Directions: Write your answers on a separate sheet of paper.

Multiple choice
1. Which of the genotypes will result in an organism that has the phenotype of the dominant allele?
   a. TT  c. Tt and tt
   b. TT and Tt  d. tt

2. In pea plants, gray seed color (G) is dominant over white seed color (g) and smooth pod shape (S) is dominant over constricted pod shape (s). A plant has the genotype GGss for these two traits. What possible genetic combination could occur in the plant’s gametes?
   a. Gs and GS  c. Gs only
   b. GS and gs  d. gS only

3. If brown horses are mated with white horses, 100% of the offspring have roan coats, in which some hairs are white and others are brown. If we assume a large number of offspring when roan horses are mated, the ratio of coat color obtained will be
   a. 50% brown, 50% white
   b. 25% brown, 50% roan, 25% white
   c. 25% roan, 50% brown, 25% white
   d. 25% white, 75% brown

4. A woman carrying the gene for hemophilia marries a man who is a hemophiliac. What percentage of their children can be expected to have hemophilia?
   a. 50%  c. 75%
   b. 0%  d. 100%

5. In pea plants, the allele for tall stem (T) is dominant over the allele for short stem (t). The allele for gray seeds (G) is dominant over the allele for white seeds (g). If a pea plant with the genotype TTGg is crossed with a pea plant with Ttgg, which of the following is NOT a possible genotype of the offspring?
   a. TTgg  c. TtGG
   b. Ttgg  d. TTGg

6. The allele for one kind of dwarfism is dominant over the allele for normal height. If a mother and father both have this type of dwarfism, could any of their children have normal height?
   a. yes, if the father is heterozygous and the mother is homozygous for the trait
   b. yes, if the mother is heterozygous and the father is homozygous for the trait
   c. yes, if the mother and father are both heterozygous for the trait
   d. no, because there is no way that a child can inherit two recessive alleles for the trait.

7. In a certain species of army ant, the gene for long mandibles (M) is dominant over the gene for short mandibles (m). If a biologist wants to produce ants with long mandibles only, which ants should be crossed?
   a. homozygous long mandibled ants with heterozygous ants.
   b. two heterozygous ants
   c. heterozygous ants and homozygous short mandibled ants
   d. two homozygous short mandibled ants

8. For a given trait, the two alleles are not alike. An individual possessing this gene combination is said to be
   a. heterozygous  c. homozygous
   b. recessive  d. pure

9. In rats, black coat color is dominant over white coat color. If some of the offspring of a cross between a black rat and a white rate are white, the black rat must have been
   a. heterozygous  c. homozygous
   b. a polyplid  d. a mutation

10. In cabbage butterflies, white flower (W) is dominant and yellow color (w) is recessive. If a pure white cabbage butterfly mates with a yellow cabbage butterfly, all the resulting butterflies are heterozygous. Which cross represents the genotypes of the parent generation?
    a. WW x ww  c. WW x Ww
    b. Ww x ww  d. Ww x Ww

11. In poultry, feathered shank (F) is dominant over clean shank (f). If the hen’s genotype is represented by ff and the rooster’s genotype is Ff, what percentage of their offspring would be expected to have feathered shanks?
    a. 50%  c. 75%
    b. 0%  d. 100%

12. A man of blood type AB marries a woman of blood type A. What are the possible blood types of their offspring if the woman’s mother was blood type O?
    a. A, B, and AB  c. AB only
    b. A and B  d. A, B, and O

13. A man heterozygous for blood type A marries a woman with blood type AB. The blood type of their offspring could not be
    a. O  c. A
    b. AB  d. B

14. If a baby has blood type O, what can you infer about the baby’s parents?
    a. Neither has type AB blood.
    b. Both have type AB blood.
    c. One must have type O blood.
    d. Neither has type O blood.
15. There are multiple alleles for the ABO blood group. Why are there only two of these alleles normally present in any one individual?
   a. Each parent contributes only one allele for the ABO blood group to the offspring.
   b. There are not enough nucleotides in a red blood cell to produce a third allele.
   c. Each allele in the ABO group must be either dominant or recessive.
   d. Blood group alleles are not segregated during meiosis.

16. A colorblind woman marries a man who has normal color vision. What are the chances of having a colorblind daughter?
   a. 0%  b. 25%  c. 50%  d. 100%

17. If a mating occurs between two parent plants that are both heterozygous for a trait with incomplete dominance, the expected ratio of phenotypes will be
   a. 1:3  b. 1:2:1  c. 1:1  d. 9:3:3:1

18. A fruit fly has two gene for eye color, but each of its sperm cell has only one. This illustrates
   a. independent assortment.  b. linked genes  c. pleiotropy  d. segregation

19. Most sex linked traits in humans are carried on the _____ chromosome, and the recessive phenotypes are seen most often in ______. 
   a. X...women  b. X...men  c. Y...women  d. Y...men

20. An individual with curly hair and an individual with straight hair mate; all of their offspring have wavy hair. What genetic pattern is being described?
   a. incomplete dominance  b. linked genes  c. sex-linked  d. codominance

Vocabulary/ Key concepts
27. _______: a segment of DNA that contains the instructions that code for a particular trait.
28. _______: specific location of a gene on a chromosome
29. _______: alternate versions of a gene at a single locus
30. _______: when the alleles of a gene are the same on the homologous chromosomes
31. _______: when the alleles of a gene are different on the homologous chromosomes
32. _______: the allele that is expressed when the alleles are heterozygous. Represented by an upper case letter
33. _______: the allele that is not expressed when the alleles are heterozygous. Represented by a lower case letter.
34. _______: the physical appearance of a trait in an organism
35. _______: the genetic make up of an organism with respect to a trait. It could be homozygous dominant, heterozygous or homozygous recessive
36. _______: Homologous pairs of genes segregate (separate) during gamete formation (meiosis).
37. _______: the mating between an individual of unknown genotype with a homozygous recessive genotype. It is usually performed when the phenotype of the unknown individual is dominant.
38. _______: Genes for different characteristics are not connected and each pair of genes for a characteristic separate independently during meiosis.
39. _______: an individual who is heterozygous for a recessive disorder and does not show symptoms of the disorder
40. _______: In a cross between a homozygous dominant parent and a homozygous recessive parent the phenotype of the offspring is in between the phenotypes of the parents. Example: When red snapdragons are crossed with white snapdragons all the offspring have pink flowers
41. _______: The alleles for A and B blood types are codominant, and both are expressed in the phenotype
42. _______: A single gene may affect phenotype in many ways. Example: the allele for sickle-cell disease
43. _______: Trait that is controlled by 2 or more genes. This situation creates a continuum of phenotypes. When the range of traits is graphed a bell shaped curve is seen Example: skin color, eye color
44. _______: Most of these human disorders carried on the X chromosome are due to recessive alleles. These are mostly seen in males
45. Examples: hemophilia, red-green color blindness

For each of the problems below you MUST include a Punnett square.
46. In dogs wire hair (W) is dominant to smooth hair. What are the genotypic and phenotypic ratios of a cross between a homozygous dominant male and a heterozygous female?
47. In tomatoes red (R) is dominant to yellow (r). What are the genotypic and phenotypic ratios of a cross between a heterozygous male and a heterozygous female?
48. Some dogs bark while trailing, others are silent. The Barker gene (B) is dominant, the silent gene (b) is recessive. The gene for normal tail (T) is dominant over the gene for screw (curly) tail (t). A barker dog with a normal tail who is heterozygous for both characteristics is mated to another dog of the same genotype. What fraction of their offspring will be barkers with screw tails?
49. The genes for dark eyes (black and brown) are usually dominant over genes for blue or gray eyes. A man with black eyes marries a woman with light gray eyes. They have two children, a boy with black eyes and a girl with blue eyes. What are the genotypes of the man, his wife, the little boy, and the little girl?
50. Coat color in one breed of mice is controlled by incompletely dominant alleles so that yellow and white are homozygous and cream is heterozygous. What phenotypes would the cross of two cream individuals produce?
51. In a legal case, a man is accused of fathering a child of blood type AB. He is blood type O and the child’s mother is blood type AB. Can this man be the father? Explain your answer.
52. Hemophilia is an x-linked recessive gene. A normal woman whose father had hemophilia marries a normal man. What are the chances of hemophilia in their children?
53. A human female “carrier” who is heterozygous for the recessive, sex-linked trait causing red-green color blindness, marries a color blind male. What proportion of their male children will have red-green color blindness?
Multiple choice
2. C – follows principle of independent assortment and principle of segregation
4. A. – hemophilia is sex linked recessive!
6. C. – if both parents are heterozygous (Aa), there is a ¼ chance of having a child that is aa
8. A. – not alike/ hetero/ different!
10.A. – pure – homo- same
12.A. If a woman is blood type A, and her mother was type O that means the woman’s genotype has to be IAi.
14.A. if either parent was AB, then the child could not be blood type O (ii)
16. A. color blind is sex linked!
18.D. 2 alleles separating into haploid gamete. Separate → segregate in anaphase I
20 B. heterozygous is ½ way between
22.C. square
24. D. descending line
26.Aa – only way they have an affected daughter (bottom left circle)

Vocabulary/ Key concepts
28.Loci
30.homozygous
32. Dominant
34. Phenotype
36. Principle of segregation
38. Principle of independent assortment
40. Incomplete dominance
42. Pleiotropy
44. Sex linked trait

Punnett Squares (can’t be easily filled out on computer so hints about set up and final answer are given)
46. WW male x Ww female

48. BbTt heterozygous for both traits x BbTt heterozygous for both traits

Barker screw tail offspring would be (B_tt)...so according to a punnett square there should be 3/16 of the offspring w/ that phenotype

50. alleles Y= yellow and y= white.
Genotypes= phenotype based on incomplete dominance
YY= yellow; Yy= cream ; yy= white

52. X^H^x^h^ crossed X^H^Y

¼ chance of having a hemophiliac child