

Anomaly's SSSS 2018 Heredity Test



You have 50 minutes to complete this test. You are only allowed a writing utensil, one two-sided 8.5 x 11 sheet of paper with information on it, and two non-programmable, non-graphing calculators. Good luck!

SECTION 1: MULTIPLE CHOICE

Directions: Circle the best response to the question being asked. (2 points each)

1. What does two capital letters notate in genetics?
 - A. Homozygous recessive
 - B. Homozygous dominant
 - C. Heterozygous recessive
 - D. Heterozygous dominant
2. Which statement is true about blood type?
 - A. It is a polygenic trait.
 - B. It follows rules of mendelian inheritance.
 - C. It is a multiple alleles trait.
 - D. Blood type alleles demonstrate incomplete dominance.
3. What is the term in genetics that describes being heterozygous for a trait?
 - A. Polygenic
 - B. Hybrid
 - C. Half and half
 - D. Multiple Alleles
4. What is another name for a Punnett Square?
 - A. Monohybrid Cross
 - B. Dihybrid Cross
 - C. Trihybrid Cross
 - D. Four-square
5. If both parents are heterozygous for an autosomal trait that follows rules of mendelian genetics, then what is the chance that the offspring will also be heterozygous for that trait?
 - A. 25%
 - B. 50%
 - C. 75%
 - D. 100%
6. Which type of RNA copies the DNA sequence in the nucleus and takes it to the cytoplasm?
 - A. nRNA
 - B. mRNA
 - C. rRNA
 - D. tRNA
7. Which of the following is NOT included in the cell cycle?

- A. G1 Phase
 - B. Synthesis Phase
 - C. Mitosis
 - D. Meiosis
8. Which of the following results in Down's Syndrome?
- A. Monosomy 21
 - B. Trisomy 21
 - C. Monosomy 23
 - D. Trisomy 23
9. In which phase of the cell cycle does a cell spend most of its time?
- A. Interphase
 - B. Mitosis
 - C. Meiosis
 - D. Cytokinesis
10. What is the genotypic ratio for heterozygous x heterozygous on a monohybrid cross?
- A. 3:1
 - B. 1:2:1
 - C. 9:3:3:1
 - D. 2:2:0
11. During oogenesis, how many of the created cells become viable?
- A. none
 - B. 1
 - C. 2
 - D. 4
12. What is the name of the disorder in which a person has three X chromosomes?
- A. Klinefelter's syndrome
 - B. Feminine disorder
 - C. Turner's Syndrome
 - D. XXX Syndrome
13. If a DNA sample is 34% thymine, then what percentage of cytosine is there?
- A. 21%
 - B. 31%
 - C. 34%
 - D. 66%
14. Which of the following is NOT involved in DNA replication?
- A. Helicase

- B. DNA Polymerase
- C. Ligase
- D. DNA Primer

15. Which of the following genetic disorders is the result of an insertion?

- A. Cystic Fibrosis
- B. Polydactyly
- C. Sickle Cell Anemia
- D. Cri-du-chat syndrome

16. About how long does mitosis usually last?

- A. 1 hour
- B. 2 hours
- C. 8 hours
- D. 20 hours

17. What is the scientific term for programmed cell death?

- A. Necrosis
- B. Cell Death
- C. Cancer
- D. Apoptosis

18. Which of the following ISN'T a stop codon?

- A. UAG
- B. UAA
- C. UGA
- D. UGG

19. About how long is the human genome (in mega-base pairs)

- A. 3200 Mb
- B. 4800 Mb
- C. 4200 Mb
- D. 2800 Mb

20. How many phases of meiosis are there?

- A. 4
- B. 6
- C. 8
- D. 9

SECTION 2: TRUE/FALSE

Directions: Mark each statement as true or false on the line next to it. If it is false, change it so that it is true. You do not have to rewrite the whole statement.

- _____ 21. Transcription occurs before translation.
- _____ 22. The genotypic ratio for two dihybrid heterozygotes crossed is 9:3:3:1
- _____ 23. Adenine and Guanine are purines because they have two rings in their structure.
- _____ 24. Deoxyribose molecules have 5 carbons while ribose molecules have 4 carbons.
- _____ 25. On tRNA, on the 3' end is an anticodon and on the 5' end is an amino acid
- _____ 26. The three stages of transcription, in the correct order, are initiation, elongation, and termination.
- _____ 27. Polydactyly, a condition which results in extra fingers and toes, is an autosomal recessive disorder
- _____ 28. Translation occurs in the nucleus.
- _____ 29. Sickle cell anemia results from a mutation that occurs on chromosome 15.
- _____ 30. Haploid cells have a number of chromosomes represented by $\frac{1}{2}n$.
- _____ 31. DNA can only replicate 3' to 5'.
- _____ 32. Cancer is caused by cells' inability to stop multiplying constantly.

- _____ 33. Codominance is displayed in snapdragon flowers.
- _____ 34. Mutations can be caused by environmental factors like UV radiation, chemicals, and temperature.
- _____ 35. There are three types of protein structures: primary, secondary, and tertiary.
- _____ 36. If a trait is Y-linked, then it can only be passed down in males in the generations to come
- _____ 37. When a trait is polygenic, it means that more than one gene controls the trait.
- _____ 38. Transcription occurs during G1 and S stages of the cell cycle
- _____ 39. When humans mate, there is an equal chance for the offspring to be male or female.
- _____ 40. The Human Genome Project was finished in 2002.

SECTION 3: SHORT ANSWER

Directions: Follow the directions written for each problem.

41. *Drosophila* is a genus of fruit flies whose eye color is determined through sex-linked inheritance. The allele for red eyes is dominant while the allele for white eyes is recessive and x-linked. Let R represent the dominant part of the allele and r the recessive.

a. Set up and fill out the Punnett square for a female with white eyes and a male with red eyes.

b. Among ALL the offspring (both male and female), what is the chance that an offspring will have white eyes?

c. If these two *Drosophila* flies have 4 male children, statistically, how many of them should have red eyes?

42. Mendel's famous experiment involved crossing pea plants and analyzing patterns of inheritance between generations. The two main characteristics that he analyzed were color of the peas (green or yellow) and texture of the seeds (round or wrinkled). The yellow color and the round seed are dominant to the green color and wrinkled seed. The letter Y represents the allele for color while the letter R represents the allele for shape.

a. Set up and fill out the dihybrid cross for a plant with seeds that are heterozygous for color and seed shape and another plant with seeds that are homozygous dominant for color and heterozygous for shape.

b. List all the genotypes in the cross and their corresponding phenotypes.

c. What is the chance that the offspring of these plants will have seeds that are heterozygous for color and homozygous dominant for shape?

43. Identify the following pedigree symbols and write what each of them signifies right next to the symbol. Be as specific as possible.



44. Mary (III-1) has sickle cell anemia. Her paternal grandfather, I-1, was heterozygous for sickle cell anemia. The genotype of Mary's paternal grandmother (I-2) is unknown, as she died many years ago, but they know that she didn't have sickle cell. Mary's father (II-2) has sickle cell. His older brother (II-1) does not have sickle cell, nor does he carry the mutated allele. Mary's maternal grandparents (I-3 & I-4), didn't have sickle cell (but we know that both of them were carriers), nor did Mary's mother (II-3). However, she is heterozygous for sickle cell.

a. Draw a pedigree that follows the above scenario. Be sure to label every individual by their generation number. Mark each individual as affected, unaffected, or carrier (heterozygous) for sickle cell. You will need to infer this for a few people.

b. If Mary marries a man who is also heterozygous for sickle cell, what is the percent chance that their offspring will have sickle cell anemia?

45. You are given the following strand of DNA:

CATCGATAGACATAGCCTAGTGTATAGCTGAGCGAGGCTAGCTAGATC

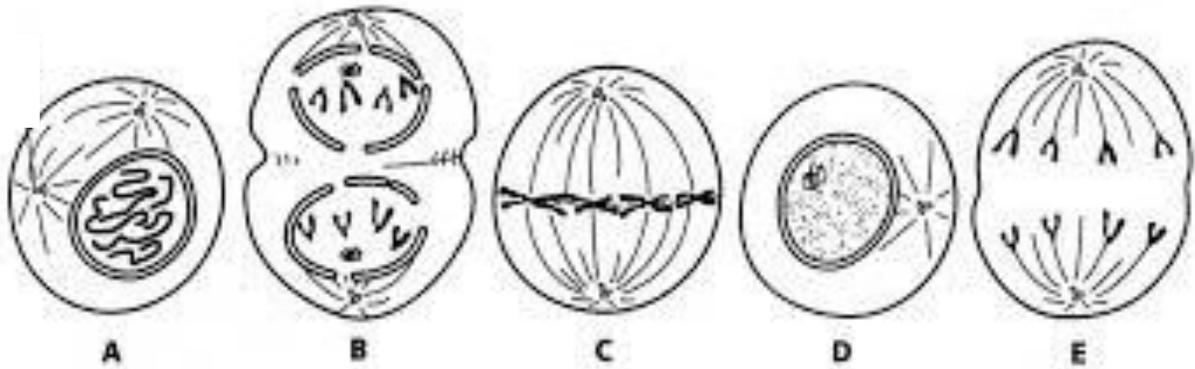
- Convert the above strand of DNA into an RNA sequence.
- When the DNA sequence is copied onto mRNA in the nucleus, what is this called?
- How many codons are in the sequence of RNA that you created?
- Using the codon to amino acid chart below, convert write the amino acid sequence that corresponds with the RNA sequence above.

	U	C	A	G
U	UUU = phe UUC = phe UUA = leu UUG = leu	UCU = ser UCC = ser UCA = ser UCG = ser	UAU = tyr UAC = tyr UAA = stop UAG = stop	UGU = cys UGC = cys UGA = stop UGG = trp
C	CUU = leu CUC = leu CUA = leu CUG = leu	CCU = pro CCC = pro CCA = pro CCG = pro	CAU = his CAC = his CAA = gln CAG = gln	CGU = arg CGC = arg CGA = arg CGG = arg
A	AUU = ile AUC = ile AUA = ile AUG = met	ACU = thr ACC = thr ACA = thr ACG = thr	AAU = asn AAC = asn AAA = lys AAG = lys	AGU = ser AGC = ser AGA = arg AGG = arg
G	GUU = val GUC = val GUA = val GUG = val	GCU = ala GCC = ala GCA = ala GCG = ala	GAU = asp GAC = asp GAA = glu GAG = glu	GGU = gly GGC = gly GGA = gly GGG = gly

- Which of the amino acids in the sequence you made are hydrophobic?
- Which of the amino acids in the sequence you made are hydrophilic?

46. Draw a nucleotide (use adenine as your nitrogenous base in the drawing) in the space below. Make sure to include what each part of the nucleotide is made of (ex. Oxygens, Hydrogens, etc).

47. Identify each of the phases of the cell cycle and describe what occurs during each phase



- a.
- b.
- c.
- d.
- e.

48. Fill out the Venn diagram comparing and contrasting mitosis and meiosis. You should have at least five differences and 3 similarities.

