Mastering the Arkansas Biology End-of-Course Exam
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## To the Student

Welcome to the Student Edition of *Mastering the Arkansas Biology End-of-Course Exam*.

### Task Regimen

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<th>Task</th>
<th>At-Home Assignment</th>
<th>In-Class Assignment</th>
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<tr>
<td>Task 1</td>
<td>Using an answer key from the teacher, locate and review any questions you missed. Place a question mark beside any question you do not understand, and bring it to class for discussion.</td>
<td>The teacher administers the test in a realistic test-taking environment.</td>
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<tr>
<td>Task 2</td>
<td>For each question you missed, find the pages in the textbook that cover the material and explain what specific information was needed to answer the question correctly. If you cannot find any helpful information in the textbook, write out three questions you have about the test question.</td>
<td>Work in a group to discuss any confusing questions and content areas. Then work through the confusing questions together.</td>
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<td>Task 3</td>
<td>For every incorrect question, go through each answer choice and explain why it is correct or incorrect. Include any tips or hints you noticed that helped you eliminate choices. Place a question mark beside any question you do not understand, and bring it to class for discussion.</td>
<td>Your teacher will lead a discussion for each question. Share your ideas and observations with the class. Keep notes of the discussion to help you review.</td>
</tr>
<tr>
<td>Task 4</td>
<td>Your teacher will provide you with a list of questions to practice. For each question, make observations and write down all of the information given in the test in the form of a graphic, a passage, or otherwise. Write the information directly on the test.</td>
<td>Work in a group to discuss each question. Make sure to note the location in the textbook where helpful information was found.</td>
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</table>
Test-Taking Tips: Student

Before the Test

- Be sure to get plenty of sleep the week before the test. A healthy amount of sleep is eight to nine hours every night.
- On the night before the test, try to do something relaxing but stimulating, such as playing a board game, exercising, or reading an enjoyable book. Cramming the night before the test can often hamper your memory and make you tired.
- On the morning of the test, eat a healthy breakfast with fresh foods that are high in protein and carbohydrates.
- On the morning of the test, clear your mind of any outside distractions so that you will be better able to focus on the test. If breaks are given during the test, use that time to relax and clear your mind.

During the Test

- Listen to and read all directions.
- Be sure you understand the question before reading the answer choices. Then, make sure to read and consider every answer choice.
- Remember to carefully consider all the information presented in the test’s graphics.
- If the test is timed, be sure to pace yourself.
- Always choose an answer. By eliminating as many incorrect choices as possible, you will have a good chance of guessing correctly and obtaining more points.
Strand: Molecules and Cells

Standard 1: Students shall demonstrate an understanding of the role of chemistry in life processes.

| MC.1.B.1 | Describe the structure and function of the major organic molecules found in living systems: |
|ventus | - carbohydrates |
|ventus | - lipids |
|ventus | - proteins |
|ventus | - nucleic acids |
|ventus | - enzymes |
|ventus | - surface tension |
|ventus | - adhesion |
|ventus | - cohesion |
|ventus | - polarity |
|ventus | - pH |

## Standard 2: Students shall demonstrate an understanding of the structure and function of cells.

| MC.2.B.1 | Construct a hierarchy of life from cells to ecosystems |
|ventus | - prokaryotes |
|ventus | - eukaryotes |
|ventus | - organelles |
|ventus | - ribosomes |
|ventus | - cytoskeleton |
|ventus | - plasma (cell) membrane |
|ventus | - active transport |
|ventus | - exocytosis |
|ventus | - osmosis |
|ventus | - diffusion |
|ventus | - endocytosis |
|ventus | - endocytosis |
|ventus | - exocytosis |
|ventus | - phagocytosis |
|ventus | - pinocytosis |
|ventus | - mitosis |
|ventus | - cytokinesis |
|ventus | - interphase |
|ventus | - metaphase |
|ventus | - anaphase |
|ventus | - telophase |
|ventus | - telophase |

MC.2.B.11 Discuss homeostasis using thermoregulation as an example
**Strand: Molecules and Cells (continued)**

<table>
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<th>Standard 3: Students shall demonstrate an understanding of how cells obtain and use energy (energetics).</th>
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<td><strong>MC.3.B.1</strong> Compare and contrast the structure and function of <em>mitochondria</em> and <em>chloroplasts</em></td>
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</table>
| **MC.3.B.2** Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP):  
  - *glycolysis*  
  - *citric acid cycle*  
  - *electron transport chain* |
| **MC.3.B.3** Compare and contrast *aerobic* and *anaerobic respiration*:  
  - *lactic acid fermentation*  
  - *alcoholic fermentation* |
| **MC.3.B.4** Describe and model the conversion of light energy to chemical energy by photosynthetic organisms:  
  - *light dependent reactions*  
  - *light independent reactions* |
| **MC.3.B.5** Compare and contrast *cellular respiration* and *photosynthesis* as energy conversion pathways |

**Strand: Heredity and Evolution**

<table>
<thead>
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<th>Standard 4: Students shall demonstrate an understanding of heredity.</th>
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<tr>
<td><strong>HE.4.B.1</strong> Summarize the outcomes of Gregor Mendel's experimental procedures</td>
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</table>
| **HE.4.B.2** Differentiate among the *laws* and *principles* of inheritance:  
  - *dominance*  
  - *segregation*  
  - *independent assortment* |
| **HE.4.B.3** Use the *laws* of probability and *Punnett squares* to predict *genotypic* and *phenotypic ratios* |
| **HE.4.B.4** Examine different modes of inheritance:  
  - *sex linkage*  
  - *incomplete dominance*  
  - *monosomy*  
  - *codominance*  
  - *multiple alleles*  
  - *trisomy*  
  - *crossing over* |
| **HE.4.B.5** Analyze the historically significant work of prominent geneticists |
| **HE.4.B.6** Evaluate *karyotypes* for abnormalities:  
  - *monosomy*  
  - *trisomy* |

**Standard 5: Students shall investigate the molecular basis of genetics.**

| HE.5.B.1 | Model the components of a *DNA* *nucleotide* and an *RNA* *nucleotide* |
| HE.5.B.2 | Describe the Watson-Crick *double helix model* of *DNA*, using the *base-pairing rule* (*adenine-thymine*, *cytosine-guanine*) |
| HE.5.B.3 | Compare and contrast the structure and function of *DNA* and *RNA* |
| HE.5.B.4 | Describe and model the processes of *replication*, *transcription*, and *translation* |
| HE.5.B.5 | Compare and contrast the different types of *mutation* events, including *point mutation*, *frameshift mutation*, *deletion*, and *inversion* |
| HE.5.B.6 | Identify effects of changes brought about by *mutations*:  
  - *beneficial*  
  - *harmful*  
  - *neutral* |
### Strand: Heredity and Evolution (continued)

**Standard 6: Students shall examine the development of the theory of biological evolution.**

| HE.6.B.1 | Compare and contrast Lamarck’s explanation of evolution with Darwin’s theory of evolution by natural selection |
| HE.6.B.2 | Recognize that evolution involves a change in allele frequencies in a population across successive generations |
| HE.6.B.3 | Analyze the effects of mutations and the resulting variations within a population in terms of natural selection |
| HE.6.B.4 | Illustrate mass extinction events using a time line |
| HE.6.B.5 | Evaluate evolution in terms of evidence as found in the following:
  - fossil record
  - DNA analysis
  - artificial selection
  - morphology
  - embryology
  - viral evolution
  - geographic distribution of related species
  - antibiotic and pesticide resistance in various organisms |
| HE.6.B.6 | Compare the processes of relative dating and radioactive dating to determine the age of fossils |
| HE.6.B.7 | Interpret a Cladogram |

### Strand: Classification and the Diversity of Life

**Standard 7: Students shall demonstrate an understanding that organisms are diverse.**

| CDL.7.B.1 | Differentiate among the different domains:
  - Bacteria
  - Archaea
  - Eukarya |
| CDL.7.B.2 | Differentiate the characteristics of the six kingdoms:
  - Eubacteria
  - Archaea
  - Protista
  - Fungi
  - Plantae
  - Animalia |
| CDL.7.B.3 | Identify the seven major taxonomic categories:
  - kingdom
  - phylum
  - class
  - order
  - family
  - genus
  - species |
| CDL.7.B.4 | Classify and name organisms based on their similarities and differences applying taxonomic nomenclature using dichotomous keys |
| CDL.7.B.5 | Investigate Arkansas’ biodiversity using appropriate tools and technology |
| CDL.7.B.6 | Compare and contrast the structures and characteristics of viruses (lytic and lysogenic cycles) with non-living and living things |
| CDL.7.B.7 | Evaluate the medical and economic importance of viruses |
| CDL.7.B.8 | Compare and contrast life cycles of familiar organisms
  - sexual reproduction
  - asexual reproduction
  - metamorphosis
  - alternation of generations |
| CDL.7.B.9 | Classify bacteria according to their characteristics and adaptations |
| CDL.7.B.10 | Evaluate the medical and economic importance of bacteria |
| CDL.7.B.11 | Describe the characteristics used to classify protists:
  - plant-like
  - animal-like
  - fungal-like |
### Standard 7: Students shall demonstrate an understanding that organisms are diverse.

| CDL.7.B.12 | Evaluate the medical and economic importance of protists |
| CDL.7.B.13 | Compare and contrast fungi with other eukaryotic organisms |
| CDL.7.B.14 | Evaluate the medical and economic importance of fungi |
| CDL.7.B.15 | Differentiate between vascular and nonvascular plants |
| CDL.7.B.16 | Differentiate among cycads, gymnosperms, and angiosperms |
| CDL.7.B.17 | Describe the structure and function of the major parts of a plant:  
  - roots  
  - stems  
  - leaves  
  - flowers |
| CDL.7.B.18 | Relate the structure of plant tissue to its function  
  - epidermal  
  - ground  
  - vascular |
| CDL.7.B.19 | Evaluate the medical and economic importance of plants |
| CDL.7.B.20 | Identify the symmetry of organisms:  
  - radial  
  - bilateral  
  - asymmetrical |
| CDL.7.B.21 | Compare and contrast the major invertebrate classes according to their nervous, respiratory, excretory, circulatory, and digestive systems |
| CDL.7.B.22 | Compare and contrast the major vertebrate classes according to their nervous, respiratory, excretory, circulatory, digestive, reproductive, and integumentary systems |

### Strand: Ecology and Behavioral Relationships

| EBR.8.B.1 | Cite examples of abiotic and biotic factors of ecosystems |
| EBR.8.B.2 | Compare and contrast the characteristics of biomes |
| EBR.8.B.3 | Diagram the carbon, nitrogen, phosphate, and water cycles in an ecosystem |
| EBR.8.B.4 | Analyze an ecosystem’s energy flow through food chains, food webs, and energy pyramids |
| EBR.8.B.5 | Identify and predict the factors that control population, including predation, competition, crowding, water, nutrients, and shelter |
| EBR.8.B.6 | Summarize the symbiotic ways in which individuals within a community interact with each other:  
  - commensalism  
  - parasitism  
  - mutualism |
| EBR.8.B.7 | Compare and contrast primary succession with secondary succession |
| EBR.8.B.8 | Identify the properties of each of the five levels of ecology:  
  - organism  
  - population  
  - community  
  - ecosystem  
  - biosphere |
### Strand: Ecology and Behavioral Relationships (continued)

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### Strand: Nature of Science

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<td><strong>NS.10.B.3</strong></td>
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| **NS.10.B.4** | Summarize the guidelines of science:  
  - explanations are based on observations, evidence, and testing  
  - hypotheses must be testable  
  - understandings and/or conclusions may change with additional empirical data  
  - scientific knowledge must have peer review and verification before acceptance |

### Standard 11: Students shall design and safely conduct scientific inquiry.

| NS.11.B.1 | Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation |
| NS.11.B.2 | Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations |
| NS.11.B.3 | Identify sources of bias that could affect experimental outcome |
| NS.11.B.4 | Gather and analyze data using appropriate summary statistics |
| NS.11.B.5 | Formulate valid conclusions without bias |
| NS.11.B.6 | Communicate experimental results using appropriate reports, figure, and tables |

### Standard 12: Students shall demonstrate an understanding of current life science theories.

| NS.12.B.1 | Recognize that theories are scientific explanations that require empirical data, verification, and peer review |
| NS.12.B.2 | Understand that scientific theories may be modified or expanded based on additional empirical data, verification, and peer review |
| NS.12.B.3 | Summarize *biological evolution* |
| NS.12.B.4 | Relate the development of the *cell theory* to current trends in cellular biology |
| NS.12.B.5 | Describe the relationship between the *germ theory of disease* and our current knowledge of immunology and control of infectious diseases |
| NS.12.B.6 | Relate the *chromosome theory of heredity* to recent findings in genetic research (e.g., *Human Genome Project-HGP*, chromosome therapy) |
| NS.12.B.7 | Research current events and topics in biology |
### Standard 13: Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.

| NS.13.B.1 | Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables |
| NS.13.B.2 | Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware) |
| NS.13.B.3 | Utilize technology to communicate research findings |

### Standard 14: Students shall describe the connections between pure and applied science.

| NS.14.B.1 | Compare and contrast biological concepts in pure science and applied science |
| NS.14.B.2 | Discuss why scientists should work within ethical parameters |
| NS.14.B.3 | Evaluate long-range plans concerning resource use and by-product disposal for environmental, economic, and political impact |
| NS.14.B.4 | Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology |

### Standard 15: Students shall describe various life science careers and the training required for the selected career.

| NS.15.B.1 | Research and evaluate science careers using the following criteria:  
* educational requirements  
* salary  
* availability of jobs  
* working conditions |
### Student Recording Chart

**Directions:** Circle each question from the Diagnostic Test that you answered *incorrectly*. If there are one or two circles marked for an indicator, write *Yes* in the *Need Practice?* box. Then complete the practice pages for that indicator.

#### Standard 1

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<tr>
<th>Indicator</th>
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### Standard 4

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#### Need Practice?  
Practice Pages: 47, 94 48, 95 48, 95 49, 96 49, 96 50, 97

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#### Need Practice?  
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#### Need Practice?  
Practice Pages: 53, 101 53, 101 54, 102

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#### Need Practice?  
Practice Pages: 54, 102 54, 103 55, 103 56, 104

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#### Need Practice?  
Practice Pages: 56, 104
Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

1. A food pyramid is one way of showing how much energy flows from one level to another in an ecosystem. Based on the pyramid below, which organism has the most energy available to it? **EBR.8.B.4**

   ![Food Pyramid Diagram]

   A. grass  
   B. grasshopper  
   C. owl  
   D. starling

2. A neutral genetic mutation might **HE.5.B.6**
   A. increase the survival chance of an organism.  
   B. cause a cell to die.  
   C. stop protein synthesis.  
   D. none of the above

3. Which classification category is the least inclusive? **CDL.7.B.3**
   A. class  
   B. family  
   C. genus  
   D. phylum

4. How does increased demand for humans’ housing primarily affect wild animals in the environment? **EBR.9.B.1**
   A. There will be more carbon dioxide in the atmosphere.  
   B. Animals have a greater risk of being struck by an automobile.  
   C. The animals’ habitat might be destroyed.  
   D. Animals might find themselves in competition with domesticated cats and dogs.

5. How might the fossil record show that an organism changed over time? **HE.6.B.5**
   A. The species changed in each successive rock layer.  
   B. The species remained unchanged throughout the rock layers.  
   C. The species disappeared from one rock layer and reappeared in a successive rock layer.  
   D. The species completely disappeared from the rock layers.

6. What do scientists think causes the differences among members of a population? **NS.12.B.3**
   A. artificial selection  
   B. biological evolution  
   C. passive transport  
   D. relative dating

7. Which detrimental event can be brought about by a protist? **CDL.7.B.12**
   A. drought  
   B. hurricane  
   C. Lyme disease  
   D. potato blight
8. Carbohydrates are important molecules in all living things. Which group of elements is found in all carbohydrates? **MC.1.B.1**
   A. calcium, carbon, potassium
   B. carbon, hydrogen, oxygen
   C. hydrogen, nitrogen, phosphorus
   D. nitrogen, oxygen, sulfur

9. In the early 1990s, the Hubble Space Telescope began receiving data from objects in the universe. Which did the Hubble Space Telescope help scientists learn? **NS.13.B.2**
   A. what makes stars shine
   B. distances to far-off galaxies
   C. the existence of nine planets in our solar system
   D. the presence of the asteroid belt in our solar system

10. Why might a scientist sometimes have to formulate a new hypothesis after conducting an experiment? **NS.12.B.2**
    A. The data might lead her to believe that her original hypothesis is incorrect.
    B. Fellow scientists might have intimidated her.
    C. An article in a science magazine supported another theory.
    D. Her assistant told her the hypothesis was wrong.

11. Which are cone-bearing plants? **CDL.7.B.16**
    A. angiosperms
    B. ferns
    C. gymnosperms
    D. liverworts

12. A whale with baleen plates, no longitudinal folds of skin running from below the mouth back to the navel, and a white gumline is classified as **CDL.7.B.4**

**Dichotomous Key: Cetacea**
A1. Teeth............................................ B (Odontoceti)
A2. Baleen plates ......................... C (Mysticeti)
B. Odontoceti

**Mysticeti**
C1. Series of longitudinal folds of skin running from below the mouth back to the navel present.......................... E (Balaenopteridae)
C2. Not present........................................................ D
D1. Gumline is white (Caperea marginata)
D2. Gumline is other color ......................................F

**Balaenopteridae**
E1. Hump on back (Magaptera novaeangliae)
E2. Hump on back not present (Balaenoptera)

F1. Numerous callosities (Eubalaena)
F2. Few callosities (Eschrichtius robustus)
    A. Balaenoptera.
    B. Balaenopteridae.
    C. *Caperea marginata*.
    D. Odontoceti.

13. Preservation of food for storage is based on **NS.12.B.5**
    A. the germ theory of sterilization.
    B. frameshift mutation.
    C. the lysogenic cycle.
    D. natural selection.
14. A biochemist is performing an experiment to determine the effects of Chemical X on the growth of bacteria. Which test tube is the control? **NS.11.B.1**

- A. 1
- B. 2
- C. 3
- D. 4

15. A scientist thinks he has discovered a reliable way to predict earthquakes. What step should the scientist take next? **NS.12.B.1**

- A. Describe the evidence to other geologists to spread the news faster.
- B. Notify the media about the discovery so that they can warn people.
- C. Educate the community in earthquake-prone areas about preparedness.
- D. Report to the scientific community so that the results can be retested.

16. Which type of organic molecule is an enzyme? **MC.1.B.2**

- A. carbohydrate
- B. lipid
- C. nucleic acid
- D. protein

17. A road is built through a swamp, dividing it into two separate areas. What is one effect of the division on the swamp ecosystem? **EBR.9.B.3**

- A. Increased carbon dioxide from cars increases photosynthesis rates.
- B. A division creates a new edge that will be the source of increased biodiversity.
- C. The division diminishes the ecosystem by only a few acres, so it will not have much effect.
- D. The division creates a barrier, reducing the ecosystem’s available resources and breeding possibilities.


- A. Viruses affect only humans, never animals.
- B. Viruses produce nontreatable symptoms.
- C. Antibiotics provide protection before an infection is contracted.
- D. Vaccines provide protection before an infection is contracted.
19. A student drew and labeled the graph below based on the results of an experiment. Why did the student include the labels activation energy and heat of reaction? **MC.1.B.4**

**Chemical Reaction Diagram**

A. to get a better grade on his experiment  
B. to show that the reaction needed heat in order to occur  
C. to explain why the experiment gave off heat  
D. to explain why methane and oxygen react to form carbon dioxide and water

20. One difference between mitochondria and chloroplasts is that chloroplasts get their color from **MC.3.B.1**

A. chlorine.  
B. chlorophyll.  
C. sodium chloride.  
D. their inner membrane.

21. Which best describes a plasma (cell) membrane’s structure? **MC.2.B.4**

A. protein layer  
B. carbohydrate layer with embedded protein molecules  
C. lipid bilayer  
D. carbohydrate-protein bilayer

22. Which is an example of a light-dependent reaction? **MC.3.B.4**

A. cellular respiration  
B. electron transport chain  
C. lactic-acid fermentation  
D. photosynthesis


A. They help fix nitrogen gas in the air.  
B. They are essential mulching material in fertilizers.  
C. They digest petroleum and other waste products in water.  
D. They kill species through disease, allowing other species to move into that niche.

24. How do fungi differ from plants? **CDL.7.B.13**

A. Fungi lack a cell wall.  
B. Fungi lack chlorophyll.  
C. Fungi lack a nucleus.  
D. Fungi need nutrients in order to grow.

25. Someone who enjoys studying physiology and is in superb physical condition might best consider a career as a **NS.15.B.1**

A. firefighter.  
B. genetic counselor.  
C. high-school biology teacher.  
D. mission-specialist astronaut.

26. RNA exists as a(n) **HE.5.B.3**

A. enzyme-substrate complex.  
B. single strand of nucleotides.  
C. double-stranded molecule.  
D. coiled protein strand.
27. Monosomy is usually lethal in humans, with only one survivable monosomic condition known to occur. How many chromosomes does a human with monosomy have?
   **HE.4.B.6**
   A. 1  
   B. 22  
   C. 45  
   D. 46

28. Which statement correctly compares plant cells and animal cells? **MC.2.B.5**
   A. Plant cells have no vacuole, but animal cells do.  
   B. Plant cells have ribosomes, but animal cells do not.  
   C. Both plant and animal cells have mitochondria.  
   D. Neither plant cells nor animal cells have a nucleus.

29. Epidermal tissue in plants is covered with a waxy layer. This helps protect the plant against **CDL.7.B.18**
   A. insects.  
   B. nitrogen loss.  
   C. water loss.  
   D. worms.

30. Which pair is ordered in the manner least complex / most complex? **MC.2.B.1**
   A. cnidarian / bacterium  
   B. fish / mollusk  
   C. fungus / virus  
   D. protist / fungus

31. Which is a biotic factor of an ecosystem? **EBR.8.B.1**
   A. plant that grows in the climate  
   B. amount of nitrogen in the soil in the ecosystem  
   C. amount of sunlight the area receives  
   D. overall temperature of the region

32. Which will probably not control the growth of bacteria? **CDL.7.B.9**
   A. exposure to air  
   B. exposure to disinfectants  
   C. freezing  
   D. high temperatures

33. In which type of ecological relationship do two organisms benefit from living together? **EBR.8.B.6**
   A. commensalism  
   B. competition  
   C. mutualism  
   D. parasitism

34. A dairy farm hires some scientists to study the effects of milk consumption on weight loss. The scientists find that milk consumption facilitates weight loss in humans. Why should other research groups test these results? **NS.11.B.3**
   A. The dairy farm scientists might have a bias.  
   B. The dairy farm scientists’ hypothesis is wrong.  
   C. All dairy products contain a high percentage of fat.  
   D. Dairy products are not traditionally associated with dieting.

35. In the nitrogen cycle, nitrogen is continuously being recycled. Which types of organisms break down nitrogen compounds in dead organisms and recycle them back into the soil? **EBR.8.B.3**
   A. worms  
   B. bacteria  
   C. green plants  
   D. plant-eating animals
36. What do all nucleotides have in common? **HE.5.B.1**
   A. nitrogenous base  
   B. DNA molecule  
   C. complex protein  
   D. three-carbon sugar

37. Which is a scientific theory? **NS.10.B.3**
   A. Green eyes are more attractive than blue eyes.  
   B. Traits are inherited from the organism’s parent(s).  
   C. Most people get their most desirable traits from their father.  
   D. The offspring of two show dogs will be a show dog as well.

38. Francis Crick, a Nobel prize winner and famous geneticist, studied how DNA bases determined the amino-acid sequence in proteins. This led to the **HE.4.B.5**
   A. discovery of the molecular formula for amino acids.  
   B. prediction of the mechanism for protein synthesis.  
   C. discovery of ribosomes.  
   D. theory that amino acids are a part of carbohydrates and lipids as well.

39. The study of proteins found in saliva indicates that saliva can be used to diagnose some diseases. The results of this study might lead to better methods of **NS.14.B.4**
   A. analyzing saliva.  
   B. making new proteins.  
   C. making artificial saliva.  
   D. determining the shape of protein molecules.

40. Gregor Mendel’s work with pea plants caused him to state that different versions of genes caused variations in inherited features. This supports the concept of **HE.4.B.1**
   A. alleles.  
   B. chromatids.  
   C. chromosomes.  
   D. RNA.

41. Black grasshoppers thrive in the wild, while green grasshoppers grow in limited numbers in the wild and near cultivated land. The two species are eaten by the same predators and compete for the same food source. As more land is converted to farmland, what will happen to the two populations? **HE.6.B.3**
   A. The black grasshoppers will outbreed the green grasshoppers.  
   B. The green grasshoppers will outnumber the black grasshoppers.  
   C. The black grasshoppers will find new wild lands in which to live.  
   D. Both grasshoppers will die out eventually from resource pressures.

42. Which organisms might one expect to find inside the Blanchard Springs Caverns? **CDL.7.B.5**
   A. bats, crickets, daddy longlegs, and Ozark blind salamanders  
   B. bats, sparrows, ladybugs, and toads  
   C. crickets, black widows, violets, and mushrooms  
   D. grubs, frogs, poison ivy, and deer
Diagnostic Test (continued)
Part 1

43. By definition, what is a prokaryote?
   MC.2.B.2
   A. bacterial cell having no digestive system
   B. bacterial cell having no excretory system
   C. bacterial cell containing no true mitochondrion
   D. bacterial cell containing no true nucleus

44. The cell theory has led to the current study of NS.12.B.4
   A. cloning.
   B. heart-valve replacement.
   C. microsurgery.
   D. recombinant DNA.

45. What is a well-known ovary of an angiosperm? CDL.7.B.19
   A. apple
   B. carrot
   C. potato
   D. radish

46. Which is a heterotroph? MC.2.B.6
   A. cyanobacterium
   B. fish
   C. tree
   D. virus

47. How do members of the domain Bacteria and members of the domain Eukarya differ? CDL.7.B.1
   A. All bacteria are unicellular; all eukarya are not.
   B. All bacteria lack a nucleus; all eukarya have one.
   C. All bacteria have cell walls; all eukarya do not.
   D. All bacteria are tiny; no eukarya are.

48. Which is a common usage of yeasts? CDL.7.B.14
   A. baking
   B. sweetening soft drinks
   C. thickening salad dressing
   D. topping salads

49. A scientist wants to present her animated model of how cancer cells divide to a group of other scientists. Which equipment would be most helpful during her presentation?
   NS.13.B.3
   A. microphone with a podium
   B. overhead projector with transparencies
   C. large monitor with computer and video compatibility
   D. carousel slide projector with 35-mm microscope slides

50. In an organism of $2n$ chromosomes, how many chromosomes does a cell have after meiotic division? MC.2.B.10
   A. $n$
   B. $2n$
   C. $2n + 1$
   D. $4n$

51. Which would best be described given the mode of a set of data? NS.11.B.4
   A. the highest grade achieved on a test in a class
   B. how students differed in scores when taking a test
   C. the average number of correct answers achieved on a test in a class
   D. how most students scored on a test in a class
52. Which type of protist is similar to a plant? \textit{CDL.7.B.11}
   A. amoeba
   B. euglena
   C. paramecium
   D. trichonympha

53. How does primary succession in a habitat differ from secondary succession? \textit{EBR.8.B.7}
   A. In primary succession, no life previously exists in the habitat.
   B. In primary succession, very complex relationships occur between organisms.
   C. In secondary succession, the habitat might be covered by a lava flow.
   D. In secondary succession, the habitat is newly formed, not disrupted.

54. Where does the electron-transport chain take place? \textit{MC.3.B.2}
   A. chloroplasts
   B. Golgi bodies
   C. mitochondria
   D. ribosomes

55. Hydra reproduce by \textit{CDL.7.B.8}
   A. budding.
   B. metamorphosis.
   C. sexual reproduction.
   D. spores.

56. Which is the most logical explanation as to why birds can fly? \textit{NS.10.B.1}
   A. They weigh very little, enabling them to fly.
   B. Birds must fly in order to catch their prey.
   C. Birds evolved certain structures and features that enable them to fly.
   D. They are predestined to fly, whereas humans are not.

57. When comparing flatworms and roundworms, which is true? \textit{CDL.7.B.21}
   A. Flatworms have no blood; roundworms do.
   B. Flatworms have primitive lungs; roundworms do not.
   C. Flatworms have no anus; roundworms do.
   D. Flatworms have no nervous system; roundworms do.

58. When did the trilobites suffer heavy losses? \textit{HE.6.B.4}

<table>
<thead>
<tr>
<th>Era</th>
<th>Mesozoic</th>
<th>Paleozoic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Cretaceous</td>
<td>Jurassic</td>
</tr>
<tr>
<td></td>
<td>Triassic</td>
<td>Permian</td>
</tr>
<tr>
<td></td>
<td>Pennsylvania</td>
<td>Mississippian</td>
</tr>
<tr>
<td></td>
<td>Devonian</td>
<td>Silurian</td>
</tr>
<tr>
<td></td>
<td>Ordovician</td>
<td>Cambrian</td>
</tr>
<tr>
<td>Years</td>
<td>65-135</td>
<td>135-181</td>
</tr>
<tr>
<td>Ago in</td>
<td>181-220</td>
<td>220-290</td>
</tr>
<tr>
<td>Millions</td>
<td>290-310</td>
<td>310-360</td>
</tr>
<tr>
<td></td>
<td>360-405</td>
<td>405-425</td>
</tr>
<tr>
<td></td>
<td>425-500</td>
<td>500-600</td>
</tr>
</tbody>
</table>

   A. late Cambrian
   B. late Devonian
   C. late Triassic
   D. end Cretaceous
59. What can you conclude about the trait followed in the pedigree shown below? **HE.4.B.4**

A. It is incompletely dominant in every other generation.
B. It is coded for a sex-linked gene.
C. It affects only females.
D. The trait shows polygenic inheritance.

60. Which is an ethical practice in scientific research? **NS.14.B.2**

A. altering results of experiments
B. withholding experimental data
C. sharing results of investigations
D. using biased sources of information

61. Which RNA nucleotide pairs with the DNA nucleotide of cytosine? **HE.5.B.2**

A. adenine
B. guanine
C. thymine
D. uracil

62. Which scientist thought that changing environmental conditions favor certain variations that promote the survival of some organisms? **HE.6.B.1**

A. John James Audubon
B. Charles Darwin
C. Robert Koch
D. Jean-Baptiste Lamarck

63. As the world’s population grows, scientists are working to develop alternative energy sources to help meet energy demands. In which figure below is the photovoltaic device probably creating the most usable energy? **NS.14.B.3**

A. [Image]
B. [Image]
C. [Image]
D. [Image]
Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

1. How might the study of the excretory system lead to better forms of kidney dialysis? **NS.14.B.1**

2. The table shows the number of chambers in the hearts of five animals. What can you conclude about how the number of chambers in the heart correlates to the complexity of the animal? **CDL.7.B.22**

<table>
<thead>
<tr>
<th>Animal</th>
<th>Number of Heart Chambers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphibian</td>
<td>3</td>
</tr>
<tr>
<td>Bird</td>
<td>4</td>
</tr>
<tr>
<td>Fish</td>
<td>2</td>
</tr>
<tr>
<td>Mammal</td>
<td>4</td>
</tr>
<tr>
<td>Reptile*</td>
<td>3</td>
</tr>
</tbody>
</table>

*A crocodile has a heart with 4 chambers.*

3. Define what is meant by the term *population* as a level of ecology. **EBR.8.B.8**

4. Briefly describe how a water bug utilizes the surface tension of water. **MC.1.B.3**
5. Briefly describe chromosome therapy. **NS.12.B.6**

6. In science, what is a hypothesis? **NS.10.B.2**

7. How is a member of the kingdom Fungi defined? **CDL.7.B.2**

8. What happens during intense exercise that can lead to a feeling of burning in the muscles? **MC.3.B.3**

9. List an advantage and a disadvantage of using products that contain antibacterial agents, such as antibacterial soaps and sprays. **NS.12.B.7**
10. Why do heart cells in the human body have a high number of mitochondria? **MC.2.B.3**

11. A student ran an experiment in which three seeds of the same species were allowed to germinate and grow in three different locations. Each seedling was grown in the same amount and type of soil, and each received the same amount of water. After 6 days, the resulting data was recorded in the table below. Give a logical, nonbiased conclusion based on the data shown. **NS.11.B.5**

<table>
<thead>
<tr>
<th>Location</th>
<th>Height (cm)</th>
<th>Leaf Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunny windowsill</td>
<td>7</td>
<td>green</td>
</tr>
<tr>
<td>Indirect sunlight</td>
<td>9</td>
<td>green</td>
</tr>
<tr>
<td>Closed closet</td>
<td>11</td>
<td>whitish yellow</td>
</tr>
</tbody>
</table>

12. In genetics, what happens in point mutation? **HE.5.B.5**

13. How does a virus interact with a living cell during its lysogenic cycle? **CDL.7.B.6**
14. A student runs an experiment to see how much fertilizer solution should be added to a plant for optimum growth. She wears safety goggles, uses latex gloves, and draws a small amount of fertilizer solution into a pipette by carefully sucking on the end of the pipette. She then adds the fertilizer solution to the plant. Describe how she should change her procedure in order to make her experiment safer to perform. **NS.11.B.2**

15. In a cell, what occurs during diffusion? Is it active or passive? **MC.2.B.7**

16. What is a cladogram, and how is it used? **HE.6.B.7**

17. What occurs during the interphase portion of the cell cycle? **MC.2.B.8**
18. A student tested a plant’s response to environmental stimuli by measuring its root growth. He planted it in a pot and watered it daily on the edges of the pot, away from the plant. He then measured the angle from the horizontal and length of the root growth. How should the student analyze this data in terms of how the plant responded to the stimuli? Support your answer. 

NS.13.B.1

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>Root Growth (cm)</th>
<th>Angle of Root Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>30° angle</td>
</tr>
<tr>
<td>2</td>
<td>2.3</td>
<td>45° angle</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>vertical</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>vertical</td>
</tr>
</tbody>
</table>


20. If a disease unique to one species in an ecosystem wipes out a sizable number of that species’ population, how will it likely affect the ecosystem? EBR.8.B.5

21. What are the two transport systems for vascular plants, and what does each transport? CDL.7.B.15
22. Describe how relative dating is used to determine the age of fossils. **HE.6.B.6**

23. In inheritance, what is meant by the term *dominance*? **HE.4.B.2**

24. Scientists have long known that fossil fuels used to power automobiles are a source of pollution as well as a limited resource. How do hybrid automobiles (cars with gasoline engines assisted by electric motors, which increase efficiency during acceleration and reduce gasoline consumption) help combat these two concerns? **EBR.9.B.2**

25. How might a biome in North America differ from one in Central America? **EBR.8.B.2**

26. Define an *endotherm*, and give three examples. **MC.2.B.11**
27. During cell division, what happens during the stage of mitosis shown below? **MC.2.B.9**

![Diagram of mitosis stage]

28. Briefly describe the process of photosynthesis. **MC.3.B.5**

29. Why is it important that the results of an experiment are subjected to peer review and verification? **NS.10.B.4**
30. A student wants to know the effect a possible change in allele frequency might have on a species’ survival. The change causes an animal to have light brown fur instead of mottled brown fur. The student runs a computer simulation for six generations. How does this change affect the population? **HE.6.B.2**

<table>
<thead>
<tr>
<th>Generation</th>
<th>Number with Light Brown Fur</th>
<th>Number with Mottled Brown Fur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>98</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>95</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>97</td>
</tr>
</tbody>
</table>

31. The figure below shows the structure of a paramecium. What kind of symmetry does a paramecium have? Support your answer. **CDL.7.B.20**
32. The ability to curl your tongue up on the sides is dominant over not being able to curl your tongue up on the sides. If both parents of a child can curl their tongue up on the sides, what is the probability that they will have a child who cannot curl his or her tongue up on the sides? Explain your answer in terms of genotype and phenotype. **HE.4.B.3**

33. In genetics, what is meant by the term *translation*? **HE.5.B.4**

34. A student created a model showing how dominant-recessive heterozygous genotype affects the phenotype of the offspring. He got the results shown below. Which type of graph would best be used to present his data with a maximum visual effect? Support your answer. **NS.11.B.6**

**Offspring of dominant-recessive heterozygous genotype parents:**

- Dominant phenotype
  - (homozygous-dominant genotype): ............................................24%
- Dominant phenotype
  - (heterozygous-dominant genotype): ...........................................53%
- Total: ..............................................................................................77%

- Recessive phenotype
  - (homozygous-recessive genotype): ............................................23%
Standards Practice: Multiple Choice
Molecules and Cells

Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

**MC.1.B.1** Describe the structure and function of the major organic molecules found in living systems: carbohydrates, proteins, enzymes, lipids, nucleic acids.

1. Which group contains only molecules that are assembled from smaller organic compounds?
   - A. proteins, carbon dioxide, DNA, starch
   - B. proteins, carbon dioxide, starch, water
   - C. proteins, DNA, fats, starch
   - D. proteins, DNA, fats, water

2. Many biochemical reactions in living systems would occur at a rate too slow to sustain life without the action of enzymes to catalyze the reaction. What is the function of the enzymes?
   - A. They increase the entropy.
   - B. They decrease the entropy.
   - C. They increase the energy gradient.
   - D. They decrease the energy of activation.

3. The diagram below shows two amino acids. What would biochemists call the result of chaining two or more of these molecules together?

   ![Amino Acids Diagram]

   - A. carbohydrate
   - B. lipid
   - C. nucleic acid
   - D. protein

**MC.1.B.2** Describe the relationship between an enzyme and its substrate molecule(s).

4. The diagram below illustrates a biochemical process that occurs in organisms. The substance labeled catalyst is also known as a(n)

   ![Biochemical Process Diagram]

   - A. antibody.
   - B. enzyme.
   - C. hormone.
   - D. inorganic compound.

5. The graph below shows the optimum temperature of two enzymes. Which does this information suggest?

   ![Enzyme Temperature Graph]

   - A. An enzyme’s activity will increase as the temperature increases.
   - B. An enzyme will change the rate in which a reaction occurs.
   - C. As an enzyme performs its function, its temperature drops.
   - D. Different enzymes perform best at different temperatures, depending on where they function.
6. What is the pH of pure water?
   A. 0
   B. 1
   C. 7
   D. 14

7. What makes a water molecule a “polar” molecule?
   A. Water has the ability to be frozen.
   B. The pH of pure water will vary with temperature.
   C. A water molecule has a slight charge on each end.
   D. A water molecule is made of three atoms.

8. Activation energy is energy required to start
   A. movement.
   B. a chemical reaction.
   C. boiling.
   D. mitosis.

9. Which is an endergonic reaction?
   A. breaking a chemical bond
   B. combustion of an ATP molecule
   C. oxidation
   D. reduction

10. Which is an exergonic reaction?
    A. building a chemical bond
    B. making a protein
    C. oxidation
    D. reduction

11. Which label should go beneath the fourth picture from the top?
    A. organ
    B. organ system
    C. organism
    D. tissue

MC.1.B.3 Investigate the properties and importance of water and its significance for life: surface tension, adhesion, cohesion, polarity, pH.

MC.1.B.4 Explain the role of energy in chemical reactions of living systems: activation energy, exergonic reactions, endergonic reactions.

MC.2.B.1 Construct a hierarchy of life from cells to ecosystems.
12. Which is a structure that performs a specialized function within a cell?
   A. organ
   B. organ system
   C. organelle
   D. tissue

13. By definition, a eukaryote is an organism whose cells
   A. contain no DNA.
   B. have no membrane-bound vesicles.
   C. have no mitochondria or ribosomes.
   D. have a nucleus and other membrane-bound vesicles.

14. Which does a prokaryotic cell have?
   A. chloroplast
   B. endoplasmic reticulum
   C. plasma membrane
   D. vacuole

15. Which is true regarding prokaryotic cells and eukaryotic cells?
   A. All unicellular organisms have eukaryotic cells.
   B. All unicellular organisms have prokaryotic cells.
   C. All multicellular organisms have eukaryotic cells.
   D. All multicellular organisms have both prokaryotic cells and eukaryotic cells.

16. What is a group of specialized cells that performs a specific function?
   A. organelle
   B. tissue
   C. organ
   D. system

17. Which organelle is known as the “packaging plant” of the cell?
   A. endoplasmic reticulum
   B. Golgi body
   C. mitochondrion
   D. nucleus

18. Which types of human body cells would likely have a high number of lysosomes?
   A. heart
   B. retinal
   C. muscle
   D. white blood

19. Which statement is NOT true about ribosomes?
   A. Ribosomes build protein by following the directions of the DNA.
   B. Ribosomes are made in the cytoplasm of the cell.
   C. Ribosomes attach to the endoplasmic reticulum when they are in the cytoplasm.
   D. Ribosomes are not bound by a membrane.
20. The plasma (cell) membrane has
A. one layer of phospholipids, through which proteins freely move.
B. one layer of phospholipids, which are laid out end to end, with a hydrophobic tail touching a hydrophilic head.
C. two layers of phospholipids, each of which has its hydrophilic side turned inward.
D. two layers of phospholipids, each of which has its hydrophilic side turned outward.

21. Which three molecules are the main components of a plasma (cell) membrane?
A. carbohydrates, nucleic acids, and phospholipids
B. carbohydrates, nucleic acids, and proteins
C. carbohydrates, phospholipids, and proteins
D. nucleic acids, phospholipids, and proteins

22. What is the large white area in the center of this plant cell?
A. chloroplast
B. mitochondrion
C. nucleus
D. vacuole

23. Both plant cells and animal cells have
A. a cell wall.
B. chloroplasts.
C. DNA in the cytoplasm.
D. free and attached ribosomes.

24. A partial food web is represented in the diagram below. Letter X most likely represents
A. autotrophs.
B. decomposers.
C. heterotrophs.
D. parasites.

25. Which is an autotroph?
A. cow
B. corn
C. sunlight
D. whale

26. A heterotroph is also known as a
A. consumer.
B. mammal.
C. predator.
D. producer.
Standards Practice: Multiple Choice
Molecules and Cells

MC.2.B.7 Compare and contrast active transport and passive transport mechanisms: diffusion, osmosis, endocytosis, exocytosis, phagocytosis, pinocytosis.

27. Which describes the process by which molecules randomly move from an area of high concentration to an area of low concentration without the expenditure of energy?
   A. active transport
   B. diffusion
   C. fluid mosaic model
   D. selective permeability

28. What happens during osmosis?
   A. Movement of an organism occurs through oozing.
   B. Food is actively brought into a cell.
   C. Water is actively brought into a cell.
   D. Water diffuses across a selectively permeable membrane.

29. Phagocytosis is a
   A. chemical reaction which takes in energy.
   B. chemical reaction which gives off energy.
   C. type of endocytosis in which a cell engulfs large particles.
   D. type of endocytosis in which a cell engulfs fluid.

MC.2.B.8 Describe the main events in the cell cycle, including the differences in plant and animal cell division: interphase, mitosis, cytokinesis.

30. During interphase, a stage in the cell cycle, the cell
   A. carries on metabolism.
   B. differentiates to have a new function.
   C. splits in two.
   D. splits in two but with half the normal number of chromosomes.

31. During cytokinesis, a stage in the cell cycle, the
   A. cell carries on metabolism.
   B. cell duplicates its number of chromosomes.
   C. cell’s chromosomes line up in the middle of the cell.
   D. cell splits in two.

32. The chromosome content of a skin cell that is about to form two new skin cells is represented in the diagram below. Which diagram best represents the chromosomes that would be found in the two new skin cells produced as a result of this process?
Standards Practice: Multiple Choice
Molecules and Cells

MC.2.B.9 List in order and describe the stages of mitosis: prophase, metaphase, anaphase, telophase.

33. During metaphase, a stage in mitosis, the cell’s chromosomes
   A. duplicate.
   B. uncoil.
   C. line up in the middle of the cell.
   D. move toward the poles of the cell.

34. During telophase, a stage in the cell cycle, the cell’s chromosomes
   A. duplicate.
   B. uncoil.
   C. line up in the middle of the cell.
   D. move toward the poles of the cell.

35. Mitosis, a stage in the cell cycle, is important for
   A. correct chromosome copying.
   B. proper removal of diseased cells.
   C. growth and repair of an organism.
   D. reproduction of an organism with the correct number of chromosomes.

MC.2.B.10 Analyze the meiotic maintenance of a constant chromosome number from one generation to the next.

36. Which statement best explains the significance of meiosis in helping to maintain continuation of a species?
   A. Meiosis produces eggs and sperm that are alike.
   B. Meiosis provides for chromosomal variation in the gametes produced by an organism.
   C. Equal numbers of eggs and sperm are produced by meiosis.
   D. The gametes produced by meiosis ensure the continuation of any particular species by asexual reproduction.

MC.2.B.11 Discuss homeostasis using thermoregulation as an example.

37. Which diagram best represents part of the process of sperm formation in an organism that has a normal chromosome number of eight?

   A. 
   B. 
   C. 
   D. 

38. What is homeostasis?
   A. growth of a living cell in the absence of oxygen
   B. stable internal conditions of a living thing
   C. use of energy by a living thing
   D. act when a living cell engulfs solutes or fluids

39. Which animal depends on inner regulation of body temperature?
   A. lizard
   B. perch
   C. sparrow
   D. turtle
Standards Practice: Multiple Choice
Molecules and Cells

MC.3.B.1 Compare and contrast the structure and function of mitochondria and chloroplasts.

40. Chloroplasts are found in the cells of
A. some animals and some plants.
B. some animals and some protists.
C. some plants and some protists.
D. only plants.

41. Both chloroplasts and mitochondria
A. create food for an organism.
B. create energy for a cell.
C. transform energy for a cell to use.
D. are found in both plant and animal cells.

42. The figure below shows the structure of a chloroplast. Grana are made from

A. tiny organelles within a chloroplast.
B. the folds of the chloroplast’s inner membrane.
C. many nucleoli stacked together.
D. many mitochondria stacked together.

MC.3.B.2 Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP): glycolysis, citric acid cycle, electron transport chain.

43. Cellular respiration produces 36 molecules of ATP from one molecule of glucose. What are the three stages of cellular respiration?
A. glycolysis, citric-acid cycle, and electron-transport chain
B. lactic-acid formation, alcoholic fermentation, and glycolysis
C. citric-acid cycle, alcoholic fermentation, and glycolysis
D. electron-transport chain, citric-acid cycle, and lactic-acid formation

44. ATP is a compound that is synthesized when
A. chemical bonds between carbon atoms are formed during photosynthesis.
B. energy stored in chemical bonds is released during cellular respiration.
C. energy stored in nitrogen is released, forming amino acids.
D. digestive enzymes break amino acids into smaller parts.

MC.3.B.3 Compare and contrast aerobic and anaerobic respiration: lactic acid fermentation, alcoholic fermentation.

45. One type of anaerobic respiration results in the production of
A. alcohol and carbon dioxide.
B. nitrogen gas and ammonia.
C. pyruvic acid and glycerol.
D. water and oxygen.
46. Which step is the same in both forms of fermentation, as well as in cellular respiration?

<table>
<thead>
<tr>
<th>Lactic Acid Fermentation</th>
<th>Alcoholic Fermentation</th>
<th>Cellular Respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>glucose ↓ glycolysis (pyruvic acid) ↓ lactic acid + 2 ATP</td>
<td>glucose ↓ glycolysis (pyruvic acid) ↓ carbon dioxide + alcohol + 2 ATP</td>
<td>glucose ↓ glycolysis (pyruvic acid) ↓ carbon dioxide + water + 36 ATP</td>
</tr>
</tbody>
</table>

A. formation of carbon dioxide and alcohol  
B. formation of carbon dioxide and water  
C. formation of lactic acid  
D. process of glycolysis

**MC.3.B.4** Describe and model the conversion of light energy to chemical energy by photosynthetic organisms: light dependent reactions, light independent reactions.

47. Which reaction takes place in the stroma of the chloroplast?  
A. carbon fixation  
B. light-dependent reaction  
C. light-independent reaction  
D. photolysis

48. Which reaction takes place in the thylakoid discs of the chloroplast?  
A. carbon fixation  
B. light-dependent reaction  
C. light-independent reaction  
D. Calvin cycle

**MC.3.B.5** Compare and contrast cellular respiration and photosynthesis as energy conversion pathways.

49. In the experiment shown below, which process occurring in the peas causes the drop of liquid to move to the left?

A. cellular respiration  
B. digestion  
C. photosynthesis  
D. protein synthesis

50. Which process releases the greatest amount of ATP?  
A. alcoholic fermentation  
B. cellular respiration  
C. lactic-acid cycle  
D. photosynthesis

51. Which is NOT shared by cellular respiration and photosynthesis?  
A. form ATP  
B. use electron transport chain  
C. break down glucose  
D. anaerobic phase in cycle
Standards Practice: Multiple Choice
Heredity and Evolution

Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

**HE.4.B.1** Summarize the outcomes of Gregor Mendel’s experimental procedures.

1. If Mendel crossed a homozygous-dominant tall plant with a homozygous-recessive short plant, what phenotype would the first generation show?
   A. All plants would show the dominant trait.
   B. All plants would show the recessive trait.
   C. Half the plants would show the dominant trait, and half would show the recessive trait.
   D. Three-quarters of the plants would show the dominant trait, and one-quarter would show the recessive trait.

2. If Mendel crossed a heterozygous yellow-seeded plant with another heterozygous yellow-seeded plant, what phenotype would the resulting generation show?
   A. All plants would show the yellow-seed trait.
   B. All plants would show a green-seed (recessive) trait.
   C. Half the plants would show the yellow-seed trait, and half would show the green-seed (recessive) trait.
   D. Three-quarters of the plants would show the yellow-seed trait, and one-quarter would show the green-seed (recessive) trait.

3. In genetic segregation,
   A. pairs of genes cross over on chromosomes, exchanging one for the other.
   B. pairs of genes separate in meiosis and each gamete receives one gene of a pair.
   C. part of the chromosome is separated, or torn away, from the main body.
   D. one chromosome is suppressed and the other determines the traits of the offspring.

4. The gene for brown eyes (B) is dominant over the gene for blue eyes (b). Two brown-eyed people have a blue-eyed child. Which genotypes make this possible?
   A. The mother and father are both homozygous brown-eyed (BB).
   B. The mother is homozygous brown-eyed (BB), and the father is heterozygous brown-eyed (Bb).
   C. The mother is heterozygous brown-eyed (Bb), and the father is homozygous brown-eyed (BB).
   D. The mother and father are both heterozygous brown-eyed (Bb).

**HE.4.B.3** Use the laws of probability and Punnett squares to predict genotypic and phenotypic ratios.

5. A researcher crosses the F₁ generation of two snapdragon plants. According to this information, what is the ratio of their offspring (F₂)?

<table>
<thead>
<tr>
<th>R</th>
<th>R</th>
<th>r</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>RR</td>
<td>Rr</td>
<td></td>
</tr>
<tr>
<td>r</td>
<td>Rr</td>
<td>rr</td>
<td></td>
</tr>
</tbody>
</table>

- Genotype | Phenotype
- RR | red
- Rr | pink
- rr | white

A. 0 red; 4 pink; 0 white
B. 1 red; 2 pink; 1 white
C. 3 red; 0 pink; 1 white
D. 4 red; 0 pink; 0 white

6. Wiry hair (W) in dogs is dominant over smooth hair (w). If a wiry-haired dog (WW) has eight puppies with a smooth-haired dog (ww), how many puppies will probably have smooth hair?
   A. 0
   B. 2
   C. 4
   D. 8
HE.4.B.4 Examine different modes of inheritance: sex linkage, codominance, crossing over, incomplete dominance, multiple alleles.

7. Which shows the most likely inheritance of a sex-linked trait?
A.  
B.  
C.  
D.  

8. In inheritance, multiple alleles are
A. two alleles of different genes that code for different traits.
B. two alleles of the same gene that code for the same trait.
C. three or more alleles of the same gene that code for the same trait.
D. three or more chromosomes that carry copies of the same gene for a trait.

HE.4.B.5 Analyze the historically significant work of prominent geneticists.

9. The study of genetics has been greatly enhanced by the
A. ability to sequence (map) DNA.
B. ability to stain chromatin material.
C. development of the Punnett square.
D. discovery of ribosomes in cells.

10. Geneticist Gregor Mendel is well known for his work with
A. fruit flies.
B. humans.
C. pea plants.
D. rabbits.

11. Francis Crick and James Watson are best known for their work on
A. the discovery of alleles.
B. the double-helix model of DNA.
C. gene therapy.
D. the Human Genome Project.


12. Which diagram illustrates fertilization that would most likely lead to the development of a normal human female?
A.  
B.  
C.  
D.  

13. Turner’s syndrome is a monosomic condition probably caused by
A. an error in the process of cloning.
B. an error in meiotic cell division.
C. a gene mutation.
D. replication of a single chromosome during mitosis.
Standards Practice: Multiple Choice

Heredity and Evolution

14. How many chromosomes does a human with trisomy have?
   A. 23
   B. 45
   C. 46
   D. 47

15. A molecule of DNA is composed of
   A. amino acids and proteins.
   B. ATP and enzymes.
   C. paired nucleotides.
   D. receptor enzymes.

16. If the structure of DNA were likened to a ladder, what would make up the “supporting structure” (not the “rungs”) of the ladder?
   A. amino acids and sugars
   B. nucleotide bases, including thymine
   C. nucleotide bases, including uracil
   D. sugar-phosphate molecules

17. If the structure of DNA were likened to a ladder, what would make up the “rungs” of the ladder?
   A. amino acids and sugars
   B. nucleotide bases, including thymine
   C. nucleotide bases, including uracil
   D. sugar-phosphate molecules

18. Which DNA nucleotide always pairs with cytosine?
   A. adenine
   B. guanine
   C. thymine
   D. uracil

19. Which DNA nucleotide pair is correct?
   A. adenine-guanine
   B. adenine-thymine
   C. cytosine-thymine
   D. guanine-thymine

20. What causes the two sides of the double helix of DNA to stay joined together?

   A. joining of base pairs
   B. joining of phosphate molecules
   C. joining of sugar molecules
   D. joining of RNA molecules

21. The presence of DNA is important for the cellular metabolic activities because DNA
   A. directs the production of enzymes.
   B. is a structural component of cell membranes.
   C. directly increases the solubility of nutrients.
   D. is the major component of cytoplasm.

22. Which DNA nucleotide base does not exist as an RNA nucleotide?
   A. adenine
   B. cytosine
   C. guanine
   D. thymine
Standards Practice: Multiple Choice

Heredity and Evolution

23. Which DNA nucleotide base pairs with the RNA nucleotide base of uracil?
   A. adenine
   B. cytosine
   C. guanine
   D. thymine

24. Proteins are chains of amino acids bonded together. Which is the correct sequence for creating proteins?
   A. Information in DNA is formed into protein directly.
   B. Information in RNA uses thermal energy to create protein.
   C. Information in RNA mutates into DNA and then is made into protein.
   D. Information in DNA is transferred into RNA and then made into protein.

25. What process is shown in the illustration below?
   A. commensalism
   B. deletion
   C. passive transport
   D. replication

26. What occurs during frameshift mutation?
   A. Part of the chromosome breaks away but reattaches normally.
   B. Part of the chromosome breaks away but reattaches in inverse orientation.
   C. An extra chromosome is added, causing a mismatching of the chromosome pairs.
   D. There is a misreading of the base pairs during translation.

27. Which can occur as a result of a deletion?
   A. frameshift mutation
   B. inversion
   C. point mutation
   D. trisomy

28. New characteristics would least likely result from
   A. mutations that occur in muscle cells and skin cells.
   B. mutations that occur in male gametes.
   C. mutations that occur in female gametes.
   D. the sorting and recombination of existing genes during meiosis and fertilization.

29. Suppose a mutation occurred in a forest in a warm climate. This mutation resulted in an albino species and probably would be
   A. beneficial.
   B. harmful.
   C. neutral.
   D. proliferative.
Standards Practice: Multiple Choice
Hereditary and Evolution

HE.6.B.1 Compare and contrast Lamarck's explanation of evolution with Darwin's theory of evolution by natural selection.

30. When Charles Darwin was developing his theory of evolution, he considered variations in a population important. However, he could not explain how the variations occurred. Which two processes could have caused the variations?
   A. adhesion and metamorphosis
   B. commensalism and mutualism
   C. crossing over and mutations
   D. phagocytosis and pinocytosis

31. In terms of evolution, Jean-Baptiste Lamarck believed that
   A. chromosomes could be surgically altered.
   B. traits were fixed at birth.
   C. different cells in an organism contain different DNA.
   D. acquired traits could be inherited.

HE.6.B.2 Recognize that evolution involves a change in allele frequencies in a population across successive generations.

32. Mutations can be considered one of the raw materials of evolution because they
   A. contribute to new variations in organisms.
   B. are usually well adapted to the environment in which they appear.
   C. are usually beneficial to the organism in which they appear.
   D. are usually harmful and cause species of organisms to become extinct.

33. Which describes the relationship between natural selection and variations within a species?
   A. The survival of individuals with different kinds of variations is due to chance.
   B. More individuals with useful variations survive and pass the variations to offspring.
   C. Genetic equilibrium controls the natural selection of variations in a population.
   D. The kinds of variations that are passed to future generations are independent of natural selection.

34. Homologous structures might be a result of a change in allele frequencies over successive generations. These structures probably continued because they
   A. were beneficial in a particular environment.
   B. were predestined in a species.
   C. made a particular organism more attractive to a mate.
   D. were neutral, not harmful, mutations.

HE.6.B.3 Analyze the effects of mutations and the resulting variations within a population in terms of natural selection.

35. Which characteristics of a population would most likely indicate the lowest potential for evolutionary change in the population?
   A. asexual reproduction and few mutations
   B. asexual reproduction and many mutations
   C. sexual reproduction and few mutations
   D. sexual reproduction and many mutations

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36. Suppose a mutation caused the birth of an albino deer. Would this mutation lend itself positively or negatively to natural selection?
   A. Positively; the light color would be easily seen by its offspring.
   B. Positively; predators are frightened by light-colored animals.
   C. Negatively; an albino deer would be easily seen by predators.
   D. Negatively; an albino deer might not be able to run as fast.

37. According to the graph, which period had the lowest rate of extinction?
   A. Cambrian (490 mya)
   B. Silurian (418 mya)
   C. Carboniferous (290 mya)
   D. Jurassic (142 mya)

38. Which period had the most extensive extinction?
   A. late Cambrian
   B. end Cretaceous
   C. end Permian
   D. late Triassic

39. Which would a scientist probably use most when analyzing evolutionary relationships among organisms?
   A. biochemistry
   B. microbiology
   C. study of analogous structures
   D. study of how an animal moved

40. What evidence would be most useful in differentiating between the remains of *Australopithecus afarensis*, a bipedal hominid that walked upright, and a more recent life-form, *Homo habilis*, the first human species?
   A. structure of the pelvis
   B. position of the foramen magnum
   C. size of the braincase
   D. number of limbs

41. The horse has changed over time. Its ancestors had a smaller body and shorter legs than the modern horse. Which describes how scientists have come to this conclusion about the evolutionary history of horses?

438 20
15 10
5 0
Millions of years ago (mya)
Extinction rate (families of species per million years)
Paleozoic Mesozoic
Paleozoic
Mesozoic
Ordovician-Silurian
Permian-Triassic
Cretaceous-Tertiary
Late Devonian
Late Triassic

Horse ancestor Modern horse
A. by examining one of the small ancestors
B. through the study of their diets
C. through evidence from fossils
D. because the horse ancestor looks almost identical to the modern horse
42. A scientist is using radiometric dating to determine the ages of four rock samples in order to determine the ages of fossils found near them. The ratios below compare the amount of parent isotopes to the amount of daughter isotopes. Which rock sample is the oldest?

A. Rock A  
B. Rock B  
C. Rock C  
D. Rock D

43. What is one advantage of radioactive dating over relative dating?
A. The age of an isolated fossil can be determined.  
B. Radioactive dating can be performed in the field.  
C. Radioactive dating can be performed by students.  
D. A simple Geiger counter can be used.

44. What is one advantage of relative dating over radioactive dating?
A. It is a very precise method.  
B. The age of multiple fossils found near each other in a rock layer can easily be determined.  
C. It can be done even if you do not know where the fossil was found.  
D. The results are irrefutable.

45. The diagram indicates that a common ancestor for species C and E is species
A. F.  
B. G.  
C. H.  
D. K.

46. Which species are least likely to be vital parts of a present-day ecosystem?
A. A and E  
B. B and F  
C. C and D  
D. E and J

47. Why are species B and C more closely related than species A and C?
A. B and C are closer to each other in the alphabet than A and C.  
B. B and C have a common ancestor that is more recent than the common ancestor of A and C.  
C. B and C are physically closer to each other on the diagram than A and C.  
D. B and C are both domesticated animals, while A is wild.
Standards Practice: Multiple Choice
Classification and the Diversity of Life

Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

**CDL.7.B.1** Differentiate among the different domains: Bacteria, Archaea, Eukarya.

Use the table below to answer questions 1 and 2.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Bacteria</th>
<th>Archaea</th>
<th>Eukarya</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell type</td>
<td>prokaryote</td>
<td>prokaryote</td>
<td>eukaryote</td>
</tr>
<tr>
<td>Cell structure</td>
<td>cell walls with peptidoglycan</td>
<td>cell walls without peptidoglycan</td>
<td>with or without cell walls</td>
</tr>
<tr>
<td>Number of cells</td>
<td>unicellular</td>
<td>unicellular</td>
<td>some unicellular; some multicellular</td>
</tr>
</tbody>
</table>

1. Which comparison of members of domain Bacteria with members of domain Eukarya is true?
   A. Bacteria are unicellular; no eukaryotes are unicellular.
   B. Bacteria and eukaryotes are prokaryotes.
   C. All bacteria and eukaryotes have cell walls.
   D. Bacteria have no true nucleus; eukaryotes have a true nucleus.

2. How can you distinguish a member of the domain Archaea from a member of the domain Bacteria?
   A. See if it is unicellular.
   B. See if it has a cell wall.
   C. See if it contains peptidoglycan.
   D. See if it has a true nucleus.

**CDL.7.B.2** Differentiate the characteristics of the six kingdoms: Eubacteria, Archaea, Protista, Fungi, Plantae, Animalia.

Use the table below to answer questions 3 and 4.

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Protista</th>
<th>Fungi</th>
<th>Plantae</th>
<th>Animalia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell type</td>
<td>eukaryote</td>
<td>eukaryote</td>
<td>eukaryote</td>
<td>eukaryote</td>
</tr>
<tr>
<td>Cell structure</td>
<td>Some have cell walls of cellulose; some have chloroplasts</td>
<td>cell walls of chitin</td>
<td>cell walls of cellulose; chloroplasts</td>
<td>no cell walls or chlo-roplasts</td>
</tr>
<tr>
<td>Number of cells</td>
<td>most unicellular; some colonial; some multicellular</td>
<td>some unicellular; most mult-icellular</td>
<td>multi-cellular</td>
<td>multi-cellular</td>
</tr>
<tr>
<td>Mode of nutrition</td>
<td>autotroph or heterotroph</td>
<td>heterotroph</td>
<td>autotroph</td>
<td>heterotroph</td>
</tr>
</tbody>
</table>

3. If an organism is unicellular, has a cell wall made of chitin, and is a heterotroph, to which kingdom does it belong?
   A. Protista
   B. Fungi
   C. Plantae
   D. Animalia

4. If an organism is multicellular, has a cell wall made of cellulose, and is an autotroph, to which kingdom does it belong?
   A. Protista
   B. Fungi
   C. Plantae
   D. Animalia
Standards Practice: Multiple Choice
Classification and the Diversity of Life

CDL.7.B.3 Identify the seven major taxonomic categories: kingdom, phylum, class, order, family, genus, species.

5. Organisms that belong to the same order must also belong to the same
   A. class.
   B. family.
   C. genus.
   D. species.

6. Of those listed, which classification category is the most inclusive?
   A. class
   B. order
   C. phylum
   D. species

7. Of those listed, which classification category is the least inclusive?
   A. class
   B. order
   C. phylum
   D. species

CDL.7.B.4 Classify and name organisms based on their similarities and differences applying taxonomic nomenclature using dichotomous keys.

Use the dichotomous key below to answer questions 8 and 9.

**Dichotomous Key: Ursidae**

**Food**
A1. Exclusively herbivorous...................... C (Ailurinae)
A2. At least partly omnivorous................. B (Mysticeti)

B1. Masseteric fossa on the lower jaw divided by a bony septum into two fossae present..... C (Ursus)
B2. Not present ............................................ (Tremarctos ornatus)

**Ailurinae**
C1. Diet exclusively bamboo(Ailuropoda melanoleuca)
C2. Varies............................................. (Airlurus fulgens)

**Ursus**
D1. Hump of muscle over shoulder present (Ursus arctos)
D2. Not present ................................................................. E
E1. Fur color white ......................... (Ursus maritimus)
E2. Other coloration ......................................................... F

F1. Leg direction turned inward while walking .......... (Helarctos malayanus)
F2. Leg direction turned forward............................... G
G1. Active at night (nocturnal)....... (Melursus ursinus)
G2. Active during the day (diurnal)... (Ursus americanus)

8. A member of the family Ursidae is at least partly omnivorous, has a masseteric fossa on the lower jaw divided by a bony septum into two fossae, and has a hump of muscle over its shoulder. It is classified as
   A. Melursus ursinus.
   B. Ursus americanus.
   C. Ursus arctos.
   D. Ursus maritimus.

9. A member of the family Ursidae is at least partly omnivorous, has a masseteric fossa on the lower jaw divided by a bony septum into two fossae, has no hump of muscle over its shoulder, has nonwhite fur, has a forward leg direction while walking, and is diurnal (active during the day). It is classified as
   A. Melursus ursinus.
   B. Ursus americanus.
   C. Ursus arctos.
   D. Ursus maritimus.
Standards Practice: Multiple Choice
Classification and the Diversity of Life

10. The number of species in an area is a measure of
A. autotrophs.
B. biodiversity.
C. a niche.
D. a population.

11. Which organism would probably NOT be found at the White River?
A. American black bear
B. bald eagle
C. belted kingfisher
D. caribou

12. The Ouachita blue star is a rare plant whose growth in Arkansas is restricted to stream channels and other wet, open habitat in the Ouachita Mountains. A good plan to preserve this plant would be to
A. take samples and preserve their leaves and flowers.
B. use genetic engineering to develop a disease-resistant form of the plant.
C. grow it in greenhouses across the state.
D. protect its growth at its native sites.

13. Which is never found in a virus?
A. carbohydrate
B. lipid
C. nucleic acid
D. protein

14. What is a virus’s “coat” called?
A. capsid
B. nodule
C. pathogene
D. prophage

15. What is a bacteriophage?
A. virus that appears like a bacterium
B. virus that can be consumed by a bacterium
C. virus that has a bacterium’s DNA
D. virus that infects a bacterium

16. Which is true of viral diseases?
A. They are generally mild.
B. They produce nontreatable symptoms.
C. Diseases caused by viruses are virtually nonexistent today.
D. Vaccines provide protection before an infection is contracted.

17. Which is NOT associated with viruses?
A. antibiotics
B. disease prevention
C. genetic engineering
D. infection of peach trees

18. Which method of asexual reproduction is this paramecium undergoing?
A. binary fission
B. budding
C. regeneration
D. spore formation
19. Which method of asexual reproduction is this planarian undergoing?

A. binary fission  
B. budding  
C. regeneration  
D. spore formation

20. Which animal undergoes metamorphosis during its life cycle?

A. alligator  
B. frog  
C. rat  
D. snake

21. Which would you NOT find in a member of eubacteria?

A. cell membrane  
B. cell wall  
C. DNA  
D. a true nucleus

22. Which increases the genetic diversity of bacteria?

A. binary fission  
B. conjugation  
C. cytokinesis  
D. spore formation

23. Which is not a role some bacteria fulfill?

A. decomposer  
B. nitrogen fixer  
C. producer  
D. spore former

24. At one time, it was thought that ulcers were caused by stress and diet. It is now believed that the bacterium *Helicobacter pylori* causes most ulcers. Which contributes to this understanding?

A. the fact that *Helicobacter pylori* is a gram-negative bacterium  
B. the discovery of the microorganism in the stomach’s lining  
C. the assumption that most people follow the same type of diet  
D. the assumption that everyone is affected by stress the same way

25. Which condition or disease is not caused by bacteria?

A. anthrax  
B. food poisoning  
C. influenza  
D. bubonic plague

26. How are protists classified?

A. by their body structure  
B. by how they move  
C. by how they obtain nutrition  
D. by how they reproduce

27. Which type of protist is a slime mold?

A. animal-like protist  
B. bacteria-like protist  
C. fungus-like protist  
D. plant-like protist

28. Which type of protist is a diatom?

A. animal-like protist  
B. bacteria-like protist  
C. fungus-like protist  
D. plant-like protist
29. Which type of protist is a ciliate?
   A. animal-like protist
   B. bacteria-like protist
   C. funguslike protist
   D. plantlike protist

30. Which disease is caused by a protist?
   A. corn smut
   B. Lyme disease
   C. malaria
   D. smallpox

31. Which is not a benefit of algae?
   A. They are high in iron and vitamin C.
   B. They perform about half of the photosynthesis on Earth.
   C. They are used to create agar, which is used in laboratories.
   D. They help break down dead matter.

32. Multicellular fungi have thin, one-cell-thick filaments called
   A. chitin.
   B. hyphae.
   C. gametangia.
   D. sporangia.

33. How many nuclei are found in fungal filament cells with crosswalls?
   A. 0
   B. 1 or 2
   C. 5 to 10
   D. 10 to 50

34. Which is an edible form of a fungus?
   A. mushroom
   B. parsley
   C. pepperoni
   D. seaweed

35. Which is a product of a fungus?
   A. aspirin
   B. penicillin
   C. sushi
   D. tofu

36. What separates yeasts from other fungi?
   A. Yeasts are heterotrophs.
   B. Yeasts have cell walls.
   C. Yeasts are animal-like fungi.
   D. Yeasts are unicellular.

37. Which are nonvascular plants?
   A. angiosperms
   B. bryophytes
   C. gymnosperms
   D. tracheids

38. How do nonvascular plants get moisture?
   A. osmosis
   B. active transport
   C. leaves
   D. deep taproot

39. What comprises the transportation system in vascular plants?
   A. antheridia and archegonia
   B. gemmae
   C. phloem and xylem
   D. rhizomes
Standards Practice: Multiple Choice
Classification and the Diversity of Life

CDL.7.B.16 Differentiate among cycads, gymnosperms, and angiosperms.

40. Cycads first appeared during the
   A. Cambrian period.
   B. Jurassic period.
   C. Permian period.
   D. Triassic period.

41. Cycads grow best in a climate that is
   A. arctic.
   B. desertlike.
   C. temperate.
   D. tropical.

42. How do angiosperms protect their seeds?
   A. within a cellular organelle
   B. within a layer of tissue
   C. on the surface of a cone
   D. inside a spore

43. Gymnosperms bear
   A. cones.
   B. flowers.
   C. mycelia.
   D. spores.

CDL.7.B.17 Describe the structure and function of the major parts of a plant: roots, stems, leaves, flowers.

44. What are the two main types of roots found in plants?
   A. cork and cambium
   B. fibrous and taproot
   C. petiole and stoma
   D. sepal and stamen

45. What structure is not found on a compound leaf?
   A. blade
   B. bulb
   C. leaflet
   D. petiole

CDL.7.B.18 Relate the structure of plant tissue to its function: epidermal, ground, vascular.

46. The interaction between guard cells and a leaf opening would NOT be involved in
   A. diffusion of carbon dioxide.
   B. feedback mechanisms.
   C. heterotrophic nutrition.
   D. maintaining homeostasis.

47. Epidermal tissues are found in the outermost cell layer of a plant. To help protect the plant, they are covered with
   A. thin, prickly spikes.
   B. glands that secrete a substance poisonous to insects.
   C. a thick, waxy layer.
   D. a thick layer of cellulose.

48. Ground tissue is the group of cells that lie between epidermal tissue and vascular tissue in plants. Where would you expect to find ground tissue with thick, rigid cell walls (sclerenchyma)?
   A. roots
   B. the stem
   C. leaves
   D. flowers

49. What does the vascular tissue phloem mainly transport through a plant?
   A. carbohydrates
   B. nitrogen
   C. oxygen
   D. water

50. Aphids, insects that eat sugar from plants, are often found on the underside of leaves. Based on this information, which type of plant tissue would one most likely find close to the underside of leaves?
   A. epidermal tissue
   B. ground tissue
   C. vascular tissue (phloem)
   D. vascular tissue (xylem)
Standards Practice: Multiple Choice
Classification and the Diversity of Life

CDL.7.B.19 Evaluate the medical and economic importance of plants.

51. The widest variety of plant genetic material that can be used by humans for future agriculture or medical research would most likely be found in a(n)
   A. large field of a genetically engineered crop.
   B. ecosystem having significant biodiversity.
   C. forest that is planted and maintained by a forest service.
   D. area that recently underwent primary succession.

CDL.7.B.20 Identify the symmetry of organisms: radial, bilateral, asymmetrical.

53. Which organism is most likely to have close-to-radial symmetry?
   A. amoeba
   B. anaconda
   C. human
   D. mushroom

54. Which organism is most likely to have bilateral symmetry?
   A. diatom
   B. dog
   C. mushroom
   D. sea star

55. Which organism is asymmetric?
   A. ant
   B. bird
   C. lizard
   D. sponge

CDL.7.B.21 Compare and contrast the major invertebrate classes according to their nervous, respiratory, excretory, circulatory, and digestive systems.

56. Which invertebrate has both a mouth and an anus as part of its digestive system?
   A. cnidarian
   B. flatworm
   C. roundworm
   D. sponge

57. Which invertebrate has both an asexual and a sexual reproductive cycle?
   A. cnidarian
   B. insect
   C. mollusk
   D. worm

CDL.7.B.22 Compare and contrast the major vertebrate classes according to their nervous, respiratory, excretory, circulatory, digestive, reproductive, and integumentary systems.

58. Which organism uses air sacs to help it breathe?
   A. amphibian
   B. bird
   C. fish
   D. reptile

59. Which organism uses its skin covering to help it regulate its internal temperature?
   A. amphibian
   B. bird
   C. fish
   D. reptile

60. What distinguishes a mammal from other vertebrate classes?
   A. Mammals do not lay eggs.
   B. Mammals have feathers.
   C. Mammals use lungs to breathe.
   D. Mammals can produce milk.
Standards Practice: Multiple Choice
Ecology and Behavioral Relationships

Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

**EBR.8.B.1** Cite examples of abiotic and biotic factors of ecosystems.

1. One biotic factor that limits the number of organisms a habitat can sustain is the
   A. availability of water.
   B. level of atmospheric oxygen.
   C. activity of decomposers.
   D. amount of soil erosion.

2. Which statement best illustrates a biotic resource interacting with an abiotic resource?
   A. rock moving during an earthquake
   B. sea turtle transporting a pilot fish to food
   C. plant absorbing sunlight, which is used for photosynthesis
   D. wind causing waves to form on a lake

3. The diagram below shows the relationships between the organisms in and around a pond. One additional biotic factor needed to make this a stable ecosystem is the presence of

   Raccoons
   → Carnivorous Fish → Minnows
   → Aquatic Crustaceans
   → Algae and Floating Plants

   A. consumers.
   B. decomposers.
   C. herbivores.
   D. producers.

**EBR.8.B.2** Compare and contrast the characteristics of biomes.

4. Study the ecosystem shown below. This ecosystem is most likely found in a

   A. tropical rain forest.
   B. tropical savanna.
   C. temperate grassland.
   D. tundra.

5. Which type of plant would be best suited to the biome shown in the illustration?

   A. large plant with no leaves
   B. large plant with red pigment
   C. small plant with large leaves
   D. small plant with no pigment
Standards Practice: Multiple Choice
Ecology and Behavioral Relationships

6. In an ecosystem, what happens to the atoms of certain chemical elements such as carbon, oxygen, and nitrogen?
   A. They move into living systems and remain there.
   B. They are never found in living systems.
   C. They move out of living systems and never return.
   D. They move into and out of living systems.

7. Which process does not contribute carbon to the carbon cycle?
   A. burning of wood
   B. acid precipitation
   C. respiration of organisms
   D. use of gasoline

8. Which type of model provides the most complete representation of the feeding relationships within a community?
   A. material cycle
   B. predator-prey association
   C. food chain
   D. food web

9. In the energy pyramid shown below, the greatest amount of energy is transferred

   ![Energy Pyramid Diagram]

   A. from level A to level B.
   B. from level A to level C.
   C. from level B to level A.
   D. from level D to level A.

10. Which sequence shows a correct flow of energy in a food chain?
    A. alga → snake → duck → deer
    B. bacterium → grass → fox → owl
    C. fungus → beetle → alga → mouse
    D. grass → grasshopper → frog → snake

11. Organisms that eat cows obtain less energy from the cows than the cows obtain from the plants they eat because the cows
    A. convert solar energy for food.
    B. store all of their energy in milk.
    C. use energy for their own metabolism.
    D. pass most of their energy to their offspring.

12. Which pair of organisms would most likely compete for food?
    A. cow and chicken
    B. snake and hawk
    C. mushroom and shrub
    D. brown bear and salmon

13. The food web below shows the relationships between native organisms in an ecosystem. A nonnative predator that feeds only on hawks is introduced to the ecosystem. How is the new predator most likely to affect the ecosystem?

   ![Food Web Diagram]

   A. Seed-bearing plants will become more abundant.
   B. The grasshopper population will decrease.
   C. The snake and the chipmunk populations will decrease.
   D. The hawk population will decrease and the snake population will increase.
14. The graph below shows the estimated population size of a certain species of lizard in a region of forest over several years. These estimates were based on the number of lizard sightings each year. Which recent event in the forest might explain the trend evident in the graph?
   A. A large number of trees were removed in 1994.
   B. The winter season of 1996 was unusually warm.
   C. A new species of predatory bird was introduced to the forest in 2000.
   D. The forest experienced a series of small fires in 2003.

16. Certain bacteria that live in a human’s large intestine help produce vitamin K. This relationship is an example of
   A. commensalism.
   B. mutualism.
   C. parasitism.
   D. predator-prey.

17. Wasp larvae obtain nutrition from tomato hornworms. The tomato hornworms do not survive. This relationship is an example of
   A. commensalism.
   B. mutualism.
   C. parasitism.
   D. predator-prey.

15. All organisms get energy from their environment. When a shark consumes food, the remora fish collects the food scraps by swimming underneath the shark. What type of relationship is demonstrated by the shark and the remora fish?
   A. commensalism
   B. mutualism
   C. neutralism
   D. parasitism

18. A new volcanic island is produced off the coast of Iceland. What will most likely be the first species to grow there?
   A. grasses
   B. lichens
   C. pioneer trees
   D. weeds

19. A region of land near a river was flooded, which destroyed the wooded area. The flood also deposited a large amount of sediment on the land. Which organisms will be the first to repopulate the land?
   A. birds
   B. bushes
   C. grasses
   D. insects

20. Define what is meant by primary succession.
   A. succession following an ecological tragedy, such as a fire or flood
   B. succession that occurs in a newly formed habitat that has never before sustained life
   C. succession of higher life forms after grasses and plants have been established
   D. succession of population in a disrupted habitat
21. Which will most likely occur if a fire or other natural disaster damages an ecosystem?
   A. The area will remain uninhabited for an indefinite number of centuries.
   B. A stable ecosystem will be reestablished after one year.
   C. An ecosystem similar to the original one will be established eventually.
   D. A stable ecosystem will become reestablished in an area that is different from the original.

22. An organism is
   A. a life-form found in a biome.
   B. a group of life-forms belonging to the same species.
   C. a nonliving component of an ecosystem.
   D. the populations found in a biome.

23. A community is
   A. a life-form found in a biome.
   B. a group of life-forms belonging to the same species.
   C. a nonliving component of an ecosystem.
   D. the interacting populations found in a biome.

24. Waste-to-Energy (WTE) is a program that sorts and burns organic waste material, including garbage, to obtain energy. In addition to reducing trash volume, which might be anticipated as an additional bonus in communities utilizing WTE?
   A. increased number of parks
   B. increased pollution of skies
   C. increased recycling of garbage
   D. decreased amount of auto emissions

25. The use of technology often alters the equilibrium in ecosystems. With which statement would most scientists agree?
   A. Humans should develop new technology to expand the influence of humans’ natural communities.
   B. Humans should learn how to control every aspect of the environment so that damage due to technology can be spread evenly.
   C. Humans should use their knowledge of ecology to consider the needs of future generations of humans and other species.
   D. Humans should develop the uninhabited parts of Earth for human population expansion.

26. A student is doing a class project on squirrels. She notices that the more trees there are in a park, the more squirrels she counts. If the city decides to cut down all the trees in one park and turn the space into a soccer field, which would be an appropriate hypothesis she could make about how the squirrel population will be affected in the following year?
   A. The population will decrease.
   B. The population will increase.
   C. In one year, she will not be able to count any squirrels in the park.
   D. Squirrels will be scared away by the extra human activity.
Standards Practice: Multiple Choice
Ecology and Behavioral Relationships

EBR.9.B.2 Evaluate long range plans concerning resource use and by-product disposal in terms of their environmental, economic, and political impact.

27. A town wants to restrict outdoor water usage in order to conserve water during a drought. The best way for the town to do this is to
A. ban all outdoor watering.
B. restrict watering to certain hours at dawn and dusk.
C. restrict watering to between noon and 2 P.M.
D. let the residents water as they want.

28. A town had several homeowners that would mow their lawns during the summer, collect the grass clippings, and dispose of them in a landfill. The town would like to institute an ordinance requiring a more ecologically sound solution. The town should ask homeowners to
A. leave the clippings to decompose in the lawn to form materials that enrich the soil.
B. spray the clippings in the lawn with imported microbes that use them for food.
C. burn the clippings and add the ashes to the soil.
D. throw the clippings into a river to provide extra food for organisms living there.

29. Which is the best strategy for reducing gasoline use and pollution due to transportation? Consider environmental and political ramifications.
A. Ban all forms of internal combustion engines, leaving alternative-fuel choices for powering transportation.
B. Raise taxes on gasoline so the average person will be forced to reduce their driving in a personal vehicle by 75 percent.
C. Enforce stricter laws on pollution values given off by personal vehicles and increase use of alternative-fuel choices.
D. Eliminate engines with more than four cylinders and restrict driving times.

EBR.9.B.3 Assess current world issues applying scientific themes (e.g., global changes in climate, epidemics, pandemics, ozone depletion, UV radiation, natural resources, use of technology, and public policy).

30. Which human activity has probably contributed most to the acidification of lakes in forests?
A. passing environmental protection laws
B. establishing reforestation projects in lumbered areas
C. burning fossil fuels that produce air pollution
D. using pesticides for the control of insects that feed on trees

31. How could the destruction of the ozone layer harm all organisms?
A. It could cause pollution levels to increase.
B. It could raise Earth’s overall temperature.
C. It could increase the exposure to ultraviolet rays.
D. It could cause an energy crisis.

32. In 1987 many countries around the world agreed to limit the use of chlorofluorocarbons (CFCs), chemicals found in air conditioners and refrigerators. Which environmental problem has been alleviated most directly by this action?
A. acid precipitation
B. global warming
C. ozone depletion
D. water pollution

33. A pandemic occurs when a disease affects a high percentage of the population over a large area, often worldwide. Which is the most likely contributing factor for a potential pandemic today?
A. decreased amounts of vaccine
B. increased global temperature
C. change in migration routes of species
D. increased international travel
Standards Practice: Multiple Choice
Nature of Science

Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

**NS.10.B.1** Explain why science is limited to natural explanations of how the world works.

1. Which is the most logical explanation as to why roots grow downward?
   A. Roots are influenced by gravity.
   B. Roots are influenced by magma.
   C. Roots grow away from light.
   D. Roots always grow in the direction of nearby water.

2. Natural explanations would NOT include explanations
   A. based on observation.
   B. slightly spun off from a current theory.
   C. based strictly on imagination.
   D. that extrapolate scientific knowledge.

**NS.10.B.2** Compare and contrast hypotheses, theories, and laws.

3. The most important characteristic of a hypothesis is that it must be
   A. correct.
   B. able to be tested.
   C. logical.
   D. written as a question.

4. The current knowledge concerning cells is the result of the investigations and observations of many scientists. The work of these scientists forms a well-accepted body of knowledge about cells. This body of knowledge is an example of a
   A. controlled experiment.
   B. hypothesis.
   C. research plan.
   D. theory.

5. A law is always
   A. based on observations.
   B. observed under varying conditions.
   C. imaginative.
   D. testable.

**NS.10.B.3** Distinguish between a scientific theory and the term “theory” used in general conversation.

6. A scientific theory
   A. is based on casual observation.
   B. has been tested.
   C. is supported by the public.
   D. has been published in a magazine.

7. Which is a scientific theory?
   A. The telephone always rings when you are eating dinner.
   B. Adults with children are unselfish.
   C. There was once a single landmass—Pangaea—that broke into today’s continents.
   D. There was once an underwater city called Atlantis.

8. Which is a “theory” that might be used in general conversation?
   A. The darker the hair color, the more quiet the individual.
   B. Hair color is influenced by more than one gene.
   C. Hair color and strength of hair are related.
   D. A person with light hair color usually has lightly pigmented skin.

9. A classmate who says, “I have a theory,” is usually
   A. drawing a conclusion.
   B. discussing an experiment.
   C. discussing a test.
   D. stating a fact.

10. A scientific theory can be used to
    A. explain related phenomena.
    B. make calculations.
    C. predict events.
    D. all of the above
Standards Practice: Multiple Choice
Nature of Science

**NS.10.B.4** Summarize the guidelines of science: explanations are based on observations, evidence, and testing; hypotheses must be testable; understandings and/or conclusions may change with additional empirical data; scientific knowledge must have peer review and verification before acceptance.

11. Which is NOT a hypothesis?
   A. A watched pot never boils.
   B. There are green aliens on Mars.
   C. Some teas have medicinal qualities.
   D. People with a cold have trouble identifying flavors.

12. Which could be tested in a scientific experiment?
   A. which planter has the most attractive design to buyers
   B. what type of plant goes best with a room’s decor
   C. how much oxygen a plant will give off
   D. what kind of people care for plants best

13. Which will NOT support an explanation?
   A. evidence
   B. imagination
   C. observation
   D. testing

**NS.11.B.1** Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation.

14. To determine the boiling point of an unknown liquid, a student heats 10 mL of the liquid in a test tube and records the temperature every minute for 20 min. In this example, time is the
   A. control.
   B. dependent variable.
   C. independent variable.
   D. hypothesis.

15. In an experiment to determine the effect of incubation temperature on the time it takes for chicken eggs to hatch, a student selects eggs that are the same size and that were laid at approximately the same time. What is the independent variable in the experiment?
   A. size of the eggs
   B. incubation temperature
   C. time the eggs were laid
   D. time it takes the eggs to hatch

16. Sugar dissolves in, or mixes completely with, water. The solubility of sugar in water is determined by measuring the maximum amount of sugar that dissolves in a given amount of water at a given temperature. A student hypothesizes that the solubility of sugar in water will increase as the temperature of the water increases. In an experiment to test this, which will be the dependent variable and which will be the independent variable?
   A. dependent: volume of water; independent: water temperature
   B. dependent: water temperature; independent: mineral content of the water
   C. dependent: amount of sugar that dissolves; independent: water temperature
   D. dependent: amount of sugar that dissolves; independent: mineral content of water

17. A student is making a rain gauge out of a glass ketchup bottle with a 2.5-cm bottle opening to see how much rain his town gets during the month of April. When making the rain gauge, he must take into consideration
   A. how much rain his town gets during the months of March and May.
   B. which color marker shows up best on the glass.
   C. the difference in the bottle’s bottom diameter as compared to the opening diameter.
   D. the pH of the rain in his town.
18. A scientist is reading a laboratory procedure for an experiment that incorporates biological, disposal, and toxic-waste hazards. Which safety symbols might she encounter?

A.  
B.  
C.  
D.  

19. To best dispose of broken glass in a laboratory, what should be done?

A. place it carefully inside a metal garbage can and surround it with as many discarded pieces of paper as possible.
B. wrap it in tissue paper and throw it away in any type of garbage can.
C. seal it in a cardboard box, label it broken glass, and place it next to a garbage can.
D. store it in an open metal can, label the outside of the can broken glass, and set it in the center of a half-filled garbage can.

20. In the laboratory, a lancet used to draw blood should be disposed of by

A. wrapping it in a plastic bag and throwing it in the garbage can.
B. sterilizing it with flame and throwing it in the garbage can.
C. dipping it in alcohol, placing the top back on, and throwing it in the garbage can.
D. placing it directly in a sharps container.

21. Ecologists monitoring a coastal ecosystem found a decrease in butterflies. They hypothesized that air quality was responsible. Other scientists hypothesized that this was a natural cycle of the ecosystem. What do these different hypotheses demonstrate?

A. Ecologists create hypotheses without proper observations.
B. Different hypotheses demonstrate that neither one is correct.
C. Ecologists must look at all possible hypotheses to follow the scientific method.
D. Scientists can have different perspectives that can lead to different hypotheses.

22. A student at a co-ed school hypothesized that practice would improve the basket-shooting abilities of non-basketball-playing students. She asked six friends to join her in the gymnasium after class to test her hypothesis. After the test, she charted her results. How could she have made her test more representative?

<table>
<thead>
<tr>
<th>Student</th>
<th>Baskets Made</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First 10 Shots</td>
</tr>
<tr>
<td>Mary</td>
<td>5</td>
</tr>
<tr>
<td>Lenora</td>
<td>6</td>
</tr>
<tr>
<td>Rita</td>
<td>3</td>
</tr>
<tr>
<td>Rose</td>
<td>7</td>
</tr>
<tr>
<td>Amber</td>
<td>4</td>
</tr>
<tr>
<td>Rae</td>
<td>4</td>
</tr>
</tbody>
</table>

A. She should have had only 5-shot trials.
B. She should have had each person shoot all 30 baskets in one trial.
C. She should have included basketball-playing students in the group.
D. She should have included males in the group.
Standards Practice: Multiple Choice
Nature of Science

NS.11.B.4 Gather and analyze data using appropriate summary statistics.
Use the table below to answer questions 23–25. A student measured the growth of several similar plants by counting the number of leaves and measuring the height. All plants grew similarly except for Plant F, which did not show signs of good health.

<table>
<thead>
<tr>
<th>Plant</th>
<th>Number of Leaves</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>12.5 cm</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>14.5 cm</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>13.0 cm</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>15.0 cm</td>
</tr>
<tr>
<td>E</td>
<td>8</td>
<td>14.5 cm</td>
</tr>
<tr>
<td>F</td>
<td>3</td>
<td>5.5 cm</td>
</tr>
<tr>
<td>G</td>
<td>9</td>
<td>15.5 cm</td>
</tr>
<tr>
<td>H</td>
<td>8</td>
<td>15.0 cm</td>
</tr>
</tbody>
</table>

23. When computing the average height of this type of plant, how should the student handle data about Plant F?
   A. Figure in its data with the rest of the statistics.
   B. Ignore the data, as the plant was not healthy.
   C. Ignore the data about its number of leaves.
   D. Ignore the data about its height.

24. Ignoring the data for Plant F, what is the median height for the plant?
   A. 12.5 cm
   B. 13.0 cm
   C. 14.5 cm
   D. 15.0 cm

25. What is the mode for the number of plant leaves?
   A. 6
   B. 7.6
   C. 8
   D. 9

NS.11.B.5 Formulate valid conclusions without bias.

26. Some cattle were given bovine growth hormone (BGH) so that they would produce more meat or milk for consumption. The cows were studied to trace the effect of BGH over a period of two years. Cow A was injected with BGH, and Cow B was not. The table shows the results of the investigation. Which is a valid conclusion from this data?

<table>
<thead>
<tr>
<th>Mass Gained by Cows (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>150</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>450</td>
</tr>
</tbody>
</table>

   A. BGH does not noticeably affect cows.
   B. The more BGH injected into a cow, the faster its mass will increase.
   C. A cow injected with the hormone will increase in mass faster than a cow not injected.
   D. A cow injected with BGH will not increase in size as fast as a cow not injected.

27. A student team conducted an experiment to observe the effect of different colors of light on the growth of radish seeds over a period of three weeks with three trials. Their results are shown in the table below. Based on these results, what should the student team conclude about radish growth?

<table>
<thead>
<tr>
<th>Height of Radish Plant (cm)</th>
<th>Red Light</th>
<th>Green Light</th>
<th>Blue Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>13</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Trial 2</td>
<td>11</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Trial 3</td>
<td>12</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

   A. Radishes will grow least in blue light.
   B. Radishes will grow best in green light.
   C. Radishes will grow tallest in red light.
   D. Radishes need all colors of light in order to grow.
Standards Practice: Multiple Choice
Nature of Science

NS.11.B.6 Communicate experimental results using appropriate reports, figures, and tables.

28. A student wants to present a line graph to her audience. Which would be best served by using a line graph?
   A. allowing the audience to make careful observations
   B. showing trends and how data changed over the length of her experiment
   C. showing how a fixed quantity is broken down into parts
   D. comparing numerical information collected from several trials

29. When showing the results of a newly-designed, insulated, portable food-storage container, which type of visual would show most dramatically that little energy is lost to the environment?
   A. bar graph
   B. circle graph
   C. list
   D. table

NS.12.B.1 Recognize that theories are scientific explanations that require empirical data, verification, and peer review.

30. Which contributes to progress in science?
   A. responding to criticism of a theory
   B. accepting a theory without testing it
   C. preventing the publication of rival theories
   D. publishing only data that agree with current theories

31. Peer review of a scientist’s work improves the scientific process because it
   A. allows other scientists to skip some research steps.
   B. allows other scientists to verify data results.
   C. gives scientists an outlet for disagreements in research style.
   D. keeps scientists in strong competition with each other.

32. A scientist revises a theory based on the results from experiments. What should be the scientist’s next step?
   A. Ask peers to review the new theory.
   B. Create a table.
   C. Test the new theory.
   D. Publish the data from the original experiment.

NS.12.B.2 Understand that scientific theories may be modified or expanded based on additional empirical data, verification, and peer review.

33. A student believes that if he studies pairs of plants, one of which grows straight and one of which grows with a bend placed in the stem, the roots will also show these same characteristics. He studies three pairs and finds that the roots all grow downward. His results are shown below. Based on his results, what should be his revised hypothesis?

<table>
<thead>
<tr>
<th>Plant</th>
<th>Mass (g)</th>
<th>Bend in Stem?</th>
<th>Primary Root Growth Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>152</td>
<td>no</td>
<td>downward</td>
</tr>
<tr>
<td>1b</td>
<td>147</td>
<td>yes</td>
<td>downward</td>
</tr>
<tr>
<td>2a</td>
<td>98</td>
<td>no</td>
<td>downward</td>
</tr>
<tr>
<td>2b</td>
<td>105</td>
<td>yes</td>
<td>downward</td>
</tr>
<tr>
<td>3a</td>
<td>247</td>
<td>no</td>
<td>downward</td>
</tr>
<tr>
<td>3b</td>
<td>289</td>
<td>yes</td>
<td>downward</td>
</tr>
</tbody>
</table>

A. Mass affects the direction of primary root growth.
B. The amount of water does not affect the direction of primary root growth.
C. Stem shape does not affect the direction of primary root growth.
D. Sunlight affects the direction of primary root growth.
Standards Practice: Multiple Choice
Nature of Science

34. Our understanding of the cell has changed over time. Which explains why this has occurred?
   A. New scientific discoveries lead to new theories.
   B. Theories are redesigned every ten years as a necessity.
   C. The constantly evolving universe requires new theories to describe it.
   D. Larger number of scientists have opinions that must be incorporated.

35. The theory of biological evolution includes the concept that
   A. species of organisms found on Earth today have adaptations not always found in earlier species.
   B. fossils are the remains of present-day species and were all formed at the same time.
   C. individuals can acquire physical characteristics after birth and pass these acquired characteristics on to their offspring.
   D. the smallest organism is always eliminated by the larger organism within the ecosystem.

36. The theory of biological evolution can be supported by
   A. extinction records.
   B. fossil records.
   C. microscopic observation.
   D. radioactive dating.

38. Cloning relates to the cell theory in that
   A. chromosomes are located in the nucleus.
   B. in cloning, an organism and its cells come from one cell.
   C. all studies in science are inherently ethical.
   D. cells can survive without a nucleus.

39. Which is not part of the germ theory of disease?
   A. Vaccines can control infection.
   B. Proper aseptic procedures will help prevent disease.
   C. The absence of exposure to air will prevent spoilage.
   D. Nonliving things can create living things, such as mold.

40. Which statement was supported by the development of the germ theory of disease?
   A. Storing food in open containers is not harmful.
   B. Washing hands helps prevent the spread of diseases.
   C. Fermentation can take place in a sterile beverage.
   D. The use of chemical agents, such as antibiotics, is a poor way to combat a disease.

41. The germ theory of disease is based on the existence of
   A. antibodies.
   B. antigens.
   C. microorganisms.
   D. protein markers.
Standards Practice: Multiple Choice

Nature of Science

**NS.12.B.6** Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project-HGP, chromosome therapy).

42. The chromosome theory of heredity states that
A. chromosomes exist in all cells.
B. chromosomes are inherited entirely from an organism’s parent(s).
C. genes are located on chromosomes and that each gene occupies a specific place on a chromosome.
D. chromosomes are either dominant or recessive and this determines the phenotype.

43. Chromosome therapy is an attempt to
A. correct defective genes that cause disorders.
B. provide genetic counseling to those that carry potentially harmful genes.
C. combat depression with the insertion of an extra chromosome.
D. study chromosomes to determine whether they lead to erratic behavior.

44. Recombinant DNA is used to produce insulin. Before this could be attempted, the
A. demand for insulin had to be determined.
B. location of the insulin gene had to be known.
C. molecular formula for insulin had to be studied.
D. cost for growing bacteria had to be known.

45. The chromosome theory of heredity is most applicable to the idea that
A. humans have 23 pairs of chromosomes.
B. a defective gene can be located on a chromosome.
C. chromosomes separate during mitotic anaphase.
D. the number of chromosomes is halved during meiotic telophase I.

**NS.12.B.7** Research current events and topics in biology.

46. When humans first domesticated dogs, there was relatively little diversity in the species. Today, there are many variations such as the German shepherd and the Dalmatian. This increase in diversity is most closely associated with
A. cloning of selected body cells.
B. recombinant DNA technology.
C. selective breeding.
D. adverse environmental influence.

47. Recently, some prescription drugs have been shown to have harmful effects on the human body. New studies are being conducted to ensure the safety of these drugs. Which describes the most appropriate way for these studies to be conducted?
A. The same scientists should reevaluate the data.
B. The government should repeat the drug companies’ studies.
C. The pharmaceutical company should study people currently on the drug.
D. A third party should investigate previous patients who were studied.

48. Some people feel that overdosing with vitamins can increase the benefits of a vitamin. What might be a disadvantage to this idea?
A. Overdosing with vitamins might lead to weight gain.
B. Excessive doses of vitamins might be harmful to one’s health.
C. Overuse of vitamins might make some vitamins scarce and hard to supply.
D. Vitamin therapy can be very expensive.
Standards Practice: Multiple Choice
Nature of Science

49. A student wants to conduct an experiment to find out if different colors (wavelengths) of light affect plant growth over a period of two months. What information should she place in her table as she collects her data?
A. plant designation, color of light used, time period, plant height
B. plant designation, color of light used, type of soil used, plant height
C. plant designation, color of light used, time period, amount of water given
D. plant designation, plant species, time period, plant height

50. A student creates a mathematical model that estimates the tail length of an alligator based on its body length. The model gives him the data shown below. In his model, he sets the comparison of body length to tail length as \( k = \frac{B}{T} \). What is the value of \( k \) in the mathematical model?

<table>
<thead>
<tr>
<th>Tail Length</th>
<th>Body Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>1.0</td>
</tr>
<tr>
<td>0.75</td>
<td>1.5</td>
</tr>
<tr>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

A. 0.5  
B. 1.0  
C. 1.5  
D. 2.0

51. Which design would be most appropriate to show the results of data gathered of the height of plants grown in five different types of soil?
A. table  
B. bar graph  
C. pie chart  
D. line graph

52. Gel electrophoresis can be used to analyze DNA fragments. First, the DNA is cut up using special enzymes. It is then placed in a gel between two electrodes. The DNA segments move differently through the gel, depending on their size. This method can also be used to analyze
A. acids.  
B. pH.  
C. proteins.  
D. water molecules.

53. Improvements in high-magnetic field magnets for magnetic resonance imaging (MRI) diagnostics have been possible because of scientific advancements in
A. alternative energy sources.  
B. mechanical engineering.  
C. perpetual-motion machines.  
D. superconductors.

54. Knowledge of atomic structure allows scientists to
A. investigate how plants and animals evolve.  
B. determine how much water humans need to drink every day.  
C. explain the chemical reactions that deplete the ozone layer.  
D. predict when a particular nucleus of a radioactive isotope will decay.

55. When a scientist investigates the structure of mitochondria, which technology allows the scientist to observe them with the most detail?
A. cloning  
B. electron microscope  
C. radioactive isotopes  
D. X rays
Standards Practice: Multiple Choice
Nature of Science

56. The Internet is a digital technology that has been most instrumental in
A. allowing researchers to store vast numbers of data.
B. allowing researchers to collect more accurate and precise data.
C. giving researchers the ability to perform complex calculations very quickly.
D. giving researchers the ability to share data quickly with scientists across the globe.

57. A doctor wants to demonstrate how her newly designed heart valve mimics the work of a real heart valve. Which would be the best way for her to do this during a lecture presentation?
A. Create a graph that shows the efficiency of the new heart valve compared to a damaged heart valve.
B. Create a graphic showing the steps she took when designing the heart valve.
C. Use a computer simulation of the valve working, both in slow motion and in real-time speed.
D. Insert a camera into a living patient to show the valve in action.

58. The study of immunology could lead to advancements in treating
A. AIDS.
B. bone regeneration.
C. depression.
D. Down syndrome.

59. Leptin is a hormone found in humans and most other living things. It has been reported that mice injected with leptin grew up to be much thinner than mice that were not injected with leptin. From birth, both groups were fed the same amount of food. Which could become new scientific knowledge if the scientific community accepts the result of this study and agrees that it applies to humans?
A. Food intake determines a person’s weight.
B. Food intake might not be the predominant cause of obesity.
C. Heredity is the only factor that determines a person’s weight.
D. Small people should eat the same amount of food as large people.

60. Which is an unethical practice in scientific research?
A. sharing results of investigations
B. disregarding conflicting data results
C. reviewing scientific conclusions
D. using educational sources of information

61. Which would pose a potentially unethical situation?
A. having researchers verify the results of a drug company’s findings
B. asking a terminally-ill patient to take part voluntarily in an experimental drug program
C. having a doctor be sponsored by a drug company that asks him her to suggest the drug to his or her patients
D. having a service dispense free medications to low-income people who already have a prescription for the medication

NS.13.B.3 Utilize technology to communicate research findings.

NS.14.B.1 Compare and contrast biological concepts in pure science and applied science.

NS.14.B.2 Discuss why scientists should work within ethical parameters.
62. A student wants to investigate how willing households in his community are to use local alternative energy sources. Which figure would be best to use in a pamphlet to raise community awareness of how household energy use contributes to primary pollutants?
   A. stationary source fuel combustion: 27.3%
   B. industrial processes: 15.0%
   C. solid-waste disposal: 2.5%
   D. miscellaneous: 9.0%

63. Industrial processes account for 15 percent of primary pollutants. How could this number best be reduced?
   A. banning factories and other sources of industrial pollution
   B. putting a high tax on luxury items so the majority of the population will not be able buy them, thus lowering the demand
   C. encouraging handmade crafting of needed and luxury goods
   D. developing alternative sources of energy to use in producing goods

64. According to the U.S. Department of Energy, the state of Arkansas has a high potential for biomass resources. Biomass resources, developed from plant material, are currently the only renewable alternative to
   A. food.
   B. petroleum.
   C. solar energy.
   D. wind power.
Standards Practice: Multiple Choice
Nature of Science

NS.14.B.4 Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology.

65. The idea of recombinant DNA is an example of the cyclical relationship between science and technology. Advancements in genetics and microbiology led to the development of recombinant DNA theory. How might the technology of recombinant DNA contribute to the advancement of science?
   A. Scientists might learn how to better protect bacteria from harm.
   B. Scientists might adapt these splicing techniques to electronics.
   C. It might be discovered that humans are genetically very similar to bacteria.
   D. New advancements in treating disease and disorders might be made.

66. Which is NOT part of the cyclical relationship between science and technology regarding the study of genetics and the Human Genome Project?
   A. By studying genetics, scientists developed new techniques to map chromosomes.
   B. By studying genetics, scientists realized that genes controlled certain traits and disorders.
   C. The Human Genome Project should indicate how a gene is coded in DNA.
   D. The Human Genome Program might lead to advancements in studying meiosis.

67. Scientists identified a fungus that creates an enzyme that quickly breaks down cellulose in straw, leading to the creation of ethanol. This will have the greatest impact on which technology?
   A. alternative energy sources
   B. mechanical engineering
   C. perpetual-motion machines
   D. superconductors

NS.15.B.1 Research and evaluate science careers using the following criteria: educational requirements, salary, availability of jobs, working conditions.

68. A person who studies hurricanes would probably benefit most from a study of
   A. ecology.
   B. ergonomics.
   C. meteorology.
   D. paleontology.

69. A city planner is partially responsible for determining how land in an area is to be used and considering the consequences of this use. Which field of scientific study might be beneficial to a city planner?
   A. ecology, to study how wetlands might be affected by building development
   B. physiology, to study how the human body might react to various chemicals released by toxins in building materials
   C. physics, to know how an earthquake might affect a proposed building design
   D. volcanology, to know how a volcano might affect the community should one erupt nearby

70. Under which condition might it be a deterrent for a student to study large-animal veterinary medicine?
   A. The student does well in comparative anatomy.
   B. The student enjoys working with cats and dogs as well as large animals.
   C. The student prefers to have a private practice.
   D. The student prefers to live in an urban area.

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Standards Practice: Short Answer
Molecules and Cells

Read each question. Then, on the lines that follow, write your answer in complete sentences.

1. Give the definition of a lipid, and tell why it is important.

2. Give the definition of a protein, and tell how it is used in the body.

3. Briefly describe how an enzyme works in a reaction.

4. Trypsin is an enzyme from pancreatic juice. The graph below shows its activity at various pH levels. What conclusion can be drawn about the activity of trypsin?

[Graph showing percent maximum activity of trypsin against pH levels]

MC.1.B.1 Describe the structure and function of the major organic molecules found in living systems: carbohydrates, proteins, enzymes, lipids, nucleic acids.

MC.1.B.2 Describe the relationship between an enzyme and its substrate molecule(s).
MC.1.B.3 Investigate the properties and importance of water and its significance for life: surface tension, adhesion, cohesion, polarity, pH.

5. Compare the terms *adhesion* and *cohesion*, and give an example of each in regards to water.

   ________________________________
   ________________________________
   ________________________________
   ________________________________

MC.1.B.4 Explain the role of energy in chemical reactions of living systems: activation energy, exergonic reactions, endergonic reactions.

6. A student performed the following experiment. He drew and labeled the graph below based on his results. Is the net reaction endergonic or exergonic? Explain your answer.

   ________________________________
   ________________________________
   ________________________________
   ________________________________

7. Briefly define the term *activation energy*.

   ________________________________
   ________________________________
   ________________________________
   ________________________________

8. Is metabolism of glucose by humans an endergonic reaction or exergonic reaction? Explain your reasoning.

   ________________________________
   ________________________________
   ________________________________
   ________________________________
9. Give a definition for the term tissue.

10. Describe the hierarchy of life from cell to organism.

11. The illustration below shows a prokaryote. What defines it as such?
12. Which organelle is the “control center” of a cell? Why is it called that?

13. According to the fluid mosaic model of the plasma membrane’s structure as shown below, how do the molecules of the membrane behave?

14. Describe how the plasma membrane uses selective permeability to maintain homeostasis in the cell.

15. How do the proteins that are receptor molecules in the plasma membrane work?

16. Describe the function(s) of the cytoskeleton in a cell’s cytoplasm.
17. Describe a vacuole in a plant cell, and compare it to the contractile vacuole in a paramecium.

18. Describe the role of centrioles in animal cells and plant cells.

19. How are autotrophic nutrition and heterotrophic nutrition different?

20. According to the energy pyramid below, are mosquito larvae autotrophs or heterotrophs? Explain your answer.
Standards Practice: Short Answer
Molecules and Cells

MC.2.B.7 Compare and contrast active transport and passive transport mechanisms: diffusion, osmosis, endocytosis, exocytosis, phagocytosis, pinocytosis.

21. The graph below shows the relative concentration of different ions inside and outside an animal cell. How can you tell that active transport is directly responsible for the net movement of K⁺ and Mg²⁺ into the animal cell?

[Graph showing concentration of ions inside and outside the cell]

**Key**
- Inside cell
- Outside cell

MC.2.B.8 Describe the main events in the cell cycle, including the differences in plant and animal cell division: interphase, mitosis, cytokinesis.

22. Describe the purpose of the process of mitosis in the cell cycle.

23. Why is interphase an important part of the cell cycle? Explain your answer.
24. Give the order of mitosis, from interphase to interphase.

25. In cell division, what happens during the stage of prophase, as shown below?

26. In cell division, what happens during the stage of anaphase, as shown below?

27. What significant occurrence happens during telophase I of meiosis? Why is it significant?

28. What significant occurrence is absent during meiosis II which happens during mitosis and meiosis I?
29. Define an ectotherm, and give three examples.

30. Study the table below. Tell which animals maintain their body temperature by external processes and which ones maintain their body temperature by internal processes.

<table>
<thead>
<tr>
<th>Animal</th>
<th>One Method of Maintaining Inner Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>insulating body fat and fur</td>
</tr>
<tr>
<td>Fish</td>
<td>migrating to warmer waters</td>
</tr>
<tr>
<td>Hummingbird</td>
<td>insulating feathers on body</td>
</tr>
<tr>
<td>Lizard</td>
<td>basking on warm rocks</td>
</tr>
<tr>
<td>Monkey</td>
<td>has sweat glands to lose heat</td>
</tr>
<tr>
<td>Snake</td>
<td>finding shelter from the sunlight</td>
</tr>
</tbody>
</table>

31. Briefly describe the structure of a mitochondrion.

32. If the chloroplasts were removed from a plant cell, what would happen to the cell?
33. Explain how carbohydrates provide energy for life functions in terms of ATP.

34. Use the image below and describe the use and production of ATP in glycolysis.

35. Briefly describe the process of alcoholic fermentation.

36. Briefly describe the process of lactic-acid fermentation.
37. Briefly describe what happens during the light-dependent phase of photosynthesis.

38. Briefly describe the light-independent phase of photosynthesis.

39. In the material cycle shown below, which processes are represented by letters A and B?

40. Compare and contrast the role of energy in photosynthesis and in cellular respiration.
Standards Practice: Short Answer
Heredity and Evolution

Read each question. Then, on the lines that follow, write your answer in complete sentences.

HE.4.B.1 Summarize the outcomes of Gregor Mendel’s experimental procedures.

1. Why was it important for Mendel to use homozygous, or true-breeding, plants in his experiments?

________________________________________________________________________

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________________________________________________________________________

2. How did Mendel’s work support the concept of alleles?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

HE.4.B.2 Differentiate among the laws and principles of inheritance: dominance, segregation, independent assortment.

3. In inheritance, what is meant by the term *independent assortment*?

________________________________________________________________________

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________________________________________________________________________

HE.4.B.3 Use the laws of probability and Punnett squares to predict genotypic and phenotypic ratios.

4. A person with hitchhiker’s thumb can bend the tips of his or her thumbs backward. Hitchhiker’s thumb is a recessive trait. People with two recessive genes (*t*) for hitchhiker’s thumb can bend the tips of their thumbs backward. However, people with a dominant gene (*T*) cannot do this. Explain how two parents with straight thumbs can have a child with hitchhiker’s thumb, and explain the probability of them doing so.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
5. In inheritance, what is meant by the term *codominance*?

6. Crossing over, as shown below, can occur during meiosis. How does crossing over contribute to gene variation?

---

**HE.4.B.5** Analyze the historically significant work of prominent geneticists.

7. The work of Rosalind Franklin was instrumental to the discovery of the model for DNA. She used X rays to create images of crystallized solids, including biological molecules such as DNA. This gave a pictorial view of atoms. How could this work help scientists discover the structure of DNA?
8. What is meant by the term *monosomy*?

9. What is shown in the karyotype below?

10. Is this a DNA nucleotide or an RNA nucleotide? Explain your answer.

11. Describe the difference between an RNA nucleotide and a DNA nucleotide.
Standards Practice: Short Answer
Heredity and Evolution

HE.5.B.2 Describe the Watson-Crick double helix model of DNA, using the base-pairing rule (adenine-thymine, cytosine-guanine).

12. Explain why the DNA model is referred to as a “double helix.”

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

13. Each grouping of three DNA nucleotides gives a code that signifies an amino acid. Explain why it is very important that, when DNA is replicated, these nucleotides are reproduced in exactly the same order.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

HE.5.B.3 Compare and contrast the structure and function of DNA and RNA.

14. Suppose a string of a DNA sequence is A-C-T-A-G-C-A-C-T-A. How would this string look when put into RNA nucleotides?

__________________________________________________________________________

__________________________________________________________________________

15. What are the three main types of RNA found in a cell?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
HE.5.B.4 Describe and model the processes of replication, transcription, and translation.

16. What process is shown in this illustration?

HE.5.B.5 Compare and contrast the different types of mutation events, including point mutation, frameshift mutation, deletion, and inversion.

17. The illustration below shows point mutation—what happens when a base pair is mismatched. Tell which base is mismatched. Then give the new base sequence of DNA after the point mutation occurs.

18. In genetics, what happens in inversion?
Standards Practice: Short Answer

Heredity and Evolution

**HE.5.B.6** Identify effects of changes brought about by mutations: beneficial, harmful, neutral.

19. How does a beneficial mutation get passed on to successive generations?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

20. Why are harmful mutations less likely to get passed on to successive generations?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**HE.6.B.1** Compare and contrast Lamarck’s explanation of evolution with Darwin’s theory of evolution by natural selection.


________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

22. Briefly describe how Jean-Baptiste Lamarck viewed evolution.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Standards Practice: Short Answer
Heredity and Evolution

HE.6.B.2 Recognize that evolution involves a change in allele frequencies in a population across successive generations.

23. Thousands of years ago, a large flock of hawks was driven from its normal migratory route by a severe storm. The birds scattered and found shelter on two distant islands, shown on the map below. The environment of island A is similar to the hawk’s original nesting region. The environment of island B is different from that of island A. The hawks have survived on these two islands with no contact between the two populations. Explain the present-day conditions of these two hawk populations.

![Map of islands](image)

HE.6.B.3 Analyze the effects of mutations and the resulting variations within a population in terms of natural selection.

24. Scientists compared fossil remains of a species that lived 5000 years ago with members of the same species living today, and concluded that this species had changed very little. Assuming that nonlethal mutations causing new characteristics did occur, give a possible explanation for this lack of change.

25. At one point, mosquitoes were susceptible to DDT, which resulted in many mosquito deaths. Some, however, proved resistant to DDT and survived, passing this resistance on to their offspring. How does this mutation affect the mosquito population? How does it affect the human population?
26. Describe the prevalence of trilobite species during and after the late Cambrian period.

27. Refer to the graph below, and describe the prevalence of dinosaur species during and after the end of the Cretaceous period.

![Mass Extinctions in Earth’s History Graph]

Mass Extinctions in Earth’s History

- Late Ordovician
- Late Devonian
- Late Triassic
- Permian-Triassic
- Cretaceous-Tertiary

28. What is the best way for a scientist to determine whether snakes evolved from fish? Support your answer.
29. The diagram below shows five rock layers and one vertical intrusion, all of which are numbered. A student wants to classify fossils found in these layers using relative dating. Rank the age of each layer, including the intrusion, from newest to oldest.

```
[Diagram of rock layers with numbers]
```

30. Describe how radioactive dating is used to determine the age of fossils.

31. Based on the analysis of the differences in amino-acid sequences of one kind of protein, scientists prepared the evolutionary tree below. Give an example of two species that would have the greatest similarity in DNA.

```
[Evolutionary tree diagram]
```

HE.6.B.6 Compare the processes of relative dating and radioactive dating to determine the age of fossils.

HE.6.B.7 Interpret a Cladogram.
Standards Practice: Short Answer
Classification and the Diversity of Life

Read each question. Then, on the lines that follow, write your answer in complete sentences.

**CDL.7.B.1** Differentiate among the different domains: Bacteria, Archaea, Eukarya.

1. How is a member of the domain Archaea defined?

2. How is a member of the domain Bacteria defined?

Use the table below to answer questions 3 and 4.

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Protista</th>
<th>Fungi</th>
<th>Plantae</th>
<th>Animalia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell type</td>
<td>eukaryote</td>
<td>eukaryote</td>
<td>eukaryote</td>
<td>eukaryote</td>
</tr>
<tr>
<td>Cell structure</td>
<td>some have cell walls of cellulose; some have chloroplasts</td>
<td>cell walls of chitin</td>
<td>cell walls of cellulose; chloroplasts</td>
<td>no cell walls or chloroplasts</td>
</tr>
<tr>
<td>Number of cells</td>
<td>most unicellular; some colonial; some multicellular</td>
<td>some unicellular; most multicellular</td>
<td>multicellular</td>
<td>multicellular</td>
</tr>
<tr>
<td>Mode of nutrition</td>
<td>autotroph or heterotroph</td>
<td>heterotroph</td>
<td>autotroph</td>
<td>heterotroph</td>
</tr>
</tbody>
</table>

3. How is a member of the Kingdom Plantae defined?

4. How is a member of the Kingdom Animalia defined?
Standards Practice: Short Answer
Classification and the Diversity of Life

CDL.7.B.3 Identify the seven major taxonomic categories: kingdom, phylum, class, order, family, genus, species.

5. Why has the classification system changed over the years (for example, having three kingdoms now instead of two)?


6. What is the most inclusive classification category that a domestic cat, jungle cat, and cougar share? Explain your answer.


CDL.7.B.4 Classify and name organisms based on their similarities and differences applying taxonomic nomenclature using dichotomous keys.

7. An amphibian has fewer than nine vertebrae, tailwagging muscles, and no inscriptive ribs. What kind of amphibian is it? Explain how you arrived at your answer.

**Dichotomous Key: Amphibia**

A1. Nine or fewer vertebrae................. B (Salentia)
A2. More than nine vertebrae ......................... C

**Salentia**

B1. Tail-wagging muscles present................. F
B2. Not present............................................. G

C1. Tail present in all life stages........ E (Caudata)
C2. Not present in all life stages...D (Gymnophiona)

D. Gymnophiona

**Caudata**

E1. Narrow grooves between each nostril and upper lip present .............. (Plethodontidae)
E2. Not present ............................................. N

F1. Inscriptional ribs present (Leiopelmatidae)
F2. Not present (Ascaphus truei)

G1. Endochondral ossifications in the hyoid plate present.............. (Bombinatodidae)
8. Ozark blind salamanders are found in the depths of the Blanchard Springs Caverns. They are native to the caverns and live deep within them. The adult Ozark blind salamander is sightless and has no pigment. What is a logical explanation for this?


9. The Arkansas alumroot is a plant that is found in the Ozark and Ouachita Mountains, in north central to northwestern Arkansas. It grows on bluffs and cliffs. It is considered a rare plant and is endemic to Arkansas. How is this information important to an Arkansas environmentalist?


CDL.7.B.6 Compare and contrast the structures and characteristics of viruses (lytic and lysogenic cycles) with non-living and living things.

10. How do viruses compare in growth and development to a cell?


11. Could viruses have been the first “living” things? Support your answer.


Standards Practice: Short Answer
Classification and the Diversity of Life

**CDL.7.B.7** Evaluate the medical and economic importance of viruses.

12. Look at the chart of diseases caused by viruses. What conclusion can you draw from it?

<table>
<thead>
<tr>
<th>Disease</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>helper T-cells of immune system are destroyed</td>
</tr>
<tr>
<td>Chicken pox</td>
<td>fever, itchy rash</td>
</tr>
<tr>
<td>Influenza</td>
<td>fever, sore throat, congestion, aches</td>
</tr>
<tr>
<td>Measles</td>
<td>fever, sore throat, itchy red rash</td>
</tr>
<tr>
<td>West Nile</td>
<td>fever, aches</td>
</tr>
</tbody>
</table>

13. How are most viral diseases transmitted to humans?

14. Describe what is meant by alternation of generations in reproduction.

15. Describe how this strawberry plant is reproducing. Is it undergoing asexual or sexual reproduction?
16. How do bacteria get energy?

17. Where do eubacteria live?

18. What are saprophytes?

19. Bacteria were used to help clean up the Exxon Valdez oil spill. In that case, bacteria quickly broke down petroleum products and reduced contaminants to the elements of carbon dioxide and water. How might this impact future environmental cleanups?

20. Bacteria are sometimes used to reduce or eliminate the need for pesticides by introducing them to affected areas to destroy the insect pests. Give two problems that can occur as a result of this introduction of bacteria to an ecosystem.
Standards Practice: Short Answer
Classification and the Diversity of Life

CDL.7.B.11 Describe the characteristics used to classify protists: plant-like, animal-like, fungal-like.

21. How are funguslike protists similar to fungi? How do they differ?

22. Describe how the four phyla of animal-like protists are classified.

CDL.7.B.12 Evaluate the medical and economic importance of protists.

23. How is agar, a thickener made from seaweed, used in scientific laboratories?

24. Bacteria feed on nutrients in water. When their population increases, they can make the water cloudy. Protozoa (protists) will feed on this bacteria. Give an example of how this knowledge might have a positive economic benefit.
Standards Practice: Short Answer
Classification and the Diversity of Life

CDL.7.B.13 Compare and contrast fungi with other eukaryotic organisms.

25. What are club fungi?

________________________________________________________

________________________________________________________

26. What is a mycelium, and what is its role in a fungus?

________________________________________________________

________________________________________________________

CDL.7.B.14 Evaluate the medical and economic importance of fungi.

27. A fungus can pair symbiotically with a photosynthetic organism (alga or cyanobacterium). This pairing is called a lichen. Describe how a lichen is beneficial to a community.

________________________________________________________

________________________________________________________

________________________________________________________

28. How are yeasts used by humans?

________________________________________________________

________________________________________________________

________________________________________________________

29. Name some common fungal infections of either humans or plants.

________________________________________________________

________________________________________________________

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30. Three types of nonvascular plants are shown below. Which phyla do they represent?

31. How is the reproductive system of a nonvascular plant tied to water?

32. Briefly define the cell type called a tracheid, and define its importance to vascular plants.

33. Briefly describe an angiosperm.

34. Briefly describe a gymnosperm.
Standards Practice: Short Answer
Classification and the Diversity of Life

CDL.7.B.17 Describe the structure and function of the major parts of a plant: roots, stems, leaves, flowers.

35. Describe the roles of the roots, stem, and leaves of a plant.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

36. What are the four structures that make up a flower?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

CDL.7.B.18 Relate the structure of plant tissue to its function: epidermal, ground, vascular.

37. Parenchyma—one type of cell in ground tissue—can contain many chloroplasts. Where might these cells be found? Explain your answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

38. What is the name of the tissue that is in the middle of this cross-section of a root tip? What function does it perform in a plant?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Standards Practice: Short Answer
Classification and the Diversity of Life

**CDL.7.B.19** Evaluate the medical and economic importance of plants.

39. Genes from some wild plants are able to provide resistance to attacks by insects. How might this information be used to benefit humans economically?

40. Recently, scientists have been sent to rain forests by pharmaceutical companies to collect samples of seeds, fruits, and leaves before these dense vegetative areas are destroyed. State one possible reason these corporations are interested in obtaining these samples.

**CDL.7.B.20** Identify the symmetry of organisms: radial, bilateral, asymmetrical.

41. What kind of symmetry do most diatoms have? Support your answer.

42. A flatworm is pictured below. What kind of symmetry does a flatworm have? Support your answer.
Standards Practice: Short Answer
Classification and the Diversity of Life

CDL.7.B.21 Compare and contrast the major invertebrate classes according to their nervous, respiratory, excretory, circulatory, and digestive systems.

43. Briefly describe the characteristics of arthropods.

44. What are the three main classes of mollusks, and what are their major distinctions?

CDL.7.B.22 Compare and contrast the major vertebrate classes according to their nervous, respiratory, excretory, circulatory, digestive, reproductive, and integumentary systems.

45. The table below shows the number of chambers in the stomachs of four animals. Based on the table, how many chambers would you expect a bear’s stomach to have? Support your answer.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Number of Stomach Chambers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camel</td>
<td>3</td>
</tr>
<tr>
<td>Cat</td>
<td>1</td>
</tr>
<tr>
<td>Cow</td>
<td>4</td>
</tr>
<tr>
<td>Dog</td>
<td>1</td>
</tr>
</tbody>
</table>

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Read each question. Then, on the lines that follow, write your answer in complete sentences.

EBR.8.B.1 Cite examples of abiotic and biotic factors of ecosystems.

1. Carrying capacity is the average number of organisms of one species that an environment can support. What abiotic factors can affect carrying capacity?

______________________________________________________________________________________

______________________________________________________________________________________

2. What biotic factors can affect carrying capacity?

______________________________________________________________________________________

______________________________________________________________________________________

EBR.8.B.2 Compare and contrast the characteristics of biomes.

3. Describe a tropical rain-forest biome, including the types of life found there.

______________________________________________________________________________________

______________________________________________________________________________________

______________________________________________________________________________________

______________________________________________________________________________________

4. Describe a tundra biome, including the types of life found there.

______________________________________________________________________________________

______________________________________________________________________________________

______________________________________________________________________________________

______________________________________________________________________________________
5. Using the diagram below, explain the role of each organism in the nitrogen cycle.

The Nitrogen Cycle

Bacteria

6. Define the role of plants in the carbon cycle.

7. State one reason why algae form the base of this energy pyramid.

8. Explain why the size of each level of the pyramid decreases from bottom to top.
9. The red fire ant from western Brazil was introduced to the southern United States. Because the ant has no natural predators in the U.S., scientists are working to control the spread of the population. They are considering bringing its natural predator, the phorid fly, into the areas with high populations of the ant. What is a likely detrimental consequence of this plan?

10. During their mating season, the female members of species X release thousands of eggs into the water where they live. The males release thousands of sperm cells. Not all of the sperm cells will fertilize an egg cell. How does this characteristic help ensure the survival of this species?

11. Suppose there is a species of lichen that is made of two organisms, an alga and a fungus, that have a mutualistic relationship. Predict what would happen if you tried to grow the fungus separately from the alga.

12. Briefly define what is meant by the term commensalism.
EBR.8.B.7 Compare and contrast primary succession with secondary succession.

13. A new volcanic island is formed from an undersea eruption. Will primary or secondary succession occur there? Explain your answer.

14. Define what is meant by the term secondary succession.

EBR.8.B.8 Identify the properties of each of the five levels of ecology: organism, population, community, ecosystem, biosphere.

15. Define what is meant by the term ecosystem as a level of ecology.

16. Define what is meant by the term biosphere as a level of ecology.

17. What is the difference between a population and a community?
EBR.9.B.1 Analyze the effects of human population growth and technology on the environment/biosphere. 

Use the table below to answer questions 18 and 19.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Commercial Fishing Boats</th>
<th>Estimated Population of Atlantic Cod (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>4</td>
<td>14.0</td>
</tr>
<tr>
<td>1997</td>
<td>6</td>
<td>12.5</td>
</tr>
<tr>
<td>1999</td>
<td>12</td>
<td>11.5</td>
</tr>
<tr>
<td>2001</td>
<td>14</td>
<td>9.0</td>
</tr>
<tr>
<td>2003</td>
<td>17</td>
<td>4.5</td>
</tr>
</tbody>
</table>


19. If scientists were concerned about the population of Atlantic cod, what action might they suggest based on the information in the table?

EBR.9.B.2 Evaluate long range plans concerning resource use and by-product disposal in terms of their environmental, economic, and political impact.

20. The following design was chosen to help provide power to a town. How will this design help conserve resource use?
Assess current world issues applying scientific themes (e.g., global changes in climate, epidemics, pandemics, ozone depletion, UV radiation, natural resources, use of technology, and public policy).

21. Briefly define global warming, including what might cause it and one positive action that could be taken to reduce its effect.

22. Briefly explain what might cause a loss of biodiversity, and suggest positive actions that could be taken to reduce the problem.

23. An invasive species is defined as a species introduced by human agency into an area where it did not naturally occur and that can establish a breeding population without further active help from humans. Describe some methods for nonnative species introductions and some possible effects.
Standards Practice: Short Answer
Nature of Science

Read each question. Then, on the lines that follow, write your answer in complete sentences.

NS.10.B.1 Explain why science is limited to natural explanations of how the world works.
1. In science, why are scientists limited to natural explanations of how the world works?

2. Give a logical explanation of why some domesticated animals can find their way back home when they are lost.

NS.10.B.2 Compare and contrast hypotheses, theories, and laws.
3. In science, what is a theory?

4. Compare a hypothesis with a law.

NS.10.B.3 Distinguish between a scientific theory and the term “theory” used in general conversation.
5. How do a scientific theory and a “theory” used in conversation differ?
Standards Practice: Short Answer

Nature of Science

NS.10.B.4 Summarize the guidelines of science: explanations are based on observations, evidence, and testing; hypotheses must be testable; understandings and/or conclusions may change with additional empirical data; scientific knowledge must have peer review and verification before acceptance.

6. A student hypothesizes that an indoor plant placed away from a window will not grow. After taking careful measurements over a period of several weeks, he found that the plant did grow. How might he revise his understanding of the situation?

7. Briefly define the terms peer review and verification, two important processes in a scientific investigation.

NS.11.B.1 Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation.

8. The illustration below shows an experiment used to determine which liquid will boil first. How should this experiment be redesigned in order to achieve better controlled factors?

9. In an experiment, a student tests three plants, exposing them to indoor light from either one lightbulb, two lightbulbs, or three lightbulbs. What are the dependent factor, the independent factor, and the controlled factor in the experiment?
10. This sign was found at the entrance of a chemical laboratory. Give reasons why this sign was placed there.

WARNING:
Goggles and aprons must be worn at all times.

11. In the laboratory, what is the proper disposal method for expended chemicals?

12. A student studied the correlation between weight and cholesterol in high-school students, using data from the school’s football team for his study. Does this study have bias that could affect the outcome? Support your answer.

13. Vitamin A is an important vitamin. It is needed to make a pigment for eyes, and a deficiency of vitamin A can cause night blindness. Suppose a study of carrots and vitamin A was sponsored by carrot growers. The study concluded that carrots are an excellent source of vitamin A and should be part of a daily diet. Is this study valid? How might this study be biased?
14. A student was taking measurements at a local dog show. She recorded the heights (at the shoulders) and weights of five dogs entered in the Shih Tzu breed category. Give the range for these Shih Tzus’ weights, the median weight of these dogs, and a possible explanation for why the height of Princess violates the parameters for an average Shih Tzu.

<table>
<thead>
<tr>
<th>Dog</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunny</td>
<td>24.1</td>
<td>5.4</td>
</tr>
<tr>
<td>Princess</td>
<td>50.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Pepper</td>
<td>27.9</td>
<td>7.0</td>
</tr>
<tr>
<td>Oscar</td>
<td>26.7</td>
<td>6.1</td>
</tr>
<tr>
<td>Buffy</td>
<td>25.4</td>
<td>5.9</td>
</tr>
</tbody>
</table>

15. A scientist tests flame retardant on pieces of wood of the same size and records the temperature using a probe 15 cm away, 2 min after ignition. Based on the data below, what should the scientist conclude? Be as specific as possible in your conclusion.

<table>
<thead>
<tr>
<th>Amount of flame retardant used</th>
<th>Fire Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 g</td>
<td>35</td>
</tr>
<tr>
<td>20 g</td>
<td>30</td>
</tr>
<tr>
<td>40 g</td>
<td>25</td>
</tr>
<tr>
<td>80 g</td>
<td>20</td>
</tr>
</tbody>
</table>
16. As part of an indoor environmental study, a student researched and tested incandescent lightbulbs and fluorescent lightbulbs to determine their efficiencies. He put his results in a graph, along with the efficiency of a gasoline engine and a steam engine to show relative efficiency to the lightbulbs. How could he best improve his presentation?

17. Give an example of when a table would communicate experimental results better than a graph.

18. How does a hypothesis become a theory?

19. Why might a solid, well-based theory be eventually revised?
Standards Practice: Short Answer
Nature of Science

**NS.12.B.2** Understand that scientific theories may be modified or expanded based on additional empirical data, verification, and peer review.

20. A student hypothesized that ice steadily heated will increase in temperature up to and after its boiling point. She researched an experiment and found the following graph. The student wants to run a similar experiment. How should she change her hypothesis?

![Heating Curve for Water](image)

**NS.12.B.3** Summarize biological evolution.

21. How might a scientist try to prove biological evolution?

---

22. How does the theory of genetic mutations support the theory of biological evolution?

---
23. Briefly describe the cell theory.

24. Relate gene therapy to the cell theory.

25. Briefly describe how the germ theory of disease is used.

26. What conclusion can you draw from the chart below?

<table>
<thead>
<tr>
<th>Bacterium</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrelia burgdorferi</td>
<td>Lyme disease</td>
</tr>
<tr>
<td>Clostridium tetani</td>
<td>tetanus</td>
</tr>
<tr>
<td>Mycobacterium tuberculosis</td>
<td>tuberculosis</td>
</tr>
<tr>
<td>Streptococcus pyogenes</td>
<td>strep throat</td>
</tr>
</tbody>
</table>

27. How did the germ theory of disease refute spontaneous generation?
28. How did the chromosome theory of heredity lead to the concept of chromosome therapy?

29. What is the Human Genome Project?

30. How did the chromosome theory of heredity lead to the concept of the Human Genome Project?

31. List an advantage and a disadvantage of stem-cell research.
32. The two graphs that appear below show population growth. Study the population growth between 1950 and 2000. Why do the two graphs show such a difference in visual perception about data from this time period?

33. What is the scientific logic behind the use of forensic DNA fingerprinting?

34. What equipment would be most useful for a long-term study of soil bacteria?
35. What is an advantage of using a computer-generated animation over a schematic?

36. What is an advantage of using a computer-based presentation program to help show data to others?

37. How might the study of the endocrine system lead to an artificial pancreas for diabetics?

38. How might the study of the immune system lead to reduced chances for organ transplant rejection?
Standards Practice: Short Answer
Nature of Science

NS.14.B.2 Discuss why scientists should work within ethical parameters.

39. Give an argument for regulating the work that scientists may do when confronted with a conflict of interest.

40. Give an argument against regulating the work that scientists may do when confronted with a conflict of interest.

NS.14.B.3 Evaluate long-range plans concerning resource use and by-product disposal for environmental, economic, and political impact.

41. With an increasing population, the demand for transportation can only be expected to increase. In order to slow the production of primary pollutants by transportation equipment, what would have the most likely possibility for success while maintaining the population’s needs?

42. The graph below shows an example of the percentages of materials recycled based on the total amount of recovered materials from waste. Based on this information, suggest products that could be developed and marketed to make recycling beneficial to all.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastics</td>
<td>1%</td>
</tr>
<tr>
<td>Metals</td>
<td>18%</td>
</tr>
<tr>
<td>Paper</td>
<td>28%</td>
</tr>
<tr>
<td>Yard waste</td>
<td>12%</td>
</tr>
<tr>
<td>Construction and demolition</td>
<td>17%</td>
</tr>
<tr>
<td>Other materials</td>
<td>22%</td>
</tr>
<tr>
<td>Glass</td>
<td>2%</td>
</tr>
<tr>
<td>Construction and demolition</td>
<td>17%</td>
</tr>
<tr>
<td>Other materials</td>
<td>22%</td>
</tr>
</tbody>
</table>
43. Explain the cyclical relationship between advances in science and advances in technology.


44. Scientists who study Earth from space used new imaging techniques to study changes in the ozone layer. How did this technology contribute to the advancement of scientific knowledge?


45. The health-care industry continues to have a demand for personnel. What are some reasons for this demand?


46. What are some conditions a student must meet in order to successfully study to become a research specialist in infectious disease?
Sample Test
Part 1

Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

1. Which do chloroplasts contain that mitochondria do not? **MC.3.B.1**
   A. ATP
   B. double membrane
   C. protein
   D. stroma

2. How do members of the domain Bacteria and members of the domain Archaea differ? **CDL.7.B.1**
   A. Bacteria are unicellular; archaea are not.
   B. Bacteria are prokaryotes; archaea are not.
   C. Bacteria have cell walls; archaea do not.
   D. Bacteria contain peptidoglycan; archaea do not.

3. In which of the choices is the order of energy transfer in an aquatic ecosystem correct? **EBR.8.B.4**
   A. alga → fish → crayfish → sunlight
   B. alga → sunlight → crayfish → fish
   C. sunlight → alga → fish → crayfish
   D. sunlight → fish → crayfish → alga

4. The process of photosynthesis converts which type of energy to chemical energy? **MC.3.B.4**
   A. heat
   B. light
   C. kinetic
   D. potential

5. Which is not caused by a fungus? **CDL.7.B.14**
   A. athlete’s foot
   B. corn smut
   C. smallpox
   D. wheat rust

6. Organisms that belong to the same class must also belong to the same **CDL.7.B.3**
   A. family.
   B. order.
   C. phylum.
   D. species.

7. A student hypothesizes that upon heating, a certain substance will always form a liquid, no matter what pressure it is under. She reviews her results, shown below. Which should be her next step? **NS.12.B.2**

   ![Phase Change Graph]

   A. revise her hypothesis to say that upon heating, a certain substance might change directly from a solid to a gas, depending on its pressure
   B. rerun the experiment nine more times to make sure her results are correct
   C. rerun the experiment at higher pressures so that a liquid is sure to occur
   D. rerun the experiment but record temperatures in degrees Fahrenheit, not in degrees Celsius

Go on
8. Which is not a common shape for bacteria? 
   CDL.7.B.9
   A. rod-shaped  
   B. sickle-shaped  
   C. spherical-shaped  
   D. spiral-shaped  

9. Why are scientists limited to natural explanations of how the world works? 
   NS.10.B.1
   A. Unnatural explanations are unanimously rejected by human beings.  
   B. Scientists must be able to test and validate explanations.  
   C. No one has been able to prove or disprove the existence of sorcery.  
   D. If unnatural explanations were considered, theories could not be finalized.  

10. Which best describes the function of the plasma (cell) membrane? MC.2.B.4
   A. It defines the organelles of the cell.  
   B. It protects the cell from all damage.  
   C. It regulates the energy level of the cell.  
   D. It regulates what enters and leaves the cell.  

11. What do all nucleotides have in common? HE.5.B.1
   A. lipid base  
   B. enzyme  
   C. simple protein  
   D. five-carbon sugar  

12. During the Apollo space program, scientists needed a way to sterilize the astronauts’ drinking water. They developed a method that uses ions to purify water. How has this development led to other new technologies? NS.14.B.4
   A. Scientists now understand how ions work.  
   B. This is the same method now used in water filters for homes.  
   C. This same technology is used for watering lawns.  
   D. Scientists no longer need to sterilize water used by astronauts.  

13. Examine the cladogram below. Which species is most closely related to species B? HE.6.B.7

   A. C  
   B. D  
   C. F  
   D. I  

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14. Which animal depends on the surrounding environment to regulate its body temperature? **MC.2.B.11**
   A. cardinal  
   B. gerbil  
   C. lizard  
   D. panther

15. Which type of protist is similar to an animal? **CDL.7.B.11**
   A. euglena  
   B. paramecium  
   C. phytoplankton  
   D. red algae

16. Which organelle shown in the diagram below releases energy for the cell by performing aerobic respiration? **MC.2.B.3**

17. Wheat and corn are major food sources in today’s economy. Both wheat and corn are seeds of **CDL.7.B.19**
   A. ferns.  
   B. grasses.  
   C. gymnosperms.  
   D. mosses.

18. A student should not use a laser in a dark room with a mirror because the mirror could shine the laser’s reflection into the student’s eyes. **NS.11.B.2**
   A. shine the laser’s reflection into the student’s eyes.  
   B. absorb the red light of the laser, leaving only damaging infrared rays.  
   C. be set on fire by the heat of the laser.  
   D. be shattered by the laser.

19. In the human body, how does an enzyme react with a substrate? **MC.1.B.2**
   A. The enzyme bonds with the substrate and releases products.  
   B. The enzyme engulfs and digests the substrate.  
   C. The enzyme causes the substrate to multiply.  
   D. The enzyme interacts with the substrate, destroying the enzyme in the process.

20. How does a vaccine help prevent a bacterial disease? **CDL.7.B.10**
   A. The vaccine contains an antibiotic that combines with the pathogen and kills the bacteria.  
   B. The vaccine uses a weakened or killed pathogen to cause the body to become immune to the disease.  
   C. The vaccine introduces a live pathogen to the body, triggering dormant antibiotics stored there.  
   D. The vaccine destroys the host cell before a bacterium can infect it.
21. A small research group determines that a newly discovered species belongs to the order Cetacea. What should the scientists do to ensure their conclusion is not biased? **NS.12.B.1**
   A. publish their findings immediately
   B. restudy the species and conduct new research
   C. allow other research groups to evaluate their data
   D. take a vote to decide the classification of the species

22. Which is a unicellular fungus? **CDL.7.B.13**
   A. fairy ring
   B. mold
   C. mushroom
   D. yeast

23. Strawberries can reproduce by means of runners, which are stems that grow horizontally along the ground. At the region of the runner that touches the ground, a new plant develops. The new plant is genetically identical to the parent because **CDL.7.B.8**
   A. the new alleles are not dominant.
   B. nuclei traveled to the new plant through the runner to fertilize it.
   C. it was produced asexually.
   D. there were no other strawberry plants in the area to provide fertilization.

24. Which harmful disorder might be caused by a genetic mutation? **HE.5.B.6**
   A. cancer
   B. emphysema
   C. epilepsy
   D. influenza

25. Which is a method used by scientists to date a fossil precisely? **HE.6.B.6**
   A. taking X-ray images of the fossil
   B. measuring the hardness of the rocks where the fossil is found
   C. determining the pH of the soil that originally covered the fossil
   D. analyzing the isotopes present in volcanic rocks found near the fossil

26. Aseptic sterilization is based on the premise that germs **NS.12.B.5**
   A. are living and can cause disease.
   B. are nonliving and cannot be killed.
   C. can only enter the body through airborne particles.
   D. cannot live outside a cell.

27. A bird with a keel and wings, but no lamellae, that dives from the surface for fish and has feet far back on its body is classified as **CDL.7.B.4**

**Dichotomous Key: Aves**

A1. Keel present .......................................................... B
A2. Keel not present.........................................................

B1. Lamellae present .......................... Anseriformes
B2. Lamellae not present ......................................... C

C1. Wings modified to flippers ..... Sphenisciformes
C2. Not modified to flippers .................................D

D1. Dives from surface for fish ...................... E
D2. Does not dive from surface for fish ............... F

E1. Feet placed far back on body ... Podicipediformes
E2. Feet not far back on body ................... Gaviiformes

F1. Nostrils enclosed in tubes ... Procellariiformes
F2. Not enclosed in tubes .............................

   A. Anseriformes.
   B. Gaviiformes.
   C. Podicipediformes.
   D. Sphenisciformes.
28. Which nucleotide bases pair with adenine?
   **HE.5.B.2**
   A. cytosine and guanine
   B. cytosine and thymine
   C. guanine and thymine
   D. thymine and uracil

29. Which are flowering seed plants?
   **CDL.7.B.16**
   A. angiosperms
   B. ferns
   C. gymnosperms
   D. hornworts

30. An inventor wants to present his new dialysis machine to a group of other scientists. Which would make the best presentation?
   **NS.13.B.3**
   A. using a working prototype to filter toxic blood which can be tested on site
   B. using a computer animation to show how blood flows through the dialysis machine
   C. using a large graphic that shows the features and safety precautions of the machine
   D. using a human subject and promising to include follow-up blood-test results in a pamphlet

31. A researcher has collected data that show the growth of the population of an endangered plant due to several acts designed to help it recover. The data were presented in a bar graph, using a large scale. How could the researcher have better presented the data to make the differences more apparent?
   **NS.11.B.6**
   A. using a circle graph
   B. using a double bar graph
   C. showing the population per month, instead of per year
   D. using a smaller scale

32. Gregor Mendel’s work with pea plants caused him to state that if offspring plants are hybrid for a trait, they will demonstrate the dominant trait only. This is known as **HE.4.B.1**
   A. Mendel’s law of alleles.
   B. Mendel’s law of dominance.
   C. Mendel’s law of genes.
   D. Mendel’s law of segregation.

33. Nucleic acids are important molecules in all living things. What do nucleic acids help to form?
   **MC.1.B.1**
   A. chromosomes
   B. connective tissue
   C. neurons
   D. red blood cells

34. How does a scientific theory and a “theory” used in conversation differ?
   **NS.10.B.3**
   A. A scientific theory might contain an opinion.
   B. A scientific theory is always true.
   C. A scientific theory has been tested.
   D. A scientific theory will explain an unexplainable event.

35. Barbara McClintock contributed the “jumping DNA” theory of genetics, for which she received the Nobel prize in science in 1983. Here, “jumping DNA” means **HE.4.B.5**
   A. parts of DNA can move around on and between chromosomes.
   B. certain DNA strands can leave a cell’s nucleus.
   C. DNA influences the reaction time of physical response in organisms.
   D. certain chromosomes can leave a cell’s nucleus.
36. Which scientist believed that organisms will acquire and pass on to their offspring variations that they need in order to survive in a particular environment? **HE.6.B.1**
   A. Charles Darwin
   B. Jean Henri Fabre
   C. Jean-Baptiste Lamarck
   D. Karl Stetter

37. Which do cnidarians have that sponges do not? **CDL.7.B.21**
   A. nerve net
   B. asymmetrical body plan
   C. ability to use oxygen
   D. ability to reproduce sexually

38. The study of embryology might lead to advancements in **NS.14.B.1**
   A. more effective antihistamines.
   B. faster healing of bone fractures.
   C. preventing obesity.
   D. preventing genetic defects.

39. A couple have four children. The mother has blue eyes, a homozygous recessive gene ss, and the father has brown eyes, a heterozygous trait Ss. How many of the children probably have brown eyes? **HE.4.B.3**

   - **s**
   - **S**
   - **Ss**
   - **ss**

   A. 0
   B. 1
   C. 2
   D. 4

40. How are most viruses spread to crops? **CDL.7.B.7**
   A. Most are airborne.
   B. Most enter through water or moisture absorbed by the plant.
   C. Most enter through the soil.
   D. Most are carried by insects.

41. An experiment measuring the growth of ten bean plants of the same species after a given period of time yielded the results shown below. Which statistic would best describe the growth of a bean plant under these conditions? **NS.11.B.4**

<table>
<thead>
<tr>
<th>Plant</th>
<th>Growth (cm)</th>
<th>Plant</th>
<th>Growth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

   A. mean
   B. mode
   C. outlier (low)
   D. range

42. Which might initiate primary succession in a habitat? **EBR.8.B.7**
   A. fire
   B. landslide
   C. logging
   D. tornado

43. An autotroph is also known as a **MC.2.B.6**
   A. consumer.
   B. mammal.
   C. predator.
   D. producer.
44. A student notices that her dog always tips over and uproots a plant that is planted in a wooden bowl. She wants to know why her dog is doing this. The student has three plants, all planted in different types of pots with different soils. After placing her plants in other containers, she decides to test whether the smell of the wooden bowl makes the dog want to tip it over. She should set out the NS.11.B.1
   A. wooden bowl with the dog’s food in it.
   B. wooden bowl with a plastic plant stuck in foam in it.
   C. wooden bowl with a similar plant and the same type of dirt in it.
   D. empty wooden bowl along with the two other empty pots.

45. A protist, an edible form of algae, is used in the creation of which product? CDL.7.B.12
   A. ice cream
   B. lemonade
   C. skim milk
   D. steak

46. DNA is held together by HE.5.B.3
   A. a phosphate group.
   B. a six-carbon sugar.
   C. hydrogen bonds.
   D. protein molecules.

47. Vascular tissue in plants is made of several types of cells. This tissue CDL.7.B.18
   A. attracts water through the polarity of its cell membranes.
   B. forms a hollow tubular transport system.
   C. prevents nutrients from reaching a plant.
   D. repels insects by means of a special odor.

48. Modern biology uses many techniques to study the molecules that make life possible. Which technology allows biologists to make sense of the large amount of data now available? NS.13.B.2
   A. advanced computers
   B. advanced microscopes
   C. chemical techniques
   D. X-ray technology

49. When did dinosaurs suffer mass extinction? HE.6.B.4

<table>
<thead>
<tr>
<th>Era</th>
<th>Mesozoic</th>
<th>Paleozoic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Cretaceous</td>
<td>Jurassic</td>
</tr>
</tbody>
</table>

   A. late Cambrian
   B. late Ordovician
   C. end Permian
   D. end Cretaceous
50. Embryology is sometimes used to study how organisms might be related to each other. Which is the most likely reason embryology is used? **HE.6.B.5**

A. The development pattern of an embryo changes, depending on external factors in the outside environment.
B. Embryos contain DNA identical to other embryos until differentiation occurs.
C. Different species in the same class often have very similar embryos.
D. Embryos look like the adult form.

51. A nuclear power plant discharged heated water into a river, making it inhospitable to some of the fish living there and more hospitable to others. Which would be the best resolution to this situation? **EBR.9.B.2**

A. Have the plant cool the water before adding it to the river.
B. Develop a new source of energy for this region.
C. Increase the number of fishing licenses for the most populous fish.
D. Introduce new species of fish to substitute for those that were lost.

52. Which organisms might one expect to find in the Ouachita National Forest? **CDL.7.B.5**

A. armadillos
B. bluestem grasses
C. ermine
D. Ozark blind salamanders

53. Yeasts use a type of anaerobic respiration that results in **MC.3.B.3**

A. alcoholic fermentation.
B. cellular respiration.
C. lactic-acid fermentation.
D. photosynthesis.

54. The diagram below shows the carbon cycle, but the label for Step 1 is missing. Which would be the best caption for Step 1? **EBR.8.B.3**

A. Plants release carbon into the air in the form of carbohydrates.
B. Plants absorb carbohydrates from the air and store it in their leaves.
C. Plants remove carbon dioxide from the air and use it to make carbohydrates.
D. Plants convert carbon into carbohydrates through the process of transpiration.

55. Increased usage by humans of chlorofluorocarbons, or CFCs, is suspected of **EBR.9.B.1**

A. altering human brain waves.
B. causing fish to die from poisoning in lakes and ponds.
C. destroying the immune system in cows.
D. destroying the ozone layer.
56. The graph below shows the energy sources that produce electricity. If a decision were made to reduce the use of nonrenewable fossil fuels, which should be developed to meet the demand for electricity with minimal pollution and ecological effect? **NS.14.B.3**

![Energy Sources of Electricity in the United States](image)

- A. natural gas and nuclear
- B. hydroelectricity and other
- C. natural gas and other
- D. other

57. A student interested in snakes studied data of the populations of rattlesnakes and jackrabbits. She found the following graph. For most years the two populations seem interconnected. However, in 1975, the two populations seem independent. Which is a possible reason for this difference? **EBR.8.B.5**

![Rattlesnake and Jackrabbit Population](image)

- A. The snakes found a prey other than jackrabbits.
- B. Some snakes migrated away from the area to find easier prey.
- C. Jackrabbits were scarce, so snakes died from hunger.
- D. An outside factor, such as disease, affected only the snake population.
58. An extension of the cell theory is that **NS.12.B.4**
   A. chromosomes can be harmed by radiation.
   B. mitochondria are inherited mainly from the mother.
   C. organelles were once free-living cells.
   D. prokaryotes are less advanced than eukaryotes.

59. Crossing over occurs when **HE.4.B.4**
   A. an organism has one less chromosome than necessary.
   B. an organism has one more chromosome than necessary.
   C. neither of two alleles for the same gene completely masks the other.
   D. two chromosomes exchange genes with each other.

60. During which stage of meiosis is the number of chromosomes in a cell reduced to a haploid condition? **MC.2.B.10**
   A. interphase I
   B. telophase I
   C. prophase II
   D. metaphase II

61. A study to determine the entire nucleotide sequence of the human chromosomes is known as the **NS.12.B.6**
   A. Chromosome Chronology.
   C. Human Genome Project.
   D. Sequencing of Chromosome X.

62. Which life-form listed below is considered most complex? **MC.2.B.1**
   A. arthropod
   B. bacterium
   C. cnidarian
   D. fungus

63. A student wants to build a windmill that will generate the most power possible. He tests different lengths of windmill blades to help him plan his design. Based on this experiment, which can he conclude about windmill blades? **NS.13.B.1**

   ![Blade Length and Power Output](image)

   A. Longer blades produce more power than shorter blades.
   B. Longer blades are more durable than shorter blades.
   C. Shorter blades produce more electricity than longer blades.
   D. Shorter blades turn faster than longer blades.

64. Which is an abiotic factor in an ecosystem? **EBR.8.B.1**
   A. bacteria in the soil
   B. the amount of precipitation the area receives
   C. a fungus growing on rotting wood
   D. predators
Sample Test
Part 2

Read each question. Then, on the lines that follow, write your answer in complete sentences.

1. In science, what is a law? **NS.10.B.2**

2. Suppose a plant experiences a change in allele frequency that causes it to produce pink flowers instead of red ones. Then the environment changes to favor only plants with pink flowers. What is the effect of this change on this population of plant? **HE.6.B.2**

<table>
<thead>
<tr>
<th>Generation</th>
<th>Number of Pink Flowers</th>
<th>Number of Red Flowers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>37</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>41</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>0</td>
</tr>
</tbody>
</table>

3. Define what is meant by the term eukaryote. **MC.2.B.2**

4. In inheritance, what is meant by the term segregation? **HE.4.B.2**
5. Briefly define what is meant by the term *parasitism*. **EBR.8.B.6**

6. A sea star is shown below. What kind of symmetry does a sea star have? Support your answer. **CDL.7.B.20**

7. How is a member of the kingdom Protista defined? **CDL.7.B.2**

8. Briefly describe the process of glycolysis. **MC.3.B.2**
9. Define what is meant by the term *community* as a level of ecology. **EBR.8.B.8**

10. A tobacco company has a division that studies the effect of tobacco on humans. Their work is then retested by an outside laboratory that the company hires. Explain why the tobacco company verifies their results in this manner and if this verification achieves the desired goal. **NS.11.B.3**

11. How does a plant cell differ from an animal cell in how it maintains its shape? **MC.2.B.5**

12. How does its method of obtaining moisture affect the overall size of a nonvascular plant? **CDL.7.B.15**

13. What are some qualities a student should possess in order to study successfully to become a pharmacist? **NS.15.B.1**
14. In cell division, what happens during the stage of mitosis shown below? **MC.2.B.9**

15. List an advantage and a disadvantage of pre-immunizing against diseases that could be used in chemical warfare. **NS.12.B.7**

16. Scientists studied frogs in the cloud forests of Costa Rica. They reported that only 20 of the 50 species originally identified in the site were found. These disappearances coincided with moisture-level reductions of the cloud forests from oceanic and atmospheric warming. What does this study indicate about climate change and its effect on the biosphere? **EBR.9.B.3**
17. A drug company tested chemical X to see if it prevented colds. In their test, 20,000 volunteers were placed in four groups. Each volunteer took a white pill every morning for one year, without knowing the contents of the pill. The resulting data were recorded in the table below. Give a logical, nonbiased conclusion, based on the data shown. **NS.11.B.5**

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Volunteers</th>
<th>Contents of Pill</th>
<th>Developed Colds (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5000</td>
<td>5 g sugar</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>5000</td>
<td>5 g sugar, 1 g X</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>5000</td>
<td>5 g sugar, 3 g X</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>5000</td>
<td>5 g sugar, 9 g X</td>
<td>15</td>
</tr>
</tbody>
</table>

18. In genetics, what is meant by the term *transcription*? **HE.5.B.4**

19. How does a virus interact with a living cell during its lytic cycle? **CDL.7.B.6**
20. Why are water molecules known as polar molecules? **MC.1.B.3**

21. What are characteristics of plants in a desert biome that help them survive? **EBR.8.B.2**

22. How can a mutation be beneficial to an organism in terms of natural selection? **HE.6.B.3**

23. The table shows the number of chambers in the stomachs of four animals. What can you conclude about how diet might affect the digestive systems of different species of mammals? **CDL.7.B.22**

<table>
<thead>
<tr>
<th>Animal</th>
<th>Number of Stomach Chambers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camel</td>
<td>3</td>
</tr>
<tr>
<td>Cat</td>
<td>1</td>
</tr>
<tr>
<td>Cow</td>
<td>4</td>
</tr>
<tr>
<td>Dog</td>
<td>1</td>
</tr>
</tbody>
</table>
24. What is meant by the term *trisomy*? **HE.4.B.6**

25. What function do leaves perform for a plant? **CDL.7.B.17**

26. What occurs during pinocytosis? Is it active or passive? **MC.2.B.7**

27. Compare and contrast the role sugar plays in photosynthesis and in cellular respiration. **MC.3.B.5**

28. In genetics, what happens in frameshift mutation? **HE.5.B.5**
29. How do scientists think differences occurred among members of a species? **NS.12.B.3**

30. A student hypothesizes that brown hair is stronger and more resistant to damage than blond hair. How might he go about testing this hypothesis? **NS.10.B.4**

31. What is meant by the term *cytokinesis*? **MC.2.B.8**

32. If a scientist refused to share the results of her investigations, why might this be considered unethical? **NS.14.B.2**

33. What is the difference between an exergonic reaction and an endergonic reaction? **MC.1.B.4**