

Science

ADVANCED SCIENCE
ECOLOGY AND GENETICS/CELLULAR RESPIRATION
SEMESTER I

STANDARD 1
The student understands and uses scientific concepts and principles.

To meet this standard, the student will:

Benchmark ASI.1.1: Use properties to identify, describe, and categorize substances, materials, and objects

Indicators:

N/A

Benchmark ASI.1.2: Identify, describe, and categorize living things based on their characteristics

Indicators:

- ASI.1.2.1 Distinguish between living and non-living things
- ASI.1.2.2 Identify the principle characteristics used to classify living things
- ASI.1.2.3 Recognize basic characteristics of living things including cellular, biochemical and genetic characteristics
- ASI.1.2.4 Recognize the basic parts of cells
- ASI.1.2.5 Distinguish between animal, plant cells and bacterial cells
- ASI.1.2.6 Distinguish between carbohydrates, proteins, and key organic compounds by chemical composition
- ASI.1.2.7 Distinguish between characteristics which can and cannot be inherited
- ASI.1.2.8 Explain defining characteristics of various biomes
- ASI.1.2.9 Recognize and understand the importance of the following for life: the chemical characteristics of water and air, the structure and function of macromolecules, the nature of enzymes
- ASI.1.2.10 Classify living things using basic characteristics including structural similarities, developmental stages, protein similarities, and DNA sequences
- ASI.1.2.11 Examine and classify local flora and fauna

Benchmark ASI.1.3: Measure properties and characteristics

Indicators:

- ASI.1.3.1 Be able to properly use a microscope and other tools to obtain accurate information about objects and events
- ASI.1.3.2 Use multiple measures to derive a best value and range of uncertainty for measurements
- ASI.1.3.3 Use and manipulate different units of measurement

Key: 1, Discipline 1.1 Standard 1.1.1 Benchmark 1.1.1.1 Indicator

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Benchmark ASI.1.4: Recognize the components, structure, and organization of systems and the interconnections within and among them

Indicators:

- ASI.1.4.1 Recognize that reproduction is essential to the continuation of a species
- ASI.1.4.2 Recognize that characteristics of organisms are determined genetically and influenced environmentally
- ASI.1.4.3 Describe the components of cells and their functions
- ASI.1.4.4 Explain the organizational hierarchy from cells, tissues, organs, and systems, up to organisms (with special emphasis on human systems and the human organism)
- ASI.1.4.5 Understand the processes of cell division and sex cell formation
- ASI.1.4.6 Predict the inheritance of traits based on the laws of heredity
- ASI.1.4.7 Explain matter and energy cycles in nature
- ASI.1.4.8 Describe how balance among producers, consumers, and decomposers is achieved and how it affects ecosystems
- ASI.1.4.9 Recognize that each organism is suited for survival in a particular environment
- ASI.1.4.10 Understand that the term evolution refers to gradual changes in characteristics over time
- ASI.1.4.11 Investigate how variation of traits, reproductive strategies, and environmental pressures impact the survival of populations and the emergence of new species
- ASI.1.4.12 Identify the basic needs of living things
- ASI.1.4.13 Describe how the structural and functional body systems of organisms operate to keep the organism alive
- ASI.1.4.14 Understand that traits and patterns of development are specified by hereditary information contained in genes

Benchmark ASI.1.5: Understand that interactions within and among systems cause changes in matter and energy

Indicators:

- ASI.1.5.1 Explain how reproduction, death, and the interdependence of organisms and their environment are involved in the process of extinction
- ASI.1.5.2 Understand interactions within and among populations including carrying capacities, limiting factors, and growth curves
- ASI.1.5.3 Understand the biotic factors which can affect the environment
- ASI.1.5.4 Investigate processes of diffusion, osmosis, and active transport
- ASI.1.5.5 Explain the interaction among nutrient cycles, energy from the sun, photosynthesis, respiration, and the energy needs of living organisms
- ASI.1.5.6 Research the scientific, technological, and mathematical knowledge and training requirements in career fields
- ASI.1.5.7 Identify an educational pathway which meets personal interest, aspirations, and abilities

Benchmark ASI.1.6: Construct and use models to predict, test, and understand scientific phenomena

Indicators:

- ASI.1.6.1 Construct and interpret scale drawings and three-dimensional models of biological systems
- ASI.1.6.2 Identify limitations of various models
- ASI.1.6.3 Understand how models serve as representations of objects, processes, or events

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STANDARD 2

The student conducts scientific investigations to expand understanding of the natural world.

To meet this standard, the student will:

Benchmark ASI.2.1: Plan and implement scientific investigations

Indicators:

- ASI.2.1.1 Distinguish between an observation and an inference
- ASI.2.1.2 Draw inferences based on observations
- ASI.2.1.3 Develop questions and testable hypotheses in response to observations
- ASI.2.1.4 Use appropriate tools to collect data and test a hypothesis
- ASI.2.1.5 Plan and conduct a controlled experiment, individually and collaboratively
- ASI.2.1.6 Develop and communicate descriptions, results, explanations, conclusions, and models from evidence
- ASI.2.1.7 Understand and follow proper safety procedures

Benchmark ASI.2.2: Think logically, analytically, and creatively

Indicators:

- ASI.2.2.1 Approach questions and problems using several different strategies
- ASI.2.2.2 Distinguish between evidence, explanation, and opinion
- ASI.2.2.3 Make predictions and create explanations by drawing inferences and recognizing patterns and relationships (especially mathematical relationships)
- ASI.2.2.4 Describe the thought process associated with a particular series of actions

Benchmark ASI.2.3: Practice the principles of scientific inquiry

Indicators:

- ASI.2.3.1 Recognize the role of science as a way of looking at the world
- ASI.2.3.2 Evaluate and modify processes of investigation
- ASI.2.3.3 Accurately record and report a series of observations
- ASI.2.3.4 Give proper credit to informative sources
- ASI.2.3.5 Explain the importance of openness, honesty, and skepticism in science
- ASI.2.3.6 Analyze a set of knowledge and recognize what is still unknown or unanswered
- ASI.2.3.7 Recognize the logical process of basing conclusions on evidence
- ASI.2.3.8 Recognize that scientific knowledge is always changing
- ASI.2.3.9 Recognize that observations can be influenced by faulty procedures and by the beliefs of the observer
- ASI.2.3.10 Recognize that scientific understanding can come from unexpected results
- ASI.2.3.11 Analyze basic assumptions held by scientists

Benchmark ASI.2.4: Understand the relationship between evidence and scientific explanation

Indicator:

- ASI.2.4.1 Understand that the process of science results from inventive acts of imagination, intelligence and logical inquiry which meet certain criteria of testability, consistency, and rules of evidence

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STANDARD 3

The student *applies science knowledge and skills to solve problems and meet challenges.*

To meet this standard, the student will:

Benchmark ASI.3.1: Identify problems and challenges in which science knowledge and skills can be applied

Indicators:

- ASI.3.1.1 Analyze a relevant problem or challenge which is related to science or technology
- ASI.3.1.2 Identify the components of the problem and criteria for a suitable solution

Benchmark ASI.3.2: Research, design, and test a variety of ways to address problems and/or challenges

Indicators:

- ASI.3.2.1 Use scientific tools and methods to individually and collaboratively research, design, test, and compare alternative solutions to a problem
- ASI.3.2.2 Conduct risk-benefit analyses, investigate trade-offs and constraints, and make predictions about the consequences of implementing various solutions to a problem

Benchmark ASI.3.3: Evaluate solutions and consequences

Indicator:

- ASI.3.3.1 Develop a written report which completely describes an experimental investigation

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STANDARD 4

The student uses effective communication skills and tools to build and demonstrate understanding of science.

To meet this standard, the student will:

Benchmark ASI.4.1: Use listening, observing, and reading skills to obtain scientific information

Indicators:

- ASI.4.1.1 Practice listening to and paraphrasing someone describing his/her own observations
- ASI.4.1.2 Read, understand, and summarize informative text

Benchmark ASI.4.2: Use writing and speaking skills to organize and express science ideas

Indicators:

- ASI.4.2.1 Construct, interpret, and utilize line graphs and other graphical displays of information
- ASI.4.2.2 Write informative reports that make use of formulas, symbols, diagrams, tables, and graphs
- ASI.4.2.3 Recognize, use, and be able to explain common science terms

Benchmark ASI.4.3: Use effective communication strategies and tools to prepare and present science information

Indicators:

- ASI.4.3.1 Utilize computer software and hardware to produce science products and conduct scientific research and investigations
- ASI.4.3.2 Recognize and interpret chemical equations
- ASI.4.3.3 Clearly present information as evidence to support a conclusion

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STANDARD 5

The student understands how science knowledge and skills are connected to other subject areas and real-life situations.

To meet this standard, the student will:

Benchmark ASI.5.1: Use mathematics to enhance scientific understanding

Indicator:

- ASI.5.1.1 Use statistical methods and estimation skills to make predictions and describe and analyze results

Benchmark ASI.5.2: Understand the relationship between science and technology

Indicators:

- ASI.5.2.1 Describe workplace situations which utilize scientific inquiry and technological design processes
- ASI.5.2.2 Explain the interdependence of science, technology, and public awareness

Benchmark ASI.5.3: Examine the relationship between science and history

Indicator:

- ASI.5.3.1 Research and describe how individual contributions, various tools and techniques, and different historical periods and events have influenced the development of science

Benchmark ASI.5.4: Examine the relationship among science, society, and the workplace

Indicators:

- ASI.5.4.1 Describe how the scientific enterprise is influenced by societal, environmental, economic, political, and ethical considerations
- ASI.5.4.2 Explain how the actions of humans can affect the environment and the supply of resources
- ASI.5.4.3 Recognize and explain some short-term and long-term consequences of science and technology

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STANDARD 6

The student understands how science knowledge carries with it responsibility for its application.

To meet this standard, the student will:

Benchmark ASI.6.1: Understand how science contributes to the treatment of diseases in the maintenance of a healthy lifestyle (Personal and Community Health)

Indicators:

- ASI.6.1.1 Identify the mechanisms for disease transmission
- ASI.6.1.2 Identify several pathogens
- ASI.6.1.3 Describe how HIV affects the immune system
- ASI.6.1.4 Describe how alcohol, tobacco and drugs affect the neural system
- ASI.6.1.5 Describe the neurochemistry of addiction

Benchmark ASI.6.2: Understand how the use of resources affects population growth and the global environment (Population)

Indicators:

- ASI.6.2.1 Describe how the management of resources directly affects populations
- ASI.6.2.2 Explain how the domestication of animals and plants has affected human population growth

Benchmark ASI.6.3: Understand the importance of maintaining resources and environmental quality (Environmental Quality/Resources)

Indicators:

- ASI.6.3.1 List at least three types of renewable resources
- ASI.6.3.2 List several primary pollutants and sources
- ASI.6.3.3 Analyze the impact of industrialization on the environment

Benchmark ASI.6.4: Understand the ethical issues inherent in scientific research (Ethics)

Indicators:

- ASI.6.4.1 Identify the components of credible scientific research
- ASI.6.4.2 Analyze the implications of current biological research in the areas of health and genetics
- ASI.6.4.3 Ensure experiments are performed without endangering animals
- ASI.6.4.4 Understand that the power of scientific knowledge carries with it ethical responsibilities as well

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