Name:_____ **PS#:**_____

Biol 3301 **Midterm 2** **Spring 2012**

Multiple Choice. Circle the single best answer. (4 pts each)

1. In *Arabidopsis*, the recessive traits of yellow flowers (*y*), spiny leaves (*sp*), early flowering (*ea*), and long internode distance (*li*) are known to be linked in that order on an autosome (*y----sp----ea----li*). You make a cross between a plant collected in the field which has the wild type phenotype for all of these traits and a lab strain that is homozygous recessive for all traits. You cross an F_1 plant back to the homozygous recessive parent and obtain the following offpsring:

wild type
yellow, spiny, early, long internodes
yellow
long internodes
yellow, long internodes
spiny, early

The best explanation for these results is that:
a) the original wildtype plant carried translocation in homozygous condition
b) the original wildtype plant carried a translocation in heterozygous condition
c) the original wild type plant carried an inversion in homozygous condition
d) the original wildtype plant carried an inversion in heterozygous condition
e) none of the above

2. Consider each of the pairs of sequences below. Which pair is characteristic of the ends of a transposable element?

a) 5'-CTAAGCTCT-3' 5'-AAGAGTCAG-3'
3'-GATTCGAGA-5' 3'-TTCTCAGTC-5'

b) 5'-CAGATTGGC-3' 5'-ACATTAACC-3'
3'-GTCTAACCG-5' 3'-TGTAATTGG-5'

c) 5'-ACATTAACC-3' 5'-ACATTAACC-3'
3'-TGTAATTGG-5' 3'-TGTAATTGG-5'

d) 5'-CTGACTCTT-3' 5'-AAGAGTCAG-3'
3'-GATTCGAGA-5' 3'-TTCTCAGTC-5'

e) none of the above

3. The recessive trait of hairy flowers (*hf*) is caused by a gene located on chromosome 13 in *Arabidopsis*. You cross a plant that is trisomic for chromosome 13 and homozygous for hairy leaves to a homozygous plant that is diploid with a wild type phenotype. If you cross the resulting F_1 offspring back to the diploid parent, what is the expected frequency of plants with hairy flowers in the F_2?

a) 1/2 b) 1/3 c) 1/6 d) 2/3 e) none of the above

4. Which of the following is not true of tetraploids?
a) they have tetraploid offspring
b) they make diploid gametes
c) they make aneuploid gametes
d) they are usually fertile
e) they are often larger than their diploid ancestors

5. Which of the following represents narrow sense heritability?

a) V_A b) $V_P - V_G - V_E$ c) V_G/V_P d) V_A/V_P e) none of the above

6. In a small Polish village, the distribution of individuals at the ABO blood type locus is 179A, 2 B and 19 O. What is the frequency of the A genotype?

a) 179/200 b) 1 - (179)/200 c) (179 + 2[2])/200 d) (179 + ½[2])/200
e) there's not enough information to tell

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8. In marigolds, the phenotype of doubled flowers is caused by a dominant allele (*Db*) at an autsomal locus. You grow 100 plants of genotype (*Db*/+) at each of three temperatures: 25ºC, 30ºC and 35ºC. At 25ºC and 30ºC, all plants have double flowers but at 35ºC, all plants have single flowers. On the basis of these data, the *Db* allele is

a) incompletely penetrant
b) codominant
c) a recessive lethal
d)a suppressor of single
e) none of the above

9. You discover a previously undescribed transposable element, "wallaby" in *Drosophila mojavensis*. You hypothesize that this element is a relatively recent invader of the *D. mojavensis* genome. Which of the following observations would mean that your hypothesis was not correct.

a) the element is present in some, but not all, populations of *D. mojavensis*
b) the copy number within an individual is low, but all elements are autonomous
c) the number of copies per genome is high, but individuals vary greatly in the location of elements in the genome
d) wallaby transposase transcripts are not recognized by RISC
e) most copies of the element are located in or near heterochromatin

10. You have two color variants of bluebonnets. The normal petal color is deep blue. One variant plant has white flowers, the other has pink flowers. If these two color variants are the result of mutations in the same gene, when you cross them you may obtain offspring with:

a) white flowers
b) pink flowers
c) lavender flowers
d) any of the above
e) none of the above

11. Which of the following does <u>not</u> represent an aneuploid individual?

a) 3n+1 b) 2n+1 c) 2n+2 d) 2n-1 e) $2n_1+n_2$

12. You are studying the inheritance of several morphological characters in parrots. From a breeding study, you obtain the following data:

	Characters			
variance	tail length	beak width	tarsus length	lifespan
phenotypic	263.4	46.7	111.8	413.8
environmental	179.1	10.2	85.4	267.4
addititive genetic	45.3	23.3	15.2	88.9
dominance genetic	39.0	13.2	11.2	57.5

Which trait has the highest narrow-sense heritability?

a) tail length b) beak width c) tarsus length d) lifespan
e) there's not enough information to tell

13. Normal eye color in houseflies is green. In a large population of flies, you find one with purple eye color. When you cross this fly to a green-eyed one, half the offspring are purple-eyed and half are green-eyed. If you cross two of purple eyed progeny to each other, one third of the offspring are green-eyed and the rest are purple. The genetic basis of the purple phenotype is most likely a:

a) deletion b) duplication c) inversion d) translocation e) transposition

14. In *Drosophila*, persimmon eye color (orange brown) is due to a recessive autosomal allele. You obtain a homozygous persimmon strain, but you notice that in some flies the compound eye is a mixture of wildtype (red) and persimmon ommatidia. The cause of this phenotype is likely to be:
a) an inversion moves the persimmon gene near heterochromatin
b) a transposable element was inserted into the persimmon gene
c) early in eye development, one cell underwent a mitotic non-disjunction
d) all of the above
e) none of the above

15. Which of the following processes can cause allele frequencies to change?
a) small population size b) directional selection c) mutation
d) all of the above e) none of the above

16. In armadillos, the normal eye color is brown. You discover a red-eyed armadillo outside Austin. You cross it to a brown-eyed armadillo and the eye color of the offspring is brown. When you cross two of the brown-eyed offspring to each other, you get 47 brown-eyed and 3 red-eyed offspring. The genotype of the original red-eyed armadillo is best represented as:
a) A/A; B/B b) A/a; B/b c) A/A; b/b d) A/a; b/b e) a/a; b/b

Short Answer. For each of the questions give a brief answer. If you feel that the answer requires a mathematical expression it is only necessary to put numbers is the proper places, you do not have to calculate the answer.

17. What are the possible outcomes of a gene duplication event?

18. Draw the main structural components of a bacterial composite tranposon.

19. Hardy-Weinberg Equilibirum is a statement about

20. Draw the chromosomal configuration of a translocation at Prophase 1 of meiosis.

Word Problems. For each question, give both an answer and an explanation of your reasoning for why this is the correct answer. (8 pts each)

21. The leaves of aloe vera may be either spiny, serrate or smooth. You have two homozygous spiny strains that you cross as diagrammed below. You then cross the F_1 offspring and obtain an F_2. What are the genotypes of the original spiny plants (the first parents). Explain your answer.

P_0	spiny	x	spiny
F_1	all serrate		
F_2	126 serrate	65 spiny	11 smooth

22. You have four homozygous lines of maize (corn). Two (C, D) have purple kernels, and two (A, B) are colorless. You make the crosses between the lines as shown below, and then cross each F_1 to itself, with the results shown. Explain these results, and give the genotype of each of the original homozygous lines (A, B, C, D).

P_0	A x C	A x D	B x C	B x D
F_1	all purple	all purple	all purple	all purple
F_2	3 purple 1 colorless	3 purple 1 colorless	3 purple 1 spotted	3 purple 1 colorless

23. You census a population of fire ants for genetic variation at the phosphoglucomutase-3 locus which has two codominant alleles, A_1 and A_2. You find the following number of each genotype: 416 A_1A_1, 726 A_1A_2, and 102 A_2A_2. Show how you would determine whether or not the population is in Hardy-Weinberg Equilibrium. It is not necessary to solve any of the calculations to a final numerical answer, but be sure to use the appropriate numbers for each calculation. Do not use symbols.