QUESTION 1:

About one in one million people are born with dyskeratosis congenita. This disease affects many areas of the body. It causes fingernails and toenails to grow abnormally and discoloration of the skin. Dyskeratosis congenita is caused by a mutation in a gene responsible for the production of ribosomes; therefore, ribosome functioning is impaired.

Which cell process would be most directly affected by this disease?

A. the production of energy
B. the production of proteins
C. the removal of substances
D. the breakdown of chemicals

QUESTION 2:

The graph shows the changes in population size of two species that live in the same habitat.

![Graph showing population size over time for two species](image)

Which conclusion can be made regarding the species?

A. Species 1 is a predator of Species 2.
B. Species 2 is a predator of Species 1.
C. Species 1 and 2 have a mutualistic relationship.
D. Species 1 and 2 have a commensalistic relationship.
QUESTION 3:

The graph shows the number of differences in the amino acids of a particular hemoglobin polypeptide in different organisms.

![Number of Amino Acid Differences in Hemoglobin Between Humans and Other Animals](chart)

What inference can be made from the data in the graph?

A. Rhesus monkeys and mice do not share a common ancestor.
B. Hemoglobin is more important to frogs than to other organisms.
C. Humans and rhesus monkeys are more similar than chickens and frogs.
D. Amino acids are the building blocks of hemoglobin in all organisms except humans.

QUESTION 4:

An organism is multicellular and can be seen without a microscope. The bar graph shows the numbers of some of the organelles in one of the cells from the organism.

![Number of Organelles](chart)

From which kingdom is this organism?

A. Animalia
B. Archaebacteria
C. Fungi
D. Plantae
QUESTION 5:

Which graph shows the most effective enzyme reduction of the amount of required activation energy?

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

A. [Diagram A]
B. [Diagram B]
C. [Diagram C]
D. [Diagram D]

QUESTION 6:

Scientists conducted an experiment to determine how different wavelengths of light affected photosynthesis. They used two groups of the same plants. The leaves of Group 1 were covered with transparent green plastic. The leaves of Group 2 were not covered with any plastic.

The results show that the plants photosynthesized best when their leaves were not covered in any plastic.

Which hypothesis do the results support?

A. If leaves are uncovered, then their chloroplasts will produce more oxygen than the leaves that are covered in green plastic.
B. If leaves are covered in green plastic, then their mitochondria will absorb more carbon dioxide than the mitochondria of uncovered leaves.
C. If leaves are uncovered, then their chloroplasts will release more carbon dioxide than the chloroplasts of leaves covered in green plastic.
D. If leaves are covered in green plastic, then their mitochondria will produce more oxygen than the leaves that are uncovered.
QUESTION 7:

Energy is transferred between trophic levels in a food pyramid. If 150,000 joules of sunlight are captured by plants, how much energy is transferred to secondary consumers?

A. 150 joules  
B. 1,500 joules  
C. 15,000 joules  
D. 150,000 joules

QUESTION 8:

Over many years, scientists study a community in an area after a volcanic eruption and create a graph like the one shown.

Which conclusion can be made regarding the cause of Stage 4?

A. Stage 4 occurred because this period is necessary for populations to increase.  
B. Stage 4 occurred because energy input and output within populations remained balanced.  
C. Stage 4 occurred because populations in the community have plenty of resources to grow.  
D. Stage 4 occurred because populations have reached a climax in which not enough resources exist to sustain growth.

QUESTION 9:

The table shows the changes in size of the populations of grasses, shrubs, and trees over 150 years.

<table>
<thead>
<tr>
<th>Changes in Plant Population Size over Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Grasses</td>
</tr>
<tr>
<td>Shrubs</td>
</tr>
<tr>
<td>Trees</td>
</tr>
</tbody>
</table>

What type of succession was taking place?

A. primary succession because trees replaced bushes  
B. secondary succession because the type of species changed twice  
C. primary succession because there was a decrease in the number of species  
D. secondary succession because the first organisms to grow were grasses
QUESTION 10:

After conducting several tests, a scientist determines that the nucleic acid sample he is studying has the following characteristics:

- Contains nucleotides linked in a chain
- Contains 4 nitrogen bases
- Made of single strand
- Uracil is present

What is the BEST conclusion the scientist can make based on the observations?

A. The nucleic acid is DNA.
B. The nucleic acid is RNA.
C. The nucleic acid is a protein.
D. More tests would be needed to determine the type of nucleic acid in the sample.

QUESTION 11:

Scientists have studied organisms near steel mills. In one study, the scientists compared the DNA of two groups of mice. One group lived near a steel mill, and the other group lived in a rural area away from the steel mill. The scientists collected data on the number of mutations occurring in each group and created the table shown.

<table>
<thead>
<tr>
<th>Population Group</th>
<th>Gene</th>
<th>Mice Offspring Counted</th>
<th>Number of DNA Genes Counted</th>
<th>Number of Mutant Genes of DNA</th>
<th>Percent Gene Mutation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>Ms6-hm</td>
<td>110</td>
<td>234</td>
<td>51</td>
<td>21.79</td>
</tr>
<tr>
<td></td>
<td>Hm-2</td>
<td>96</td>
<td>150</td>
<td>23</td>
<td>15.33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>384</strong></td>
<td><strong>74</strong></td>
<td><strong>19.27</strong></td>
<td></td>
</tr>
<tr>
<td>Steel Mill</td>
<td>Ms6-hm</td>
<td>94</td>
<td>188</td>
<td>50</td>
<td>26.60</td>
</tr>
<tr>
<td></td>
<td>Hm-2</td>
<td>75</td>
<td>96</td>
<td>30</td>
<td>31.25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>284</strong></td>
<td><strong>80</strong></td>
<td><strong>28.17</strong></td>
<td></td>
</tr>
</tbody>
</table>

Which prediction can be made from this data?

A. Mice that live in rural areas will have more genes expressed than mice near steel mills.
B. Mice that live near steel mills will have more genes expressed than mice in rural areas.
C. Mice that live in rural areas will have higher rates of abnormalities due to mutations than mice near steel mills.
D. Mice that live near steel mills will have higher rates of abnormalities due to mutations than mice in rural areas.
QUESTION 12:

Scientists and farmers studied how populations of insects on a farm changed after the farmer started using an insecticide on the crops. The diagram shows population sizes, both before and after the insecticide was applied.

![Insect Population Response to Insecticide](image)

What conclusion can be made about the Insect A and Insect B populations?

A. The insecticide was specific to Insect B.
B. The insecticide became less effective for Insect A.
C. Some insects passed a beneficial mutation to offspring.
D. The farmer missed spraying insecticide on some plants.

QUESTION 13:

A student is demonstrating how water moves across cell membranes to maintain homeostasis. The student uses dialysis bags, which are semipermeable and model cell membranes. The student fills each of the three bags with 100 mL of a 10% salt solution and ties the end of each bag. In Beaker 1, the student places 200 mL of a 5% salt solution. In Beaker 2, the student places 200 mL of a 10% salt solution. In Beaker 3, the student places 200 mL of a 20% salt solution.

![Beakers](image)

What kind of environments are in Beakers 1, 2, and 3?

A. Beaker 1: hypotonic, Beaker 2: hypotonic, Beaker 3: isotonic
B. Beaker 1: hypertonic, Beaker 2: isotonic, Beaker 3: hypotonic
C. Beaker 1: isotonic, Beaker 2: hypertonic, Beaker 3: hypotonic
D. Beaker 1: hypotonic, Beaker 2: isotonic, Beaker 3: hypertonic
QUESTION 14:

In 1976, the enzyme DNA helicase was discovered. DNA helicase breaks bonds between nitrogenous bases. Which statement BEST describes how the discovery of DNA helicase furthered the understanding of DNA replication?

A. It revealed the mechanism by which two DNA strands are “unzipped” from each other.
B. It resulted in the development of laboratory methods of replicating RNA.
C. It led scientists to discover that DNA is made up of nucleotides.
D. It helped uncover the double-helix structure of DNA.

QUESTION 15:

The diagram shows a plant’s responses to stimuli.

Which table presents explanations for the plant’s responses?

A. | Response | Explanation |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In response to light, a plant hormone causes the shoot to lengthen more on one side, and the stem bends toward the light.</td>
</tr>
<tr>
<td>2</td>
<td>In response to gravity, a plant hormone accumulates in certain areas, and the roots grow downward.</td>
</tr>
</tbody>
</table>

B. | Response | Explanation |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In response to light, the chloroplasts begin to photosynthesize, and the shoot leans toward the light.</td>
</tr>
<tr>
<td>2</td>
<td>In response to water, the vacuoles on one side of the roots swell, and the roots grow downward.</td>
</tr>
</tbody>
</table>

C. | Response | Explanation |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In response to the heat, sensors in the shoot are activated, and the shoot bends toward the Sun.</td>
</tr>
<tr>
<td>2</td>
<td>In response to touching the soil, sensors in the root are activated, and the roots grow downward.</td>
</tr>
</tbody>
</table>

D. | Response | Explanation |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In response to gravity, a plant hormone causes cell replication, and the shoot grows upward.</td>
</tr>
<tr>
<td>2</td>
<td>In response to light, a plant hormone causes cells to move away from the Sun, and the roots grow downward.</td>
</tr>
</tbody>
</table>
QUESTION 16:

Scientists noted that each of several anole lizard species in the Caribbean islands has a body type that seems to be well suited for its own habitat. For example, the anole species that live mainly on tree trunks have stocky bodies and long legs. Anoles that live in grassy areas are slender and have very long legs. Scientists also noted that distinct anole species with the same body types can be found on several different islands. These findings are consistent with the mechanism of natural selection, which favors adaptations that allow a species to survive in its environment.

The scientists developed a few hypotheses for the finding that the twig-dwelling anole species found on several of the islands have thin bodies, large toe pads, and short legs and tails. They then performed DNA analysis on each of these twig-dwelling species. This analysis revealed that the twig-dwelling species on different islands did not share a recent common ancestor.

Which of these hypotheses is supported by the findings?

A. A species of twig-dwelling anoles developed on one island, and then descendents spread out to other islands.
B. The twig-dwelling anoles are much better adapted to living in the Caribbean islands than the trunk-dwelling and grass-dwelling anoles.
C. Each twig-dwelling species came from distant ancestors but evolved in similar ways despite separated habitats.
D. Twig-dwelling anoles, trunk-dwelling anoles, and grass-dwelling anoles all evolved from the same ancestor.

QUESTION 17:

People who have Tay-Sachs disease cannot metabolize some lipids effectively. Tay-Sachs is a recessive disorder. A student used a Punnett square to determine the probability of offspring inheriting the disease. The results from a Punnett Square are 25% TT, 25% Tt, and 25% tt. (T represents the dominant allele for this condition; t represents the recessive allele.)

Which conclusion can be made regarding the genotypes of the parents and the probability of inheriting a Tay-Sachs allele?

A. The parents must be TT and tt, which yields a 25% chance of expressing the disease.
B. The parents must be Tt and tt, which yields a 50% chance of inheriting an allele for the disease.
C. The parents must be TT and TT, which yields a 25% chance of inheriting an allele for the disease.
D. The parents must be Tt and Tt, which yields a 75% chance of inheriting an allele for the disease.
QUESTION 18:

**How Cell Parts Help Maintain Homeostasis**

<table>
<thead>
<tr>
<th>Cell Part</th>
<th>Produces ATP When Needed</th>
<th>Allows and Controls the Passage of Substances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitochondrion</td>
<td></td>
<td>?</td>
</tr>
</tbody>
</table>

Which cell structure should the student use to BEST complete the table?

A. nucleus  
B. cytoplasm  
C. cell membrane  
D. endoplasmic reticulum

QUESTION 19:

A scientist studied the energy contribution of different types of cellular respiration to a runner during an endurance running event. The scientist then created the graph shown from the data collected.

![Graph showing percentage of aerobic and anaerobic energy use during long-distance running race](image)

Which conclusion can be made regarding the mechanisms for obtaining energy in Line 1 and Line 2?

A. ATP is obtained through aerobic respiration for Line 1 while anaerobic respiration occurs for Line 2.  
B. ATP is obtained through anaerobic respiration for Line 1 while aerobic respiration occurs for Line 2.  
C. Line 1 shows energy is obtained through production of glucose molecules while Line 2 shows energy obtained through the production of protein molecules.  
D. Line 1 shows energy is obtained through the production of fat molecules while Line 2 shows energy obtained through the production of carbohydrate molecules.