

# Heredity Test

## SSSS

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Tiebreaker questions are marked with two asterisks (\*\*), and will be considered in the order they are given.

There will be 3 sections - a multiple choice section, a true/false section, and a free response section. Most multiple choice questions will be worth 2 points. True/False questions will be worth 1 point. Points for free response questions will vary.

Good luck!

## Multiple Choice

1. Only one ovum is produced from oogenesis. What are the other cells produced called? (2 points)
  - a. Zygotes
  - b. Polar Bodies
  - c. Sperm
  - d. Barr Bodies
2. Which of the following is NOT a requirement for a population to be in the Hardy-Weinberg Equilibrium? (2 points)
  - a. No migration
  - b. Random mating
  - c. Large population size
  - d. Natural selection
3. How many pea plant characteristics did Mendel study? (2 points)
  - a. 4
  - b. 6
  - c. 7
  - d. 8
4. What is the structure of DNA found in prokaryotes? (2 points)
  - a. Double-stranded and linear
  - b. Double-stranded and circular
  - c. Single-stranded and linear
  - d. Single-stranded and circular
5. Which types of inheritance is blood type an example of? **Choose 2.** (3 points)
  - a. Codominance
  - b. Straight dominant/recessive
  - c. Incomplete dominance

- d. Epistasis
6. Which of the following are not either fatal or almost always fatal? **Choose 2.** (3 points)
- a. Trisomy 13
  - b. Trisomy X
  - c. Trisomy 18
  - d. Trisomy 21
7. What is a disadvantage of using Taq Polymerase in PCR? (2 points)
- a. It has a high mutation rate
  - b. It's expensive
  - c. It synthesizes DNA slowly
  - d. It denatures at high temperatures
8. Which of the following is NOT true about X-inactivation? (2 points)
- a. Once an X chromosome is inactivated, it will remain inactivated.
  - b. It is also called lyonization.
  - c. One X chromosome is almost never silenced any more than the other - it's almost always unbiased
  - d. Some genes on the inactivated X chromosome remain expressed.
9. Which are true about euchromatin and heterochromatin? Choose 2. (2 points)
- a. Euchromatin is transcribed more often; heterochromatin is transcribed less.
  - b. Euchromatin is more condensed.
  - c. Heterochromatin is commonly referred to as "beads on a string" because of its appearance.
  - d. Heterochromatin is used to make centromeres and telomeres.
10. \*\*According to the chromosome map below, the pair of genes exhibiting the highest recombination rate is \_\_\_\_, and the pair with the lowest recombination

rate is \_\_\_\_\_. (2 points)



- a. A-B; A-C
- b. A-C; A-B
- c. A-C; B-C
- d. B-C; A-C

11. How many histones are in a nucleosome? (2 points)

- a. 0
- b. 1
- c. 2
- d. 4
- e. 6
- f. 8
- g. 10
- h. More than 10

12. Hurler's Syndrome almost always results in death by age... (2 points)

- a. 1
- b. 3
- c. 5
- d. 10

13. Small Nuclear RNAs... (2 points)

- a. Help maintain the telomeres
- b. Are usually ~150 nucleotides long
- c. Play an important role in the splicing of pre-mRNA
- d. All of the above
- e. None of the above

14. In Martians, extreme wisdom (W) is dominant, while normal wisdom (w) is recessive. Additionally, immortality (I) is dominant to mortality (i). A Martian that is homozygous for immortality and has normal wisdom marries a Martian

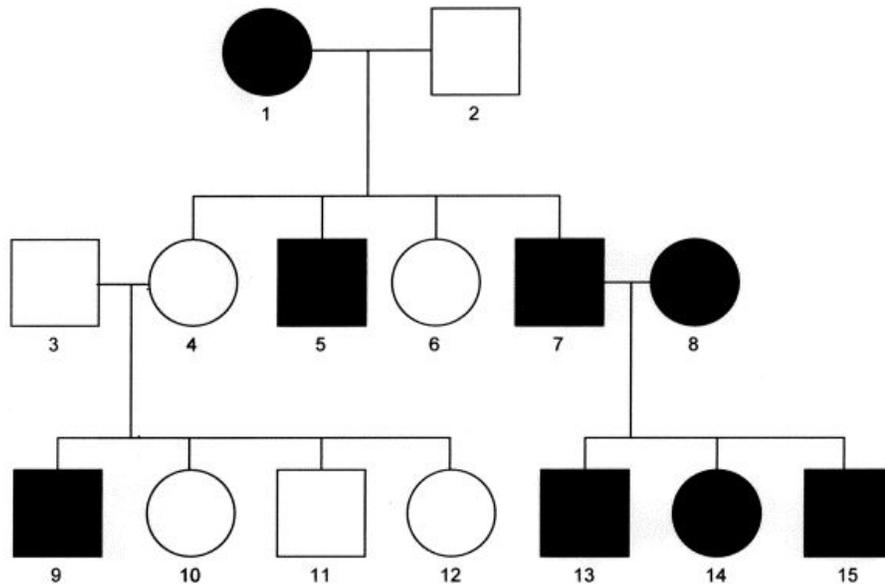
that is heterozygous for immortality and heterozygous for extreme wisdom.  
What percentage of their children will have extreme wisdom? (2 points)

- a. 0%
- b. 25%
- c. 50%
- d. 75%
- e. 100%

15. Based on the above scenario, what percentage of their children will have both normal wisdom and immortality? (2 points)

- a. 0%
- b. 25%
- c. 50%
- d. 75%
- e. 100%

16. What is the mode of inheritance for the trait shown in the image below? (2 points)



- a. Autosomal Recessive
- b. Autosomal Dominant
- c. X-linked Recessive
- d. X-linked Dominant

- e. Y-linked Recessive
  - f. Y-linked Dominant
17. Which of the following is the same as the coding strand? (2 points)
- a. Sense strand
  - b. Antisense strand
  - c. Template strand
  - d. None of the above
18. Which of the following are needed for PCR? Choose 4. (4 points)
- a. DNA template
  - b. A DNA polymerase
  - c. Agarose gel
  - d. dNTPs
  - e. An RNA polymerase
  - f. Buffer solution
19. \*\*How many possible genotypes would there be if a gene had 5 alleles? (2 points)
- a. 1
  - b. 5
  - c. 10
  - d. 15
  - e. 25
20. Oh which chromosome is the gene for Huntington's disease found? (2 points)
- a. Chromosome 1
  - b. Chromosome 4
  - c. Chromosome 7
  - d. Chromosome 11
21. \*\*During which stage of spermatogenesis do spermatids form tails? (2 points)
- a. Spermatocytogenesis
  - b. Spermatidogenesis
  - c. Ootidogenesis

d. Spermiogenesis

22. The frequency of two alleles in a gene pool is 0.19 (A) and 0.81(a). The population is in the Hardy-Weinberg equilibrium. Calculate the percentage of heterozygous individuals in the population. Answer may be rounded. (2 points)

- a. 15%
- b. 31%
- c. 41%
- d. 66%

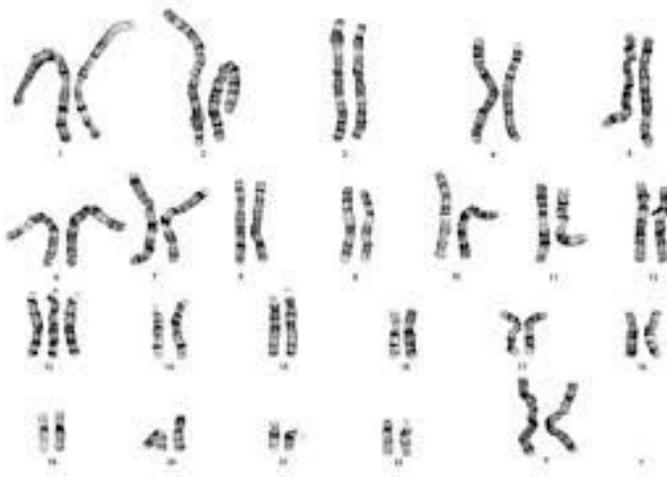
23. \*\*Based on the scenario above, calculate the percentage of homozygous recessives in the population. (2 points)

- a. 15%
- b. 31%
- c. 41%
- d. 66%

24. How many sperm are produced from spermatogenesis? (2 points)

- a. 1
- b. 2
- c. 4
- d. 5
- e. 8
- f. 10

25. What genetic disease does the karyotype below show? (2 points)



- a. Patau's Syndrome
- b. Klinefelter's Syndrome
- c. Cri du Chat Syndrome
- d. Edwards Syndrome

26. How many hydrogen bonds are there between adenine and thymine? (2 points)

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5

27. Which of the following is TRUE about alternative splicing? (2 points)

- a. Exon skipping is the least common form of alternative splicing.
- b. Alternative splicing is less common in humans than other invertebrates
- c. >60% of disease-causing mutations affect splicing, as opposed to affecting coding sequences.
- d. Cancerous cells contain less abnormally spliced mRNAs.

True/False

Write either “true” or “false” in the space under each question/scenario.

Each true/false question will be worth one point.

28. Given this mRNA code, lysine will be produced. AAG AAA AUG GGU CAC UGA

29. Paracentric inversion includes the centromere, and there is one break on each arm (as opposed to pericentric inversion, where both breaks are in one arm).

30. There are 2 hydrogen bonds between adenine and uracil.

31. Cri du Chat Syndrome is caused by deletion of the long arm of chromosome 5, and people who with it who live to age 1 will have an average life expectancy.

32. mRNA, tRNA, and rRNA are the only types of RNA.

33. Prokaryotic DNA replication is faster than eukaryotic DNA replication.

34. Guanine is a purine.

35. The most common form of DNA is B-DNA.

36. Penetrance is the same as expressivity.

37. People with type A blood have B antigens on the red blood cells.

38. Post-translational modifications are common (and exist).

### Free Response (short/long answer)

39. In dragons, long snouts (S) are dominant over short snouts (s), and red scales (R) are dominant over green yellow scales (r). When a red, long-snout dragon

mates with a yellow, short-snout dragon, the offspring (F1) all have red scales and half have long snouts. Based on these results, what is the genotype of the parental generation? (3 points)

40. In wheel bugs, gray body color is dominant over white body color. The trait for enlarged front legs is dominant over short front legs. When parents with genotypes  $ccFf$  and  $Ccff$  are crossed, what are the phenotypic ratios for the possible resulting offspring? (3 points)

41. What is a phenocopy? (3 points)

42. What are 3 examples of traits influenced by environmental factors? (4 points)

43. What are the three models of DNA replication? (3 points)

44. Explain the 3 main differences between pre-mRNA and mature mRNA. (4 points)

45. \*\*Explain the role of telomerase, and why it is important. (3 points)

46. Briefly explain why X-inactivation occurs. (4 points)

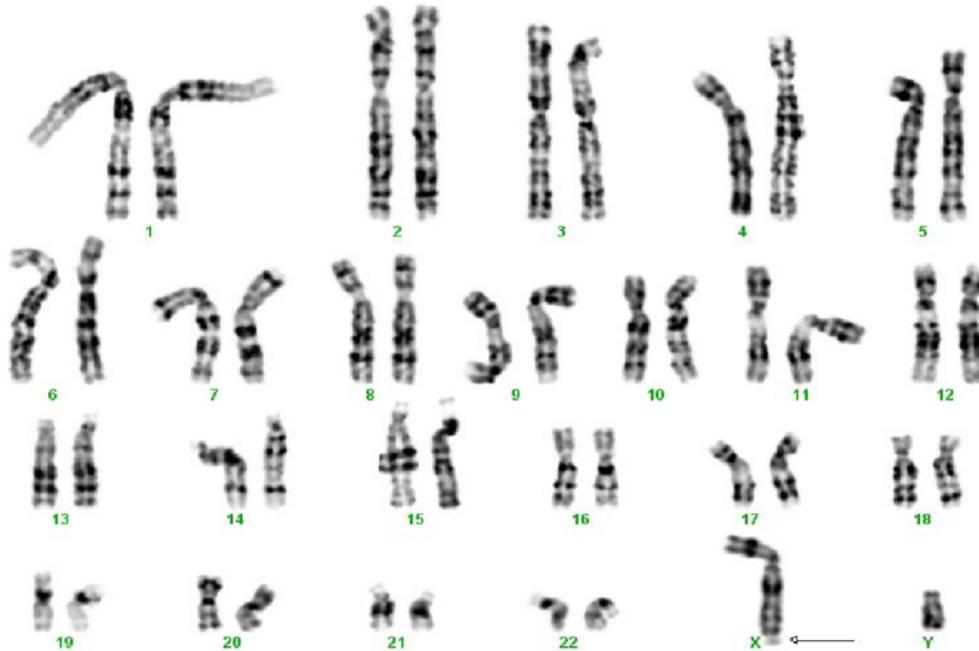
47. How are metaphase I and metaphase II different? (3 points)

48. What is a kinetochore? (4 points)

49. Briefly describe what happens during G1 phase and S phase. Mention the restriction point. (4 points)

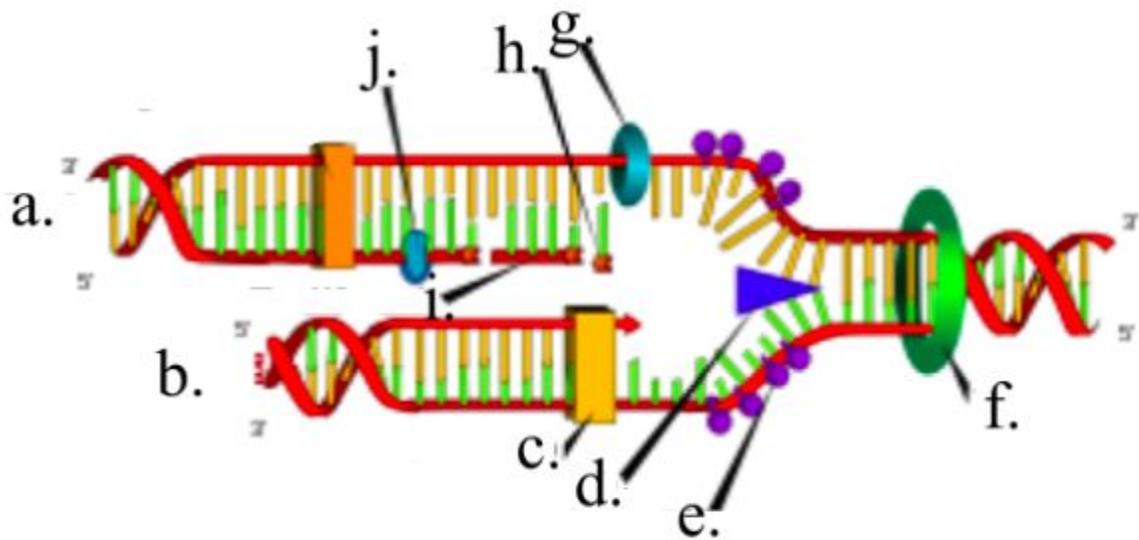
50. What is the difference between a transversion and a transition? (2 points)

51. What genetic disorder is shown in this karyotype? (2 points)



52. List two symptoms of the disorder above. (3 points)

53. What gene is responsible for the disorder above? (2 points)



54. Label this diagram: (2 points each)

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.

55. \*\*Which DNA molecule will travel further during gel electrophoresis, one with 150 base pairs or one with 1000 base pairs? Explain why. (.01 points)

56. Name an example of an autosomal dominant disorder. (2 points)

57. Name an example of an autosomal recessive disorder. (2 points)

58. Name an example of an X-linked dominant disorder (2 points)

59. Name an example of an X-linked recessive disorder (2 points)