Introduction - Biology

The following released test questions are taken from the Biology Standards Test. This test is one of the California Standards Tests administered as part of the Standardized Testing and Reporting (STAR) Program under policies set by the State Board of Education.

All questions on the California Standards Tests are evaluated by committees of content experts, including teachers and administrators, to ensure their appropriateness for measuring the California academic content standards in Biology. In addition to content, all items are reviewed and approved to ensure their adherence to the principles of fairness and to ensure no bias exists with respect to characteristics such as gender, ethnicity, and language.

This document contains released test questions from the California Standards Test forms in 2003 and 2004. First on the pages that follow are lists of the standards assessed on the Biology Test. Next are released test questions. Following the questions is a table that gives the correct answer for each question, the content standard that each question is measuring, and the year each question last appeared on the test. It should be noted that asterisked (*) standards found in the *Science Content Standards for California Public Schools, Kindergarten through Grade 12*, are not assessed on the California Standards Tests in Science and, therefore, are not represented in these released test questions.

The following table lists each reporting cluster, the number of items that appear on the exam, and the number of released test questions that appear in this document. The released test questions for Biology, Chemistry, Earth Science, and Physics are the same test questions found in different combinations on the Integrated Science 1, 2, 3, and 4 tests.

Biology — Released Test Questions

REPORTING CLUSTER	NUMBER OF QUESTIONS ON EXAM	NUMBER OF RELEASED TEST QUESTIONS
Investigation and Experimentation (Standards: BIIE1. a-n)	6	3
Cell Biology (Standards: BI1. a-h)	9	4
Genetics (Standards: BI2. a-g, BI3. a-b, BI4. a-e, BI5. a-c)	18	9
Ecology and Evolution *Ecology* (Standards: BI6. a-f) *Evolution* (Standards: BI7. a-d, BI8. a-e)	16	9
Physiology (Standards: BI9. a-e, BI10. a-e)	11	5
TOTAL	60	30

In selecting test questions for release, three criteria are used: (1) the questions adequately cover a selection of the academic content standards assessed on the Biology Test; (2) the questions demonstrate a range of difficulty; and (3) the questions present a variety of ways standards can be assessed. These released test questions do not reflect all of the ways the standards may be assessed. Released test questions will not appear on future tests.

For more information about the California Standards Tests, visit the California Department of Education's Web site at http://www.cde.ca.gov/ta/tg/sr/resources.asp.

THE INVESTIGATION AND EXPERIMENTATION REPORTING CLUSTER

The following 14 California content standards are included in the Investigation and Experimentation reporting cluster and are represented in this booklet by three test questions. These questions represent only some ways in which these standards may be assessed on the California Biology Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Investigation and Experimentation	
BIIE1.	**Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four reporting clusters, students should develop their own questions and perform investigations. Students will:**
BIIE1. a.	Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
BIIE1. b.	Identify and communicate sources of unavoidable experimental error.
BIIE1. c.	Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
BIIE1. d.	Formulate explanations by using logic and evidence.
BIIE1. e.	Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
BIIE1. f.	Distinguish between hypothesis and theory as scientific terms.
BIIE1. g.	Recognize the usefulness and limitations of models and theories as scientific representations of reality.
BIIE1. h.	Read and interpret topographic and geologic maps.
BIIE1. i.	Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).
BIIE1. j.	Recognize the issues of statistical variability and the need for controlled tests.
BIIE1. k.	Recognize the cumulative nature of scientific evidence.
BIIE1. l.	Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
BIIE1. m.	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.
BIIE1. n.	Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).

THE CELL BIOLOGY REPORTING CLUSTER

The following eight California content standards are included in the Cell Biology reporting cluster and are represented in this booklet by four test questions. These questions represent only some ways in which these standards may be assessed on the California Biology Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Cell Biology	
BI1.	**The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:**
BI1. a.	*Students know* cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.
BI1. b.	*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.
BI1. c.	*Students know* how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.
BI1. d.	*Students know* the central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.
BI1. e.	*Students know* the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins.
BI1. f.	*Students know* usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.
BI1. g.	*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.
BI1. h.	*Students know* most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

THE GENETICS REPORTING CLUSTER

The following 17 California content standards are included in the Genetics reporting cluster and are represented in this booklet by nine test questions. These questions represent only some ways in which these standards may be assessed on the California Biology Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Genetics	
BI2.	**Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept:**
BI2. a.	*Students know* meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.
BI2. b.	*Students know* only certain cells in a multicellular organism undergo meiosis.
BI2. c.	*Students know* how random chromosome segregation explains the probability that a particular allele will be in a gamete.
BI2. d.	*Students know* new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).
BI2. e.	*Students know* why approximately half of an individual's DNA sequence comes from each parent.
BI2. f.	*Students know* the role of chromosomes in determining an individual's sex.
BI2. g.	*Students know* how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents.
BI3.	**A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. As a basis for understanding this concept:**
BI3. a.	*Students know* how to predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive).
BI3. b.	*Students know* the genetic basis for Mendel's laws of segregation and independent assortment.
BI4.	**Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:**
BI4. a.	*Students know* the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.
BI4. b.	*Students know* how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.
BI4. c.	*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.

BI4. d.	*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.
BI4. e.	*Students know* proteins can differ from one another in the number and sequence of amino acids.
BI5.	**The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:**
BI5. a.	*Students know* the general structures and functions of DNA, RNA, and protein.
BI5. b.	*Students know* how to apply base-pairing rules to explain precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA.
BI5. c.	*Students know* how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.

THE ECOLOGY AND EVOLUTION REPORTING CLUSTER

The following 15 California content standards are included in the Ecology and Evolution reporting cluster and are represented in this booklet by nine test questions. These questions represent only some ways in which these standards may be assessed on the California Biology Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Ecology	
BI6.	**Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:**
BI6. a.	*Students know* biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
BI6. b.	*Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
BI6. c.	*Students know* how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.
BI6. d.	*Students know* how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
BI6. e.	*Students know* a vital part of an ecosystem is the stability of its producers and decomposers.
BI6. f.	*Students know* at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.
Evolution	
BI7.	**The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time. As a basis for understanding this concept:**
BI7. a.	*Students know* why natural selection acts on the phenotype rather than the genotype of an organism.
BI7. b.	*Students know* why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.
BI7. c.	*Students know* new mutations are constantly being generated in a gene pool.
BI7. d.	*Students know* variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.
BI8.	**Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:**
BI8. a.	*Students know* how natural selection determines the differential survival of groups of organisms.
BI8. b.	*Students know* a great diversity of species increases the chance that at least some organisms survive major changes in the environment.
BI8. c.	*Students know* the effects of genetic drift on the diversity of organisms in a population.
BI8. d.	*Students know* reproductive or geographic isolation affects speciation.
BI8. e.	*Students know* how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.

THE PHYSIOLOGY REPORTING CLUSTER

The following 10 California content standards are included in the Physiology reporting cluster and are represented in this booklet by five test questions. These questions represent only some ways in which these standards may be assessed on the California Biology Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Physiology	
BI9.	**As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment. As a basis for understanding this concept:**
BI9. a.	*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.
BI9. b.	*Students know* how the nervous system mediates communication between different parts of the body and the body's interactions with the environment.
BI9. c.	*Students know* how feedback loops in the nervous and endocrine systems regulate conditions in the body.
BI9. d.	*Students know* the functions of the nervous system and the role of neurons in transmitting electrochemical impulses.
BI9. e.	*Students know* the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.
BI10.	**Organisms have a variety of mechanisms to combat disease. As a basis for understanding the human immune response:**
BI10. a.	*Students know* the role of the skin in providing nonspecific defenses against infection.
BI10. b.	*Students know* the role of antibodies in the body's response to infection.
BI10. c.	*Students know* how vaccination protects an individual from infectious diseases.
BI10. d.	*Students know* there are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.
BI10. e.	*Students know* why an individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign.

1 **Two students were testing the amount of fertilizer that would best promote the growth of strawberries in a garden. Which of the following could be an unavoidable source of experimental error?**

A length of the study

B variation in the strawberry plants

C the cost of watering the plants

D fertilization during the study

2 **A computer model of cellular mitosis can simulate the aspects of cellular division quite well. However, microscopic observation of actual cellular mitosis can improve understanding because actual observations**

A may reveal greater unknown complexities.

B are easier than a computer model to view.

C are the same each time.

D may provide division events in sequence.

3 **After a volcanic eruption has covered an area with lava, which of the following is the *most* likely order of succession in the repopulation of the area?**

A lichens → grasses → shrubs → trees

B mosses → grasses → lichens → trees

C grasses → trees → mosses → lichens

D shrubs → grasses → trees → lichens

4 **The cell membrane of the red blood cell will allow water, oxygen, carbon dioxide, and glucose to pass through. Because other substances are blocked from entering, this membrane is called**

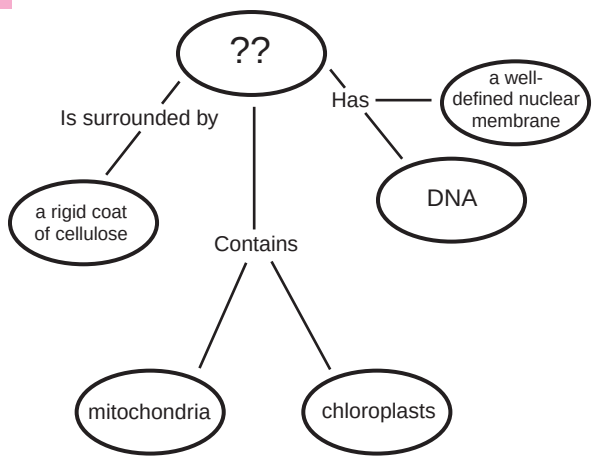
A perforated.

B semi-permeable.

C non-conductive.

D permeable.

5



Which of these *best* completes this concept map?

A an animal cell

B a prokaryotic cell

C a virus

D a plant cell

6 **Which molecule in plant cells first captures the radiant energy from sunlight?**

A glucose

B carbon dioxide

C chlorophyll

D adenosine triphosphate

7 **A cell from heart muscle would *probably* have an unusually high proportion of**

A lysosomes.

B mitochondria.

C mRNA.

D Golgi bodies.

8 **If a corn plant has a genotype of Ttyy, what are the possible genetic combinations that could be present in a single grain of pollen from this plant?**

A Ty, ty

B TY, ty

C TY, Ty, ty

D Ty, ty, tY, TY

9 **In fruit flies, the gene for red eyes (R) is dominant and the gene for sepia eyes (r) is recessive. What are the possible combinations of genes in the offspring of two red-eyed heterozygous flies (Rr)?**

A RR only

B rr only

C Rr and rr only

D RR, Rr, and rr only

10 **In certain breeds of dogs, deafness is due to a recessive allele (d) of a particular gene, and normal hearing is due to its dominant allele (D). What percentage of the offspring of a normal heterozygous (Dd) dog and a deaf dog (dd) would be expected to have normal hearing?**

A 0%

B 25%

C 50%

D 100%

11 **Fur color in cats is controlled by an autosomal gene that can occur in the dominant form, (*B*), or the recessive form, (*b*). The length of the cat's fur is controlled by another autosomal gene which occurs in the dominant form, (*S*), or the recessive form, (*s*). The table below shows the traits for these allele codes.**

Gene	Trait
B	black fur
b	white fur
S	short-haired fur
s	long-haired fur

The following genotypes were found in a male cat and a female cat.

***BbSs* (male)** ***bbSS* (female)**

Which one of the following choices is true of the phenotype of offspring from these parents?

A *All* offspring will have black fur.

B *All* offspring will have white fur.

C *All* offspring will have long-haired fur.

D *All* offspring will have short-haired fur.

12

Codons Found in Messenger RNA

Second Base

First Base	U	C	A	G	*Third Base*
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	Stop	Stop	A
	Leu	Ser	Stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

A strand of mRNA containing the repeating sequence AAGAAGAAGAAG could code for which of the following amino acid sequences?

A lys–arg–glu–lys

B ser–ser–glu–glu

C lys–arg–lys–arg

D lys–lys–lys–lys

13 **Which of these would *most* likely cause a mutation?**

A the placement of ribosomes on the endoplasmic reticulum

B the insertion of a nucleotide into DNA

C the movement of transfer RNA out of the nucleus

D the release of messenger RNA from DNA

14 **Although there are a limited number of amino acids, many different types of proteins exist because the**

A size of a given amino acid can vary.

B chemical composition of a given amino acid can vary.

C sequence and number of amino acids is different.

D same amino acid can have many different properties.

15 **5' G T A _ _ _ A A 3'**

3' C A T G C A T T 5'

This segment of DNA has undergone a mutation in which three nucleotides have been deleted. A repair enzyme would replace them with

A CGT.

B GCA.

C CTG.

D GTA.

16 **The bacterium *Agrobacterium tumefaciens* infects plants, and a portion of its DNA is inserted into the plant's chromosomes. This causes the plant to produce gall cells, which manufacture amino acids that the bacterium uses as food. This process is a natural example of**

A polyploidy.

B genetic manipulation.

C grafting.

D hybridization.

17 **Scientists found that, over a period of 200 years, a mountain pond was transformed into a meadow. During that time, several communities of organisms were replaced by different communities. Which of these *best* explains why new communities were able to replace older communities?**

A The original species became extinct.

B Species in the older community died from old age.

C The abiotic characteristics of the habitat changed.

D Diseases that killed the older organisms disappeared.

18 **Rabbits introduced into Australia over 100 years ago have become a serious pest to farmers. Rabbit populations increased so much that they displaced many native species of plant eaters. What is the *most* logical explanation for their increased numbers?**

A Rabbits have a high death rate.

B There are few effective predators.

C Additional rabbit species have been introduced.

D There is an increase in rabbit competitors.

19 **Complete burning of plant material returns carbon primarily to the**

A herbivores.

B water.

C vegetation.

D atmosphere.

20

Rabbit coat color

Allele	Phenotype
C	Rabbit with fully colored coat
c^{ch}	Rabbit with light gray coat
c^{h}	Himalayan rabbit: white with dark ear tips, nose, paws, and tail
c	Albino rabbit

Order of dominance C → c^{ch} → c^{h} → c

The chart shows four alleles at the same locus that affect rabbits' coat color. Each allele is dominant to the ones below it. Rabbits with an albino or Himalayan coat are more susceptible to predators. Which of the following genotypes will produce a rabbit that is *least* likely to survive?

A $c^{ch}c$

B Cc

C $c^{h}c$

D Cc^{h}

21 **In carrier pigeons there is a rare inherited condition that causes the death of the chicks before hatching. In order for this disease to be passed from generation to generation there must be parent birds that**

A are heterozygous for the disease.

B have the disease themselves.

C produce new mutations for this disease.

D are closely interbred.

22 **Which of these *best* illustrates natural selection?**

A An organism with favorable genetic variations will tend to survive and breed successfully.

B A population monopolizes all of the resources in its habitat, forcing other species to migrate.

C A community whose members work together utilizes all existing resources and migratory routes.

D The largest organisms in a species receive the only breeding opportunities.

23 **A species of finch has been studied on one of the geographically isolated Galapagos Islands for many years. Since the island is small, the lineage of every bird for several generations is known. This allows a family tree of each bird to be developed. Some family groups have survived and others have died out. The groups that survive *probably* have**

A interbred with other species.

B inherited some advantageous variations.

C found new places on the island to live.

D been attacked by more predators.

24 **A small population of chimpanzees lives in a habitat that undergoes no changes for a long period. How will genetic drift probably affect this population?**

A It will accelerate the appearance of new traits.

B It will promote the survival of chimpanzees with beneficial traits.

C It will increase the number of alleles for specific traits.

D It will reduce genetic diversity.

25 **A single species of squirrel evolved over time into two species, each on opposite sides of the Grand Canyon. This change was *most* likely due to**

A higher mutation rates on one side.

B low genetic diversity in the initial population.

C the isolation of the two groups.

D differences in reproductive rates.

26 **In order for the body to maintain homeostasis, the chemical decomposition of food to produce energy must be followed by**

A water intake.

B muscle contractions.

C waste removal.

D nervous impulses.

27 **The respiratory system depends on the nervous system for signals to**

A enhance the amount of available oxygen in the lungs.

B coordinate muscles controlling breathing.

C release enzymes to increase the exchange of gases.

D exchange gases with the circulatory system.

28 **Striking the tendon just below the kneecap causes the lower leg to jerk. Moving an object quickly toward the face can cause the eyes to blink shut. These are examples of**

A learned responses.

B short-term memory.

C reflex reactions.

D sensory overload.

29 **The Sabin vaccine is a liquid containing weakened polio viruses. Vaccinated individuals become protected against polio because the weakened viruses**

A prevent further viral invasion.

B induce an inflammatory response.

C promote production of antibodies.

D are too weak to cause illness.

30 **Which of the following require a host cell because they are *not* able to make proteins on their own?**

A blue-green algae

B bacteria

C protozoans

D viruses

Question Number	Correct Answer	Standard	Year of Test
1	*B*	BIIE1.B	2003
2	*A*	BIIE1.G	2004
3	*A*	BIIE1.I	2004
4	*B*	BI1.A	2004
5	*D*	BI1.C	2003
6	*C*	BI1.F	2003
7	*B*	BI1.G	2004
8	*A*	BI2.C	2004
9	*D*	BI2.G	2003
10	*C*	BI3.A	2003
11	*D*	BI3.A	2004
12	*D*	BI4.A	2003
13	*B*	BI4.C	2003
14	*C*	BI4.E	2004
15	*A*	BI5.B	2004
16	*B*	BI5.C	2003
17	*C*	BI6.B	2003
18	*B*	BI6.C	2004
19	*D*	BI6.D	2003
20	*C*	BI7.A	2003
21	*A*	BI7.B	2004
22	*A*	BI7.D	2004
23	*B*	BI8.A	2004
24	*D*	BI8.C	2004
25	*C*	BI8.D	2003
26	*C*	BI9.A	2003
27	*B*	BI9.B	2003
28	*C*	BI9.B	2004
29	*C*	BI10.C	2004
30	*D*	BI10.D	2003