vascular plant
	7.1k Explain the reproductive processes in flowering plants	Science Content Standards for California Public Schools, Grade 7: 1c Students know the nucleus is the repository from genetic information in plant and animal cells; 5f Students know the structures and processes by which flowering plants generate pollen, ovules, seeds and fruit
Ch 32-An Introduction to Animal Diversity	7.1f Compare single-celled and multicellular organisms, noting the role of cell differentiation in the development of multicellular organisms	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop their cells differentiate; 5b students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.
Ch 33-Onvertibrates	7.1f Compare single-celled and multicellular organisms, noting the role of cell differentiation in the development of multicellular organisms	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop their cells differentiate; 5b students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire

		system.
Ch 36-Transport in Vascular Plants	7.1j Describe the life processes of various plant groups, including, but not limited to, reproduction, photosynthesis, respiration, and transpiration	Science Content Standards for California Public Schools, Grade 3: 1c Students know machines and living things convert stored energy in to motion and heat; Grade 7: 1d Students know that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis
Ch 37-Plant Nutrition	7.1j Describe the life processes of various plant groups, including, but not limited to, reproduction, photosynthesis, respiration, and transpiration	Science Content Standards for California Public Schools, Grade 3: 1c Students know machines and living things convert stored energy in to motion and heat; Grade 7: 1d Students know that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis
Ch 38-Angiosperm Reproduction and Biotechnology	7.1j Describe the life processes of various plant groups, including, but not limited to, reproduction, photosynthesis, respiration, and transpiration	Science Content Standards for California Public Schools, Grade 3: 1c Students know machines and living things convert stored energy in to motion and heat; Grade 7: 1d Students know that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis
Ch 39-Plant Responses to Internal and External Signals	7.1j Describe the life processes of various plant groups, including, but not limited to, reproduction, photosynthesis, respiration, and transpiration	Science Content Standards for California Public Schools, Grade 3: 1c Students know machines and living things convert stored energy in to motion and heat; Grade 7: 1d Students know that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis
Ch 40-Basic Principles of Animal form and Function	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students

		know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system
Ch 41-Animal Nutrition	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system
Ch 42-Circulation and Gas Exchange	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for

		movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system
Ch 43-The Immune System	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that

		heart valves prevent backflow of blood in the circulatory system
Ch 44-Osmoregulation and Excretion	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system
Ch 45-Hormones and the Endocrine System	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a

		microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system
Ch 46-Animal Reproduction	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system
Ch 47-Animal Development	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and

		sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system
Ch 48- Nervous Systems	7.1h Describe the structures and functions of human body systems, including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems	Science Content Standards for California Public Schools, Grade 5: 2a Students know many multicellular organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to provide a structural framework for movement; 5d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy; 5e Students know the function of the umbilicus and placenta during pregnancy; 5g Students know how to relate the structures of the eye and ear to their functions; 6D Students know how simples lenses are used in a magnifying glass, the eye, a cameral, a telescope and a microscope; 6h Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system; 6j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system

Chapter	**Biology/Life Science Subject Matter Requirements**	**Academic content standards for kindergarten through grade twelve, adopted by the California State Board of Education**
Ch 5 - The structure and function of Macromolecules	1.3h Explain anabolic and catabolic pathways involved in the metabolism of macromolecules (e.g., polysaccharides, nucleic acids, proteins, lipids)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1h* Students know *most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors*
	2.1a Relate the structure and function of DNA, RNA (ribonucleic acid), and proteins to the concept of variation in organisms	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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; 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. 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.. 5a Students know the general structures and functions of DNA, RNA, and protein. 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*
Ch 6 - A tour of the cell	1.1a Compare prokaryotic cells, eukaryotic cells, and viruses in terms of complexity, general structure, differentiation, and their requirements for growth and replication.	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1c Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure; and 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
	1.3d Explain the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1e* Students know *the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins*
	1.3e Explain the role of chloroplasts in obtaining and storing usable energy	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1f* Students know *usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide; 1i* Students know *how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production*
	1.3f Explain the role of mitochondria in cellular respiration	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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.*
Ch 7 - Membrane structure and function	1.3a Diagram the structure of the cell membrane and relate the structure to its function	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1a* Students know *cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings*
	1.3b Explain methods of transport across the membrane (e.g., diffusion, active transport, endocytosis and exocytosis)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1a* Students know *cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings*

	1.3c Explain the role of semipermeable membranes in cellular communication	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1a* Students know *cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings; 1j* Students know *how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both*
	1.3d Explain the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1e* Students know *the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins*
	1.3e Explain the role of chloroplasts in obtaining and storing usable energy	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1f* Students know *usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide; 1i* Students know *how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production*
	1.3f Explain the role of mitochondria in cellular respiration	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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.*
Ch 8 - An introduction to metabolism	1.3 g Explain the role of enzymes in chemical reactions and describe an experiment to test the catalytic role of enzymes and factors that affect enzyme activity (e.g., levels of protein organization, temperature, ionic conditions, concentration of enzyme and substrate, pH)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
Ch 9 - Cellular respiration: Harvesting chemical energy	1.3f Explain the role of mitochondria in cellular respiration	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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.
	1.3h Explain anabolic and catabolic pathways involved in the metabolism of macromolecules (e.g., polysaccharides, nucleic acids, proteins, lipids)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1h* Students know *most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors*
Ch 10 - Photosynthesis	1.3e Explain the role of chloroplasts in obtaining and storing usable energy	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1f* Students know *usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide; 1i* Students know *how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production*
	1.3h Explain anabolic and catabolic pathways involved in the metabolism of macromolecules (e.g., polysaccharides, nucleic acids, proteins, lipids)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1h* Students know *most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors*
Ch 11 - Cell communication	1.3c Explain the role of semipermeable membranes in cellular communication	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1a* Students know *cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings; 1j* Students know *how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both*
Ch 12 - The cell cycle	1.2a Describe the stages of the cell cycle	*Science Content Standards for California Public Schools, Grades 7: 1e* Students know *cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes*
	1.2b Diagram and describe the stages of the mitotic process	*Science Content Standards for California Public Schools, Grades 7: 1e* Students know *cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes*

Ch 13 - Meiosis and sexual life cycles	2.2a Explain the necessity of both meiosis and fertilization in promoting variation	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 2a 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. 2b Students know only certain cells in a multicellular organism undergo meiosis. 2d Students know new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).*
	2.2b Describe the role of chromosomes in determining phenotypes (e.g., sex determination, chromosomal aberrations)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 2e Students know why approximately half of an individual's DNA sequence comes from each parent; 2f Students know the role of chromosomes in determining an individual's sex.*
	2.2c Predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (e.g., autosomal or X-linked, dominant or recessive, co-dominance)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 2g Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents; 3c * Students know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes*
	2.2d Explain the genetic and cellular bases for Mendel's laws of dominance, segregation and independent assortment	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 3b Students know the genetic basis for Mendel's laws of segregation and independent assortment; 8a Students know how natural selection determines the differential survival of groups of organisms*
Ch 14 - Mendel and the gene idea	2.2b Describe the role of chromosomes in determining phenotypes (e.g., sex determination, chromosomal aberrations)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 2e Students know why approximately half of an individual's DNA sequence comes from each parent; 2f Students know the role of chromosomes in determining an individual's sex*

	2.2c Predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (e.g., autosomal or X-linked, dominant or recessive, co-dominance)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 2g Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents; 3c * Students know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes*
	2.2d Explain the genetic and cellular bases for Mendel's laws of dominance, segregation and independent assortment	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 3b Students know the genetic basis for Mendel's laws of segregation and independent assortment; 8a Students know how natural selection determines the differential survival of groups of organisms*
	2.3a Explain how random chromosome segregation explains the probability that a particular allele will be in a gamete	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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)*
	2.3c Describe how alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
	3.2c Explain the conditions for Hardy-Weinberg equilibrium and why they are unlikely to appear in nature, and solve equations to predict the frequency of genotypes in a population	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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
Ch 15 - The chromosomal basis of inheritance	2.1b Describe chromosome structure as a sequence of genes each with a specific locus	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
	2.2b Describe the role of chromosomes in determining phenotypes (e.g., sex determination, chromosomal aberrations)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 2e Students know why approximately half of an individual's DNA sequence comes from each parent; 2f Students know the role of chromosomes in determining an individual's sex.*
	2.2c Predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (e.g., autosomal or X-linked, dominant or recessive, co-dominance)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 2g Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents; 3c * Students know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes*
	2.2d Explain the genetic and cellular bases for Mendel's laws of dominance, segregation and independent assortment	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 3b Students know the genetic basis for Mendel's laws of segregation and independent assortment; 8a Students know how natural selection determines the differential survival of groups of organisms*
	2.3c Describe how alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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
Ch 16 - The molecular basis of inheritance	1.3h Explain anabolic and catabolic pathways involved in the metabolism of macromolecules (e.g., polysaccharides, nucleic acids, proteins, lipids)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1h* Students know *most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors*
	2.1a Relate the structure and function of DNA, RNA (ribonucleic acid), and proteins to the concept of variation in organisms	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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; 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. 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.. 5a Students know the general structures and functions of DNA, RNA, and protein. 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*
Ch 17 - From gene to protein	1.1a Compare prokaryotic cells, eukaryotic cells, and viruses in terms of complexity, general structure, differentiation, and their requirements for growth and replication.	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1c Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure; and 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
	1.3h Explain anabolic and catabolic pathways involved in the metabolism of macromolecules (e.g., polysaccharides, nucleic acids, proteins, lipids)	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 1h* Students know *most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors*
	2.1a Relate the structure and function of DNA, RNA (ribonucleic acid), and proteins to the concept of variation in organisms	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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; 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. 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.. 5a Students know the general structures and functions of DNA, RNA, and protein. 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
	2.1b Describe chromosome structure as a sequence of genes each with a specific locus	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
	2.3b Recognize that specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences among the genes themselves	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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; 7c Students know new mutations are constantly being generated in a gene pool.*
	2.3d Distinguish when and why 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	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
Ch 20-DNA technology and genomics	2.4a Recognize how genetic engineering (biotechnology) produces biomedical and agricultural products	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 5c Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products; 5e * Students know how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of* new protein products
	2.4b Describe the construction of recombinant DNA molecules by basic DNA technology including restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 5d * Students know how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.*

	2.5a Discuss issues of bioethics including genetic engineering, cloning, the human genome project, gene therapy, and medical implications	*Science Content Standards for California Public Schools, Grades 9-12, Investigation and Experimentation:1m 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*
Ch 22-Descent with modification: A Darwinian view of life	3.1a Explain why natural selection acts on the phenotype rather than the genotype of an organism	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 7a Students know why natural selection acts on the phenotype rather than the genotype of an organism*
	3.2a Analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 8e* Students know *how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction*
	3.3a Distinguish between the accommodation of an individual organism to its environment and the gradual adaptation of a lineage of organisms through genetic change	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
Ch 23-The evolution of populations	3.1b Predict the survival potential of various groups of organisms based on the amount of diversity in their gene pools	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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.; 7d* Students know *variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.*
	3.2b Analyze the effects of evolutionary patterns on the diversity of organisms (e.g., genetic drift, convergent evolution, punctuated	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 8b* Students know *a great diversity of species increases the chance that at least some organisms survive major*

	equilibrium, patterns of selection)	*changes in the environment; 8c* Students know *the effects of genetic drift on the diversity of organisms in a population*
	3.2c Explain the conditions for Hardy-Weinberg equilibrium and why they are unlikely to appear in nature, and solve equations to predict the frequency of genotypes in a population	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
Ch 24-The origin of species	3.3b Describe a scenario that demonstrates the effects of reproductive or geographic isolation on speciation	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 8b Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment*
Ch 25-Phylogeny and systematics	3.2a Analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 8e* Students know *how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction*
	3.4b Construct a branching diagram (cladogram) from a variety of data sources illustrating the phylogeny between organisms of currently identified taxonomic groups	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 8g* Students know *how several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another*
Ch 26- The tree of life: An introduction to biological diversity	3.2a Analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 8e* Students know *how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction*

	3.3b Describe a scenario that demonstrates the effects of reproductive or geographic isolation on speciation	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 8b Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment*
	3.4a Explain the theoretical origins of life on Earth	*Science Content Standards for California Public Schools, Grades 9-12, Biology/Life Sciences: 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*
Ch 40-Basic principles of animal form and function	1.4c Explain the homeostatic role of the major organs (e.g., kidneys, heart, brain)	*Science Content Standards for California Public Schools,* Grades 9-12: *Biology/LifeSciences* 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. 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; 9i * Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms*
Ch 41- Animal nutrition	1.4a Relate the complementary activity of major body systems (e.g., circulatory, digestive, respiratory, excretory) to provide cells with oxygen and nutrients and remove waste products	*Science Content Standards for California Public Schools, Grade 7: 5a* Students know *plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism Grades 9-12:*

		Biology/LifeSciences 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.
	1.4c Explain the homeostatic role of the major organs (e.g., kidneys, heart, brain)	*Science Content Standards for California Public Schools*, Grades 9-12: *Biology/LifeSciences* 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. 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; 9i * Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms*
	1.4e Explain the role of hormones (e.g., digestive, reproductive, osmoregulatory) in providing internal feedback mechanisms for homeostasis at the cellular level and in whole organisms	*Science Content Standards for California Public Schools*, Grades 9-12: *Biology/LifeSciences* 9f * *Students know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts; 9h** Students know *the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2} , and ATP*

Ch 42- Circulation and gas exchange	1.4a Relate the complementary activity of major body systems (e.g., circulatory, digestive, respiratory, excretory) to provide cells with oxygen and nutrients and remove waste products	*Science Content Standards for California Public Schools, Grade 7: 5a* Students know *plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism Grades 9-12: Biology/LifeSciences 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.*
Ch 44-Osmoregulation and excretion	1.4a Relate the complementary activity of major body systems (e.g., circulatory, digestive, respiratory, excretory) to provide cells with oxygen and nutrients and remove waste products	*Science Content Standards for California Public Schools, Grade 7: 5a* Students know *plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism Grades 9-12: Biology/LifeSciences 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.*
	1.4c Explain the homeostatic role of the major organs (e.g., kidneys, heart, brain)	*Science Content Standards for California Public Schools,* Grades 9-12: *Biology/LifeSciences* 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. *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; 9i * Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms*
	1.4e Explain the role of hormones (e.g., digestive, reproductive, osmoregulatory) in providing internal feedback mechanisms for homeostasis at the cellular level and in whole organisms	*Science Content Standards for California Public Schools*, Grades 9-12: *Biology/LifeSciences* 9f * *Students know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts; 9h** Students know *the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2} , and ATP*
Ch 45-Hormones and the endocrine system	1.4b Explain and analyze the role of the nervous system in mediating communication between different parts of the body and the body's interactions with the environment	*Science Content Standards for California Public Schools,Grade 7: 5b Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system Grades 9-12 Biology/Life Sciences: 9b Students know how the nervous system mediates communication between different parts of the body and the body's interactions with the*

		environment;; 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
	1.4c Explain the homeostatic role of the major organs (e.g., kidneys, heart, brain)	*Science Content Standards for California Public Schools*, Grades 9-12: *Biology/LifeSciences* 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.* *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; 9i * Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms*
	1.4d Explain the function of feedback loops in the nervous and endocrine systems to regulate conditions in the body and predict the effects of disturbances on these systems	*Science Content Standards for California Public Schools*, Grades 9-12: *Biology/LifeSciences* 9c *Students know how feedback loops in the nervous and endocrine systems regulate conditions in the body*

	1.4e Explain the role of hormones (e.g., digestive, reproductive, osmoregulatory) in providing internal feedback mechanisms for homeostasis at the cellular level and in whole organisms	*Science Content Standards for California Public Schools,* Grades 9-12: *Biology/LifeSciences* 9f * *Students know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts; 9h* * Students know *the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2} , and ATP*
Ch 46- Animal Reproduction	1.4e Explain the role of hormones (e.g., digestive, reproductive, osmoregulatory) in providing internal feedback mechanisms for homeostasis at the cellular level and in whole organisms	*Science Content Standards for California Public Schools,* Grades 9-12: *Biology/LifeSciences* 9f * *Students know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts; 9h* * Students know *the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2} , and ATP*
Ch 48-Nervous systems	1.4b Explain and analyze the role of the nervous system in mediating communication between different parts of the body and the body's interactions with the environment	*Science Content Standards for California Public Schools,Grade 7: 5b Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system Grades 9-12 Biology/Life Sciences: 9b Students know how the nervous system mediates communication between different parts of the body and the body's interactions with the environment;; 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
Ch 49-Sensory and motor mechanisms	1.4b Explain and analyze the role of the nervous system in mediating communication between different parts of the body and the body's interactions with the environment	*Science Content Standards for California Public Schools,Grade 7: 5b Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system Grades 9-12 Biology/Life Sciences: 9b Students know how the nervous system mediates communication between different parts of the body and the body's interactions with the environment;; 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*
	1.4f Describe the role of the musculo-skeletal system in providing structure, support, and locomotion to the human organism	*Science Content Standards for California Public Schools,* Grade 7: 5c *Students know how bones and muscles work together to provide a structural framework for movement*