AP Biology Free Response Questions

Big Idea 3 – Version1

1. A new species of fly was discovered on an island in the South Pacific. Several different crosses were performed, each using 100 females and 100 males. The phenotypes of the parents and the resulting offspring were recorded.

Cross I: True-breeding bronze-eyed males were crossed with true-breeding red-eyed females. All the F1 offspring had bronze eyes. F1 flies were crossed, and the data for the resulting F2 flies are given in the table below.

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| **F2 Phenotype**  | **Male** | **Female** |
| Bronze eyes | 3,720 | 3,800 |
| Red eyes | 1,260 | 1,320 |

Cross II: True-breeding normal-winged males were crossed with true-breeding stunted-winged females. All the F1 offspring had stunted wings. F1 flies were crossed, and the data for the resulting F2 flies are given in the table below.

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| **F2 Phenotype** | **Male** | **Female** |
| Normal wings | 1,160 | 1,320 |
| Stunted wings | 3,600 | 3,820 |

Cross III: True-breeding bronze-eyed, stunted-winged males were crossed with true-breeding red-eyed, normal-winged females. All the F1 offspring had bronze eyes and stunted wings. The F1 flies were crossed with true-breeding red-eyed, normal-winged flies, and the results are shown in the table below.

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| **Phenotype** | **Male** | **Female** |
| Bronze eyes, stunted wings | 2,360 | 2,220 |
| Bronze eyes, normal wings | 220 | 300 |
| Red eyes, stunted wings | 260 | 220 |
| Red eyes, normal wings | 2,240 | 2,180 |

1. What conclusions can be drawn from cross I and cross II? **Explain** how your conclusions for each cross.
2. What conclusions can be drawn from the data from cross III? **Explain** how the data supports your conclusions.
3. **Identify** and **discuss** TWO different factors that would affect whether the Island’s fly population is in Hardy-Weinberg equilibrium for the traits above.

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2. A research team has genetically engineered a strain of fruit flies to eliminate errors during DNA replication. The team claims that this will eliminate genetic variation in the engineered flies. A second research team claims that eliminating errors during DNA replication will not entirely eliminate genetic variation in the engineered flies.

(a) **Provide** ONE piece of evidence that would indicate new genetic variation has occurred in the engineered flies.

(b) **Describe** ONE mechanism that could lead to genetic variation in the engineered strain of flies.

(c) **Describe** how genetic variation in a population contributes to the process of evolution in the population.

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4. In an investigation of fruit-fly behavior, a covered choice chamber is used to test whether the spatial distribution of flies is affected by the presence of a substance placed at one end of the chamber. To test the flies’ preference for glucose, 60 flies are introduced into the middle of the choice chamber at the insertion point indicated by the arrow in the figure above. A cotton ball soaked with a 10% glucose solution is placed at one end of the chamber, and a dry cotton ball with no solution is placed at the other end. The positions of flies are observed and recorded every minute for 10 minutes.

(a)  **Predict** the distribution of flies in the chamber after 10 minutes and **justify** your prediction.

(b)  **Propose** ONE specific improvement to each of the following parts of the experimental design and **explain** how the modification will affect the experiment.

(c)  The experiment described above is repeated with ripe bananas at one end and unripe bananas at the other end. Once again the positions of the flies are observed and recorded every minute for 10 minutes. The positions of flies after 1 minute and after 10 minutes are shown in the table below.