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

		carbohydrates, fats, proteins, and
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	DNA 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 cell7.1b Relate the structure of	Science Content Standards for California Public Schools, Grade 7: 1f Students know that as multicellular organisms develop, their cells differentiate. Science Content Standards for California Public Schools, Grade 7:
	organelles and cells to their functions	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:

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	of mitosis and meiosis as	1e Students know cells divide to
	processes of cellular and	increase their numbers through a
	organismal reproduction	process of mitosis which results in
	organismar reproduction	two daughter cells with identical sets
		of chromosomes
Ch 14-Mendel and the	5.1a Explain the inheritance	Science Content Standards for
Gene Idea	of traits which are	California Public Schools, Grade 7:
	determined by one or more	2b Students know sexual
	3	reproduction produces offspring that
	genes, including dominance,	inherit half of their genes from each
	recessiveness, sex linkage,	parent; 2c Students know an
	phenotypes, genotypes, and	inherited trait can be determined by
	incomplete dominan	one or more genes; 3a Students know
	I I	both genetic variation and
		environmental factors are causes of
		evolution and diversity of organisms.
	5.1b Solve problems that	Science Content Standards for
	illustrate monohybrid and	California Public Schools, Grade7:
	dihybrid crosses	2a Students know the differences
	diffyoria crosses	between the life cycles and
		reproduction methods of sexual and
		asexual organisms
	5.1c Compare sexual and	Science Content Standards for
	asexual reproduction	California Public Schools, Grade 7:
	asonaar reproduction	2a Students know the differences
		between the life cycles and
		reproduction methods of sexual and
		asexual organisms
	5.1g Describe evidence, past	Science Content Standards for
	and present, that supports the	California Public Schools, Grade 7:
	1	3c Students know how independent
	theory of evolution,	lines of evidence from geology,
	including diagramming	fossils, and comparative anatomy
	relationships that	provide the bases for the theory of
	demonstrate shared	evolution; 3d Students know how to
	characteristics of fossil and	construct a simple branching diagram
		to classify living groups of organisms
	living organisms	by shared derived characteristics and
		how to expand the diagram to include
		fossil organisms
	7.1e Identify the function	Science Content Standards for
	and explain the importance	California Public Schools, Grade 7:
	of mitosis and meiosis as	1e Students know cells divide to
		increase their numbers through a
	processes of cellular and	process of mitosis which results in
	organismal reproduction	two daughter cells with identical sets
		of chromosomes
Ch 15-The	5.1a Explain the inheritance	Science Content Standards for
Chromosomal Basis of	of traits which are	California Public Schools, Grade 7:
		2b Students know sexual
Inheritance	determined by one or more	reproduction produces offspring that
	genes, including dominance,	inherit half of their genes from each
	recessiveness, sex linkage,	parent; 2c Students know an
	phenotypes, genotypes, and	inherited trait can be determined by
		one or more genes; 3a Students know
	incomplete dominan	both genetic variation and
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		environmental factors are causes of
		evolution and diversity of organisms.
	5.1b Solve problems that	Science Content Standards for
	illustrate monohybrid and	California Public Schools, Grade7:
	dihybrid crosses	2a Students know the differences
		between the life cycles and
		reproduction methods of sexual and
		asexual organisms
	5.1c Compare sexual and	Science Content Standards for
	asexual reproduction	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	Science Content Standards for
	and explain the importance	California Public Schools, Grade 7:
	of mitosis and meiosis as	1e Students know cells divide to
	processes of cellular and	increase their numbers through a
	1 -	process of mitosis which results in
	organismal reproduction	two daughter cells with identical sets
C1 1 C T1 3 5 1 1	7.16 F. 1.1.1.	of chromosomes
Ch 16-The Molecular	5.1f Explain the process of	Science Content Standards for
Basis of Inheritance	DNA replication	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
CL 17 F	511E 1:1 (1 1:	encoded protein Science Content Standards for
Ch 17-From Gene to	5.1d Explain how the coding	California Public Schools, Grade 7:
Protein	of DNA (deoxyribonucleic	2d Students know plant and animal
	acid) controls the expression	cells contain many thousands of
	of traits by genes	different genes and typically have
	7 8	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	Science Content Standards for
		California Public Schools, Grade 7:
	explain their causes	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	Science Content Standards for
	-	California Public Schools, Grades 9-
	protein synthesis, including	12 Biology 1d: Students know the
	transcription and translation	12 Diology 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: If 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

		organs tissues and calls. The failure
	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: If 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.
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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; 6f 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 sincluding, but not limited to, the skeletal, reproductive, nervous, and circulatory systems 7. The Describe the structures and circulatory systems including, but not limited to, the skeletal, reproductive, nervous, and circulatory systems 8. 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 benes 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 prognancy; 5g Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to compare joints in the body with structures used in machines and simple devices; 6f Students know how to	Γ	1	T
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limited to, the skeletal, reproductive, nervous, and circulatory systems organisms have specialized structures to support the transport of materials; Grade 7: 2c Students know how bones and muscles work together to			
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circulatory systems bones and muscles work together to			
		=	
		circulatory systems	_
provide a structural framework for		-	provide a structural framework for

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	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 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 to compare joints in the body with structures used in machines and simple devices; 6i Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how to compare joints in the body with structures used in machines and simple devices; 6i Students know how to relate the structure application of this principle applies to the
		advantage and how the application of this principle applies to the musculoskeletal system; 6j Students
		know that contractions of the heart

		heart valves prevent backflow of
67.44.6	511 5	blood in the circulatory system
Ch 44-Osmoregulation	7.1h Describe the structures	Science Content Standards for
and Excretion	and functions of human body	California Public Schools, Grade 5:
	systems, including, but not	2a Students know many multicellular
	limited to, the skeletal,	organisms have specialized structures
		to support the transport of materials;
	reproductive, nervous, and	Grade 7: 2c Students know how
	circulatory systems	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	7.1h Describe the structures	Science Content Standards for
		California Public Schools, Grade 5:
the Endocrine System	and functions of human body	2a Students know many multicellular
	systems, including, but not	organisms have specialized structures
	limited to, the skeletal,	to support the transport of materials;
	reproductive, nervous, and	Grade 7: 2c Students know how
	circulatory systems	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
L	l	camerai, a terescope and a

	T	Ţ
		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	7.1h Describe the structures	Science Content Standards for
Reproduction	and functions of human body	California Public Schools, Grade 5:
Reproduction	•	2a Students know many multicellular
	systems, including, but not	organisms have specialized structures
	limited to, the skeletal,	to support the transport of materials;
	reproductive, nervous, and	Grade 7: 2c Students know how
	circulatory systems	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	7.1h Describe the structures	Science Content Standards for
		California Public Schools, Grade 5:
Development	and functions of human body	2a Students know many multicellular
	systems, including, but not	organisms have specialized structures
	limited to, the skeletal,	to support the transport of materials;
	reproductive, nervous, and	Grade 7: 2c Students know how
	circulatory systems	bones and muscles work together to
	circulatory systems	provide a structural framework for
		movement; 5d Students know how
		the reproductive organs of the human
		female and male generate eggs and
	I	Tomate 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
C1 40 N	7.11 D 3 3 4	blood in the circulatory system
Ch 48- Nervous	7.1h Describe the structures	Science Content Standards for California Public Schools, Grade 5:
Systems	and functions of human body	2a Students know many multicellular
	systems, including, but not	organisms have specialized structures
	limited to, the skeletal,	to support the transport of materials;
	reproductive, nervous, and	Grade 7: 2c Students know how
	circulatory systems	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: Id 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

	1.3d Explain the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins	nucleus to translation of proteins on ribosomes in the cytoplasm 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: If Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide; Ii 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

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	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: If Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide; Ii 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

	1	chemical-bond energy available to
		cells by completing the breakdown of
		glucose to carbon dioxide.
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	1.3h Explain anabolic and	Science Content Standards for
	catabolic pathways involved	California Public Schools, Grades 9-
	in the metabolism of	12, Biology/Life Sciences: 1h
		Students know most macromolecules
	macromolecules (e.g.,	(polysaccharides, nucleic acids,
	polysaccharides, nucleic	proteins, lipids) in cells and
	acids, proteins, lipids)	organisms are synthesized from a
		small collection of simple precursors
Ch 10 - Photosynthesis	1.3e Explain the role of	Science Content Standards for
	chloroplasts in obtaining and	California Public Schools, Grades 9-
	storing usable energy	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	Science Content Standards for
	catabolic pathways involved	California Public Schools, Grades 9-
	in the metabolism of	12, Biology/Life Sciences: 1h
		Students know most macromolecules
	macromolecules (e.g.,	(polysaccharides, nucleic acids,
	polysaccharides, nucleic	proteins, lipids) in cells and
	acids, proteins, lipids)	organisms are synthesized from a
		small collection of simple precursors
Ch 11 - Cell	1.3c Explain the role of	Science Content Standards for
communication	semipermeable membranes in cellular communication	<u>California Public Schools</u> , Grades 9- 12, Biology/Life Sciences: 1a
	in centular communication	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
CI 12 TII II	10 5 7 4	cytoskeleton or cell wall or both
Ch 12 - The cell cycle	1.2a Describe the stages of	Science Content Standards for
	the cell cycle	California Public Schools, Grades 7: le 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	Science Content Standards for
	the stages of the mitotic	California Public Schools, Grades 7:
		1e Students know cells divide to
	process	increase their numbers through a
		process of mitosis, which results in
		two daughter cells with identical sets
		of chromosomes

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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, codominance)	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, codominance)	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, codominance)	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: Ih 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: Id 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: Im 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	3.1a Explain why natural	Science Content Standards for
modification: A	selection acts on the	<u>California Public Schools</u> , Grades 9-
Darwinian view of life	phenotype rather than the	12, Biology/Life Sciences: 7a
	genotype of an organism	Students know why natural selection acts on the phenotype rather than the
		genotype of an organism
	3.2a Analyze fossil evidence	Science Content Standards for
	with regard to biological	<u>California Public Schools</u> , Grades 9-
	diversity, episodic	12, Biology/Life Sciences: 8e Students know how to analyze fossil
	speciation, and mass	evidence with regard to biological
	extinction	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	3.1b Predict the survival	Science Content Standards for
populations	potential of various groups	<u>California Public Schools</u> , Grades 9-
	of organisms based on the	12, Biology/Life Sciences: 7b Students know why alleles that are
	amount of diversity in their	lethal in a homozygous individual
	gene pools	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	Science Content Standards for
	evolutionary patterns on the	California Public Schools, Grades 9-
	diversity of organisms (e.g.,	12, Biology/Life Sciences: 8b
	genetic drift, convergent	Students know a great diversity of
	evolution, punctuated	species increases the chance that at least some organisms survive major
	c rotation, panetaatea	icusi some oi guiusius sui vive mujoi

	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

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	3.3b Describe a scenario that demonstrates the effects of reproductive or geographic isolation on speciation 3.4a Explain the theoretical origins of life on Earth	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 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	1.4c Explain the homeostatic	Science Content Standards for
of animal form and	role of the major organs	California Public Schools,
function	(e.g., kidneys, heart, brain)	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	1.4a Relate the	Science Content Standards for
nutrition	complementary activity of	California Public Schools,
	major body systems (e.g.,	Grade 7: 5a Students know
	circulatory, digestive,	plants and animals have levels
	respiratory, excretory) to	of organization for structure
	provide cells with oxygen	and function, including cells,
	and nutrients and remove	tissues, organs, organ systems,
	waste products	and the whole organism
		Grades 9-12:

Biology/LifeSciences 9a Students know how the complementary activity of major body systems provid cells with oxygen and nutri and removes toxic waste products such as carbon dioxide. 1.4c Explain the homeostatic role of the major organs Science Content Standards California Public Schools,	
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know how hormones (inclu	aing
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osmoregulatory) provide	
internal feedback mechanis	
for homeostasis at the cellu	
level and in whole organism	
1.4e Explain the role of <u>Science Content Standards</u>	<u>for</u>
hormones (e.g., digestive, <u>California Public Schools</u> ,	
reproductive, Grades 9-12:	
osmoregulatory) in providing Biology/LifeSciences 9f *	_
internal feedback Students know the individual	
mechanisms for homeostasis functions and sites of secre	tion
at the cellular level and in of digestive enzymes	
whole organisms (amylases, proteases,	
nucleases, lipases), stomac	h
acid, and bile salts; 9h *	
Students know the cellular	and
molecular basis of muscle	
contraction, including the	
roles of actin, myosin, Ca+-	,
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 1.4c Explain the homeostatic role of the major organs	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. Science Content Standards for California Public Schools,
	(e.g., kidneys, heart, brain)	Grades 9-12: Biology/LifeSciences 9a Students know how the complementary activity of major body systems provides

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		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
	1.4 5 1: 1 1 6	level and in whole organisms
	1.4e Explain the role of	Science Content Standards for
	hormones (e.g., digestive,	<u>California Public Schools,</u>
	reproductive,	Grades 9-12:
	osmoregulatory) in providing	Biology/LifeSciences 9f *
	internal feedback	Students know the individual
	mechanisms for homeostasis	functions and sites of secretion
	at the cellular level and in	of digestive enzymes
	whole organisms	(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	1.4b Explain and analyze the	Science Content Standards for
the endocrine system	role of the nervous system in	California Public
,	mediating communication	Schools, Grade 7: 5b Students
	between different parts of the	know organ systems function
	body and the body's	because of the contributions of
	interactions with the	individual organs, tissues, and
	environment	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
		interactions with the

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1.4c Explain the homeostatic role of the major organs (e.g., kidneys, heart, brain) 1.4d Explain the function of feedback loops in the nervous and endocrine systems to regulate	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 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 Science Content Standards for California Public Schools, Grades 9-12: Biology/LifeSciences 9c
feedback loops in the nervous and endocrine	Science Content Standards for California Public Schools, Grades 9-12:
disturbances on these systems	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

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	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 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
	1.46 D	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