Name: _____ Student #: _____

BIOL2107 Fundamentals of Genetics
Midterm I

Version 1

February 11, 2014

Name: _____ Student #: _____

A. Multiple choice (15 questions worth 1 mark each). Answer multiple choice questions on the answer sheet provided.

1. _____ are alternate forms of a gene.
a. alleles
b. mutations
c. genotypes
d. linkage groups
e. diads

2. _____ is a form of cell division that typically gives rise to 2 identical daughter cells.
a. meiosis
b. prophase
c. telophase
d cytokinesis
e. mitosis

3. _____ refers to the interaction of two alleles at a single locus in which the heterozygotes do not resemble either homozygote.
a. Codominance
b. Incomplete dominance
c. Pleiotropy
d. Polymorphism
e. Multimorphic

4. Sickle cell anemia is a recessive genetic disorder occurring in individuals carrying two copies of the $HB\beta^S$ allele of the β-globin gene. The wildtype $Hb\beta^A$ allele of the β-globin gene..._____.
a. is dominant to $HB\beta^S$.
b. is recessive to $HB\beta^S$.
c. is codominant with $HB\beta^S$.
d. is incompletely dominant to $HB\beta^S$.
e. exhibits a variety of dominance relationships with $HB\beta^S$.

Name: _____ Student #: _____

5. Pure breeding sweet pea plants with white flowers are crossed to yield an F1 generation with all purple flowers. Following a F1 selfcross, a 9:7 ratio of purple to white flowers in the F2 generation was observed. What is the most plausible explanation?
a. This is an example of incomplete dominance involving 2 loci.
b. Alleles at two independent assorting genes are exhibiting complementary gene action.
c. Flower colour is controlled by two genes that are linked.
d. This represents a monohybrid cross with incomplete dominance.
e. This represents an example of dominant epistasis.

6. In a dihybrid cross, the A allele exhibits incomplete dominance over the a allele while the B allele similarly exhibits incomplete dominance over the b allele. The A allele controls seed colour while the B allele controls flower colour. The A and B genes sort independently. How many possible combinations of phenotypes can be generated?
a. 3
b. 4
c. 9
d. 16
e. 25

7. What is the phenotype of fruit flies (*Drosophila melanogaster*) carrying two copies of the X chromosome and 1 copy of the Y chromosome?
a. Normal female
b. Normal male
c. Hermaphrodite
d. Klinefelter syndrome
e. Dies before hatching.

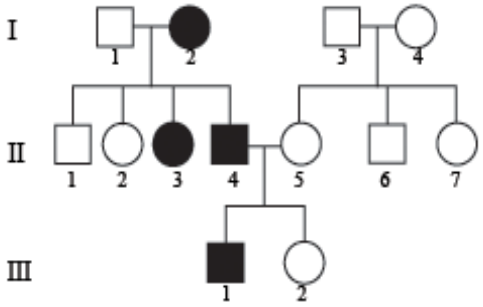
8. How many sister chromatids are present at metaphase of mitosis in *Drosophila* have 2n=8 chromosomes?
a. 2
b. 4
c. 8
d. 16
e. 2^n

9. What combination listed below best describes chromosome number and DNA content during metaphase I?
a. the cells are diploid with 2C DNA content.
b. the cells are diploid with 4C DNA content.
c. the cells are tetrads with 2C DNA content.
d the cells are tetraploid with 4C DNAcontent.
e. the cells are haploid with 2C DNA content.

Name: _____ Student #: _____

10. In females (human), meiosis _____.
a. is initiated following puberty.
b. is initiated once a month.
c. is asymmetrical.
d. is initated following fertilization.
e. is symmetrical.

Use the following pedigree to answer questions 11-13 and assume that the disease causing trait under consideration is rare with 100% penetrance and that there is no consanguineous mating in previous generations.



11. What pattern of inheritance is most likely represented in the pedigree above.
a. recessive lethal
b. autosomal recessive
c. autosomal dominant
d. recessive X linked
e. dominant x-linked

12. Using the same pedigree, what is the probability that the father of individual I-2 (1st generation #2) was unaffected?
a. 0 %
b. 25 %
c. 50 %
d. 75 %
e. 100 %

13. Using the same pedigree, what is the probability that the future grandchildren of individual III-1 (3rd generation # 1) will be affected by the disease.
a. 0 %
b. 12.5 %
c. 25 %
d. 50 %
e. 100 %

Name: _____ Student #: _____

14. The _____ progeny ware usually analyzed in x-linked gene mapping experiments.
a. dihybrid
b. trihybrid
c female
d. male
e. F1

15. When mapping linked genes on autosomes using a two point cross, dihybrids are crossed with _____.
a. other dihybrids
b. homozygous dominant individuals.
c homozygous recessive individuals.
d. individuals with similar genotype.
e. individuals with similar phenotype.

Name: _____ Student #: _____

B. Short answer section
Answer 2 of these 3 questions in the space provided. (5 marks each)

1. The ABO blood system is controlled by 3 alleles at the I locus (I^A, I^B and I^O). (a) Indicate the known dominance interactions between every possible pair of alleles and then express these relationships as a dominance hierarchy (2 marks). (b) How many blood types can be produced from these 3 alleles alone (1 marks). (c) Indicate the ABO blood types of potential donors and recipients that are compatible with each other. (2 mark)?

Name: _____ Student #: _____

2. In lab, you perform a cross between a true breeding white-eyed female fruit fly with a brown body and a red-eyed male fruitfly with a yellow body. White eyes (w) is recessive to red eyes (w+) and yellow body (y) is recessive to brown (y+). The w and y genes are 1.1 mu apart on the x chromosome. Show all work required to answer the following questions (1 mark).

(a) what percent of the male offspring will have white eyes and a brown body in the F1 generation? (1 mark)

(b) If F1 females and F1 males are crossed, what proportion of the F2 male progeny are expected to be recombinants? (1 mark)

(c) what fraction of the F2 male progeny are expected to have white eyes? (1 mark)

(d) what percentage of the F2 males are expected to have red eyes and a brown body? (1 mark)

Name: _____ Student #: _____

3. You have been trying to determine the genetic interaction between 2 genes that control coat colour in mice (B and C). In monohybrid experiments, you have found that B (black) is dominant over b (brown). Using other true breeding strains in a separate monohybrid experiment, you determined that C (black mice) is dominant over c (albino mice). To determine how these genes interact, you performed a dihybrid cross between true breeding albino mice and true breeding brown mice. The F1 progeny were all black.

(a) Give the starting genotypes of the pure breeding parental albino and brown mice as well as their hybrid F1 progeny, assuming that the parental mice were both homozygous dominant at one of these genes (1 mark).

(b) Use a Punnett square to visualize the genotypes produced in the F2 generation? (2 marks)

(c) What interaction between C and B is most likely to exist if the F1 selfcross results in 18 black, 6 brown and 8 albino mice (1 mark).

(d) what cross would you perform to explain the genotype of the albino mice? Include the genotypes in you answer (1 mark)