

Tutorials are designed specifically for the Virginia Standards of Learning to prepare students for the Standards of Learning tests.

Biology Tutorials offer targeted instruction, practice, and review designed to help students develop fluency, deepen conceptual understanding, and apply scientific thinking skills. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing their ability to explain and analyze biological scenarios, students build the depth of knowledge and higher-order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible through focused content, guided analysis, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high-impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

## 1. CHEMISTRY OF LIFE

### • CHARACTERISTICS OF LIFE

- **BIO.3.b** characteristics of prokaryotic and eukaryotic cells;
- **BIO.2.d** the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.
- **BIO.3.e** the impact of surface area to volume ratio on cell division, material transport, and other life processes.
- **BIO.4.b** maintenance of homeostasis;
- **BIO.5.c** cell specialization;
- **BIO.5.a** cell growth and division;
- **BIO.7.c** how natural selection leads to adaptations;

### • BIOMOLECULES

- **BIO.2.b** the structure and function of macromolecules;
- **BIO.5.g** the structure, function, and replication of nucleic acids;

### • ENZYMES

- **BIO.2.c** the nature of enzymes; and

## 2. CELL STRUCTURE AND FUNCTION

### • PROKARYOTIC AND EUKARYOTIC CELLS

- **BIO.3.a** evidence supporting the cell theory;
- **BIO.3.b** characteristics of prokaryotic and eukaryotic cells;
- **BIO.3.d** the cell membrane model; and
- **BIO.3.c** similarities between the activities of the organelles in a single cell and a whole organism;
- **BIO.5.a** cell growth and division;
- **BIO.4.b** maintenance of homeostasis;
- **BIO.4.c** how the structures and functions vary among and within the Eukarya kingdoms of protists, fungi, plants, and animals, including humans;

### • PLANT AND ANIMAL CELLS

- **BIO.3.b** characteristics of prokaryotic and eukaryotic cells;
- **BIO.3.c** similarities between the activities of the organelles in a single cell and a whole organism;

- **PASSIVE TRANSPORT**

- **BIO.3.b** characteristics of prokaryotic and eukaryotic cells;
- **BIO.3.c** similarities between the activities of the organelles in a single cell and a whole organism;
- **BIO.3.d** the cell membrane model; and
- **BIO.3.e** the impact of surface area to volume ratio on cell division, material transport, and other life processes.
- **BIO.4.b** maintenance of homeostasis;
- **BIO.2.a** water chemistry and its impact on life processes;

- **ACTIVE TRANSPORT**

- **BIO.3.b** characteristics of prokaryotic and eukaryotic cells;
- **BIO.3.d** the cell membrane model; and
- **BIO.3.e** the impact of surface area to volume ratio on cell division, material transport, and other life processes.
- **BIO.4.b** maintenance of homeostasis;

### 3. CELLULAR ENERGETICS

- **PHOTOSYNTHESIS**

- **BIO.2.d** the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.
- **BIO.3.c** similarities between the activities of the organelles in a single cell and a whole organism;

- **CELLULAR RESPIRATION**

- **BIO.2.d** the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.
- **BIO.3.b** characteristics of prokaryotic and eukaryotic cells;
- **BIO.3.c** similarities between the activities of the organelles in a single cell and a whole organism;

### 4. CELL GROWTH AND REPRODUCTION

- **THE CELL CYCLE**

- **BIO.5.a** cell growth and division;
- **BIO.5.g** the structure, function, and replication of nucleic acids;
- **BIO.3.e** the impact of surface area to volume ratio on cell division, material transport, and other life processes.
- **BIO.4.d** human health issues, human anatomy, and body systems;
- **BIO.5.c** cell specialization;

- **MITOSIS**

- **BIO.5.a** cell growth and division;

### 5. DNA STRUCTURE AND FUNCTION

- **COMPONENTS OF DNA**

- **BIO.5.g** the structure, function, and replication of nucleic acids;
- **BIO.2.b** the structure and function of macromolecules;
- **BIO.5.e** historical development of the structural model of DNA;

- **THE GENETIC CODE**

- **BIO.5.g** the structure, function, and replication of nucleic acids;
- **BIO.5.h** events involved in the construction of proteins;

- **BIO.5.j** exploration of the impact of DNA technologies.
- **BIO.1.m** current applications of biological concepts are used.
- **BIO.5.i** use, limitations, and misuse of genetic information; and

- **DNA REPLICATION**

- **BIO.5.g** the structure, function, and replication of nucleic acids;

## 6. GENE EXPRESSION

- **T RANSCRIPTION**

- **BIO.2.b** the structure and function of macromolecules;
- **BIO.5.g** the structure, function, and replication of nucleic acids;
- **BIO.5.h** events involved in the construction of proteins;

- **T RANSLATION**

- **BIO.5.g** the structure, function, and replication of nucleic acids;
- **BIO.5.h** events involved in the construction of proteins;
- **BIO.2.c** the nature of enzymes; and

## 7. MUTATIONS

- **GENETIC CHANGES IN DNA**

- **BIO.4.d** human health issues, human anatomy, and body systems;
- **BIO.5.f** genetic variation;
- **BIO.5.i** use, limitations, and misuse of genetic information; and

- **GENETIC CHANGES IN CHROMOSOMES**

- **BIO.5.g** the structure, function, and replication of nucleic acids;
- **BIO.5.f** genetic variation;
- **BIO.5.i** use, limitations, and misuse of genetic information; and
- **BIO.5.j** exploration of the impact of DNA technologies.
- **BIO.1.m** current applications of biological concepts are used.
- **BIO.4.d** human health issues, human anatomy, and body systems;

## 8. HEREDITY

- **MENDELIAN LAWS OF HEREDITY**

- **BIO.1.g** validity of data is determined;
- **BIO.5.d** prediction of inheritance of traits based on the Mendelian laws of heredity;
- **BIO.5.f** genetic variation;
- **BIO.1.d** graphing and arithmetic calculations are used as tools in data analysis;
- **BIO.1.e** conclusions are formed based on recorded quantitative and qualitative data;

- **MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE**

- **BIO.5.d** prediction of inheritance of traits based on the Mendelian laws of heredity;

## 9. REPRODUCTION

- **SEXUAL AND ASEQUAL REPRODUCTION**

- **BIO.7.b** how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;

- **BIO.5.b** gamete formation;
- **BIO.5.f** genetic variation;

- **MEIOSIS**

- **BIO.5.b** gamete formation;
- **BIO.5.d** prediction of inheritance of traits based on the Mendelian laws of heredity;
- **BIO.5.f** genetic variation;
- **BIO.7.b** how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;

## 10. EVOLUTION

- **MULTIPLE LINES OF EVIDENCE**

- **BIO.6.b** fossil record interpretation;
- **BIO.7.a** evidence found in fossil records;
- **BIO.7.e** scientific evidence and explanations for biological evolution.
- **BIO.6.a** structural similarities among organisms;
- **BIO.6.c** comparison of developmental stages in different organisms;
- **BIO.6.d** examination of biochemical similarities and differences among organisms; and

- **THE FOSSIL RECORD**

- **BIO.6.b** fossil record interpretation;
- **BIO.7.a** evidence found in fossil records;
- **BIO.7.d** emergence of new species; and
- **BIO.7.e** scientific evidence and explanations for biological evolution.

## 11. MECHANISMS OF EVOLUTION

- **NATURAL SELECTION**

- **BIO.7.c** how natural selection leads to adaptations;
- **BIO.5.f** genetic variation;
- **BIO.7.b** how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;
- **BIO.7.e** scientific evidence and explanations for biological evolution.

- **EVOLUTION OF SPECIES**

- **BIO.6.b** fossil record interpretation;
- **BIO.7.d** emergence of new species; and
- **BIO.7.e** scientific evidence and explanations for biological evolution.
- **BIO.7.a** evidence found in fossil records;
- **BIO.7.c** how natural selection leads to adaptations;

## 12. CLASSIFICATION

- **TAXONOMY**

- **BIO.1.i** alternative scientific explanations and models are recognized and analyzed; and
- **BIO.5.j** exploration of the impact of DNA technologies.
- **BIO.6.a** structural similarities among organisms;
- **BIO.6.d** examination of biochemical similarities and differences among organisms; and
- **BIO.6.e** systems of classification that are adaptable to new scientific discoveries.
- **BIO.6.b** fossil record interpretation;
- **BIO.6.c** comparison of developmental stages in different organisms;

- **THE SIX KINGDOMS**

- **BIO.4.a** comparison of their metabolic activities;
- **BIO.4.c** how the structures and functions vary among and within the Eukarya kingdoms of protists, fungi, plants, and animals, including humans;
- **BIO.6.a** structural similarities among organisms;
- **BIO.6.c** comparison of developmental stages in different organisms;
- **BIO.6.d** examination of biochemical similarities and differences among organisms; and
- **BIO.4.b** maintenance of homeostasis;
- **BIO.6.e** systems of classification that are adaptable to new scientific discoveries.

### 13. FUNCTIONS OF ANIMAL SYSTEMS

- **HOMEOSTASIS AND DYNAMIC EQUILIBRIUM**

- **BIO.4.b** maintenance of homeostasis;
- **BIO.4.d** human health issues, human anatomy, and body systems;

- **THE IMMUNE AND LYMPHATIC SYSTEMS**

- **BIO.4.d** human health issues, human anatomy, and body systems;

- **THE NERVOUS SYSTEM**

- **BIO.4.d** human health issues, human anatomy, and body systems;
- **BIO.4.c** how the structures and functions vary among and within the Eukarya kingdoms of protists, fungi, plants, and animals, including humans;

### 14. CYCLES IN NATURE

- **THE CARBON CYCLE**

- **BIO.8.b** nutrient cycling with energy flow through ecosystems;
- **BIO.8.d** the effects of natural events and human activities on ecosystems; and

- **THE NITROGEN AND PHOSPHORUS CYCLES**

- **BIO.8.b** nutrient cycling with energy flow through ecosystems;
- **BIO.8.d** the effects of natural events and human activities on ecosystems; and

### 15. MATTER AND ENERGY

- **FOOD CHAINS AND WEBS**

- **BIO.8.b** nutrient cycling with energy flow through ecosystems;
- **BIO.8.d** the effects of natural events and human activities on ecosystems; and
- **BIO.8.a** interactions within and among populations including carrying capacities, limiting factors, and growth curves;

- **PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS**

- **BIO.8.b** nutrient cycling with energy flow through ecosystems;
- **BIO.1.d** graphing and arithmetic calculations are used as tools in data analysis;
- **BIO.1.e** conclusions are formed based on recorded quantitative and qualitative data;
- **BIO.8.a** interactions within and among populations including carrying capacities, limiting factors, and growth curves;

### 16. ECOLOGY OF SUCCESSION

- **SUCCESSION IN COMMUNITIES**

- **BIO.8.c** succession patterns in ecosystems;

- **BIO.8.d** *the effects of natural events and human activities on ecosystems; and*

- **NATURAL IMPACTS ON ECOSYSTEMS**

- **BIO.8.d** *the effects of natural events and human activities on ecosystems; and*

- **BIO.8.c** *succession patterns in ecosystems;*