

Designer Genes - Key

Written for the 2021 Scioly Summer Study Session

Each part of a short answer question marked with a {n} is required to get n points on a question. Points Possible: 79 with tiebreakers, 76 without

Part 1 Answers {30 points total, 31 with tiebreaker points}

1. C - DNA has a backbone made of a sugar and a phosphate, while RNA does not
2. Relieving strain on the DNA {1} by relaxing positive supercoiling/causing negative supercoiling in DNA {1}
3. B - A mutation that only affects one or very few nucleotides of a gene
4. A - Somatic mutations cannot be inherited, but germline mutations can
5. Wobble
6. Genes located on the same chromosome {1}
7.
 - i. Yes, {1} they possess two X chromosomes {1}
 - ii. Klinefelter's Syndrome {1}
8. B - The Pribnow-Schaller box
9. Nucleus {1}, mitochondria {1}, chloroplast {1}
10. D - A diploid nucleus divides to form haploid nuclei
11. Histone {1}
12. D - Anaphase
13. Met Thr Ala Leu Ile Ser Arg Stop
14. Core promoter {1}, proximal promoter {1}, distal promoter {1}
15. B - False
16. The new codon codes for a different amino acid {1}, resulting in a protein that cannot perform its original duty {1}
17. A - Nondisjunction in Anaphase II results in two affected daughter cells
18. A transcription factor is a protein {1} that controls the rate of transcription of a specific gene {1}
19. Hershey and Chase used radioactive isotopes {.5} to mark proteins {.5} in some viruses and {.5} DNA in others. The virus {.5} infected a bacterium {.5} and the bacterium infected by the virus with the marked DNA showed radioactivity. {.5}
20. A - Leptotene, zygotene, pachytene, diplotene, diakinesis

Part 2 Answers {25 points total, 26 with tiebreaker points}

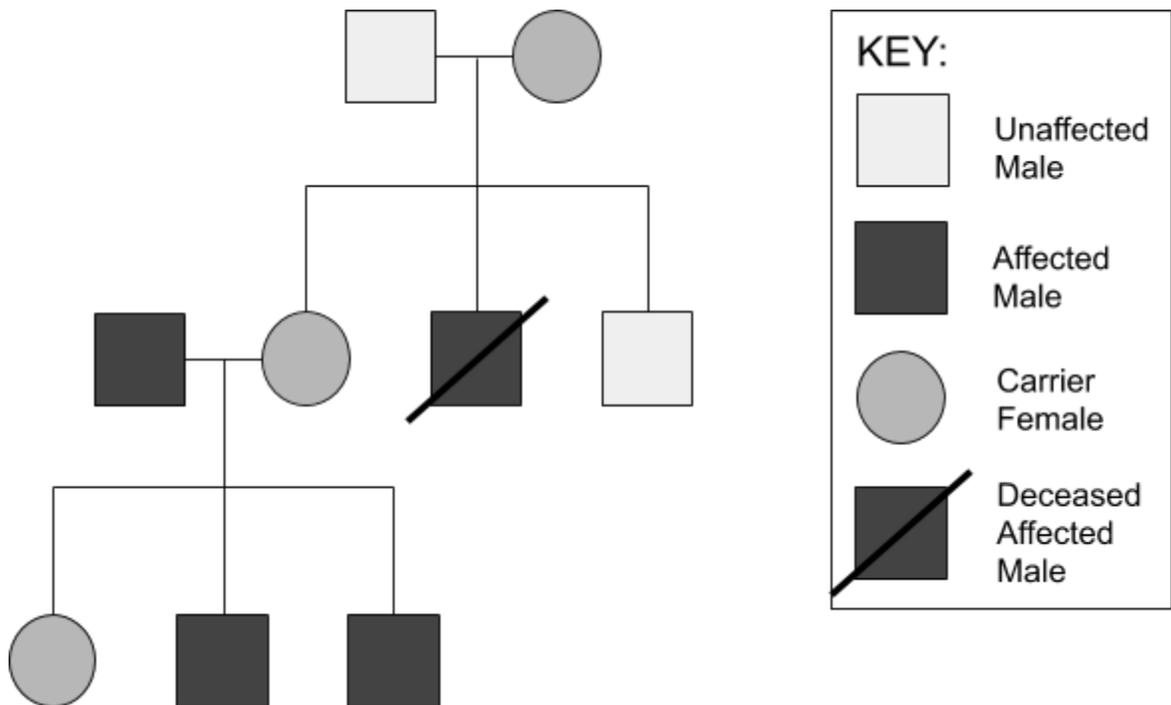
21. When one gene suppresses or alters another gene {1}
22. C - Heterozygous
- 23.

	RL	RI	rL	rl
RL	RRLL	RRLI	RrLL	RrLI
RI	RRLI	RRII	RrLI	RrII
RL	RRLL	RRLI	RrLL	RrLI
RI	RRLI	RRII	RrLI	RrII

One point for the correct genotypes being crossed, two points for the correct results.

24. B - Incomplete dominance
25. Answers should be given in percentages: 40.3% heterozygous {1}, 51.8% homozygous dominant {1}, and 7.8% homozygous recessive {1}.
26.
 - i. Autosomal dominant {1}
 - ii. Autosomal recessive {1}
27. C - 50%
28. Autosomal dominant {1}
29. D - Individual 1: B, Individual 2: A
30. Just one {1}, AaBbCc
31. A polymorphism is when a population possesses more than one gene at a locus {1}, such as in peppered moths or ladybugs.
32. B - Phylogenetic trees show time, while cladograms do not
33. Genetic recombination is when genetic material is exchanged between chromosomes {1}, allowing for offspring to exhibit a new genotype not seen in either of the parents {1}
34. i. A sex-linked trait is located on a sex chromosome {1} instead of an autosomal chromosome.

ii.



One point for correct number of individuals, one point for correct relations, one point for correct status (affected, unaffected, deceased), one point for correct genders, and one point for the presence of an accurate key. Key does not have to match the answer key exactly, but should define both the shapes and colors used.

35. A - The genes are likely linked if the difference between the observed and expected frequencies is statistically significant

Part 3 Answers {21 points total, 22 with tiebreaker points}

36. C - The pores of the gel are too small to allow large molecules to travel easily
- 37.
- i. 1. Denaturation {.5}, separating the DNA strands through heat {.5}
 - 2. Annealing {.5}, cooling the DNA so that primers can bind to it {.5}
 - 3. Elongation/extension/synthesizing {.5}, making a new DNA strand {.5}
- ii. Normal polymerase does not function at a high heat {.5}, and Taq polymerase is more stable in heat {.5}
38. A - Terminating the replication of DNA
39. Accepted answers include treating diseases and producing medicine, determining a gene's function, investigating mutations, or any other plausible answer. One point is awarded per accepted answer.
40. D - Southern blotting detects DNA and northern blotting detects RNA
41. B - Paternity testing
- 42.
- i. Clustered regularly interspaced short palindromic repeats {1}
 - ii. Bacterial immune system {1}
43. A - Option 1
44. Microarrays can be used to detect cancer-causing single nucleotide polymorphisms (SNPs) {1}
45. It is less expensive compared to newer methods {1}
46. D - Both prokaryotes and eukaryotes use the same genetic code
47. A DNA ladder is used to measure the length of a DNA strand {1} sequenced using gel electrophoresis {1}
48. C - PCR
49. Reverse transcription involves building complementary DNA from an RNA template {1}, and it is used in creating DNA microarrays {1}
50. D - A blot that detects interactions between RNA and proteins