

# **1. Unit 1- The Nature of Life (Life Science, Engineering Design) Copied from: Biology (Life Science), Copied on: 02/21/22**

Content Area: **Science**  
Course(s): **Biology**  
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## **Title Section**

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## **Department of Curriculum and Instruction**



**Belleville Public Schools**

**Curriculum Guide**

**Biology, High School**

**The Nature of Life**

**Belleville Board of Education**

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Board Approved: September 23, 2019

## **Unit Overview**

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Science is not a list of facts, but a way of knowing. Science is an organized method of evaluating evidence about the natural world. Scientific research reveals, rules and patterns that can explain, and predict some events in nature. To ensure that scientific knowledge is used for the benefit of society, we must all understand the nature of science. The study of Biology requires a thorough understanding of the nature of science, and the use of science practice to evaluate complex problems.

## **Enduring Understanding**

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- Science is not a list of facts, but a way of knowing.
- Observations, questions, and experiments are used to explain the natural world.
- Scientific research reveals, rules and patterns that can explain, and predict some events in nature.
- The study of Biology requires an understanding of the nature of science and science and engineering practices.
- There are millions of organisms on Earth, which share common characteristics, demonstrating both the unity and diversity of life.

## **Essential Questions**

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- Why is it essential that scientists share knowledge, collaborate, and build on each other's discoveries?
- What is the role of skepticism in scientific research?
- How does the hierarchy of biological organization illustrate emergent properties?
- What are the major themes of biology?
- What characteristics are shared by all living things?
- Why is the scientific method of investigation universally accepted?

## **Exit Skills**

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By the end of Unit 1 Biology Students should be able to

- Implement Scientific Methodology
- Explain how scientific attitudes help generate new ideas
- Learn the Engineering Design process and how it relates to the Scientific Method
- Recall characteristics of all living things

## **New Jersey Student Learning Standards (NJSL-S)**

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[NextGen Science Standards](#)

SCI.9-12.HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

|                   |  |
|-------------------|--|
| 9-12.HS-LS1       | From Molecules to Organisms: Structures and Processes  |
| 9-12.HS-LS1-3     | Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.   |
| 9-12.HS-LS1-2     | Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.   |
| 9-12.HS-LS1-2.2   | Developing and Using Models  |
| 9-12.HS-LS1-2.2.1 | Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.   |
| 9-12.HS-LS1-3.3   | Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.  |
| 9-12.HS-LS1-3.3.1 | Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. |
| 9-12.HS-LS1-1.6   | Constructing Explanations and Designing Solutions  |
| 9-12.HS-LS1-1.6.1 | Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.                        |

## Interdisciplinary Connections

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|                 |   |
|-----------------|---|
| LA.RH.9-10.2    | Determine the theme, central ideas, key information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.   |
| MA.S-IC.A       | Understand and evaluate random processes underlying statistical experiments   |
| LA.WHST.11-12.2 | Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.   |
| LA.WHST.11-12.5 | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.  |
| LA.WHST.11-12.7 | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  |
| LA.WHST.11-12.8 | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| LA.WHST.11-12.9 | Draw evidence from informational texts to support analysis, reflection, and research.   |

## Learning Objectives

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Students who understand the concepts are able to:

- State the goals of science.

- Describe the steps used in scientific methodology.
- Explain how scientific attitudes generate new ideas.
- Describe the importance of peer review.
- Explain what a scientific theory is.
- Explain the relationship between science and society.
- List the characteristics of living things.
- Identify the central themes of biology.
- Explain how life can be studied at different levels.
- Discuss the importance of a universal system of measurement.

**Action Verbs:** Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

| <b>Remember</b> | <b>Understand</b> | <b>Apply</b> | <b>Analyze</b> | <b>Evaluate</b> | <b>Create</b> |
|-----------------|-------------------|--------------|----------------|-----------------|---------------|
| Choose          | Classify          | Choose       | Categorize     | Appraise        | Combine       |
| Describe        | Defend            | Dramatize    | Classify       | Judge           | Compose       |
| Define          | Demonstrate       | Explain      | Compare        | Criticize       | Construct     |
| Label           | Distinguish       | Generalize   | Differentiate  | Defend          | Design        |
| List            | Explain           | Judge        | Distinguish    | Compare         | Develop       |
| Locate          | Express           | Organize     | Identify       | Assess          | Formulate     |
| Match           | Extend            | Paint        | Infer          | Conclude        | Hypothesize   |
| Memorize        | Give Examples     | Prepare      | Point out      | Contrast        | Invent        |
| Name            | Illustrate        | Produce      | Select         | Critique        | Make          |
| Omit            | Indicate          | Select       | Subdivide      | Determine       | Originate     |
| Recite          | Interrelate       | Show         | Survey         | Grade           | Organize      |
| Select          | Interpret         | Sketch       | Arrange        | Justify         | Plan          |
| State           | Infer             | Solve        | Breakdown      | Measure         | Produce       |
| Count           | Match             | Use          | Combine        | Rank            | Role Play     |
| Draw            | Paraphrase        | Add          | Detect         | Rate            | Drive         |
| Outline         | Represent         | Calculate    | Diagram        | Support         | Devise        |
| Point           | Restate           | Change       | Discriminate   | Test            | Generate      |
| Quote           | Rewrite           | Classify     | Illustrate     |                 | Integrate     |
| Recall          | Select            | Complete     | Outline        |                 | Prescribe     |
| Recognize       | Show              | Compute      | Point out      |                 | Propose       |
| Repeat          | Summarize         | Discover     | Separate       |                 | Reconstruct   |
| Reproduce       | Tell              | Divide       |                |                 | Revise        |
|                 | Translate         | Examine      |                |                 | Rewrite       |
|                 | Associate         | Graph        |                |                 | Transform     |
|                 | Compute           | Interpolate  |                |                 |               |
|                 | Convert           | Manipulate   |                |                 |               |
|                 | Discuss           | Modify       |                |                 |               |
|                 | Estimate          | Operate      |                |                 |               |
|                 | Extrapolate       | Subtract     |                |                 |               |
|                 | Generalize        |              |                |                 |               |
|                 | Predict           |              |                |                 |               |



### **Suggested Activities & Best Practices**

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- Surface Tension and Scientific Method Penny Lab
- Characteristics of Life Wheel Activity
- Is Yeast Alive Lab
- Conclusion Writing Practice
- Metric Measurement Lab
- Safety Contract
- Safety Quiz
- Lab Safety Scavenger Hunt

### **Assessment Evidence - Checking for Understanding (CFU)**

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Assessments Generated using ExamView Test Generator and Test Bank from Miller/Levine Biology 2017  
(Summative)

Common, Department Quarterly Benchmarks (Benchmark)

Oncourse Assessment Tools (Formative)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests

- Web-Based Assessments
- Written Reports

## **Primary Resources & Materials**

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Prentice Hall: Biology

Kenneth R Miller, Ph.D. - Joseph Levine, Ph.D. - New Jersey - Pearson Prentice Hall, Upper Saddle River - 2014, 2017

## **Ancillary Resources**

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- PearsonEasyBridge.com
- Chrome Book Projects/ Research/ Analysis
- Google Classroom
- On-line Databases via Media Center

## **Technology Infusion**

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- Creation of Characteristics of Life Powerpoint/ Prezi presentation
- Collaborative Document Editing using Google Docs



# Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts  
 Photostory 3  
 Kid Story Builder  
 Music Maker Jam  
 Paint A Story  
 Office 365  
 MS PowerPoint  
 Stack 'Em Up  
 NqSquared Numbers  
 Physamajig  
 Xylophone 8

Wikipedia  
 Skydrive  
 Lync  
 SkyMap  
 Skype  
 Office 365  
 Puzzle Touch  
 Easy QR  
 Memorylage  
 Life Moments  
 Word Cloud Maker

Where's Waldo?  
 MS Excel  
 Flipboard  
 Office 365  
 Nova Mindmapping

Ted Talks  
 Record Voice Pen



Originally taken from <http://www.coetail.com/vzimmer/files/2013/02/1Padagogy-Wheel.001.jpg>  
 And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

## **Alignment to 21st Century Skills & Technology**

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|-----------------|--|
| CRP.K-12.CRP4   | Communicate clearly and effectively and with reason.   |
| CRP.K-12.CRP8   | Utilize critical thinking to make sense of problems and persevere in solving them.   |
| CAEP.9.2.12.C.3 | Identify transferable career skills and design alternate career plans.   |
| TECH.8.1.12.B   | Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.   |
| TECH.8.1.12.C   | Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.                  |
| TECH.8.1.12.F   | Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. |

## **21st Century Skills/Interdisciplinary Themes**

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- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

## **21st Century Skills**

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- Civic Literacy
- Environmental Literacy
- Global Awareness
- Health Literacy

## **Differentiation**

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### **Differentiations:**

Students participate in jigsaw style activity to review characteristics of living things.

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

### **Hi-Prep Differentiations:**

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- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

### **Lo-Prep Differentiations**

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

### **Special Education Learning (IEP's & 504's)**

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Students are provided with written notes and digital copies of presentations, as well as hard copy and digital textbook access.

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan

- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

## **English Language Learning (ELL)**

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Students are provided with glossary in their native language.

Spanish speaking students may utilize Spanish Edition of Textbook for in class assignments.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

## **At Risk**

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Student provided access to digital learning tools via EasyBridge platform.

This should include virtual labs, presentations, videos, and practice questions.

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing

- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

## **Talented and Gifted Learning (T&G)**

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Students may design, run, and present experimental procedures to test hypothesis related to the characteristics of life.

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

## **Sample Lesson**

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**Unit Name:** The Nature of Science

**NJSLS: See Linked Standards**

**Interdisciplinary Connection: See Linked Standards**

**Statement of Objective:** Accurately communicate the procedure used for building a structure out of blocks (in writing), modeling the way scientists write procedures that can be replicated.

**Anticipatory Set/Do Now:**

Read the following excerpt and write a short five sentence response:

"Although Rosalind Franklin prompted the discovery of the double helix shape of D.N.A., with X-ray crystallography image, the credit and Nobel Prize was awarded to Watson and Crick. They used her work to eventually come up with the model with have today. Was this fair?"

**Learning Activity:**

1. Working with a partner behind a screen, assemble ten Lego blocks into an unusual structure. Write directions that others can use to replicate that structure, without ever seeing it.
2. Exchange directions with another team. Replicate their structure by following their directions.
3. Compare the replicated structures with the originals. Identify which parts of the directions were clear and accurate and which were unclear and misleading.

**Student Assessment/CFU's:**

Teacher Observation Checklist

**Materials:**

10 lego blocks per group, lined paper, table screens

**21st Century Themes and Skills: See Linked Standards**

**Differentiation/Modifications:**

(Process) Pair Kinesthetic learners with Auditory/ Visual Learners. Have the Kinesthetic learner build the original structure, and the partner, write the procedure. When exchanging the procedure sheets, have the students switch roles and have the Auditory/ Visual learner build the replicate, while the Kinesthetic learner reads the directions aloud.

**Integration of Technology:**

Ted Talks/ Ted Ed- lessons worth sharing

<http://www.ed.ted.com>

**"Following Directions with Goofy"**

Summary: Accurate communication is important in science as is collaboration. That includes not only writing directions well, so that results of experiments can be replicated and validated, but also "following directions", in a precise way. This puts just as much responsibility on the person on the receiving end.

LA.RST.9-10.3

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CRP.K-12.CRP2

Apply appropriate academic and technical skills.

CRP.K-12.CRP4

Communicate clearly and effectively and with reason.

SCI.9-12.HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.