Multiple choice: Unless otherwise directed, circle the one best answer (2 points each)

1. The first person to apply experimental techniques and mathematical analysis to the study of inheritance was:
   A. Darwin
   B. Aristotle
   C. Tschermak
   D. Mendel
   E. Hippocrates

2. Mendel succeeded where others had failed in part because of:
   A. his knowledge of chromosomes
   B. his understanding of DNA structure
   C. his use of mathematics and statistics
   D. his acceptance of Darwin’s evolutionary theory
   E. his use of fruit flies as experimental organisms

Short answer (show your work or thinking to get partial credit):

1. If the allele for tall is represented by $T$ and the allele for dwarf by $t$, give the gametes produced by the parents and the phenotypes of the offspring for each of the following crosses:
   a. $Tt \times tt$
   b. $TT \times Tt$
   c. $Tt \times Tt$

2. A pure-breeding, tall pea plant is crossed with a pure-breeding, short pea plant. All of the offspring of this cross are tall.
   a. Which allele is dominant, and how do you know?
   b. What are the genotypes of these offspring?
   c. Suppose two of these offspring are crossed and produce 1000 offspring. How many tall and how many short plants will you expect?
   d. How many of each genotype would you expect among the 1000 offspring?
3. While tromping through the woods, you come across a very unusual animal: an odorless skunk. Of course, you immediately want to study the inheritance of this trait! Since you don’t have any pure-breeding skunks around, you cross your odorless skunk with an ordinary, stinky skunk chosen at random. Half of the 18 offspring are odorless, and half are smelly.

   a. There are two different ways you could’ve gotten this result. Diagram both possible crosses below, showing genotypes and phenotypes of parents and offspring. Be sure to define your symbols!

   Possibility #1

   Possibility #2

   b. Now, what one further cross could you do in order to decide which possibility is the correct one?

4. A male’s genotype is $AaBBCCddEeFF$. What fraction of the sperm cells produced by this individual will carry the dominant $A$ allele, the dominant $C$ allele and the recessive $e$ allele?
True or False? Read carefully: a question is false unless it is completely true!

1. The importance of Mendel's work was recognized by many of his contemporaries, including Darwin.  
2. Genes control simple traits like hair color and blood type, but more complex characteristics such as development and behavior of higher organisms are usually not genetic.  
3. The effect of a recessive allele is seen phenotypically only in a homozygous individual.  
4. We can tell which allele is dominant because it produces a larger size, darker color or some other kind of stronger characteristic.  
5. We can predict the overall outcome of a genetic cross, given a large number of offspring, but not the specific outcome of one fertilization event.  
6. Any gene can come in one of two forms, called alleles.  
7. Mendel’s work helped Darwin better understand the genetic basis of natural selection.  
8. Darwin was the first to publish a scientific theory that effectively explained how traits are inherited.  
9. Darwin was the first to base a theory of genetics on experiments and evidence.  
10. Mendel’s Law of Segregation says each gamete gets one allele of each gene.  
11. Pure-breeding individuals could be either homozygous dominant or heterozygous.  
12. There could be hundreds of alleles of a particular gene in the population as a whole, but one individual can only have one or two different alleles for that gene.  
13. Each cell in your body has the same set of genes, and each cell has two alleles for each gene.  
14. Every person has the same set of genes, though they may not have the same alleles.  
15. If the genotypes of the two parents are known (for a particular gene), Mendelian genetics can be used to accurately predict the genotype of their child.  
16. A haploid gamete (sperm or egg cell) has the same genes as a diploid body cell.
**Fill in the blank:**

1. Most of your body cells are ________________, meaning they have two alleles of each gene. However, _______________ cells are haploid, meaning they have only one allele of each gene.

2. A gene is typically responsible for one inherited ________________, while a(n) ________________ is a form of a gene that produces one inheritable trait.

3. An individual’s genetic makeup is referred to as his/her ________________, while the visible or measurable effects of that genetic makeup is called the ________________.

4. In a cross between two true-breeding parents, the allele that produces the phenotype seen in the ________________ generation is considered to be the ________________ allele.

5. If an individual is true-breeding, we can say that he/she is ________________ for the gene we are looking at.