AP Biology
Chi Square Practice Problems

Name: _____
Date: _____ Per: ____

Chi-square is a statistical tool that helps us to decide if the observed ratio is close enough to the expected ratio to be acceptable. Chi-square analysis can be used in any area, not just genetics. Whenever you have to determine if an expected ratio fits an observed ratio, you can use the Chi-square.

$$X^2 = \Sigma \frac{(O-E)^2}{E}$$

Chi Square Significance Table

Degrees of Freedom (n)	5% Probability Value (P)
1	3.84
2	5.99
3	7.81
4	9.49

1. In peas, yellow seeds (A) are dominant over green (a) seeds. In a cross between two plants both heterozygous for seed color, the following was observed:
   Yellow = 4400
   Green = 1624
   Does the data fit the predicted phenotypic ratio?

Phenotype	Obseved (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Totals					

2. In peas, smooth seeds (R) are dominant over wrinkled (r) seeds. In the P generation, a plant homozygous for smooth seeds is crossed with a plant with wrinkled seeds. The resulting F_1 plants are crossed. The seeds of the observed F_2 generation were:
   Smooth = 5474
   Wrinkled = 1850
   Does the data fit the predicted phenotypic ratio?

Phenotype	Obseved (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Totals					

3. In a flowering plant, white flowers (B) are dominant over red (b), and short plants (E) are dominant over tall (e) plants. When two double heterozygote (BbEe) plants were crossed, the resulting phenotypes were observed:

White, short = 206
Red, short = 83
White, tall = 65
Red, tall = 30

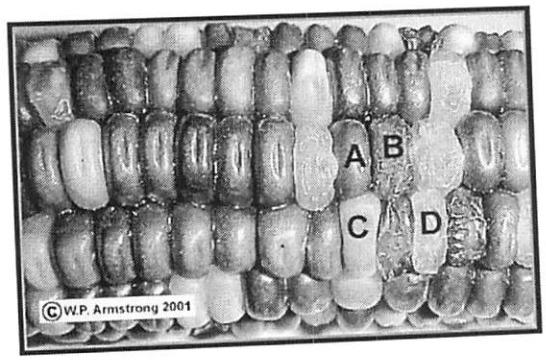
Does the data fit the predicted phenotypic ratio?

Phenotype	Obseved (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Totals					

4. In corn, purple kernels (D) are dominant over yellow (d), and smooth kernels (G) are dominant over shrunken (g). An ear of corn has 381 kernels, illustrated at right:

A: purple, smooth = 216
B: purple, shrunken = 79
C: yellow, smooth = 65
D: yellow, shrunken = 21

Does the data fit your predicted phenotypic ratio? (Your prediction would be the kernels are the result of a double heterozygous cross with a ratio of 9:3:3:1)



Phenotype	Obseved (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Totals					

6. Color blindness is a sex-linked trait in Bombats. A female who is a carrier of the color blind allele mates with a male who is color blind. The phenotypes of their offspring are:
   Normal female = 132
   Color blind female = 124
   Normal male = 126
   Color blind male = 136
   Does the data fit your predicted phenotypic ratio?

Phenotype	Obseved (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Totals					

7. In cats, fur color is determined by the codominant, sex-linked alleles: black (B) and orange (O). A calico female (X^BX^O) is bred (many times) with a black male (X^BY). They produce the following offspring:
   Black female = 78
   Calico female = 65
   Black male = 81
   Orange male = 45
   Does the data fit your predicted phenotypic ratio?

Phenotype	Obseved (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Totals					