

NJBCT SAMPLE MULTIPLE-CHOICE QUESTIONS

The following multiple-choice questions are samples of the types included in the test. Responses to the answers are included with a rationale as to why the answer is correct.

Biology/Life Science Core Course Content—p.27: Explain how the chemical and structural properties of DNA allow for genetic information to be **encoded** in genes and replicated.

1. Scientists use a certain technique to measure RNA levels in various cell types. Which of the following is most directly observed by this technique?
 - A. mutation
 - B. biomagnification
 - C. gene expression
 - D. osmotic regulation

Rationale: The correct answer is C.

The majority of genes are expressed as the proteins they encode. This process occurs in two steps (transcription and translation), both involving types of RNA.

Biology/Life Science Core Course Content—p. 30: Demonstrate through modeling (Punnett square) how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring.

2. A certain trait is caused by a recessively inherited gene that is not sex-linked. A man and a woman, neither of whom exhibit the trait, have a child with the trait. What is the probability their second child will have the trait?
 - A. 0%
 - B. 25%
 - C. 50%
 - D. 100%

Rationale: The correct answer is B.

An individual can inherit two different alleles for the same gene—one dominant and one recessive. An individual with a recessive allele for a particular trait will exhibit that form of the trait only when the dominant allele for the trait is not present. A Punnett square can be used to predict the probability of inheriting a particular trait.

Biology/Life Science Core Course Content—p15: Explain how food webs are limited and how pyramidal relationships exist.

3. A pyramid of biomass illustrates the relative amount of living organic matter available at each trophic level in an ecosystem. How is this concept illustrated on a pyramid of biomass?
- A. Plants are always located on the top of the pyramid.
 - B. Plants are always located in the middle of the pyramid.
 - C. Plants are shown to have the smallest number of individual organisms.
 - D. Plants form the base of the pyramid and have the greatest overall biomass.

Rationale: The correct answer is D.

A large mass of plants (autotrophs) at the base of a pyramid of biomass is required to support fewer organisms on the top. With each step to a higher trophic level there is a decrease in the biomass.

Biology/Life Science Core Course Content—p.15: Recognize that the chemical bonds of food molecules contain energy, which is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed.

4. Athletes want a drink to help them maintain constant cellular respiration during their game. To accomplish this goal, their drink should contain
- A. ATP.
 - B. lipids.
 - C. glucose.
 - D. proteins.

Rationale: The correct answer is C.

The breakdown of simple sugars, such as glucose, provides immediate energy for cellular activities.

Biology/Life Science Core Course Content—p. 32: New traits may result from new combinations of existing genes. Selective differences may lead to dramatic changes in the characteristics of organisms over time.

5. Brussels sprouts, cabbage, and cauliflower are all variations of the same species of mustard plant. If they are allowed to crossbreed, they will eventually produce similar-looking offspring. What process created these different variations in the first place?
- A. sexual reproduction
 - B. natural selection
 - C. DNA transplants
 - D. selective breeding

Rationale: The correct answer is D.

Brussels sprouts, cabbage, and cauliflower are all the same species of plant—*Brassica oleracea*. The individual variations in the plant structures did not occur naturally, but were created through many years of selection.

Biology/Life Science Core Course Content—p.18: Recognize the process of photosynthesis as providing a vital connection between the Sun and the energy needs of living systems. Describe how plants capture energy by absorbing light and use it to form strong chemical bonds.

6. Which cellular process in plants makes them useful to animals as a source of energy?
- A. ATP production
 - B. DNA replication
 - C. cellular respiration
 - D. glucose production

Rationale: The correct answer is D.

Photosynthesis is a process by which certain living plants capture solar energy from the Sun. Then, in the presence of chlorophyll, plants use the energy to convert carbon dioxide and water into energy-rich carbohydrates such as glucose.

Biology/Life Science Core Course Content—p.30: Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents.

The Genetics of Mouse Fur

Trait	Gene	Inheritance
Dark brown fur	<i>B</i>	dominant
Light brown fur	<i>b</i>	recessive

7. If two heterozygous mice (*Bb*) are repeatedly crossed, what is the probability that an offspring will have dark brown fur?
- A. $\frac{1}{3}$
- B. $\frac{1}{2}$
- C. $\frac{3}{4}$
- D. $\frac{3}{2}$

Rationale: The correct answer is C.

When two *Bb* hybrids are crossed, four possible combinations of genes may occur. A Punnett square will illustrate how the genes *B* and *b* from hybrid parents, combining by chance, will result in offspring that are $\frac{1}{4}$ pure dominant, $\frac{1}{2}$ hybrid (*Bb*, *bB*), and $\frac{1}{4}$ pure recessive (*bb*).

Biology/Life Science Core Course Content—p. 12: Disease is a result of a malfunctioning system, organ, [or] cell . . . [R]elate this to treatment interventions. Emerging technologies show promise in preventing and treating diseases.

8. In 2000, gene therapy was used to cure three infants with Severe Combined Immune Deficiency (SCID). The technology can only be used if SCID is what kind of disease?
- A. inherited
- B. infectious
- C. metabolic
- D. contagious

Rationale: The correct answer is A.

Many inherited diseases are the result of having defective genes. Gene therapy is a technique for correcting defective genes responsible for disease development. Inherited diseases should not be confused with contagious diseases. Contagious diseases are normally transmitted by microbes, people, animals, or food.

NJBCT SAMPLE PERFORMANCE ASSESSMENT TASK (PAT)

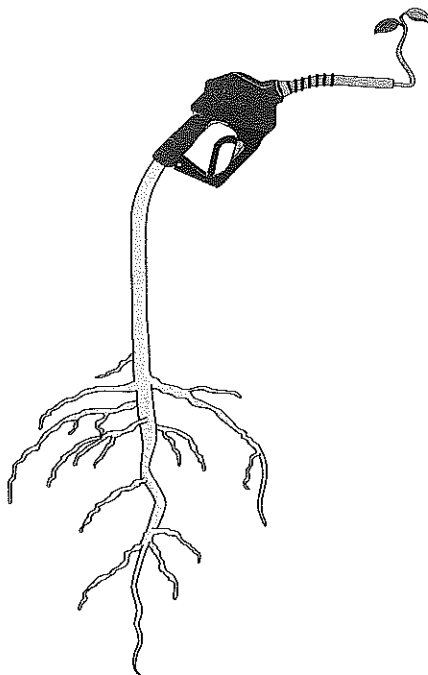
The performance assessment task (PAT) on pages 8–12 is a sample of the type included in the NJBCT. Following the PAT, on pages 13–19, are sample student responses and their scores to help you understand how the response was scored.

Fueling Change

CropCorp is a new corporation with the mission of developing new **biofuels**¹. You have been hired as a consultant to manage its newly acquired farm. You must decide which crop will most efficiently transform sunlight into a product that can be used to make a **biofuel**. You want to choose a crop that will make the most efficient use of space and resources (land, fertilizer, money).

The farm you are planning for is located in central New Jersey, where the soil is a mix of sand, clay, and organic material with some stone and gravel. The land is flat with a 2-acre pond and 100 acres of forest that can be used for logging. One acre of land is approximately the size of a football field.

All alternative fuel decisions have environmental and economic costs that must be considered. CropCorp would like you to recommend which crop, corn or **switchgrass**², should be planted on the new farm.



¹ **biofuels** – any fuels that are obtained from a renewable biological resource

² **switchgrass** – native prairie grass that can be grown in abundance in the United States

Figure 1
Relevant Data Regarding Corn and Switchgrass Crops

	Corn	Switchgrass
Approximate number of vehicles using fuel type	4 million	0 Note: Technology still being developed
Approximate number of working farms	300,000	100
Minimum temperature	32°F	−42°F
After-harvest regrowth rate	None	Moderate
Other uses for crop	Seed, food, starch, animal feed, sweetener	Decorative landscaping
Precipitation range	20–50 inches/year	12–60 inches/year
Soil textures	Medium	Coarse, fine, and medium
Harvest per acre (average)	3.5 tons/acre	11.5 tons/acre
Fuel per acre (in GJ ³)	10.15 GJ/acre	26.45 GJ/acre
Part of plant converted to biofuel	Grain	All parts
Cost per acre of production	\$100–150/acre	\$75–100/acre

³ GJ – one billion joules, which are units of energy used to measure energy content

Your Task:

- 1) Review the data about corn and switchgrass provided in Figure 1.
- 2) Determine which **ONE** crop you think would be the better crop for the farm, considering all factors provided in Figure 1.
- 3) Write a persuasive argument to the president of the corporation, detailing your decision and justifying your **ONE** crop choice using data from Figure 1. Be sure to include all of the following elements:
 - Which crop you have chosen and why.
 - Cite evidence and data from Figure 1 to support your recommendation.
 - Address potential environmental and economic consequences of your recommendation.

Please write your response in paragraph form.

Fueling Change Scoring Rubric

4 POINTS	3 POINTS	2 POINTS	1 POINT
<ul style="list-style-type: none"> • Selects and thoroughly explains crop choice with no misconceptions. • Uses extensive data from table to support decision. • Shows strong evidence of weighing multiple environmental and economic consequences. • All arguments are strongly based on scientific evidence and/or principles. 	<ul style="list-style-type: none"> • Selects and explains crop choice with no misconceptions. • Uses some data from table to support decision. • Shows some evidence of weighing multiple environmental and economic consequences. • Most arguments are based on scientific evidence and/or principles. 	<ul style="list-style-type: none"> • Selects and explains crop choice with minor misconceptions. • Uses data from table to support decision. • Some arguments are based on scientific evidence and/or principles. 	<ul style="list-style-type: none"> • Selects but does not explain crop choice. • Does not use data from table to support decision. • Few to no arguments are based on scientific evidence and/or principles.