

Topic: Basic Biological Principles

Days: 7

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

3.2.10.A - Important

Apply knowledge and understanding about the nature of scientific and technological knowledge.

- Compare and contrast scientific theories and beliefs.
- Know that science uses both direct and indirect observation means to study the world and the universe.
- Integrate new information into existing theories and explain implied results.

3.2.10.C - Important

Apply the elements of scientific inquiry to solve problems.

- Generate questions about objects, organisms and/or events that can be answered through scientific investigations.
- Evaluate the appropriateness of questions.
- Design an investigation with adequate control and limited variables to investigate a question.
- Conduct a multiple step experiment.
- Organize experimental information using a variety of analytic methods.
- Judge the significance of experimental information in answering the question.
- Suggest additional steps that might be done experimentally.

3.2.10.B - Important

Apply process knowledge and organize scientific and technological phenomena in varied ways.

- Describe materials using precise quantitative and qualitative skills based on observations.
- Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.
- Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.

3.3.10.A - Essential

Explain the structural and functional similarities and differences found among living things.

- Identify and characterize major life forms according to their placement in existing classification groups.
- Explain the relationship between structure and function at the molecular and cellular levels.
- Describe organizing schemes of classification keys.
- Identify and characterize major life forms by kingdom, phyla, class and order.

Topic: Biochemistry

Days: 14

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

S11.B.1.1.1 - Essential

Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological).

3.1.10.B - Important

Describe concepts of models as a way to predict and understand science and technology.

- Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).
- Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).
- Apply mathematical models to science and technology.

Topic: Cell Processes

Days: 49

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

S11.B.1.1.1 - Essential

Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological).

S11.B.1.1.2 - Essential

Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into existing classification groups, compare systems).

S11.B.1.1.3 - Essential

Compare and contrast cellular processes (e.g., photosynthesis and respiration, meiosis and mitosis, protein synthesis and DNA replication).

S11.B.2.2.2 - Essential

Compare and contrast the functions of mitosis and meiosis in passing on genetic information.

3.1.10.A - Important

Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.

- Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).
- Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.
- Explain the concept of system redesign and apply it to improve technological systems.
- Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.
- Analyze and describe the effectiveness of systems to solve specific problems.

3.1.10.B - Important

Describe concepts of models as a way to predict and understand science and technology.

- Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).
- Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).
- Apply mathematical models to science and technology.

3.1.10.C - Important

Apply patterns as repeated processes or recurring elements in science and technology.

- Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.
- Examine and describe stationary physical patterns.
- Examine and describe physical patterns in motion.

3.1.10.E - Important

Describe patterns of change in nature, physical and man made systems.

- Describe how fundamental science and technology concepts are used to solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, feedback systems).
- Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously).
- Describe the effects of error in measurements.
- Describe changes to matter caused by heat, cold, light or chemicals using a rate function.

3.2.10.A - Important

Apply knowledge and understanding about the nature of scientific and technological knowledge.

- Compare and contrast scientific theories and beliefs.
- Know that science uses both direct and indirect observation means to study the world and the universe.
- Integrate new information into existing theories and explain implied results.

3.2.10.B - Important

Apply process knowledge and organize scientific and technological phenomena in varied ways.

- Describe materials using precise quantitative and qualitative skills based on observations.
- Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.
- Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.

3.2.10.C - Important

Apply the elements of scientific inquiry to solve problems.

- Generate questions about objects, organisms and/or events that can be answered through scientific investigations.

Topic: Cell Processes

Days: 49

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

- Evaluate the appropriateness of questions.
- Design an investigation with adequate control and limited variables to investigate a question.
- Conduct a multiple step experiment.
- Organize experimental information using a variety of analytic methods.
- Judge the significance of experimental information in answering the question.
- Suggest additional steps that might be done experimentally.

3.3.10.B - Essential

Describe and explain the chemical and structural basis of living organisms.

- Describe the relationship between the structure of organic molecules and the function they serve in living organisms.
- Identify the specialized structures and regions of the cell and the functions of each.
- Explain how cells store and use information to guide their functions.
- Explain cell functions and processes in terms of chemical reactions and energy changes.

3.3.10.A - Essential

Explain the structural and functional similarities and differences found among living things.

- Identify and characterize major life forms according to their placement in existing classification groups.
- Explain the relationship between structure and function at the molecular and cellular levels.
- Describe organizing schemes of classification keys.
- Identify and characterize major life forms by kingdom, phyla, class and order.

Topic: Evolution

Days: 15

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

S11.B.2.1.1 - Important

Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, embryological studies, or DNA studies that are relevant to the theory of evolution.

S11.B.2.1.2 - Essential

Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population.

S11.B.2.1.3 - Essential

Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population.

S11.B.2.1.4 - Important

Explain why natural selection can act only on inherited traits.

3.1.10.A - Important

Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.

- Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).
- Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.
- Explain the concept of system redesign and apply it to improve technological systems.
- Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.
- Analyze and describe the effectiveness of systems to solve specific problems.

3.1.10.B - Important

Describe concepts of models as a way to predict and understand science and technology.

- Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).
- Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).
- Apply mathematical models to science and technology.

3.1.10.E - Important

Describe patterns of change in nature, physical and man made systems.

- Describe how fundamental science and technology concepts are used to solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, feedback systems).
- Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously).
- Describe the effects of error in measurements.
- Describe changes to matter caused by heat, cold, light or chemicals using a rate function.

3.3.10.A - Essential

Explain the structural and functional similarities and differences found among living things.

- Identify and characterize major life forms according to their placement in existing classification groups.
- Explain the relationship between structure and function at the molecular and cellular levels.
- Describe organizing schemes of classification keys.
- Identify and characterize major life forms by kingdom, phyla, class and order.

3.3.10.B - Essential

Describe and explain the chemical and structural basis of living organisms.

- Describe the relationship between the structure of organic molecules and the function they serve in living organisms.
- Identify the specialized structures and regions of the cell and the functions of each.
- Explain how cells store and use information to guide their functions.
- Explain cell functions and processes in terms of chemical reactions and energy changes.

3.3.10.D - Essential

Explain the mechanisms of the theory of evolution.

- Analyze data from fossil records, similarities in anatomy and physiology, embryological studies and DNA studies that are relevant to the theory of evolution.
- Explain the role of mutations and gene recombination in changing a population of organisms.
- Compare modern day descendants of extinct species and propose possible scientific accounts for their present appearance.
- Describe the factors (e.g., isolation, differential reproduction) affecting gene frequency in a population over time and their consequences.
- Describe and differentiate between the roles of natural selection and genetic drift.
- Describe changes that illustrate major events in the earth's development based on a time line.
- Explain why natural selection can act only on inherited traits.
- Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time.

(Ecosystem Standards are in the Environment and Ecology Standard Category (4.6).)

Topic: Interdependence of Life

Days: 10

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

S11.B.3.1.1 - Important
Explain the significance of diversity in ecosystems.

S11.B.3.1.2 - Important
Explain the biotic (i.e., plant, animal, and microbial communities) and abiotic (i.e., soil, air, temperature, and water) components of an ecosystem and their interaction.

S11.B.3.1.3 - Important
Describe how living organisms affect the survival of one another.

S11.B.3.1.4 - Important
Explain the similarities and differences in the major biomes (e.g., desert, tropical rain forest, temperate forest, coniferous forest, tundra) and the communities that inhabit them.

S11.B.3.1.5 - Important
Predict how limiting factors (e.g., physical, biological, chemical factors) can affect organisms.

S11.B.3.2.1 - Important
Use evidence to explain how cyclical patterns in population dynamics affect natural systems.

S11.B.3.2.2 - Important
Explain biological diversity as an indicator of a healthy environment.

S11.B.3.2.3 - Important
Explain how natural processes (e.g., seasonal change, catastrophic events, habitat alterations) impact the environment over time.

4.6.10.B - Important
Explain how cycles affect the balance in an ecosystem.

- Describe an element cycle and its role in an ecosystem.
- Explain the consequences of interrupting natural cycles.

4.6.10.C - Important
Analyze how ecosystems change over time.

- Identify and explain the succession stages in an ecosystem.
- Identify causes of succession.
- Analyze consequences of interrupting natural cycles.

4.7.10.A - Important
Explain the significance of diversity in ecosystems.

- Explain the role that specific organisms have in their ecosystem.
- Identify a species and explain what effects its increase or decline might have on the ecosystem.
- Identify a species and explain how its adaptations are related to its niche in the environment.

4.7.10.B - Important
Explain how structure, function and behavior of plants and animals affect their ability to survive.

- Describe an organism's adaptations for survival in its habitat.
- Compare adaptations among species.

4.7.10.C - Important
Identify and explain why adaptations can lead to specialization.

- Explain factors that could lead to a species' increase or decrease.
- Explain how management practices may influence the success of specific species.
- Identify and explain criteria used by scientists for categorizing organisms as threatened, endangered or extinct.

3.1.10.A - Important
Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.

- Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).
- Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.
- Explain the concept of system redesign and apply it to improve technological systems.

Topic: Interdependence of Life

Days: 10

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

- Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.
- Analyze and describe the effectiveness of systems to solve specific problems.

3.1.10.B - Important

Describe concepts of models as a way to predict and understand science and technology.

- Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).
- Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).
- Apply mathematical models to science and technology.

3.2.10.C - Important

Apply the elements of scientific inquiry to solve problems.

- Generate questions about objects, organisms and/or events that can be answered through scientific investigations.
- Evaluate the appropriateness of questions.
- Design an investigation with adequate control and limited variables to investigate a question.
- Conduct a multiple step experiment.
- Organize experimental information using a variety of analytic methods.
- Judge the significance of experimental information in answering the question.
- Suggest additional steps that might be done experimentally.

3.1.10.C - Important

Apply patterns as repeated processes or recurring elements in science and technology.

- Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.
- Examine and describe stationary physical patterns.
- Examine and describe physical patterns in motion.

Topic: Organisms and Diversity

Days: 30

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

S11.B.1.1.1 - Essential

Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological).

S11.B.1.1.2 - Essential

Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into existing classification groups, compare systems).

3.1.10.A - Important

Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.

- Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).
- Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.
- Explain the concept of system redesign and apply it to improve technological systems.
- Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.
- Analyze and describe the effectiveness of systems to solve specific problems.

3.1.10.B - Important

Describe concepts of models as a way to predict and understand science and technology.

- Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).
- Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).
- Apply mathematical models to science and technology.

3.1.10.C - Important

Apply patterns as repeated processes or recurring elements in science and technology.

- Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.
- Examine and describe stationary physical patterns.
- Examine and describe physical patterns in motion.

3.2.10.A - Important

Apply knowledge and understanding about the nature of scientific and technological knowledge.

- Compare and contrast scientific theories and beliefs.
- Know that science uses both direct and indirect observation means to study the world and the universe.
- Integrate new information into existing theories and explain implied results.

3.2.10.B - Important

Apply process knowledge and organize scientific and technological phenomena in varied ways.

- Describe materials using precise quantitative and qualitative skills based on observations.
- Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.
- Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.

3.3.10.A - Essential

Explain the structural and functional similarities and differences found among living things.

- Identify and characterize major life forms according to their placement in existing classification groups.
- Explain the relationship between structure and function at the molecular and cellular levels.
- Describe organizing schemes of classification keys.
- Identify and characterize major life forms by kingdom, phyla, class and order.

3.3.10.B - Essential

Describe and explain the chemical and structural basis of living organisms.

- Describe the relationship between the structure of organic molecules and the function they serve in living organisms.
- Identify the specialized structures and regions of the cell and the functions of each.
- Explain how cells store and use information to guide their functions.
- Explain cell functions and processes in terms of chemical reactions and energy changes.

Topic: Reproduction and Inheritance

Days: 30

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

S11.B.3.3.3 - Important

Explain the environmental benefits and risks associated with human-made systems (e.g., integrated pest management, genetically engineered organisms, organic food production).

S11.B.1.1.1 - Essential

Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological).

S11.B.1.1.2 - Essential

Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into existing classification groups, compare systems).

S11.B.1.1.3 - Essential

Compare and contrast cellular processes (e.g., photosynthesis and respiration, meiosis and mitosis, protein synthesis and DNA replication).

S11.B.2.1.2 - Essential

Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population.

S11.B.2.1.3 - Essential

Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population.

S11.B.2.2.1 - Essential

Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication).

S11.B.2.2.3 - Essential

Explain how different patterns of inheritance affect population variability. (i.e., multiple alleles, co-dominance, dominance, recessiveness, and sex-influenced traits).

3.1.10.A - Important

Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.

- Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).
- Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.
- Explain the concept of system redesign and apply it to improve technological systems.
- Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.
- Analyze and describe the effectiveness of systems to solve specific problems.

3.1.10.B - Important

Describe concepts of models as a way to predict and understand science and technology.

- Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).
- Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).
- Apply mathematical models to science and technology.

3.1.10.C - Important

Apply patterns as repeated processes or recurring elements in science and technology.

- Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.
- Examine and describe stationary physical patterns.
- Examine and describe physical patterns in motion.

3.1.10.E - Important

Describe patterns of change in nature, physical and man made systems.

- Describe how fundamental science and technology concepts are used to solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, feedback systems).
- Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously).
- Describe the effects of error in measurements.
- Describe changes to matter caused by heat, cold, light or chemicals using a rate function.

3.2.10.B - Important

Apply process knowledge and organize scientific and technological phenomena in varied ways.

- Describe materials using precise quantitative and qualitative skills based on observations.
- Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.
- Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.

Topic: Reproduction and Inheritance

Days: 30

Subject(s): Science

Grade(s): 9th, 10th, 11th, 12th

3.2.10.A - Important

Apply knowledge and understanding about the nature of scientific and technological knowledge.

- Compare and contrast scientific theories and beliefs.
- Know that science uses both direct and indirect observation means to study the world and the universe.
- Integrate new information into existing theories and explain implied results.

3.2.10.C - Important

Apply the elements of scientific inquiry to solve problems.

- Generate questions about objects, organisms and/or events that can be answered through scientific investigations.
- Evaluate the appropriateness of questions.
- Design an investigation with adequate control and limited variables to investigate a question.
- Conduct a multiple step experiment.
- Organize experimental information using a variety of analytic methods.
- Judge the significance of experimental information in answering the question.
- Suggest additional steps that might be done experimentally.

3.3.10.B - Essential

Describe and explain the chemical and structural basis of living organisms.

- Describe the relationship between the structure of organic molecules and the function they serve in living organisms.
- Identify the specialized structures and regions of the cell and the functions of each.
- Explain how cells store and use information to guide their functions.
- Explain cell functions and processes in terms of chemical reactions and energy changes.

3.3.10.C - Essential

Describe how genetic information is inherited and expressed.

- Compare and contrast the function of mitosis and meiosis.
- Describe mutations' effects on a trait's expression.
- Distinguish different reproductive patterns in living things (e.g., budding, spores, fission).
- Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria).
- Explain the relationship among DNA, genes and chromosomes.
- Explain different types of inheritance (e.g., multiple allele, sex-influenced traits).
- Describe the role of DNA in protein synthesis as it relates to gene expression.