## Diagnostic Category Skills List

### Basic Biological Principles/Chemical Basis for Life

- Describe characteristics shared by all prokaryotic and eukaryotic organisms; characteristics include the ability to reproduce, ability to produce proteins, presence of certain cell structures, and the presence of genetic material.
- Describe relationships between cellular structures and functions in prokaryotes and eukaryotes and at various levels of biological organization.
- Describe how the unique properties of water (e.g., freezing point, high specific heat, cohesion) support life on Earth.
- Compare the structures and functions of biological macromolecules (carbohydrates, lipids, proteins, and nucleic acids) and describe their formation from carbon-based monomers.
- Describe how enzymes function in cells as catalysts in reactions and how enzymes are affected by their environmental conditions (e.g., temperature, pH).

### Theory of Evolution/Ecology

- Describe how populations can changes in response to natural selection, genetic mutations, and other factors that affect interactions of members of a population; natural selection includes the frequency of alleles in a population as a sign of genetic fitness, physical appearance that provides protection for organisms and the ability to adapt to a changing environment.
- Describe evidence supporting the theory of evolution (i.e., fossils, anatomical, physiological, embryological, biochemical, and universal genetic code).
- Distinguish between the scientific terms hypothesis, inference, law, theory, principle, fact, and observation.
- Describe the levels of ecological organization and recognize characteristic living and nonliving components of different ecosystems.
- Describe energy flow, organism interactions, cycling of matter, effects of limiting factors, and changes in response to disturbances within ecosystems; flow is demonstrated using energy webs and pyramids.

Additional Materials and Resources can be found at:

**http://www.pdesas.org/**

or

**https://pa.drcedirect.com/**

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CLASSROOM DIAGNOSTIC TOOLS

# Biology Course Summary and Diagnostic Category Skills List

The Biology summary describes the unifying themes upon which instructional time should be focused. The Big Ideas in Science describe practices that students should engage in throughout their learning in Science. The Diagnostic Category Skills List provides descriptions of skills that students can be expected to demonstrate within each Diagnostic Category while taking the Classroom Diagnostic Tools for Biology. While this list does not include every possible skill that students may encounter within the CDT, it does provide a representative sample for each diagnostic category. Additionally, science instruction should not address these as discrete skills but rather incorporate them with the Big Ideas in Science as a part of an integrated curriculum.

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## Biology Summary

In Biology, instructional time should focus on five unifying themes: (1) approaching science as a reliable and tentative way of knowing and explaining the natural world; (2) weighing evidence and use scientific approaches to ask questions, investigate, and make informed decisions; (3) making and use observations to analyze relationships and patterns in order to explain phenomena, develop models, and make predictions; (4) evaluating systems, in order to connect how form determines function and how any change to one component affects the entire system; (5) explaining how the natural and designed worlds are interrelated and the application of scientific knowledge and technology can have beneficial, detrimental, or unintended consequences.

## Big Ideas in Science

1. Develop and use system models.
2. Observe patterns to guide organization and classification and prompt questions which lead to investigations.
3. Investigate flow of energy and matter into, out of, and within systems.
4. Evaluate structures of living things and objects as they relate to their properties and functions.
5. Investigate cause and effect relationships to make predictions and explain events.
6. Design models to explore stability and change in systems.

## Bioenergetics/Homeostasis & Transport

- Describe the roles of cell structures involved in transforming energy; roles include the absorption of solar energy by chloroplasts and the production of ATP by mitochondria.
- Compare photosynthesis and cellular respiration and describe the role of ATP during cellular reactions; comparison includes identifying the reactants for photosynthesis ($CO_2$, $H_2O$) as the products for cellular respiration, and recognizing the energy produced during photosynthesis as ATP is utilized during cellular respiration.
- Describe the cell structures and mechanisms involved in the transport of materials into, out of, and within a cell; descriptions include the role of the plasma membrane in the movement of materials by diffusion, osmosis, facilitated diffusion and active transport into and out of cells.
- Explain how organisms maintain homeostasis; explanations include how systems interact with positive and negative feedback loops, such as sweating to help an organism lower their body temperature.

## Cell Growth & Reproduction/Genetics

- Describe the stages of the cell cycle (interphase, nuclear division, cytokinesis) and compare the processes and outcomes of mitotic and meiotic nuclear divisions; outcomes include the number of chromosomes in resulting cells and the effects of both processes on biodiversity.
- Explain how genetic information is inherited by describing DNA replication and the functional relationships between DNA, genes, alleles, and chromosomes.
- Describe patterns of inheritance and processes that alter an organism's chromosomes; descriptions include autosomal patterns, such as dominant, recessive, co-dominant and polygenic and sex-linked patterns; alteration include nondisjunction of chromosomes or crossing over of genetic information during replication.
- Describe the processes and cell structures involved in protein synthesis (i.e., transcription, translation, and protein modification).
- Describe possible impacts of genetic engineering in the fields of medicine, forensics, and agriculture.