1. The scientific study of heredity is called:
    a. Meiosis
    b. Crossing-over
    c. Genetics
    d. Pollination

2. The "father" of genetics was:
    a. T.A. Knight
    b. Hans Krebs
    c. Gregor Mendel
    d. None of the above

3. A genetic cross between an individual of unknown genotype and a homozygous recessive is called a (n)_____.
    a. Self-cross
    b. Testcross
    c. F1 cross
    d. F2 cross

4. In crossing a homozygous recessive with a heterozygote, what is the chance of getting an offspring with the homozygous recessive phenotype?
    a. 0%
    b. 25%
    c. 50%
    d. 75%
    e. 100%

Questions 5-7 below refer to the following terms. Each term may be used once, more than once or not at all.

A. Incomplete dominance
B. Multiple Alleles
C. Pleiotrophy
D. Epistasis
E. Penetrance

5. The ability of a single gene to have multiple phenotype effects.
6. One example is the ABO blood group system.
7. The phenotype of the heterozygote differs from the phenotypes of both homozygotes

8. Which of the following is an example of polygenic inheritance?
    a. Pink flowers in snapdragons
    b. The ABO blood group in humans
    c. Sex-linkage in humans
    d. White and purple color in sweet peas
    e. Skin pigmentation in humans

9. Three babies were recently mixed up in a hospital. After consideration of the data below, which of the following represents the correct baby/parent combinations?

Couple #	I	II	III
Blood Types	A and A	A and B	B and O

Baby #	1	2	3
Blood Types	B	O	AB

a. I-3, II-1, III-2
b. I-1, II-3, III-2
c. I-2, II-3, III-1
d. I-2, II-1, III-3
e. I-3, II-2, III-1

Questions 10-13 below will use the following answers. Each answer may be used once, more than once or not at all.

A. Huntington's disease
B. Tay-Sachs disease
C. PKU
D. Hemophilia
E. Sickle-cell disease

10. Effects of this recessive single gene can be completely overcome by regulating the diet of the affected individual.

11. This is caused by a dominant single gene defect and generally does not appear until the individual is 30-40 years of age.

12. Individuals with this disorder are unable to metabolize gangliosides, which affects proper brain development. Affected individuals die in early infancy.

13. Substitution of the "wrong" amino acid in the hemoglobin protein results in this disorder.

14. In a cross AaBbCc x AaBbCc, what is the probability of producing the genotype AABBCC?
a. 1/4
b. 1/8
c. 1/16
d. 1/32
e. 1/64

15. If inheritance of a human trait is X-linked recessive, any of the following could result except that…
    a. Expression of the trait might "skip" a generation.
    b. The trait could be more common in female than males.
    c. All females might become homozygous for the trait.
    d. The gene for the trait might mutate to a dominant allele.
    e. Females could be a mosaic of two cells.

16. The following is a list of chromosomal alterations. Which one of there would automatically cause two of the others?
    a. Deletion
    b. Duplication
    c. Inversion
    d. Reciprocal translocation
    e. Nonreciprocal translocation

17. What do all human males inherit from their mother?
    a. Mitochondrial DNA
    b. X chromosome
    c. Male-pattern baldness
    d. Only A and B are correct
    e. A, B and C are correct

18. A mammalian zygote with which of the following chromosomal abnormalities will NEVER develop into a viable embryo?
    a. YO
    B. XO
    c. XXX
    d. XXY
    e. XXXY

19. What does independent assortment refer to?
    a. The separation of alleles in anaphase I
    b. The random arrangement of chromosomal tetrads at metaphase I
    c. The separation of chromatids in anaphase II
    d. The random arrangement of gene loci on a chromosome
    e. The fact that any pair of chromatids in a tetrad can cross over

20. A Barr body is normally found in the nucleus of which kind of human cell?
    a. Unfertilized egg cells only
    b. Sperm cells only
    c. Somatic cells of a female only
    d. Somatic cells of a male only
    e. Both male and female somatic cells

21. The particular position of a gene on a chromosome is known as a (n)_____.
    a. Allele
    b. Tetrad
    c. Chiasm
    d. Locus
    e. Map distance

22. A man who carries an X-linked allele will pass it on to _____.
    a. All of his daughters
    b. Half of his daughters
    c. All of his sons
    d. Half of his sons
    e. All of his children

23. Male-calico cats are the result of
    a. Sex-linked inheritance
    b. Nondisjunction, where the male calico presumable has two XX chromosomes
    c. Incomplete dominance of multiple alleles
    d. Recessive alleles retaining their fundamental natures even when expressed
    e. A reciprocal translocation

24. People who have red hair usually have freckles. This can best be explained by _____.
    a. Linkage
    b. Reciprocal translocation
    c. Independent assortment
    d. Sex-influenced inheritance
    e. Nondisjunction

25. Biotechnology is presently being used to do which of the following?
    a. Produce vaccines
    b. Detect defects in human germ cells
    c. Produce human gene products
    d. Only A and C are correct
    e. A, B and C are correct

26. PCR could be used to amplify DNA from which of the following?
    a. A fossil
    b. A fetal cell
    c. A virus
    d. Only B and C are correct
    e. A, B and C are correct

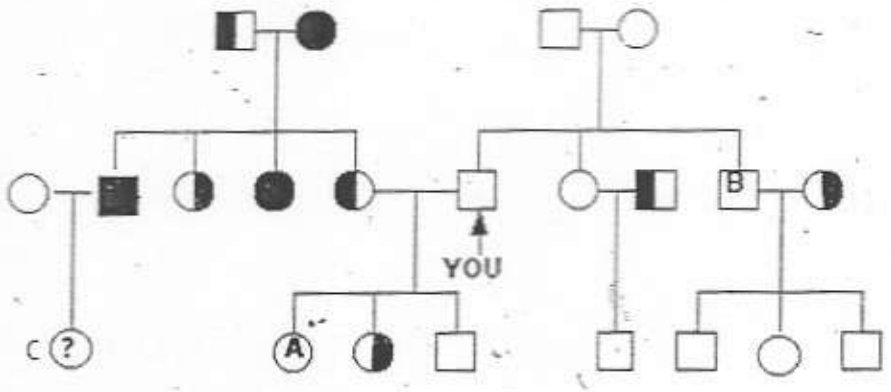
27. It is theoretically possible for a gene from any organism to function in any other organism. Why is this possible?
    a. All organisms have the same genetic code
    b. All organisms are made up of cells.
    c. All organisms have similar nuclei
    d. All organisms have ribosomes
    e. All organisms have transfer RNA

Use the following choices to answer questions 28-32 below. Each choice may be used once, more than once or not at all

A. Restriction enzymes
B. DNA Ligase
C. Reverse transcriptase
D. RNA polymerase
E. DNA polymerase

28. Which enzyme permanently seals together DNA fragments that have complementary sticky ends?
29. Which enzyme adds a phosphate groups to ribose?
30. Which enzyme is used to make multiple copies of genes in the polymerase chain reaction (PCR)?
31. Which enzyme is used to produce RFLPs?
32. *Eco*RI is an example of which type of enzyme?

Use the following pedigree to answer questions 33-36 below.



33. Find "yourself " on the pedigree. How is person A related to you?
    a. Your sister
    b. Your aunt
    c. Your daughter
    d. Your son

34. Who is person B?
    a. Your brother
    b. Your father
    c. Your uncle
    d. Your mother

35. Is this a sex-linked gene?
    a. Yes
    b. No

36. What is the genotype of person C?
    a. Homozygous
    b. Haploid
    c. Heterozygous
    d. No way to tell

37. This genetics "law" states that one allele is masked while the other is expressed.
    a. The Law of Independent Assortment
    b. Law of Dominance
    c. Law of Segregation
    d. Law of Expression

38.The observable traits of an organism is its
    a. Phenotype
    b. Genotype
    c. Pedigree
    d. Karyotype

39. Crossing a purebred green (green is dominant to yellow) podded plant with a purebred yellow-podded plant is symbolized by:
    a. Gg x gg
    b. GG x gg
    c. Gg x Gg
    d. GG x GG

40. Crosses between AaBb and AaBb lead to phenotypic ratios of:
    a. 4:8:4
    b. 4:4:4:4
    c. 9:1
    d. 9:3:3:1

For questions 41-61 you may show your work on this test but be sure to place your answer on the answer sheet.

In bears, a gene for nail color produces three colors:
BB=Black WW=white BW=Brown
Cross a black-nailed bear with a brown nailed bear. What is the probability of getting:

41. Black-nailed bears?
42. Brown nailed bears?
43. White-nailed bears?
44. What type of dominance is this problem an example of?

In horses, the color black (B is dominant to chestnut color (b) and the ability to trot (T) is dominant to pacing (t). A horse that is heterozygous for black color, but homozygous for trotting is mated to a chestnut pacer.

45. What is the genotypic ratio for the F1 generation?
46. What is the phenotypic ratio for the F1 generation?

Human hair color is a polygenic trait represented by many alleles. Use the key below to answer the following questions.

BB=dark brown	bb=blonde	RR=red
BR=auburn	Bb=light brown	Rb=carrot red

47. What are the genotypic ratios of the F2 generation if one parent had dark brown hair and the other blonde?
48. What are the phenotypic ratios of the F2 generation if one parent had dark brown hair and the other blonde?
49. What are the genotypes of the parents given the following offspring:
    ½ auburn: ¼ carrot red: ¼ light brown
50. What are the phenotypes of the parents given the same offspring as above?

Use the information from the figure below to answer questions 51-53.

The plasmid pGEN101 shown in Figure 20.4 was treated with various mixtures of restriction enzymes. The electrophoresis gel shows the results of each of these digestions.

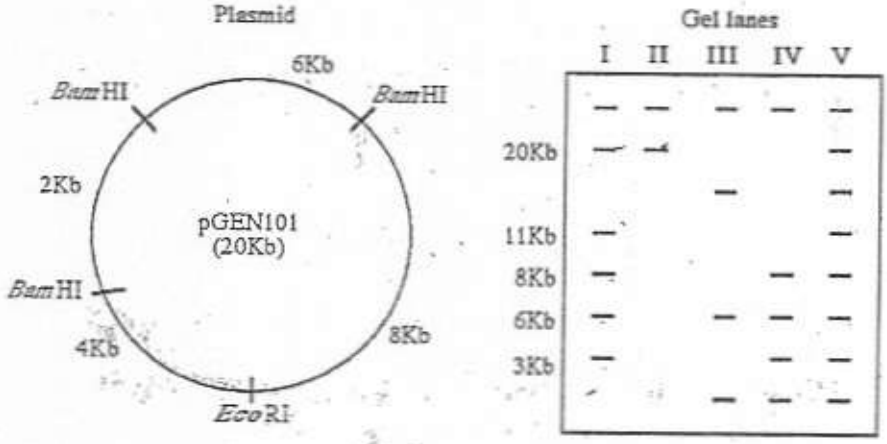
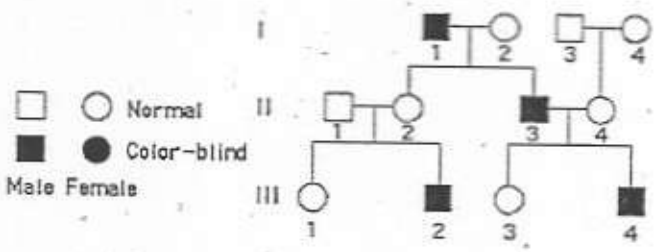


Figure 20.4

51. Which lane represents the fragments produced using *Bam*HI only?
52. Which lane represents the fragments produced using *Eco*RI only?
53. Which lane represents the fragments produced when the plasmid was cut with both *Eco*RI and *Bam*HI?

The following pedigree chart indicates the inheritance of color-blindness. Refer to this chart to answer questions 54-59.

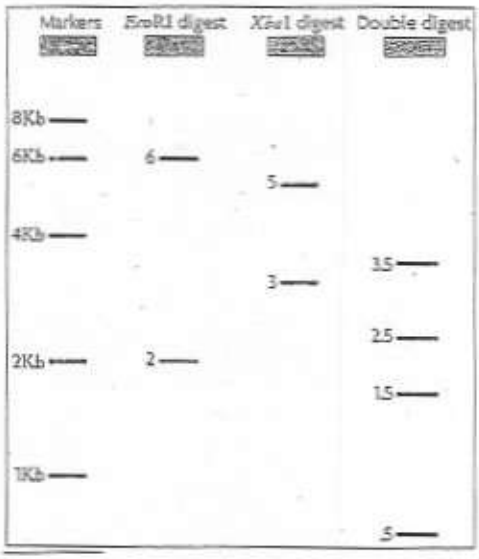


54. What is the genotype of individual III-2
55. What is the genotype of individual I-2?
56. In the pedigree, what is the probability that individual III-1 is heterozygous?
57. In the pedigree what is the probability that individual; III-3 is homozygous?
58. Individual III-1 could be homozygous or heterozygous. When she has children, which of the following possible fathers would be most informative of her genotype?
    a. a normal man
    b. a color-blind man
    c. a normal man but only if his mother was color-blind
    d. a color-blind man, but only if his mother was color-blind
    e. All of the above would be equally informative

59. In this pedigree, several of the characteristics of sex-linked recessive traits are apparent. Which one is NOT demonstrated in this pedigree?

a. More males than females demonstrate the trait
b. females serve as "carriers" for the trait by being heterozygous
c. The occurrence of the trait skips generations
d. Daughters of affected fathers are normal unless their mother is also affected.

Question 60-62 refer to the restriction digest below:



60. How many DNA fragments did the single digests produce?
61. How many times did *Eco*RI and *Xba*I cut the DNA molecule?

62. (Tie Breaker)
Draw a Restriction map for the gel above on the plasmid below