AP Biology Exam Practice Grid–In Questions

Transmission Genetics Edition

In snapdragons (*Antirrhinum*), the phenotype for flower color is governed by two alleles – red (R) and white (W). Heterozygous individuals have pink flowers. Two pink individuals are crossed to produce 465 offspring.

Bell:

1. Calculate how many of these offspring are expected to have the red phenotype. Round your response to the nearest whole number.

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In corn (*Zea mays*), purple kernels (R) are dominant to yellow kernels (r). Cobs from the offspring of a cross between a purple plant and yellow plant were used in a lab. A student counts 329 purple and 299 yellow kernels on one cob.

2. Calculate the chi-squared value for the null hypothesis that the purple parent was heterozygous for purple kernels. Give your answer to the nearest tenth.

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In a dog breed known as the Mexican Hairless, the "hairless" phenotype is a result of a mutation displaying an autosomal dominant pattern of inheritance. Homozygous recessive individuals (hh) display a "coated" phenotype. Inheriting two copies of the mutation (HH) is lethal during embryonic development.

3. In a cross between two dogs with the hairless phenotype, what proportion of puppies born is expected to be hairless? Give your answer in the form of a fraction.

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Wild-type fruit flies have red eyes (+). The "white-eyed" phenotype (w) is recessive and results from a mutation on the X chromosome. During a lab, students cross a white-eyed male with a homozygous red-eyed female. A red-eyed female and a red-eyed male from the F1 generation are then bred to produce 573 offspring.

4. How many of the offspring are predicted to be white-eyed males? Round your response to the nearest whole number.

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A plant geneticist is investing the inheritance of genes for bitter taste (Su) and explosive rind (e) in watermelon (*Citrullus lanatus*). Explosive rind is recessive and causes watermelons to burst when cut. Non-bitter watermelons are a result of the recessive genotype (susu). The geneticist wishes to determine if the genes assort independently. She performs a testcross between a bitter/non-explosive hybrid and a plant homozygous recessive for both traits. The following offspring are produced:

bitter/non-explosive – 88 bitter/explosive – 68 non-bitter/non-explosive – 62 non-bitter/explosive – 81

5. Calculate the chi-squared value for the null hypothesis that the two genes assort independently. Give your answer to the nearest tenth.

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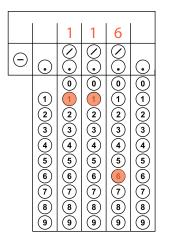
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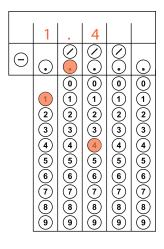
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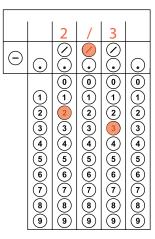
Question 1:



Question 2:



Question3:



Question 4:

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Question 5:

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Explanations

Question 1: A cross between two pink snapdragons (RW x RW) should yield the following phenotypic ratio - 1:2:1 (red,pink,white). 25% of the offspring are expected to be red so the calculation would be .25 x 465 = 116.25, which is rounded to the whole number 116.

Question 2: A cross between a heterozygous purple corn plant (Rr) and a yellow corn plant (rr) would yield offspring that display a 1:1 ratio between purple and yellow kernels. Of the 628 kernels, it would be expected that 314 would be purple and 314 would be yellow. The chi-square value is calculated below. The acceptable answer for this question should be 1.4.

Phenotype	observed	expected	obs-exp	(obs-exp) ²	(obs-exp) ² /exp
Purple	329	314	15	225	0.72
Yellow	299	314	-15	225	0.72
					$X^2 = 1.44$

Question 3: Inheriting two copies of the hairless mutation is lethal in embryonic development; therefore, the parents must be heterozygous (Hh) for their hairlessness. In the offspring, individuals with the (HH) genotype die before birth and are not calculated as a genotypic class. This means that the proportion of hairless puppies born would be 2/3.

Question 4: The parental cross ($X^+X^+ \mathbf{x} X^wY$) produced male offspring with the genotype X^+Y and females with the genotype X^+X^w . If a male and female from the F1 are crossed, 25% of the offspring will be white-eyed males. 0.25 x 573 = 143.25 or 143 rounded to the nearest whole number.

Question 5: A cross between Susu/Ee x susu/ee watermelon plants is expected to produce offspring in a 1:1:1:1 phenotypic ratio. The chi-square value is calculated below. The range of acceptable answers for this question should be 5.6-5.7.

Phenotype	Observed	Expected	obs-exp	(obs-exp)2	(obs-exp)2/exp
bitter/non-explosive	88	74.75	13.25	175.56	2.35
bitter/explosive	68	74.75	-6.75	45.56	0.61
non-bitter/non-explosive	62	74.75	-12.75	162.56	2.17
non-bitter/explosive	81	74.75	6.25	39.06	0.52
					X ² = 5.65

References:

(Question 3) <u>http://www.sciencemag.org/content/321/5895/1462.abstract</u> (Question 5) <u>http://hortsci.ashspublications.org/content/39/6/1175.full.pdf</u>

