AP Biology Name _Answer Key___

Free Response Question

Sexual life cycles produce genetic variation among offspring. How do the following mechanisms contribute to the genetic variation arising from sexual reproduction:

1) Independent Assortment of Chromosomes
2) Crossing Over
3) Random Fertilization

For each mechanism include the following:

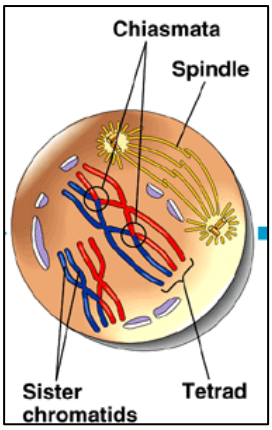
a) Discuss how the mechanism happens in meiosis.
b) Explain how the mechanism results in genetic variation.

Free Response Scoring Guide

This would be a 9 point response. Each part (#1, #2, and #3) has a maximum of 3 points.
For each number, A is worth 2 points (1 for correctly naming WHEN in meiosis the process occurs and 1 point for correctly describing WHAT occurs) and B is worth one point.

Sample Response: [Note: I have been very wordy in my responses because I didn't want this to be at all unclear if you are using this as a review guide. Your answer does not need to be this long!]

1) Independent Assortment of Chromosomes occurs in Meiosis I during metaphase. All of the homologous chromosomes are pairs at the metaphase plate and they are lined up randomly. Some of the chromosomes lined up on the right hand side of the metaphase plate will be from the individual's mom and some will be from dad, but how the chromosomes line up for one set of homologues happens totally separately from how the next set of homologues lines up (that's why the process is called independent, the homologous pairs do not impact each other). This leads to genetic diversity because with multiple chromosomes there are multiple combinations that could be passed on to the sex cell. For humans, with 23 pairs of homologous chromosomes, there are 8 million combinations of chromosomes that could be given to the sex cells being made.
2) Crossing over occurs in Meiosis I during prophase. Sister chromatids have been made and homologous pairs are formed into tetrads that get essentially "locked together" where the homologous pairs meet up. If the sister chromosomes from the homologues are overlapped (or crossed over) when they get locked together the regions of overlap are called chiasma (if there's more than one it's chiasmata) and this will lead to the mixing of chromosomes that used to be totally separate. Obviously, this mixing will lead a new and unique combination of DNA that wouldn't have been possible otherwise which is genetic variation.



3) Random fertilization occurs after meiosis is complete and a zygote is formed when sperm meets egg (fertilization). All of the genetic variation created by independent assortment and crossing over has led to a huge amount of sperm and eggs with varied chromosomes combinations. Any one of these sperm cells could be the one that fertilizes the egg (hence it being called "random") and this is yet another way that we create genetic diversity.