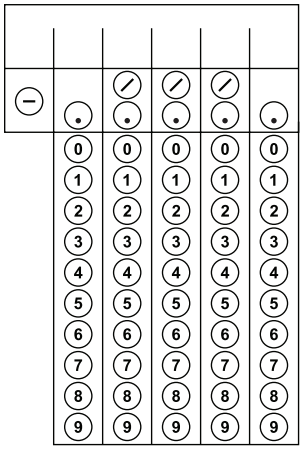
Name: _____ Bell: _____ Date: _____

AP Biology Exam Practice
Grid–In Questions
Transmission Genetics Edition

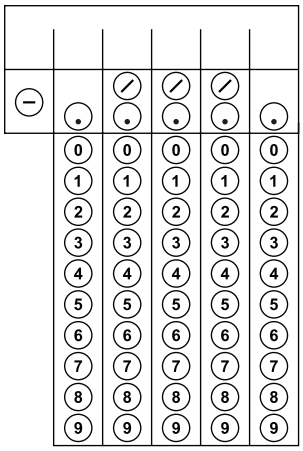
In snapdragons (*Antirrhinum*), the phenotype for flower color is governed by two alleles – red (R) and white (W). Heterozygous individuals have pink flowers. Two pink individuals are crossed to produce 465 offspring.

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



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 hundredth.



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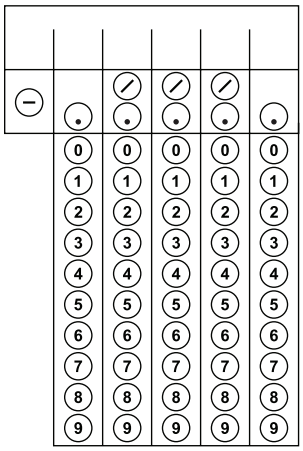
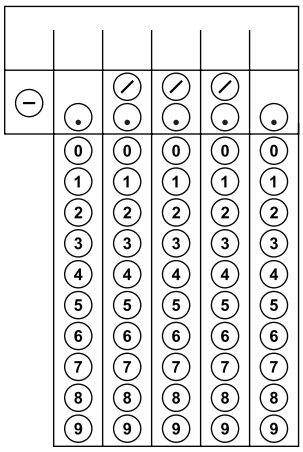
In a dog breed known as the Mexican Hairless, the "hairless" phenotype is a result of a mutation displaying an autosomal dominant pattern of inheritance. Homozygous recessive individuals (hh) display a "coated" phenotype. Inheriting two copies of the mutation (HH) is lethal during embryonic development.

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.



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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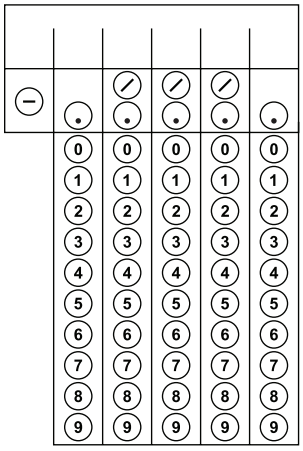
A plant geneticist is investing the inheritance of genes for bitter taste (Su) and explosive rind (e) in watermelon (*Citrullus lanatus*). Explosive rind is recessive and causes watermelons to burst when cut. Non-bitter watermelons are a result of the recessive genotype (susu). The geneticist wishes 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 hundredth.



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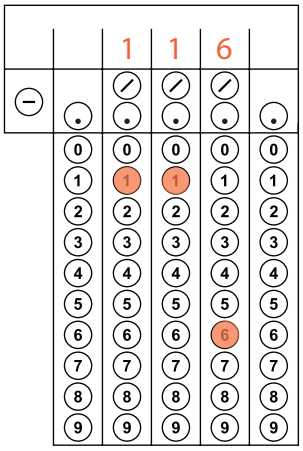
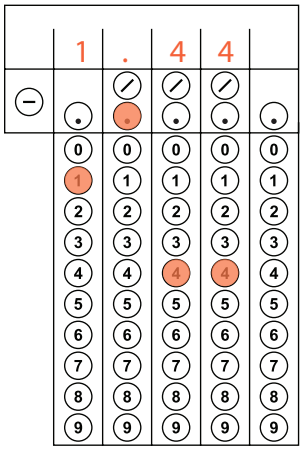
TEACHER GUIDE

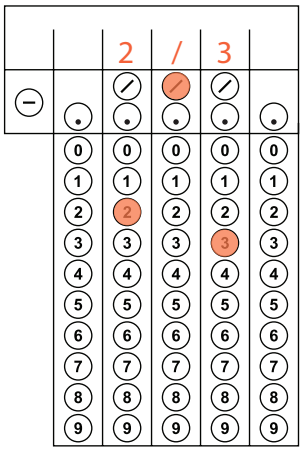
Question 1:



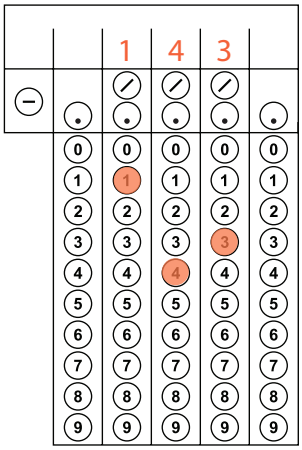
Question 2:



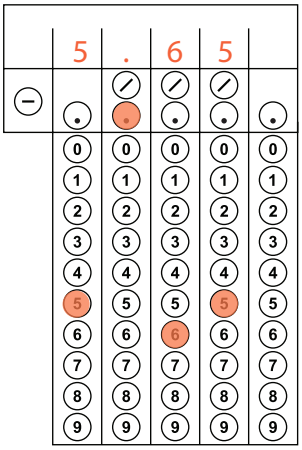
Question3:



Question 4:



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 558 kernels, it would be expected that 279 would be purple and 279 would be yellow. The chi-square value is calculated below. The range of acceptable answers for this question should be 1.43-1.44.

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^+ **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 5.65-5.66

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