B

Biology Standard
B.5.c.

Teacher's Masters

California Education and the Environment Initiative

High-Tech Harvest: Genetic Engineering and the Environment

California Education and the Environment Initiative
Approved by the California State Board of Education, 2010

The Education and the Environment Curriculum is a cooperative endeavor of the following entities:
California Environmental Protection Agency
California Natural Resources Agency
Office of the Secretary of Education
California State Board of Education
California Department of Education
California Integrated Waste Management Board

Key Leadership for the Education and Environment Initiative:
Linda Adams, Secretary, California Environmental Protection Agency
Patty Zwarts, Deputy Secretary for Policy and Legislation, California Environmental Protection Agency
Andrea Lewis, Assistant Secretary for Education and Quality Programs, California Environmental Protection Agency
Mark Leary, Executive Director, California Integrated Waste Management Board
Mindy Fox, Director, Office of Education and the Environment, California Integrated Waste Management Board

Key Partners:
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Office of Education and the Environment
1001 I Street • Sacramento, California 95812 • (916) 341-6769
http://www.calepa.ca.gov/Education/EEI/

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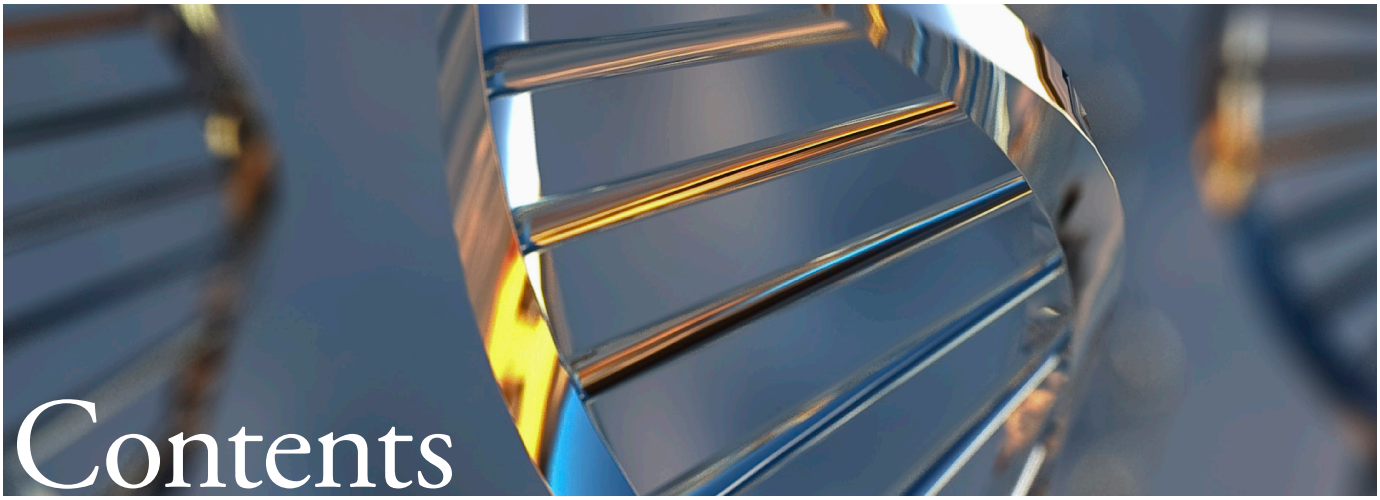

Contents

Lesson 1 Super Rice in California

None required for this lesson.

Lesson 2 Taking Genes, Making Products

None required for this lesson.

Lesson 3 Down on the Pharm

None required for this lesson.

Lesson 4 Going Beyond the Field

None required for this lesson.

Lesson 5 Return to Super Rice

None required for this lesson.

Lesson 6 Making Decisions about Genetic Engineering

None required for this lesson.

Assessments

High-Tech Harvest: Genetic Engineering and the Environment—Traditional Unit Assessment Master 2

Genetic Engineering Essay—Alternative Unit Assessment Master 7

Name: _____

Instructions: Select the best answer and circle the correct letter. (1 point each)

1. When scientists genetically engineer novel organisms, they insert genes that _____.
   a. they build by combining nucleotides in new ways
   b. come from other organisms of the same species
   c. come from other organisms of a different species
   d. come from nonliving organisms

2. Transgenic organisms _____.
   a. contain DNA from another species
   b. are created using selective breeding
   c. are created using Recombinant DNA technology
   d. a and c

3. Genetically engineered foods _____.
   a. are only sold after review and approval by the U.S. Department of Agriculture
   b. are sold in the U.S. and other countries
   c. are opposed by some people who fear that GMO foods could make people sick or damage the environment
   d. All of the above.

4. Plants that are genetically engineered to produce vaccines _____.
   a. create vaccines that are more expensive than traditional vaccines
   b. make it easier to create increased supplies of vaccines at lower costs
   c. could make vaccine distribution harder
   d. b and c

5. Scientists are currently attempting to genetically engineer bacteria that can produce fuel _____.
   a. because production of ethanol from crops like corn and sugar cane requires many acres of farm land
   b. because the microdiesel will be more efficient than ethanol
   c. because the microdiesel will decrease carbon dioxide in the atmosphere
   d. All of the above.

6. Why did California ban production of genetically engineered rice?
   a. There are easier and more inexpensive ways to produce pharmaceuticals.
   b. The government was concerned about cross-contamination of the rice crop.
   c. Japan threatened to ban imports if they contained evidence of genetic modification.
   d. b and c

Name: _____

Instructions: Complete the following tasks in the spaces provide. (4 points each)

7. Explain how and why the interchange of genetic materials can cause a problem if genetically engineered plants are grown near non-genetically engineered plants.

_____

_____

_____

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_____

8. Explain whether genetic contamination can be reduced or prevented. If so, how?

_____

_____

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Instructions: Choose either the super-salmon or the mercury-absorbing poplar trees (both genetically engineered products studied) and answer the following questions:

9. Why was a new gene inserted into the genetically engineered product and where did that new gene come from? (2 points)

_____

_____

_____

_____

_____

_____

Name: _____

10. List at least two ways the product you chose in the previous question might influence natural systems, biological diversity, or human health. Explain your responses. (2 points)

_____

_____

_____

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_____

_____

11. To what extent can this genetically engineered product be prevented from entering natural systems? Explain. (3 points)

_____

_____

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Instructions: Complete the following tasks in the spaces provide.

12. Recombinant DNA technology (rDNA) is a process used by genetic engineers to create new transgenic organisms. List two naturally occurring resources that scientists use in the rDNA process. (3 points)

_____

_____

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Name: _____

13. If the State of California were to pass a law banning genetically engineered corn, such as Bt corn, from being grown or imported into California, who would want to lobby or testify for or against this bill? Write three paragraphs describing at least three stakeholders and the case each could make for or against banning engineered corn. (10 points)

Banning Genetically Engineered Corn Scoring Tool

Criteria	5 points	4 points	3 points	0 points
Stakeholders	Identifies three legitimate stakeholders.	Identifies two legitimate stakeholders.	Identifies one legitimate stakeholder.	No legitimate stakeholders identified.
Case	Describes three cases or arguments.	Describes two cases or arguments.	Describes one case or argument.	No accurate and complete arguments described.

Name: _____

Name: _____

Instructions: Pick one type of genetically engineered product (either agricultural or biomedical) that you have studied in this unit. Describe the wide range of considerations and decision-making processes that are involved in deciding whether this particular product should continue to be researched, developed, or grown. Describe risks and benefits related to this product.

Your essay should:

- describe the product and what natural genetic resources are used to produce it.
- identify and explain the beneficial, neutral, or detrimental effects this product could have on natural systems and human health.
- explain if the product can or cannot be prevented from entering natural systems.
- identify the spectrum of factors that should be considered in making decisions about the production and use of this product.

Use the **Genetic Engineering Essay Scoring Tool** to guide your writing.

Name: _____

Name: _____

Genetic Engineering Essay Scoring Tool

Criteria	4 points	3 points	2 points	1 point
Genetically engineered product and natural genetic resources used in its production	Includes a complete and detailed description of a genetically engineered product and genetic resources used in its production.	Includes a partially detailed description of a genetically engineered product and genetic resources used in its production.	Includes a genetically engineered product or genetic resources used in its production but explanation lacks sufficient detail.	Does not include a genetically engineered product or does not explain it in any detail.
Production and use of genetically engineered product influences natural systems and human health	Includes a complete and detailed description of how the production and use of a genetically engineered product influences natural systems and human health.	Includes a partially detailed description of how the production and use of a genetically engineered product influences natural systems and human health.	Includes a description of how the production or use of a genetically engineered product influences natural systems or human health but explanation lacks sufficient detail.	Does not include an example of the production or use of the genetically engineered product influences natural systems or human health or does not explain it in any detail.
Preventing genetically engineered product entering natural systems	Includes a complete and detailed description of how the genetically engineered product can or cannot be prevented from entering natural systems.	Includes a partially detailed description of how the genetically engineered product can or cannot be prevented from entering natural systems.	States that the genetically engineered product can or cannot be prevented from entering natural systems but provides minimum details.	Does not include an example of how the genetically engineered product can or cannot be prevented from entering natural systems or does not explain it in any detail.
Effects genetically engineered product have on natural systems and human health	Includes a complete and detailed explanation of beneficial, neutral, or detrimental effects this product may have on natural systems and human health.	Includes a partially detailed explanation of beneficial, neutral, or detrimental effects this product may have on natural systems and human health.	Identifies a beneficial, neutral, or detrimental effect this product may have on natural systems or human health but provides minimum details.	Does not identify a beneficial, neutral, or detrimental effect this product may have on natural systems or human health does not explain it in any detail.

Name: _____

Genetic Engineering Essay Scoring Tool (Continued)

Criteria	4 points	3 points	2 points	1 point
Factors to be considered in making decisions about the production and use of genetically engineered product	Includes a complete and detailed spectrum of factors that should be considered in making decisions about the production and use of this genetically engineered product.	Includes a partially detailed description of spectrum of factors that should be considered in making decisions about the production and use of this genetically engineered product.	Includes some factors that should be considered in making decisions about the production or use of this genetically engineered product but provides minimum details.	Does not include a factor that should be considered in making decisions about the production or use of this genetically engineered product or does not explain it in any detail.
Totals				

Total Score: _____

Comments: _____

_____

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