Student Name: ____________________________________________

Missouri
DEPARTMENT OF ELEMENTARY & SECONDARY
EDUCATION
End-of-Course Assessment

Biology

Pre-Test

Staple Here
Acknowledgements:

Photo of Cavefish. Courtesy of Missouri Department of Conservation.

Illustration of Daphne Birds. This illustration is in the public domain under Create Commons Attribution CC BY 3.1. http://creativecommons.org/licenses/by/3.0/. Source: Lumen Learning OER. http://courses.lumenlearning.net/biology/chapter/chapter-11-evolution-and-its-processes/#m45943.
Directions to the Student

Today you will be taking the Missouri Biology Test. This is a test of how well you understand the course level expectations for Biology.

There are several important things to remember:

1. Read each question carefully and think about the answer. Then choose the one answer that you think is best.
3. If you do not know the answer to a question, skip it and go on. You may return to it later if you have time.
4. If you finish the test early, you may check over your work.
1. Ozark cavefish are small, colorless, blind fish that live in caves in southwest Missouri. The label indicates the lateral line in an Ozark cavefish. The lateral line is a system of sense organs used to detect movement, pressure, and vibration.

How does a lateral line improve the chances of survival for Ozark cavefish?

A. by improving their overall speed  
B. by allowing for a larger body size  
C. by improving their ability to locate prey  
D. by providing them camouflage to evade predators
2. The table shows the amount of energy stored in each molecule in the photosynthesis reaction. Use the data to answer the question.

\[ 6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow 6\text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \]

**Molecular Energy in Photosynthesis**

<table>
<thead>
<tr>
<th>Name of Molecule</th>
<th>Chemical Formula</th>
<th>Amount of Energy per Molecule (in kJ per mole)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>CO(_2)</td>
<td>799</td>
</tr>
<tr>
<td>Water</td>
<td>H(_2)O</td>
<td>467</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O(_2)</td>
<td>495</td>
</tr>
<tr>
<td>Glucose</td>
<td>C(<em>6)H(</em>{12})O(_6)</td>
<td>9,467</td>
</tr>
</tbody>
</table>

Which statement correctly describes the flow of energy in photosynthesis?

A. Photosynthesis releases energy when the reactants rearrange and form the bonds in the products.

B. Photosynthesis releases energy when carbon dioxide and water combine to form glucose molecules.

C. Photosynthesis stores energy because more energy is stored in glucose than it is in carbon dioxide or water.

D. Photosynthesis stores energy because energy is released when glucose is formed from carbon dioxide and water.
3. The passage describes a condition that is inherited. Select the statements which lead scientists to believe the condition is genetically-controlled.

Select all that apply.

The condition is caused by ○ a mutation that changes a protein that affects connective tissues. Connective tissues help the body grow and develop properly. The mutation can cause abnormal growth of bones, abnormalities in the heart, and problems with vision. A hypothesis exists that Abraham Lincoln had this condition. Lincoln was unusually tall, ○ had long limbs, and other physical features characteristic of the condition. Some researchers have speculated that Lincoln's mother died young from complications of this condition. In 1960, ○ a male descendent of Lincoln's great-great-grandfather was positively identified having this condition. Experts believe that nearly half of the people who have this condition do not know they have it, but ○ there are treatments available for people diagnosed with this condition.
4. The following question has two parts. First, answer Part A. Then, answer Part B.

Daphne birds can be classified into two categories of beak depths, shallower beaks, which have a height of 9 mm or less, and deeper beaks, which have a height of 10 mm or larger. In 1976, the mean beak depth was 9.5 mm and there were groups of birds on either side of this mean. The graphs show mean beak depth for the Daphne bird. Study the differences from 1976 to 1978. Note a drought occurred in 1977.

Part A

If the drought continued, what is a reasonable expectation for the distribution of beak depths in the bird species?

A. One hundred percent of the population will have a beak depth of 10.5 mm instead of 10.0 mm.

B. Sixteen percent of the population will have a beak depth of 9 mm instead of only 4% of the population with 9 mm.

C. Ten percent of the population will have a beak depth of 9 mm and 16% of the population will have a beak depth of 13 mm.

D. Sixteen percent of the population will have a beak depth of 10 mm and 3% of the population will have a beak depth of 9 mm.
Part B

Which explanation describes the predicted pattern of beak change due to continued drought?

A. Dry conditions will cause the extinction of smaller beaked birds and therefore a new species of birds will arise in the environment.

B. Dry conditions do not appear to favor birds of any particular beak depth and therefore the populations will hover equally around the mean beak depth.

C. Dry conditions favor birds with larger beak depths so the proportion of the population with larger beak depths will increase and smaller beak depths will decrease.

D. Dry conditions favor birds with smaller beak depths, which will reproduce with greater frequency and increase the proportion of smaller beak depths within the population.
5. The diagram shows the processes of DNA replication and mitosis.

Why does DNA replication occur before mitosis and cell division? Be sure your answer addresses:

- the products of DNA replication
- the products of mitosis
- why replication must occur first

Use evidence from the diagram to support your explanation.

Enter the response in the space provided.
A scientist studied the effect of precipitation on two species within the same ecosystem. The data is shown in the graphs.
6. The following question has two parts. First, answer Part A. Then, answer Part B.

Part A

Which claim is best supported by the data?

A. As annual precipitation increases, the populations of Species A and B increase.

B. As annual precipitation increases, the populations of Species A and B decrease.

C. As annual precipitation increases, the population of Species A increases while Species B decreases.

D. As annual precipitation increases, the population of Species A decreases while Species B increases.

Part B

If the precipitation levels observed in year ‘09 remain the same and other resources remain constant, identify and describe what can be predicted to occur with the population of Species B over the next 6 years?

Enter the answer in the box.
7. **What evidence supports common ancestry between two species?**

   **Select all that apply.**

   A. living in the same biome
   B. growing to the same size
   C. having similar anatomical structure
   D. finding fossil evidence of each species
   E. determining their DNA sequences are quite similar
8. The region of DNA indicated in the diagram is called a

- chromosome.
- gene.
- nucleotide.
- protein.

It contains instructions that code for

- chromosomes.
- genes.
- nucleotides.
- proteins.
9. The following question has two parts. First, answer Part A. Then, answer Part B.

The image summarizes the impact of natural disasters on human migration. Use the image to answer the questions.

Part A

Which type of natural disaster resulted in the greatest human migration?

A. earthquakes
B. floods
C. landslides
D. volcanic eruptions
Part B

Identify two reasons people migrate from these areas after a natural disaster. For each reason, provide one strategy for reducing these migrations.

Enter the response in the box.

10. The black-tailed jackrabbit lives in the desert. These rabbits maintain their body temperature by releasing heat through their long ears. If global temperatures continue to rise, what change would be expected in this rabbit species over time?

A. Rabbits with longer ears would have an advantage and be more likely to survive.

B. Rabbits with lighter-colored ears would have an advantage and be more likely to survive.

C. Individual rabbits will grow longer ears during their lifetimes and pass these traits on to their offspring.

D. Individual rabbits will acquire other adaptations during their lifetimes and pass these traits on to their offspring.
11. A newly fertilized egg cell develops into a new organism. The diagram shows the development of this cell.

Development

Fertilized Egg

Select the words that complete these statements.

- Differentiation
- Fertilization
- Growth
- Mitosis

is a process by which cells begin to change and become specific types of cells. A group of similar cells working together to perform a specific function is called a(n)

- organ.
- organism.
- organ system.
- tissue.
Human body temperature is 98.6°F and must be maintained for proper function of human body systems. Thermal homeostasis is the ability of an organism to maintain its stable internal body temperature. When it is cold, one way the human body maintains normal temperature, is to constrict blood vessels to conserve heat and to prevent sweat glands from secreting fluid.

Other mammals maintain body temperature in cold climates in different ways. Otters maintain body temperature by trapping air pockets in their thick fur which insulates them from the cold. Harbor seals retain their heat with a thick layer of fat under the skin which insulates them from the cold. During an oil spill in a cold climate, sea otters have been found to be less likely to survive than harbor seals.

12. **Which best explains why sea otters are less likely than harbor seals to maintain homeostasis after an oil spill?**

A. The layer of oil on sea otters encourages greater heat loss.

B. The layer of oil on sea otters interferes with reproductive abilities.

C. Oil penetrates the air pockets in sea otters’ fur which they use for insulation and temperature regulation.

D. Oil penetrates the air pockets in sea otters’ fur which interferes with their ability to be buoyant and stay above the water line.

13. **A student walks to school in the morning when the outside temperature is 60°F. When the same student walks home after school, the outside temperature has dropped to 35°F. In this situation, how is thermal homeostasis maintained?**

A. The student’s heart rate drops as a negative feedback mechanism to deliver less oxygen to the lungs.

B. The student begins to sweat as a positive feedback mechanism to reduce the core body temperature.

C. The student begins to shiver as a negative feedback mechanism to increase the core body temperature.

D. The student’s breathing rate slows as a positive feedback mechanism to deliver more oxygen to the lungs.
14. The column on the left contains responses of the body. The column on the right lists systems of the body. Match the response to the corresponding body system. Options may be used more than once.

- Body begins to shiver
- Blood vessels constrict
- Sweat glands produce less fluid
- Brain recognizes temperature drop

- Circulatory System
- Endocrine System
- Muscular System
- Nervous System

15. Which statement correctly describes macromolecules?

A. Nitrogen is essential for carbohydrate formation.
B. Lipids are water-loving molecules critical for cell functions.
C. Most macromolecules contain carbon, hydrogen, and oxygen.
D. Repeating units, called amino acids, contain phosphorus and are used to build nucleic acids.

16. A student examined an unknown molecule that contained carbon, hydrogen, oxygen, and nitrogen. No additional elements were found in the molecule.

Which type of molecule was examined?

A. protein
B. nucleotide
C. triglyceride
D. carbohydrate
17. **Two different fish species, the Arctic cod and Antarctic toothfish, are separated by great distance. Although they are not genetically related, both produce a similar protein that prevents them from freezing in cold waters. What is the best explanation for the similarities between these two fish?**

A. Individuals with favorable genetic mutations were able to survive cold waters.

B. The introduction of a new predator caused the fish to move into deeper, colder waters.

C. The cod and toothfish share a recent, common ancestor, and therefore similar genomes.

D. Climate change is increasing the water’s temperature and preventing the fish from freezing.

18. **A variety of evidence suggests common ancestry of living things. Which pieces of evidence support common ancestry?**

   Select all that apply.

A. Scientists have discovered fossils that demonstrate a transition from one animal group to another.

B. Closely related species share more of the same amino acid sequences than more distantly related species.

C. Organisms that live in the same location grow to the same size and have the same adaptations for survival.

D. Body structures no longer useful in a species demonstrate that species will mutate into new species over time.

E. Adult body forms of various species appear unique but similar structures are observed during embryological development.
19. **Use the diagram to answer the question.**

What contributed to the natural selection of the finches’ beaks?

Select all that apply.

A. Eating tough seeds made their beaks thicker.
B. There was an abundance of food available for all finches.
C. Genetic variation for beak size existed within the population.
D. Certain beak shapes were better suited for different food sources.
E. Reproduction increased in individuals who located enough food.
20. Carbon cycles through living things, water, the atmosphere, and the rocks that compose Earth. Some processes absorb carbon dioxide and other processes release carbon dioxide.

The list contains examples of processes that contribute to the carbon cycle.

- decomposition of organic matter
- volcanic eruptions
- rock-weathering and erosion
- build-up of shells and bones of marine organisms
- cellular respiration
- photosynthesis
- combustion of fossil fuels
- integration of atmospheric carbon into oceanic compounds

Why are atmospheric carbon dioxide levels rising, but total carbon levels remaining the same? Be sure your answer provides three possible explanations.

Enter the response in the space provided.
Many Missouri deer have brown fur color which helps them blend into their surroundings and avoid predators. However, there are also albino deer that lack this coloring. The albino trait is located on an autosome\(^1\). Albino deer are highly preyed upon and rarely survive to reproduce.

\(^1\) *autosome*: term used to refer to the non-sex related chromosomes
21. The first albino deer born in a population was **most likely** due to

- exposure to chemicals after birth.
- a mutation in a parent body cell.
- a mutation in the DNA of a gamete.
- exposure to environmental changes.

22. An albino female deer (aa) breeds with a homozygous normal (AA) male. Complete the Punnett square for the first generation of offspring of these parents. Draw a line from the alleles and genotypes to the correct locations.
23. If the albino female continues to produce offspring with the homozygous, normal male, the genotype of the offspring produced will be o AA, o Aa, o aa, and their phenotype would be o albino. o brown. o light brown. This type of inheritance pattern is known as o complete dominance. o incomplete dominance. o sex-linked dominance.
24. The offspring of the original albino doe and the original homozygous male mate with other deer and produce more generations. Many allele combinations are possible. Create a Punnett square that demonstrates the allele combinations necessary for a \( \frac{1}{4} \) chance of an albino offspring.

Draw a line from the alleles and genotypes to the correct locations.
25. Asian carp, an invasive species, were introduced accidentally into Missouri aquatic ecosystems. Both the Asian carp and the native paddlefish are plankton feeders. After the introduction of Asian carp, the paddlefish populations immediately began to decline.

Based on the information provided, why is the native paddlefish population declining?

Select all that apply.

A. They occupy the same niche as the Asian carp.
B. Native paddlefish compete for the same food as the Asian carp.
C. The introduction of Asian carp caused a drop in water temperatures.
D. Native paddlefish populations are declining as a result of increased human consumption.
E. The introduction of Asian carp limited the locations where native paddlefish can hide from predators.

26. There are two variations of a species of peppered moth. One is a very light gray and the other is black. All of the moths live on trees with white bark. What is most likely to lead to more black moths and fewer gray moths?

A. Drought kills many of the trees.
B. A contagious disease kills many of the moths.
C. Air pollution stains the tree bark a darker color.
D. New predators are introduced and eat more moths.
In the 1800's, wolves were top predators in Yellowstone National Park. As humans moved westward, wolf populations were negatively impacted. Human expansion decreased their available prey. Human agricultural practices introduced livestock, which were easy prey for wolves. Humans protected their livestock and intentionally eliminated the wolves. By the mid-1900's, no wolf packs lived in Yellowstone National Park. This left the park with few top predators. As a result, elk overgrazed young willow and cottonwood trees that stabilized riverbanks. This caused increased erosion, which filled rivers with silt. Fish populations declined as a result of the additional silt in the rivers and populations of animals that depended upon fish also declined. With a drop in cottonwood and willow trees, songbird and beaver populations lost potential habitat and materials needed to construct habitat. Fewer beaver dams resulted in fewer small, still ponds which fish use to reproduce and grow to adulthood. In 1995, wolves were reintroduced to Yellowstone National Park.

27. **Why were wolves reintroduced to Yellowstone National Park?** In addition, provide two pieces of evidence that would show the wolf reintroduction successfully improved overall ecosystem health within Yellowstone National Park.

Enter the answer in the box provided.
28. Scientists measured levels of dissolved oxygen and carbon dioxide in a pond ecosystem over several days. The figure shows the results of this experiment.

Based on the data, under which conditions did the rate of photosynthesis decline?

Select all that apply.

A. during the day  
B. during the night  
C. during sunny days  
D. during cloudy days  
E. when CO₂ levels were high  
F. when O₂ levels were high
29. Some cells contain two copies of each chromosome, and some cells contain only one copy of each chromosome. Which types of cells contain two copies of each chromosome?

Select all that apply.

A. egg cell  
B. skin cell  
C. body cell  
D. blood cell  
E. sperm cell
30. **As a zygote divides to form new cells, groups of cells specialize to carry out functions that are essential to the organism. What causes cells to differentiate into specialized cells?**

A. the activation of specific genes  
B. the activation of specific tissues  
C. the activation of specific sex cells  
D. the activation of specific amino acids

31. **Which human activity would decrease the biodiversity of a wetland¹?**

A. adding a drainage system  
B. cleaning pollution out of the water  
C. reintroducing native aquatic plants  
D. restricting the use of water on farmland

¹_wetland: an area of land saturated by water, similar to a swamp or marsh_
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<tr>
<th>Session</th>
<th>Item</th>
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<th>MLS Code</th>
<th>Answer</th>
<th>Points</th>
<th>Point Breakdown</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>MC</td>
<td>9-12.LS4.C.1</td>
<td>C</td>
<td>1</td>
<td></td>
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<tr>
<td>1</td>
<td>2</td>
<td>MC</td>
<td>9-12.LS1.C.1</td>
<td>C</td>
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<tr>
<td>1</td>
<td>3</td>
<td>HT</td>
<td>9-12.LS3.A.1</td>
<td>1, 3</td>
<td>1</td>
<td>• 1 point for two correct answers</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>MC</td>
<td>9-12.LS4.B.2</td>
<td>D</td>
<td>2</td>
<td>• 1 point for each correct answer</td>
</tr>
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</table>
| 1       | 5    | CR   | 9-12.LS1.B.1   |        | 3      | • 3 points for a correct description of:  
|          |      |      |                |        |        | o the result at end of DNA replication  
|          |      |      |                |        |        | o the result at end of mitosis  
|          |      |      |                |        |        | o why replication must occur before mitosis  
|          |      |      |                |        |        | • 2 points for a description that has two of the answers above  
|          |      |      |                |        |        | • 1 point for a description that has one of the answers above  
|          |      |      |                |        |        | • 0 points for any other answer |
| 1       | 6    | MC   | 9-12.LS2.A.1   | D      | 3      | Part A (1 point):  
|          |      | CR   |                |        |        | • 1 point for correct answer  
|          |      |      |                |        |        | Part B (2 points):  
|          |      |      |                |        |        | • 2 points for a correct description that predicts population size staying near carrying capacity and describes fluctuation around carrying capacity  
|          |      |      |                |        |        | • 1 point for a description of either predicting population size staying near carrying capacity OR describing fluctuation around carrying capacity  
<p>| 1       | 7    | MS   | 9-12.LS4.A.1   | C, E   | 1      | • 1 point for two correct answers |
| 1       | 8    | IC   | 9-12.LS1.A.1   | Gene, Proteins | 1 | • 1 point for two correct answers |</p>
<table>
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<tr>
<th>Session</th>
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</table>
|         | 9    | MC    | 9-12.ESS3.A.1    | Part A: A              | 3      | **Part A (1 point):**  
|         |      |       |                  | Part B: (See Point Breakdown) |        | • 1 point for correct answer  
|         |      | CR    |                  |                         |        | **Part B (2 points):**  
|         |      |       |                  |                         |        | • 2 points for a correct description that contains two reasons why humans migrate after a natural disaster AND two strategies for how humans can reduce migrations  
|         |      |       |                  |                         |        | • 1 point for a description that contains two reasons why humans migrate after a natural disaster OR two strategies for how humans can reduce migrations  |
| 1       | 10   | MC    | 9-12.LS4.B.2     | A                       | 1      | **2 points for five correct answers and no incorrect answers**  
| 1       | 11   | IC    | 9-12.LS1.B.1     | Differentiation, Tissue | 1      | **1 point for five correct answers and one incorrect answer OR four correct answers and no incorrect answers**  
| 1       | 12   | MC    | 9-12.LS1.A.3     | C                       | 1      | **0 points for all other combinations**  
| 1       | 13   | MC    | 9-12.LS1.A.3     | C                       | 1      | **2 points for three correct answers**  
|         |      |       |                  |                         |        | **1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers**  
|         |      |       |                  |                         |        | **0 points for all other combinations**  |
| 1       | 14   | LM    | 9-12.LS1.A.2     | Numbers = Left Column, Letters = Right Column A2, B3, C1, C2, D4 | 2      | **2 points for three correct answers**  
|         |      |       |                  |                         |        | **1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers**  
|         |      |       |                  |                         |        | **0 points for all other combinations**  |
| 1       | 15   | MC    | 9-12.LS1.C.3     | C                       | 1      | **2 points for three correct answers**  
| 1       | 16   | MC    | 9-12.LS1.C.3     | A                       | 1      | **1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers**  
|         |      |       |                  |                         |        | **0 points for all other combinations**  |
| 1       | 17   | MC    | 9-12.LS4.C.2     | A                       | 1      | **2 points for three correct answers**  
|         |      |       |                  |                         |        | **1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers**  
|         |      |       |                  |                         |        | **0 points for all other combinations**  |
| 1       | 18   | MS    | 9-12.LS4.A.1     | A, B, E                 | 2      | **2 points for three correct answers**  
|         |      |       |                  |                         |        | **1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers**  
|         |      |       |                  |                         |        | **0 points for all other combinations**  |
| 1       | 19   | MS    | 9-12.LS4.B.1     | C, D, E                 | 2      | **2 points for three correct answers**  
|         |      |       |                  |                         |        | **1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers**  
<p>|         |      |       |                  |                         |        | <strong>0 points for all other combinations</strong>  |</p>
<table>
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</thead>
</table>
| 1       | 20   | CR   | 9-12.LS2.B.3 |        | 2      | - 2 points for three correct answers of why carbon dioxide levels are rising AND a correct description of why carbon levels remain constant  
- 1 point for either three correct answers of why carbon dioxide levels are rising OR a correct description of why carbon levels remain constant  
- 0 points for not correctly answering either |
| 1       | 21   | IC   | 9-12.LS3.B.2 | A Mutation In The DNA Of A Gamete | 1      | |
| 1       | 22   | DND  | 9-12.LS3.B.4 | Letters = Columns Numbers = Rows  
Aa = B2, B3, C2, C3  
A = B1, C1  
a = A2, A3 | 2      | - 2 points for eight correct answers  
- 1 point for seven or six correct answers  
- 0 points for less than six correct answers |
| 1       | 23   | IC   | 9-12.LS3.B.4 | Aa, Brown, Complete Dominance | 2      | - 2 points for three correct answers  
- 1 point for the a correct answer to the first part only OR correct answers to the last two parts only |
| 1       | 24   | DND  | 9-12.LS3.B.4 | Letters = Columns Numbers = Rows  
A = A2, B1  
a = A3, C1  
AA = B2  
Aa = B3, C2  
aa = C3 | 3      | - 3 points for eight correct answers  
- 2 points for Male (first row) and Female (first column) correct  
- 1 point for Male (first row) OR Female (first column) correct  
- 0 points for any other combination |
| 1       | 25   | MS   | 9-12.LS2.A.1 | A, B | 1      | - 1 point for two correct answers |
| 1       | 26   | MC   | 9-12.LS4.C.2 | C | 1      | - 3 points for a correct answer that explains:  
- why wolves were reintroduced  
- provides a change that indicate success of the reintroduction  
- provides a second change that indicate success of the reintroduction  
- 2 points for a description that has two of the answers above  
- 1 point for a description that has of one of the answers above  
- 0 points for any other answer |
| 1       | 27   | CR   | 9-12.LS2.C.1 |        | 3      | - 3 points for a correct answer that explains:  
- why wolves were reintroduced  
- provides a change that indicate success of the reintroduction  
- provides a second change that indicate success of the reintroduction  
- 2 points for a description that has two of the answers above  
- 1 point for a description that has of one of the answers above  
- 0 points for any other answer |
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</table>
| 1       | 28   | MS   | 9-12.LS2.B.1 | B, D, E  | 2      | • 2 points for three correct answers  
• 1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers  
• 0 points for all other combinations |
| 1       | 29   | MS   | 9-12.LS3.A.1 | B, C, D  | 2      | • 2 points for three correct answers  
• 1 point for three correct and one incorrect answer OR two correct answers and no incorrect answers  
• 0 points for all other combinations |
| 1       | 30   | MC   | 9-12.LS1.A.1 | A        | 1      |                                                                                  |
| 1       | 31   | MC   | 9-12.LS4.C.3 | A        | 1      |                                                                                  |