Multiple Choice

Topic: inbreeding and fitness Difficulty: moderate

13. A small population of wolves founded by a single breeding pair on the Scandinavian peninsula in 1983 showed little vitality until 1991, when the population began to grow exponentially. What event in 1991 led to the increased vitality of the population?

A) several years of unusually mild winters

B) infusion of new genes into the pack by a single immigrant male

C) cessation of hunting by humans

D) recovery of the Scandinavian caribou herd

E) all of the above

Answer: B

Topic: population genetics Difficulty: easy

14. Genetic analyses are finding new applications in ecology, leading to the understanding of the geographic structure of natural populations, mating relationships, movements of individuals within populations, and histories of change in population size.

A) True B) False

Answer: A

Topic: molecular basis of evolution Difficulty: moderate

15. A given amino acid is encoded by only a single, unique base sequence in DNA.

A) True B) False

Answer: B

Topic: mutation Difficulty: moderate

16. A point mutation (substitution of a single nucleotide in a DNA codon) in a gene for a particular protein always results in a change in the amino acid sequence in the corresponding protein.

A) True B) False

Answer: B

Topic: mutation Difficulty: easy

17. Although there may be many different alleles of a particular gene in the gene pool for a population, each diploid individual can only carry a small portion of that genetic variation.

A) True B) False

Answer: A

Topic: genetic markers Difficulty: moderate

18. Microsatellites are tandem repeats of sequences of two, three, or four nucleotides in an individual’s DNA. Although noncoding, these microsatellites are useful as \_\_\_\_\_\_\_\_\_\_.

A) safeguards against mutation

B) regulators of gene expression

C) genetic markers

D) attachment points for spindle fibers

E) all of the above

Answer: C

Topic: maintenance of genetic variation Difficulty: moderate

19. Natural selection generally tends to reduce genetic variation. Which of the following can maintain or even enhance the level of genetic variation present in a population?

A) mutation

B) immigration

C) spatial/temporal environmental variation

D) heterozygote superiority

E) all of the above

Answer: E

Topic: mutation Difficulty: moderate

20. The probability that an individual complex organism (such as a vertebrate) is likely to sustain one or more mutations in some part of its genome during its lifetime is:

A) zero. B) slight, but close to zero. C) small. D) high.

Answer: D

Topic: frequency-dependent selection Difficulty: moderate

21. Although the human sickle-cell gene causes debilitating anemia when expressed in homozygous form, it persists at relatively high frequency in some African populations, because in heterozygous condition, the sickle-cell allele confers an advantage. What is that advantage?

A) protection against malaria

B) protection against ionizing effects of UV radiation

C) protection against food-borne diseases

D) protection against coronary heart disease

E) protection against mutations

Answer: A

Topic: frequency-dependent selection Difficulty: moderate

22. The advantage to heterozygotes described in the previous question is an example of \_\_\_\_\_\_\_\_\_\_.

A) unusually high mutation rate

B) random genetic variation

C) a silent mutation

D) a major histocompatibility complex

E) frequency-dependent selection

Answer: E

Topic: Hardy-Weinberg equilibrium Difficulty: easy

23. The Hardy-Weinberg law states that the frequencies of alleles and genotypes remain constant from generation to generation in a population with \_\_\_\_\_\_\_\_\_\_.

A) a large (infinite) number of individuals

B) random mating

C) no natural selection

D) no mutation

E) no migration between populations

F) All of the above conditions must be met.

Answer: F

Topic: Hardy-Weinberg equilibrium Difficulty: moderate

24. In a particular population, gene A has only two alleles, A1 and A2. The frequencies of these two alleles are known and designated *p* and *q*, respectively. What would the equilibrium frequency of the genotype A1A2 be?

A) *p*2 B) *q*2 C) *pq*  D) 2*pq*  E) *p*2 + 2*pq* + *q*2

Answer: D

Topic: Hardy-Weinberg equilibrium Difficulty: easy

25 In a particular population, gene A has only two alleles, A1 and A2. The frequencies of these two alleles are known and you calculate the Hardy-Weinberg equilibrium frequencies of the three possible genotypes, A1A1, A1A2, and A2A2. The actual frequencies of these genotypes in the population depart substantially from the equilibrium frequencies. Which of the following processes is responsible for this departure from equilibrium frequencies?

A) genetic drift D) natural selection

B) assortative mating E) any of the above, or some combination

C) migration

Answer: E

Topic: Hardy-Weinberg equilibrium Difficulty: hard

26. Of the following, the Hardy-Weinberg equilibrium is much more sensitive to departures from one. Which is it?

A) infinite population size D) no natural selection

B) no mutation E) random mating

C) no migration

Answer: E

Topic: assortative mating Difficulty: moderate

27. Of the two kinds of assortative mating, one leads to a reduction in the proportion of heterozygotes in a population. Which is it?

A) positive B) negative

Answer: A

Topic: assortative mating Difficulty: easy

28. Which of the following results in inbreeding?

A) negative assortative mating C) random mating

B) positive assortative mating D) abstinence

Answer: B

Topic: assortative mating Difficulty: moderate

29. You maintain two monkeyflower (*Mimulus guttatus*) populations, one with enforced selfing, the other (control) where outcrossing is permitted. Which of the two populations exhibits consistently high ovule number and number of viable pollen grains per flower, generation after generation?

A) selfed B) outcrossed

Answer: B

Topic: inbreeding coefficient Difficulty: hard

30. When all alleles of a gene except one are lost from a population, we say that the remaining allele is fixed. When fixation occurs, what is the value of the inbreeding coefficient (*F*)?

A) 0.0 D) 0.5

B) 0.125 E) 1.0

C) 0.25

Answer: E

Topic: inbreeding and fitness Difficulty: moderate

31. In studies of both song sparrows and wolves, researchers found the following relationship between the survival of offspring and the inbreeding coefficient (*F*).

A) Survival increased with increasing values of the inbreeding coefficient.

B) Survival decreased with increasing values of inbreeding coefficient.

C) Survival showed no relationship to values of the inbreeding coefficient.

D) The relationship of survival and inbreeding coefficient depended on the species studied.

Answer: B

Topic: assortative mating Difficulty: easy

32. In experiments with the plant *Banksia spinulosa*, researchers in Australia showed that individual plants:

A) can make distinctions among developing embryos on the basis of their genotypes.

B) cannot make distinctions among developing embryos on the basis of their genotypes.

Answer: A

Topic: genetic drift Difficulty: easy

33. Genetic drift results from stochastic variation in birth and death rates, and it is thus most important in \_\_\_\_\_\_\_\_\_\_ populations.

A) small B) medium C) large D) all

Answer: A

Topic: genetic drift Difficulty: hard

34. A small population of a sexually reproducing lizard has dwindled to two individuals, one male and one female. Both are heterozygous (B1B2) for the gene B. These individuals mate and produce three offspring. The adults are then eaten by a bird. What is the probability that allele B2 has become fixed in the population, which now consists of the three offspring?

A) 1/64 B) 1/16 C) 1/4 D) 1/27 E) 1/9 F) 1/3

Answer: A

Topic: founder events Difficulty: easy

35. A large "raft" of floating vegetation breaks loose from a tropical mainland area during a violent hurricane. After days adrift, the raft reaches a small island. Among the animals on this raft are eight lizards belonging to a species not previously found on the island. Several years later, the population established by these individuals is studied carefully and found to have a \_\_\_\_\_\_\_\_\_\_ level of genetic variation compared to the parent (mainland) population from which the original eight colonists came.

A) substantially enhanced B) similar C) substantially reduced

Answer: C

Topic: population bottleneck Difficulty: easy

36. Loss of genetic variability in a population following colonization or any other form of population decline is referred to as a \_\_\_\_\_\_\_\_\_\_.

A) population meltdown D) population bottleneck

B) population crash E) population enhancement

C) population extinction

Answer: D

Topic: population bottleneck Difficulty: moderate

37. Which of the following species of East African carnivores has been monitored closely by conservationists after the discovery that this animal has practically no genetic variation?

A) lion B) tiger C) bear D) cheetah E) leopard

Answer: D

Topic: effective population size Difficulty: hard

38. A population of an endangered plant is monitored over a period of 5 years. The following population sizes are recorded: 30, 50, 30, 20, and 70. What is the effective population size (*N*e)?

A) exactly 40

B) greater than 40

C) less than 40

D) There is insufficient information presented to answer this question.

Answer: C

Topic: effective population size Difficulty: moderate

39. Imbalance in the number of males and females contributing to future generations, as occurs in many promiscuous mating systems, has which of the following effects on effective population size?

A) increase

B) no effect

C) reduction

D) There is insufficient information presented to answer this question.

Answer: B

Topic: genetic trace of population change Difficulty: hard

40. The example of the Galápagos tortoises presented in the text contrasted two medium-sized populations (100–600 tortoises) with a third, much larger, population (3,000–5,000 tortoises), all found on Isabela Island. The largest population has considerably lower variation in its mitochondrial haplotype, with most individuals representing a single haplotype. What did researchers conclude about this largest population?

A) It was founded by one or a small number of individuals and recently grew to its present large size.

B) It is an ancient population, and emigrants from this population likely founded the two smaller populations.

C) It is a fragment of a much larger population that was recently split by volcanic activity into the three present-day populations.

D) It is an enigmatic population, because large populations always have greater genotypic diversity.

Answer: A

Topic: coalescence Difficulty: hard

41. All the copies of a single gene in a population will have descended from a single copy that existed at some time in the past. We refer to the elapsed time as the \_\_\_\_\_\_\_\_\_\_ time.

A) heterozygosity

B) homozygosity

C) extinction

D) coalescence

Answer: D

Topic: mutation-drift balance Difficulty: hard

42. The fact that within-island genetic similarity among Galápagos hawks declines with increasing island area is indicative of lower values of the equilibrium fixation index on larger islands, a reflection of:

A) equilibria established between processes of genetic drift and mutation.

B) equilibria established between processes of immigration and extinction.

C) equilibria established between processes of immigration and emigration.

D) equilibria established between processes of births and deaths.

Answer: A

Topic: migration-drift balance Difficulty: hard

43. As a rule of thumb, how many immigrants per generation would be sufficient to prevent genetic differentiation in a subpopulation with respect to genes that have no (neutral) effect on fitness?

A) 1/4

B) 1

C) 4

D) 40

Answer: B

Topic: geographic variation Difficulty: easy

44. Plants of yarrow, *Achillea millefolium*, grown from seed collected from various habitats ranging from sea level to more than 3,000 meters in elevation, retained distinctive differences in plant size and other traits when grown in a common garden at sea level, indicating the existence of \_\_\_\_\_\_\_\_\_\_ variation.

A) random B) catastrophic C) ecotypic D) assortative

Answer: C

Topic: geographic variation Difficulty: moderate

45. As illustrated in the research conducted by Price and Wasser on *Delphinium nelsoni*, outbreeding is always desirable, even if matings occur between individuals separated by great distance.

A) True B) False

Answer: B

Topic: geographic variation Difficulty: hard

46. Antonovics and Bradshaw discovered that plants of sweet vernal grass growing on mine tailings in North Wales exhibited high zinc tolerance, despite the existence nearby of plants with relatively low zinc tolerance. They proposed that \_\_\_\_\_\_\_\_\_\_ for zinc tolerance on the mine tailings was sufficiently high to overcome gene flow from adjacent intolerant plants.

A) mutation rate

B) selection pressure

C) genetic drift

D) heterozygosity

Answer: B

Topic: geographic variation Difficulty: hard

47. In the zinc-tolerant subpopulation of sweet vernal grass discussed in the preceding question, what was happening that would limit the flow of intolerant genes from the adjacent subpopulation on uncontaminated soils?

A) increased vegetative reproduction

B) increased mortality

C) increased outcrossing

D) increased self-compatibility

Answer: D

Short Answer

Topic: molecular basis of evolution Difficulty: easy

48. Molecules of DNA are comprised of four kinds of subunits (adenine, thymine, cytosine, and guanine) called \_\_\_\_\_\_\_\_\_\_.

Answer: nucleotides

Topic: molecular basis of evolution Difficulty: easy

49. Each amino acid in a protein is encoded by a sequence of three subunits of a DNA molecule; such a coding sequence is referred to as a \_\_\_\_\_\_\_\_\_\_.

Answer: codon

Topic: molecular basis of evolution Difficulty: easy

50. Certain mutations are referred to as \_\_\_\_\_\_\_\_\_\_ because the mutated coding sequence still codes for the same amino acid as the unmutated coding sequence. Such mutations have no consequences for fitness.

Answer: silent mutations

Topic: allele frequencies Difficulty: moderate

51. When an organism is haploid or the reference is to a haploid part portion of the genome (gametes, mitochondria, chloroplasts), it is more appropriate to use the term \_\_\_\_\_\_\_\_\_\_ instead of genotype.

Answer: haplotype

Topic: assortative mating Difficulty: easy

52. \_\_\_\_\_\_\_\_\_\_ assortative mating occurs when individuals preferentially mate with individuals that are like themselves.

Answer: Positive

Topic: inbreeding depression Difficulty: easy

53. \_\_\_\_\_\_\_\_\_\_ is the reduction of fitness caused by inbreeding.

Answer: Inbreeding depression

Topic: genetic drift Difficulty: moderate

54. \_\_\_\_\_\_\_\_\_\_ results in changes in allele frequencies due to random variations in fecundity, mortality, and inheritance of gene copies through male and female gametes.

Answer: Genetic drift

Topic: founder events Difficulty: easy

55. When a new population is established by a few individuals, the resulting reduction in genetic variation (compared to the parental population) is referred to as a \_\_\_\_\_\_\_\_\_\_.

Answer: founder event

Topic: gene flow Difficulty: easy

56. \_\_\_\_\_\_\_\_\_\_ is the reduction of fitness caused by inbreeding.

Answer: Inbreeding depression

Topic: geographic variation Difficulty: moderate

57. We recognize the Swedish botanist \_\_\_\_\_\_\_\_\_\_ for his pioneering work with common garden experiments that identified ecotypes, genetically differentiated populations restricted to specific habitats.

Answer: Turreson