**REEF SURVIVOR BOARD GAME - GRADING RUBRIC**

**Answers in red**

**Additional answers/notes by grader in green**

**Question Classification from Bloom’s Taxonomy & Points**

**Reef Survivor Pre-Lab Worksheet**

**L6-Q5 (A) + L6-Q5 (B): Score out of 2**

Q3.b. Which community is more likely to survive environmental change, one with lots of only a few types of reef builder, or a community with many different types of reef builder? **Remember**

A diverse community with many different type of reef builders is more likely to survive environmental change because the range of organisms means that it’s likely something will be able to survive the stress. Having lots of one type of organism is not helpful if it is the one that gets killed.

+1 State that a community with many different types of reef builders is more likely to survive

**Reef Survivor Follow-Up Worksheet**

**L6-Q3 (A) + L6-Q3 (B): Score out of 1**

3. a. What are the mechanisms that ADD variation to gene frequency? **Remember**

Mutation and Migration; gene flow (Added while grading)

+1 Mechanisms are correctly listed

[two correct answers= 1

one correct answer= 0.5

all four answers= 0

two correct, one wrong= 0.5

one correct, two wrong= 0

no answer= 0]

**L6-Q4 (A) + L6-Q4 (B): Score out of 3**

b. Do genetic mutations occur for the good of the organism or are they random? Do they help or hurt organisms? Or can they do both? **Remember**

Genetic mutations occur randomly. They may negatively, positively, or neutrally affect an organism or species.

+2 State random occurrence and its effect on an organism

**L6-Q4 (B), follow up question Score out of 3**

d. Using your experience with the reef game, provide an example of a mutation that was beneficial, another that was detrimental, and a third that was neutral. Include the organism, mutation, and disaster in your examples. **Understand**

Answers may vary. Positive mutations help organisms better adapt to their environment and increase chances of survival and reproduction. Neutral mutations have no effect on an organism. Harmful mutations cause genetic disorders which decrease the chance of survival and reproduction.

Some students mentioned that they did not have any detrimental or beneficial mutations during the game and hence did not write an answer. They should be able to write this answer from pre lab. In such situations 0 is awarded. There are some students who have hypothesized situations and hence have received points.

+1 Identify a beneficial mutation (including the organism, mutation, and disaster)

+1 Identify a neutral mutation (including the organism, mutation, and disaster)

+1 Identify a harmful mutation (including the organism, mutation, and disaster)

**L6-Q1 (A) + L6-Q1 (B): Score out of 3**

e. Can an organism or species "prepare for" environmental changes or stresses? Explain your answer. What does this tell you about natural selection? (3 points) **Understand**

+2 An organism can’t prepare for environmental changes or stresses because they do not know what environmental disaster is coming and they cannot predict/control their mutations.

+1 Natural selection removes variation and thus organisms cannot prepare for the environmental change and whether or not they will survive it. Change is always (at least) one generation behind the stress so Natural Selection cannot be predicted.

**L6-Q5 (A) + L6-Q5 (B): Score out of 2**

4. a. Which community is more likely to survive environmental change, one with lots of only a few types of reef builder, or a community with many different types of reef builder? **Remember**

A diverse community with many different type of reef builders is more likely to survive environmental change because the range of organisms means that it’s likely something will be able to survive the stress. Having lots of one type of organism is not helpful if it is the one that gets killed.

+1 State that a community with many different types of reef builders is more likely to survive

6-8. Sketch questions are found below with their respective rubrics. **Apply**

**L6-Q6 (B): Score out of 9**

6. Sketch a reef system, identify reef builders, stresses and how those stresses may change the reef through time. Make sure your sketch is labeled (e.g., the organism, the process description, the result of the process). *Note: There are multiple correct answers!* **Apply**

Fleshy algae would be considered as a stressor if answer is explained well.

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| **Identify the components of the system** | **Categories:**  1. Boundaries – environment (deep, intermediate, shallow)  2. Organisms – labeled  3. Other physical components – visible mutations | **Basic (1)** | Diagram includes components from one of the categories |
| **Good (2)** | Diagram includes components from two of the categories |
| **Very good (3)** | Diagram includes components from three of the categories |
| **Ability to identify dynamic relationships among components** | **Categories:**  1. Identify stresses/impact on organism  2. Environmental Stressor (e.g., Hurricane, global warming)  3. Modification of organism through time (due to stressor effect) | **Basic (1)** | Diagram includes dynamic relationships from one of the categories |
| **Good (2)** | Diagram includes dynamic relationships from two of the categories |
| **Very Good (3)** | Diagram includes dynamic relationships from three or more of the categories or student identifies one or two dynamic relations and they locate them in space |
| **Excellent (4)** | Diagram includes dynamic relationships from three categories and locate them in the space |
| **Thinking temporally (prediction)** | | **Basic (1)** | The diagram includes processes evidencing temporal thinking |
| **Good (2)** | The diagram includes processes evidencing temporal thinking and a basic understanding of reef systems and geological time |

**L6-Q2 (A) + L6-Q2 (B): Score out of 9**

7. This reef game models evolution. Make a simple sketch about how mutation, migration, random processes, and natural selection can impact a community. How might this lead to extinction over geological timescales? Make sure your sketch is labeled (e.g., the organism, the process description, the result of the process). *Note: There are multiple correct answers!* **Apply**

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| --- | --- | --- | --- |
| **Identify the components of the system** | **Categories:**  1. Organisms – labeled  2.. Other physical components – visible mutations  3. Mechanisms labelled- e.g., mutation, migration, natural selection, and random processes | **Basic (1)** | Diagram includes components from one of the categories |
| **Good (2)** | Diagram includes components from two of the categories |
| **Very good (3)** | Diagram includes components from three of the categories |
| **Ability to identify dynamic relationships among components** | **Categories:**  1. Demonstrate mutation and migration  2. Demonstrate random processes and natural selection  3. Demonstrate variation in gene frequency (either positive for mutation and migration, and negative for random processes and natural selection) | **Basic (1)** | Diagram includes dynamic relationships from one of the categories |
| **Good (2)** | Diagram includes dynamic relationships from two of the categories |
| **Very Good (3)** | Diagram includes dynamic relationships from categories one and two and evidence of variation in population from either category 1 or two. |
| **Excellent (4)** | Diagram includes dynamic relationships from categories one and two and evidence of variation in population from both categories one and two and demonstrated the connection between all the four mechanisms. |
| **Thinking temporally (prediction and discusses the extinction aspect)** | | **Basic (1)** | The diagram includes processes evidencing temporal thinking |
| **Good-how these processes lead to extinction over time**  **(2)** | The diagram includes processes evidencing temporal thinking and a basic understanding of geological time |

**L6-Q7 (B): Score out of 6**

8. Sketch a cross section of your reef bathymetry (depth of the water), include three of your reef builders. How did the water depth impact the chance of those organisms surviving (i.e., did the depth help or hinder their survival?) **Apply**

Students pasting the game board have received points for the boundary category since the game board indicated the depth, but not for “water” in other physical components, at least students should label water.

“Boundaries” are ocean basin and the different depths/topographies of the sea floor.

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| **Identify the components of the system** | **Categories:**  1. Boundaries – environment (deep, intermediate, shallow)  2. Organisms – labeled (three reef builders)  3. Other physical components – water, contaminants, hurricane waves, snow, no land or presence of land) | **Basic (1)** | Diagram includes components from one of the categories |
| **Good (2)** | Diagram includes components from two of the categories |
| **Ability to identify dynamic relationships among components** | **Categories:**  1 Show depth water effect on organism’s survival  2. Connection to environmental events from game play  3. Highlight the characteristics that helped or hindered the organism in relation to water depth and environmental stress | **Basic (1)** | Diagram includes dynamic relationships from one of the categories |
| **Good (2)** | Diagram includes dynamic relationships from two of the categories |
| **Very Good (3)** | Diagram includes dynamic relationships from three or more of the categories or student identifies one or two dynamic relations and they locate them in space |