**Mississippi Academic Assessment Program**

**Biology**

**OTT Answers**

The information for each item, including the performance objective, DOK level, item type, and correct answer, is located in this document. The items appear in the order as shown in the table.

**Note**: The item types are representative of items that will appear in the biology test.

| Item Number | Performance Objective | DOK Level | Item Type | Correct Answer |
|---|---|---|---|---|
| 1 | (BIO.3A.2) Compare and contrast mitosis and meiosis in terms of reproduction. | 3 | Technology Enhanced | See Answer Key |
| 2 | (BIO.3A.3) Investigate chromosomal abnormalities (e.g., Down syndrome, Turner's syndrome, and Klinefelter syndrome) that might arise from errors in meiosis (nondisjunction) and how these abnormalities are | 2 | Multiple Choice | B |
| 3 | (BIO.1D.2) Develop and use models to explain how the cell deals with imbalances of solute concentration across the cell membrane (i.e., hypertonic, hypotonic, and isotonic conditions, sodium/potassium | 2 | Technology Enhanced | See Answer Key |
| 4 | (BIO.5.1) Illustrate levels of ecological hierarchy, including organism, population, community, ecosystem, biome, and biosphere. | 2 | Technology Enhanced | See Answer Key |
| 5 | (BIO.3B.1) Demonstrate Mendel's law of dominance and segregation using mathematics to predict phenotypic and genotypic ratios by constructing Punnett squares with both homozygous and heterozygous | 3 | Technology Enhanced | See Answer Key |
| 6 | (BIO.1B.1) Develop and use models to compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids (DNA and RNA) in organisms. | 2 | Multiple Choice | C |
| 7 | (BIO.1E.2) Identify and describe the changes that occur in a cell during replication. Explore problems that might occur if the cell does not progress through the cycle correctly (cancer). | 2 | Multiple Choice | B |
| 8 | (BIO.3C.3) Use models to predict how various changes in the nucleotide sequence (e.g., point mutations, deletions, and additions) will affect the resulting protein product and the subsequent inherited | 3 | Multiple Choice | D |
| 9 | (BIO.5.4) Develop and use models to describe the flow of energy and amount of biomass through food chains, food webs, and food pyramids. | 2 | Multiple Choice | A |
| 10 | (BIO.5.5) Evaluate symbiotic relationships (e.g., mutualism, parasitism, and commensalism) and other co-evolutionary (e.g., predator-prey, cooperation, competition, and mimicry) relationships within specific | 2 | Multiple Choice | A |

**Mississippi Academic Assessment Program**

**Biology**

**OTT Answer Key**

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| Item Number | Performance Objective | DOK Level | Item Type | Correct Answer |
|---|---|---|---|---|
| 11 | (BIO.1B.1) Develop and use models to compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids (DNA and RNA) in organisms. | 2 | Multiple Choice | A, C |
| 12 | (BIO.1B.2) Design and conduct an experiment to determine how enzymes react given various environmental conditions (i.e., pH, temperature, and concentration). Analyze, interpret, graph, and present data to... | 2 | Multiple Choice | C |
| 13 | (BIO.1A.1) Develop criteria to differentiate between living and non-living things. | 1 | Technology Enhanced | See Answer Key |
| 14 | (BIO.2.2) Develop models of the major reactants and products of photosynthesis to demonstrate the transformation of light energy into stored chemical energy in cells. Emphasize the chemical processes. | 2 | Technology Enhanced | See Answer Key |
| 15 | (BIO.3B.4) Analyze and interpret data (e.g., pedigrees, family, and population studies) regarding Mendelian and complex genetic traits (e.g., sickle-cell anemia, cystic fibrosis, muscular dystrophy.) | 2 | Multiple Choice | C |
| 16 | (BIO.1E.3) Relate the processes of cellular reproduction to asexual reproduction in simple organisms (i.e., budding, vegetative propagation, regeneration, binary fission). Explain why the DNA of the daughter cells... | 2 | Technology Enhanced | See Answer Key |
| 17 | (BIO.1A.2) Describe the tenets of cell theory and the contributions of Schwann, Hooke, Schleiden, and Virchow. | 1 | Technology Enhanced | See Answer Key |
| 18 | (BIO.3B.3) Investigate traits that follow non-Mendelian inheritance patterns (e.g., incomplete dominance, codominance, multiple alleles in human blood types, and sex-linkage). | 2 | Multiple Choice | C |
| 19 | (BIO.1C.1) Develop and use models to explore how specialized structures within cells (e.g., nucleus, cytoskeleton, endoplasmic reticulum, ribosomes, Golgi apparatus, lysosomes, mitochondria, chloroplast.) | 2 | Multiple Choice | B |
| 20 | (BIO.1A.4) Use evidence from current scientific literature to support whether a virus is living or non-living. | 2 | Technology Enhanced | See Answer Key |
| 21 | (BIO.3C.2) Evaluate the mechanisms of transcription and translation in protein synthesis. | 2 | Technology Enhanced | See Answer Key |
| 22 | (BIO.4.3) Construct cladograms/phylogenetic trees to illustrate relatedness between species. | 2 | Multiple Choice | A, D |
| 23 | (BIO.4.6) Construct explanations for the mechanisms of speciation (e.g., geographic and reproductive isolation). | 2 | Multiple Choice | C |
| 24 | (BIO.5.6) Analyze and interpret population data, both density-dependent and density-independent, to define limiting factors. Use graphical representations (growth curves) to illustrate the carrying capacity. | 2 | Multiple Choice | D |
| 25 | (BIO.2.3) Develop models of the major reactants and products of cellular respiration (aerobic and anaerobic) to demonstrate the transformation of the chemical energy stored in food to the available energy of ATP. | 2 | Technology Enhanced | See Answer Key |

**Mississippi Academic Assessment Program**

**(MAAP) Biology**

**OTT Answer Key**

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**Note**: The item types are representative of items that will appear in the biology test.

| Item Number | Performance Objective | DOK Level | Item Type | Correct Answer |
|---|---|---|---|---|
| 26 | (BIO.5.5) Evaluate symbiotic relationships (e.g., mutualism, parasitism, and commensalism) and other co-evolutionary (e.g., predator-prey, cooperation, competition, and mimicry) relationships within specific environments. | 2 | Technology Enhanced | See Answer Key |
| 27 | (BIO.3B.3) Investigate traits that follow non-Mendelian inheritance patterns (e.g., incomplete dominance, codominance, multiple alleles in human blood types, and sex-linkage). | 2 | Multiple Choice | D |
| 28 | (BIO.3C.1) Develop and use models to explain the relationship between DNA, genes, and chromosomes in coding the instructions for the traits transferred from parent to offspring. | 2 | Multi-Select | D, F |
| 29 | (BIO.4.2) Evaluate empirical evidence of common ancestry and biological evolution, including comparative anatomy (e.g., homologous structures and embryological similarities), fossil record, molecular/biochemical similarities (e.g., gene and protein homology), and biogeographic distribution. | 2 | Technology Enhanced | See Answer Key |
| 30 | (BIO.2.1) Use models to demonstrate that ATP and ADP are cycled within a cell as a means to transfer energy. | 2 | Multiple Choice | C |
| 31 | (BIO.2.4) Conduct scientific investigations or computer simulations to compare aerobic and anaerobic cellular respiration in plants and animals, using real world examples. | 2 | Multiple Choice | B |
| 32 | (BIO.5.3) Analyze and interpret quantitative data to construct an explanation for the effects of greenhouse gases on the carbon dioxide cycle and global climate. | 3 | Technology Enhanced | See Answer Key |
| 33 | (BIO.5.7) Investigate and evaluate factors involved in primary and secondary ecological succession using local, real world examples. | 2 | Technology Enhanced | See Answer Key |
| 34 | (BIO.3A.1) Model sex cell formation (meiosis) and combination (fertilization) to demonstrate the maintenance of chromosome number through each generation in sexually reproducing populations. Explain why the DNA of the daughter cells is different from the DNA of the parent cell. | 1 | Multiple Choice | D |
| 35 | (BIO.3C.4) Research and identify how DNA technology benefits society. Engage in scientific argument from evidence over the ethical issues surrounding the use of DNA technology (e.g., cloning, transgenic organisms, stem cell research, and the Human Genome Project, gel electrophoresis). | 2 | Technology Enhanced | See Answer Key |
| 36 | (BIO.1C.2) Investigate to compare and contrast prokaryotic cells and eukaryotic cells, and plant, animal, and fungal cells. populations. | 2 | Technology Enhanced | See Answer Key |

| | | | | |
|---|---|---|---|---|
| 37 | (BIO.4.1) Use models to differentiate between organic and chemical evolution, illustrating the steps leading to aerobic heterotrophs and photosynthetic autotrophs. | 2 | Technology Enhanced | See Answer Key |
| 38 | (BIO.4.4) Design models and use simulations to investigate the interaction between changing environments and genetic variation in natural selection leading to adaptations in populations and differential success of populations. | 2 | Multiple Choice | C |
| 39 | (BIO.4.5) Use Darwin's Theory to explain how genetic variation, competition, overproduction, and unequal reproductive success acts as driving forces of natural selection and evolution. | 2 | Multiple Choice | B |
| 40 | (BIO.5.2) Analyze models of the cycling of matter (e.g., carbon, nitrogen, phosphorus, and water) between abiotic and biotic factors in an ecosystem and evaluate the ability of these cycles to maintain the health and sustainability of the ecosystem. | 2 | Technology Enhanced | See Answer Key |

# OTT Answer Key

## Item Number 1

1. Circle or underline **one** option from **each** of the three sections below to complete a claim about the cause of Klinefelter syndrome.

**Claim (select one)**

It is the result of a mutation during mitosis.

It is the result of a mutation during meiosis.

**Evidence (select one)**

There is a decrease in the number of sex chromosomes in the affected male.

There is a decrease in the number of nonsex chromosomes in the affected male.

There is an increase in the number of sex chromosomes in the affected male.

There is an increase in the number of nonsex chromosomes in the affected male.

**Reasoning (select one)**

Mutations during meiosis affect sex chromosomes.

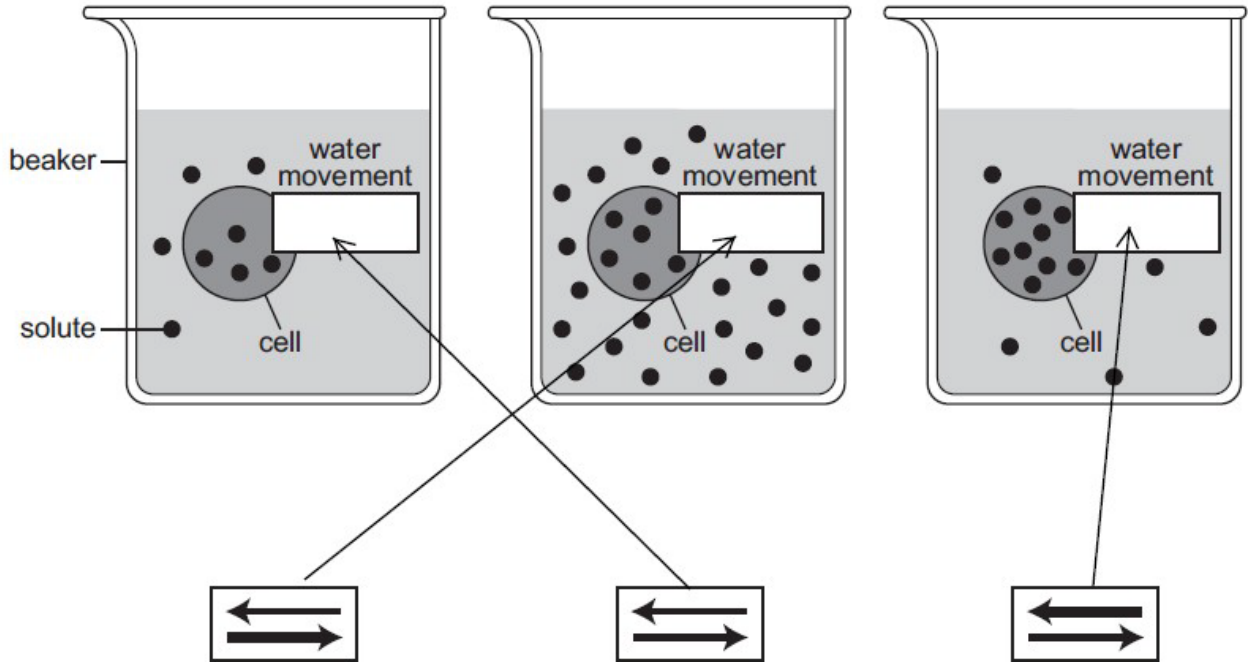
Mutations during meiosis affect nonsex chromosomes.

Mutations during mitosis affect sex chromosomes.

Mutations during mitosis affect nonsex chromosomes.

**Item Number 3**

3. The models below are set up to represent how a cell responds to imbalances in solute concentration. Draw a line from the correct arrow set to the appropriate beaker to show how water will move into or out of the cell in each beaker for the solute conditions shown.




**Item Number 4**

4. A 350-acre area in central Mississippi called Old Cove has mature hardwood trees, birds, reptiles, amphibians, and many plant species. Students wrote three descriptions related to the Old Cove environment.

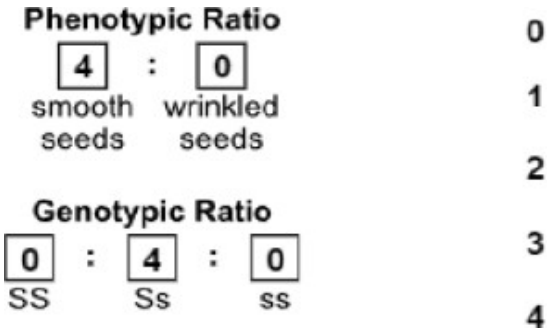
**Descriptions Written by Students**

1. all the wild turkeys living in Old Cove
2. an individual woodland salamander living in Old Cove
3. all the living organisms in Old Cove

Mark one box in each row of the table below to match the correct level of organization represented by each description.

| | biome | community | organism | population |
|---|---|---|---|---|
| Description 1 | | | | X |
| Description 2 | | | X | |
| Description 3 | | X | | |

**Item Number 5**




Please NOTE: When ratios are given based on Punnett squares for monohybrid crosses, the numbers in the ratio usually add up to 4. However, the ratio of 1:0 is equivalent to 4:0; so are 2:0 and 3:0.

Correct Answers for the Phenotypic Ratio could be 1:0, 2:0, 3:0, 4:0. For the Genotypic Ratio, Correct Answers can include 0:1:0, 0:2:0, 0:3:0, and 0:4:0.

**Item Number 13**

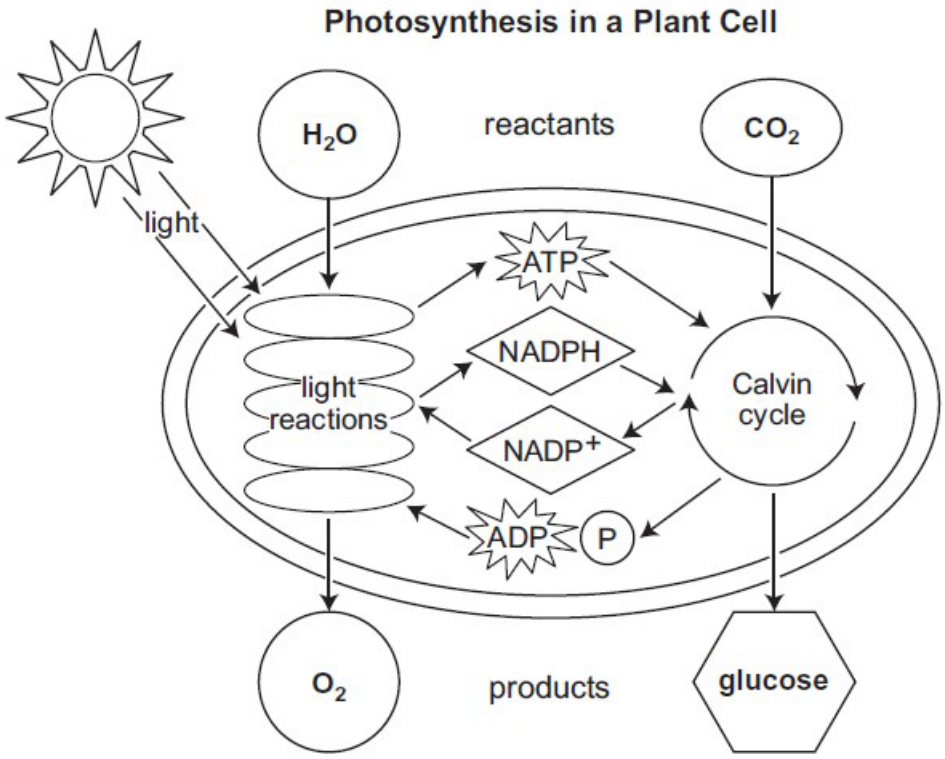
13. Write the characteristics in the boxes in the chart to compare living and nonliving things.

**Characteristics of Living and Nonliving Things**

| Living Characteristics | Nonliving Characteristics |
|---|---|
| can reproduce | cannot grow |
| can respond to stimuli | exists without taking in energy |
| can release energy for work | |

**Item Number 14**

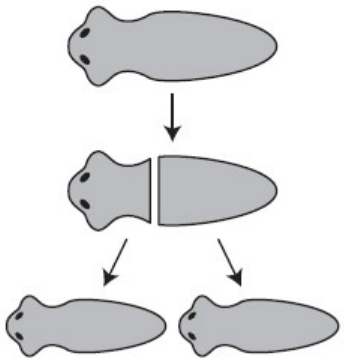
**14.** Write the labels in the shapes next to "reactants" and "products" in the diagram to show th major reactants and products of photosynthesis in a plant cell.



**Item Number 16**

**16.** A planarian is a type of multicellular organism. A process that occurs in a planarian is represented in the model below.

**Planarian**



Circle one word or phrase in each set of parentheses to **best** describe this process.

The model represents the process of ( budding / regeneration / vegetative propagation ).

This process is a type of ( asexual / sexual ) reproduction that is most similar to ( meiosis / mitosis ).

The two organisms that result from this process contain DNA that is ( identical / different ).

**Item Number 17**

**17.** The discovery of cells was made possible by the invention and refinement of the microscope. Over the years, different individuals provided evidence for what is now known as the cell theory. Four scientists are primarily credited with establishing the three basic concepts of the cell theory.

Mark one box in each row of the table below to identify the scientist(s) **most** associated with the cell theory concept listed.

| | Schleiden and Schwann | Hooke | Virchow |
|---|---|---|---|
| All living things are made of cells; plants and animals are made of cells. | X | | |
| Cells come from cells; diseased cells produce diseased cells. | | | X |
| The cell is the basic unit of life; cells can be studied scientifically. | | X | |

**Item Number 20**

**20.** The classification of viruses as living or nonliving entities has changed throughout history. Initially thought to be poisons, viruses have been classified over time as a specialized form of life and as a biological chemical. Today, their classification remains uncertain.

Write the number next to each claim next to the **one** piece of evidence that **best** supports that claim.

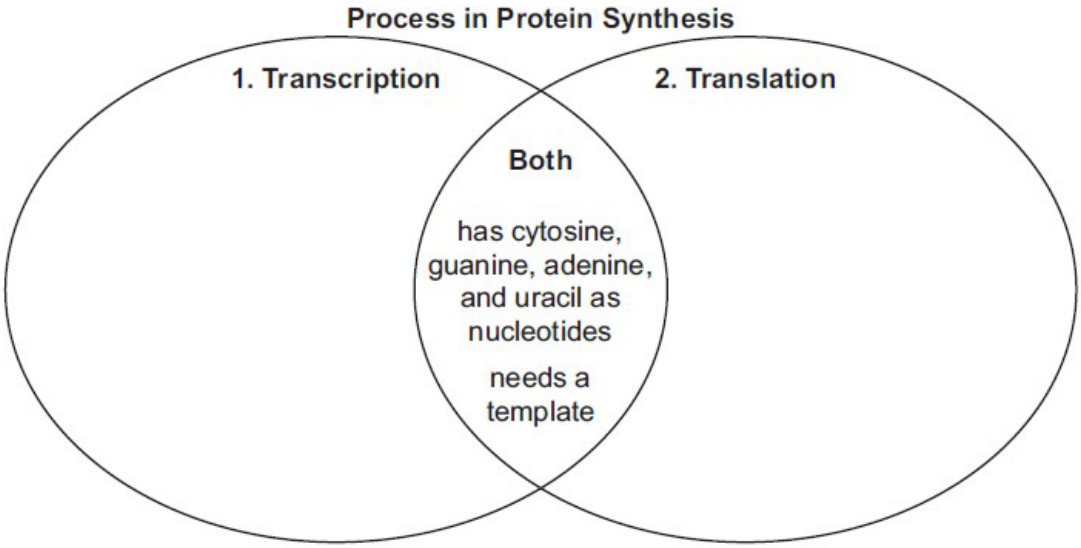
| Claim | Evidence |
|---|---|
| | Viruses replicate by simple mitosis. |
| | Most viruses are larger than common bacterial cells, such as *E. coli*. |
| 1 | Each virus has either RNA or DNA, compounds found in cells. |
| 2 | Viruses must use living cells to produce additional viruses. |
| | Viruses infect only animal cells. |

**1. Viruses are living.**

**2. Viruses are nonliving.**

**Item Number 21**

**21.** A student uses a Venn diagram to compare the mechanisms of transcription and translation during protein synthesis. The incomplete diagram is shown.




Write the number 1 or 2 next to each descriptor to identify whether it should be grouped with transcription (1) or translation (2) in the Venn diagram.

| | |
|---|---|
| **has mRNA as a product** | 1 |
| **occurs in ribosomes** | 2 |
| **has polypeptide as a product** | 2 |
| **occurs in the nucleus** | 1 |

**Item Number 25**

**25.** A student is developing a chart to compare aerobic respiration and anaerobic respiration in both plants and animals. The incomplete chart is shown.

Circle one word or phrase in each set of parentheses to complete the chart.

| | Aerobic Respiration | Anaerobic Respiration (plants) | Anaerobic Respiration (animals) |
|---|---|---|---|
| Is oxygen required? | yes | ( yes / no ) | no |
| Is there glycolysis? | yes | ( yes / no ) | yes |
| What is the ATP yield? | 36 | 2 | 2 |
| Is glucose completely broken down? | yes | no | ( yes / no ) |
| What end products are produced? | carbon dioxide and water | ethanol and carbon dioxide | ( carbon dioxide and water / lactic acid ) |

**Item Number 26**

**26.** The table includes descriptions of four different types of relationships between organisms. Record the number of each relationship in the table to correctly identify which type of relationship each description represents.

| Description | Type of Relationship |
|---|---|
| A king snake stalks a small mouse before constricting it and eating it whole. | **predation** |
| A tapeworm enters a host's digestive system and feeds on digested food. | **parasitism** |
| An oxpecker bird lands on the back of a rhinoceros and feeds on parasites while being protected from predators. | **mutualism** |
| Barnacles grow on the skin of a whale, leaving it unharmed, while filtering food as the whale swims. | **commensalism** |

**Item 29 - Answers**

**Part A:**

Compared to Hyracotherium, the height of modern horses has ( decreased / (increased) / stayed the same ) and the number of toes has ((decreased) / increased / stayed the same).

**Part B:** 3

**Item 32 – Answers**

**Part A:** Circle a word in each set of options to explain a possible relationship between the data in the two graphs.

The relationship between atmospheric carbon dioxide concentration and the length of the growing season is most likely ((direct) / indirect ) because as atmospheric carbon dioxide concentration increases, the length of the growing season ( increases / decreases ).

**Part B:** Further research indicates that the change in atmospheric carbon dioxide concentration correlates with observed changes in pollen concentration and the length of the pollen season. Circle a word in each set of options to **best** explain these observations.

Increases in atmospheric carbon dioxide concentration have likely caused global annual average temperatures to ( rise / lower ) and plant photosynthesis rates to ( increase / decrease ). These changes result in ( greater / reduced ) plant growth and ( more / less ) pollen production.

**Item 33 – Answers**

| Event | Primary Succession | Secondary Succession |
|---|---|---|
| 1 | | X |
| 2 | X | |
| 3 | X | |
| 4 | | X |
| 5 | X | |
| 6 | | X |

**Item 35 – Answers**

| | Benefit | Risk |
|---|---|---|
| cross-pollination with native organic plants | | X |
| decrease in the consumer price of meat | X | |
| human hormonal effects from consumption | | X |
| increase in crop tolerance from pesticides | X | |

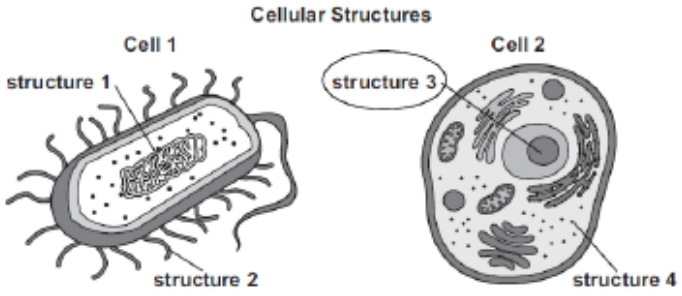
**Item 36 - Answers**

Part A

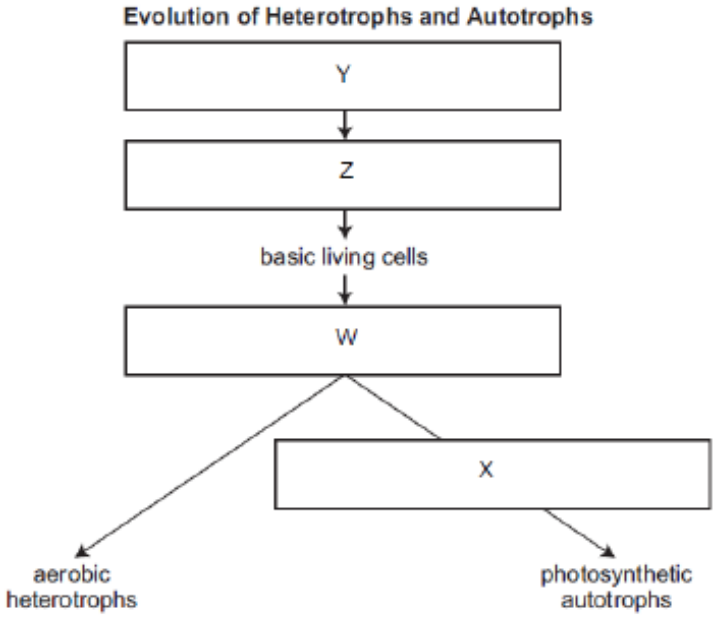
Characteristics of Eukaryotic and Prokaryotic Cells

| Characteristic | Type of Cell |
|---|---|
| has ribosomes | 3 |
| has a cell membrane | 3 |
| has DNA in the cytoplasm | 1 |
| has membrane-bound organelles | 2 |

Part B



**Item 37 - Answers**




**Item 40 - Answers**

**Part A:** Based on the diagram, which component is a direct product of abiotic and biotic activities in this cycle?

(A.) nitrates

**B.** nitrites

**C.** ammonium

**D.** atmospheric nitrogen

**Part B:** What is the role of nitrogen-fixing bacteria in this cycle?

(A.) making atmospheric nitrogen available for plants

**B.** transforming sunlight energy into usable energy for plants

**C.** breaking down dead plant matter and releasing it as nitrogen into the atmosphere

**D.** increasing the amount of plant matter that decomposers can convert to ammonium