

**Directions:** Read each question carefully and completely. Select the **ONE BEST** answer and record your choice by **CAREFULLY** blackening the proper space on your answer sheet with a #2 pencil. If you make a mistake, erase your old answer completely.

1. Continuous traits generally exhibit which phenotypes?  
A. one                      B. more than one                      C. a range of                      D. both B and C
2. Continuous traits show more than one phenotypes because they  
A. are determined by more than one gene  
B. are determined by genes with multiple alleles  
C. are determined by mutant alleles  
D. occur in more than one organism
3. Which of the following is an example of continuous trait?  
A. color of seed pods in peas                      B. ABO blood types in humans  
C. coat color in mice                      D. birth weight in baboons
4. The distribution of continuous traits can best be described as  
A. linear                      B. bell-shaped                      C. hyperbolic                      D. logarithmic
5. The statistical term that describes the center of a distribution of phenotypes in a sample along a continuous range of possibilities is the  
A. mean                      B. standard deviation                      C. mode                      D. variance
6. The proportion of phenotypic variance that results from additive genetic variance is the ----- variability.  
A. broad - sense                      B. narrow - sense                      C. variable                      D. genetic
7. The statistical measurement that describes the degree to which individual measurements spread out about the center of a distribution is the  
A. mean                      B. median                      C. chi value                      D. variance                      E. covariance
8. When graphing a distribution of phenotypes for a continuous trait, a broad curve implies  
A. very little variation in the phenotypes                      B. a large standard deviation  
C. a small variance                      D. a large correlation coefficient
9. Heritability can be defined as the  
A. phenotypic similarities observed among family members  
B. influence that one gene has on the expression of an unrelated gene  
C. degree to which phenotypic variation is influenced by heredity  
D. contribution of mutations to the degree of variability within a population  
E. degree to which phenotypic variation is influenced by the environment

10. The proportion of phenotypic variance in a population that results from genetic differences among individuals is expressed as the
- A. additive genetic variance                      B. narrow sense heritability  
C. broad sense heritability                      D. environmental variance
11. For a particular trait, the narrow - sense heritability can be expressed in terms of the
- A. additive genetic variance and the phenotypic variance  
B. genetic additive variance and the environmental variance  
C. gene-environmental interaction and the genetic variance  
D. genetic variance and the phenotypic variance
12. Which of the following traits has a continuous distribution?
- A. amount of milk produced by cows                      B. learning ability in humans  
C. human fingerprint patterns                      D. all of the above
13. If a quantitative trait controlled by a polygenic series has six segregating alleles, how many genotypes will be expected in the second filial generation?
- A. 3                      B. 6                      C. 12                      D. 27                      E. 36
14. If a quantitative trait controlled by a polygenic series contains eight segregating alleles, how many phenotypes would be expected in the F<sub>2</sub>?
- A. 4                      B. 8                      C. 9                      D. 18                      E. 27
15. Genes that are linked
- A. segregate to opposite poles during meiosis  
B. do not assort independently during meiosis  
C. segregate independently during meiosis  
D. all of the above
16. To construct a genetic map showing the relative positions of genes on a chromosome, the genes under study must be
- A. homologous                      B. recessive                      C. linked                      D. mutant
17. If two genes are not linked, then the expected phenotypic ratio resulting from a test cross would be
- A. 9:3:3:1                      B. 1:2:1                      C. 3:1                      D. 1:1:1:1                      E. 1:1
18. X, Y and Z are linked genes. Based on test cross data the frequency of recombination between genes X and Y was determined to be 33.1 map units; between genes X and Z the distance was 11.8 map unit and between genes Y and Z the distance was 21.3 map unit. What is the order of these three genes on the chromosome?
- A. X-Y-Z                      B. X-Z-Y                      C. Z-Y-X                      D. Y-X-Z
19. For a two point test cross, if the percentage of recombinants is 50%, the two genes are probably
- A. on different chromosome                      B. distant from one another on the same chromosome



29. The type of genetic exchange between bacterial cells that involves the transfer of small, extrachromosomal pieces of DNA is  
 A. transversion      B. transduction      C. transformation  
 D. conjugation      E. translocation

30. Which type of genetic exchange in bacteria requires direct cell-to-cell contact?  
 A. transformation      B. conjugation      D. transduction

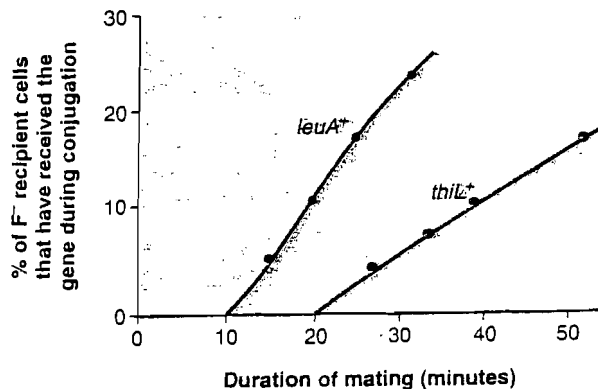
31. The plasmid that mediates conjugation in *E. coli* is the ----- factor  
 A. F      B. R      C. C      D. P

32. An Hfr strain of *E. coli* with the genotype  $a^+ b^+ c^+ d^+ e^+ f^+$  is mated with an  $F^-$  auxotrophic strain with the genotype  $a^- b^- c^- d^- e^- f^-$ . Conjugation is stopped at 10 minutes intervals and the genotypes of the resulting conjugants are determined. The following results are obtained:

After 10 minutes	$e^+$
After 20 minutes	$a^+ e^+$
After 30 minutes	$a^+ b^+ e^+$
After 40 minutes	$a^+ b^+ d^+ e^+$
After 50 minutes	$a^+ b^+ c^+ d^+ e^+$
After 60 minutes	$a^+ b^+ c^+ d^+ e^+ f^+$

What is the correct order of genes on this bacterial chromosome?

- A. a-b-c-d-e-f      B. c-d-e-f-a-b      C. e-a-b-d-c-f      D. f-e-d-c-b-a
33. An Hfr strain that is  $leuA^+$  and  $thiL^+$  was mated to a strain that is  $leuA^-$  and  $thiL^-$ . In the data points shown below, the mating was interrupted and the percentage of recombinants for each gene was determined by streaking on plates that lacked either leucine or thiamine as shown in the graph. What is the map distance (in minutes) between these two genes?



- A. 10      B. 15      C. 20      D. 25      E. 30

34. Which of the following traits or diseases are determined by nuclear genes?

- A. snail coiling pattern      B. streptomycin resistance      C. Leber's hereditary optic neuropathy
35. During the life cycle of some bacteriophages, the viral chromosome can integrate into the host bacterium's chromosome. In this state the virus is termed a  
 A. phage      B. phage lysate      C. prophage      D. episome
36. Cotransductants can be detected when the transduced genes are  
 A. closely linked      B. mutant      C. on different chromosome      D. both B and C
37. In the case of genetic exchange in bacteria by transformation  
 A. the transfer is unidirectional      B. a complete diploid is formed  
 C. the transformed cells remain haploid      D. both A and C are correct
38. Extranuclear inheritance refers to the transfer of genes located in  
 A. nucleus      B. mitochondria      C. chloroplasts      D. both B and C
39. In some strains of the plant *mirabilis jalapa*, the model for inheritance of leaf color assumes that  
 A. autonomous division of the chloroplast genome occurs  
 B. leaf color is determined by chloroplast genes —  
 C. segregation of plastids to progeny cells occurs randomly  
 D. all of the above
40. The [*poky*] mutant of *Neurospora*  
 A. exhibits a slower rate of growth than the wild type  
 B. cannot reproduce      C. all of the above
41. Yeast mutants called *petites* obtain energy from  
 A. aerobic oxidation of glucose      B. photosynthesis      C. fermentation
42. Extranuclear inheritance is exhibited by  
 A. albino mutants in cats      B. [*poky*] mutants in *Neurospora*  
 C. hemophilia in humans      D. all of the above
43. Which yeast mutant overcomes the wild type mitochondria so that a respiratory deficient phenotype results?  
 A. *segregational petite*      B. *neutral petite*      C. *suppressive petite*
44. Which of the following genetic diseases is related to a mitochondrial DNA defect?  
 A. Leber's hereditary optic neuropathy      B. cystic fibrosis  
 C. retinoblastoma      D. Alzheimer disease
45. In most disease resulting from mtDNA defects, the cells of affected individuals contain  
 A. mutant mitochondria only      B. normal mitochondria only

C. both mutant and normal mitochondria      D. no mitochondria

46. In the extranuclear inheritance of genes from higher eukaryotes, the offspring of a genetic cross typically exhibits the phenotype of
- A. the maternal parent only      B. the paternal parent only  
C. both parents      D. neither parents
47. Which of the following is a characteristic of non-Mendelian inheritance?
- A. ratios typical of Mendelian segregation are not found  
B. in multicellular eukaryotes, the results of reciprocal crosses are not the same as reciprocal crosses involving nuclear genes  
C. genes cannot be mapped to the chromosomes in the nucleus  
D. inheritance is not affected by substituting a nucleus with a different genotype  
E. all of the above
48. Maternal effect involves
- A. nuclear genes    B. mitochondrial genes    C. chloroplast genes    D. all of the above
49. For two linked genes, C and D with alleles in coupling, which of the following arrangements would indicate that recombination had occurred between the two genes?
- A. C+ D+/ C- D-      B. C- D-/ C+ D+      C. C+ D-/ C+ D-      D. C+ D-/ C- D+
50. The transformation frequencies for genes A and B are each  $10^{-3}$ . The frequency of co-transformation for these two genes is also  $10^{-3}$ . Therefore, these genes are probably
- A. very close to one another on the chromosome  
B. on the two different chromosome  
C. far apart from one another on the chromosome  
D. on two separate plasmids inside the cell  
E. all of them are correct