

B - Heredity 2020 - Nov 7 Country-wide SO Practice - 11-07-2020

Hi everyone! I hope you have a blast taking this test, I will be available after 3 pm PT to answer any questions. It shouldn't be too hard, so don't stress :). Remember, I ain't ever seen tw pretty best friends.

1. (1.00 pts)

How many types of antigens that appear on blood are currently known?

- A) 3
- B) 36
- C) over 100
- D) over 300
- E) over 600

2. (1.00 pts) Which of the following proteins is involved cleavage furrow formation?

- A) Actin
- B) Dynein
- C) Kinesin
- D) Tubulin

3. (1.00 pts) In eukaryotes, the initiator tRNA always carries which amino acid?

- A) Leucine
- B) Valine
- C) Methionine
- D) Histidine

4. (1.00 pts) DNA polymerase moves down the template strand 5' to 3

- True
- False

5. (1.00 pts)

The albino allele codes for a non-functional tyrosinase, an enzyme that catalyzes the first reaction in the synthesis of melanin (a dark pigment) from the amino acid tyrosine. Some animals with a himalayan coat color have a mutation in the albino allele that causes them to produce a temperature-sensitive tyrosinase. In other words, the tyrosinase enzyme only works at certain temperatures. If a himalyan kitten is colored sandy tan, with black parts near his ears, nose, paw, and tail, you'd expect that tyrosinase extracted from this kitten's cells would have the greatest activity at which temperature?

- A) Above 37 degrees C
- B) Exactly 37 degrees C
- C) Below 37 degrees C

6. (1.00 pts) During DNA replication, which enzyme unwinds the DNA helix into single strands?

- A) Topoisomerase
- B) single strand binding proteins
- C) Primase
- D) Helicase

7. (1.00 pts)

Consider the following DNA sequence: 5'-ATGACCGACTTGAAAGGGACC-3' You may assume that this DNA sequence is a coding strand. Several similar sequences containing various mutations are shown below: a. 5'-ATGACCGACTTGAAAACC-3' b. 5'-ATGACCGACTTAAAAGGGACC-3' c. 5'-ATGCCGACTTGAAAGGGACC-3' d. 5'-ATGACCACCGACTTGAAAGGGACC-3' e. 5'-ATGACCGACTTCAAAGGGACC-3'

Which mutated DNA sequence contains a missense mutation?

- A) a
- B) b
- C) c
- D) d
- E) e

8. (1.00 pts)

Consider the following DNA sequence: 5'-ATGACCGACTTGAAAGGGACC-3' You may assume that this DNA sequence is a coding strand. Several similar sequences containing various mutations are shown below: a. 5'-ATGACCGACTTGAAAACC-3' b. 5'-ATGACCGACTTAAAAGGGACC-3' c. 5'-ATGCCGACTTGAAAGGGACC-3' d. 5'-ATGACCACCGACTTGAAAGGGACC-3' e. 5'-ATGACCGACTTCAAAGGGACC-3'

Which mutated DNA sequence is most likely to produce a nonfunctional protein?

- A) a
- B) b
- C) c
- D) d
- E) e

9. (1.00 pts)

In a certain African population, 4% of the population is born with sickle cell anemia (aa). What is the percentage of individuals who enjoy the selective advantage of the sickle cell gene (increased resistance to malaria)? Assume the population is in Hardy-Weinberg equilibrium.

- A) 12%
- B) 32%
- C) 16%
- D) 8%
- E) 42%

10. (1.00 pts) Adenine binds with thymine (in DNA), and guanine binds with

- A) cytosine
- B) uracil
- C) thymine too

- D) adenine

**11. (1.00 pts)**

The recessive allele b occurs with a frequency of 0.8 in a population of crabs that is in Hardy-Weinberg equilibrium. What is the frequency of the homozygous dominant individuals?

- A) 0.8  
 B) 0.32  
 C) 0.04  
 D) 0.64  
 E)

**12. (1.00 pts)** What are the pyrimidine nitrogenous bases in DNA?

(Mark ALL correct answers)

- A) Thymine  
 B) Adenine  
 C) Guanine  
 D) Cytosine  
 E) Uracil

**13. (1.00 pts)** Structural abnormalities in chromosomes cannot be caused by:

- A) Deletion  
 B) Multiplication  
 C) Inversion  
 D) Translocation

**14. (1.00 pts)** What are the three basic components of a functional mature sperm cell?

- A) A flagellum, a nucleus, and an acrosome  
 B) An acrosome, a flagellum, and mitochondria  
 C) Mitochondria, a flagellum, and a nucleus  
 D) A nucleus, cytosol, and a flagellum  
 E) A nucleus, mitochondria, and an acrosome

**15. (1.00 pts)** A fertilized egg is called a  and has chromosomes from both parents.

- A) zygote  
 B) egg cell  
 C) sperm cell  
 D) fetus

**16. (1.00 pts)** Cloning produces organisms that have

- A) identical genes
- B) dominant genes
- C) recessive genes
- D) two complete sets of chromosomes
- E) levi jeans

**17. (1.00 pts)**

Manx cats have a very short or non-existent tail. This short tail allele (S/s) is dominant. However, a cat homozygous for the short tail allele typically does not survive past early fetal development. Thus all manx cats are heterozygous. What is the ratio of short-tailed offspring to long-tailed offspring in a cross between two short-tailed Manx cats?

- A) 1/4
- B) 3/4
- C) 1/2
- D) 2/3

**18. (1.00 pts)**

Some traits can be present in both sexes but are only expressed in one sex. An example is the beard growth allele. The beard growth allele is autosomal dominant and also requires interaction with significant amounts of testosterone in order to produce phenotypic effects. Thus, it is typically only expressed in males who have much higher testosterone levels than females. Bob, who is heterozygous for the beard allele mates with Beth who is homozygous recessive. They have a daughter named Bonnie. Unfortunately, Bonnie has a tumor in her adrenal gland that causes abnormally high testosterone secretion. What is the probability that Bonnie will grow a beard?

- A) 2:3
- B) 2:1
- C) 3:2
- D) 1:2

**19. (1.00 pts)**

First of all, DNA melting does not mean turning DNA into a liquid from a solid, it simply means separating the two strands of the double helix (very important for lots of experiments involving DNA!). The temperature at which this occurs varies based on the composition of the DNA strand. The adenine-thymine pair bond involves two hydrogen bonds while the cytosine-guanine pair has three. More hydrogen bonds require higher temperatures to melt. Which of the following nucleotide sequences has the highest melting temperature a. 3'-TATATATATA-5' b. 3'-CTAGCTAGCTAG-5' c. 3'-CCGGCCGGCCGG-5' d. 3'-AATTCGGAATT-5'

- A) a
- B) b
- C) c
- D) d

**20. (1.00 pts)** DNA is composed of a phosphate group, a sugar, and a nitrogenous base. What type of sugar is found in DNA?

(Mark **ALL** correct answers)

- A) Glucose
- B) Ribose
- C) Deoxyribose
- D) Deoxyglucose
- E) Dextrose

**21. (1.00 pts)** Which of the following scientists were involved in the discovery of DNA's semiconservative replication?

- A) Alfred Hershey
- B) Rosalind Franklin
- C) Matthew Meselson
- D) Frederick Sanger

22. (1.00 pts) Ultraviolet radiation can act as a mutagen in which of the following ways?

- A) It creates thymine dimers.
- B) It synthesized benzo[a]pyrene
- C) It creates adenine dimers.
- D) None of the above.

23. (1.00 pts) What is a technique used to detect specific DNA sequences within DNA samples?

- A) Northern Blot
- B) western blot
- C) southwestern blot
- D) Southern blot

24. (1.00 pts) What is a technique used to study gene expression by detection of RNA?

- A) western blot
- B) northern blot
- C) southern blot
- D) western blot

25. (1.00 pts) What is a collection of microscopic DNA spots attached to a solid surface?

- A) Western Blot
- B) Northern Blot
- C) DNA Microarray
- D) in situ hybridization

26. (1.00 pts) What technique did James Watson and Francis Crick (aided by Rosalind Franklin) use to determine the double helix structure of DNA?

- A) in situ hybridization
- B) X-ray crystallography
- C) phosphodiester-enzyme analysis
- D) DNA electrophoresis

27. (1.00 pts) Which of the following RNA sequences would form the strongest stem-loop structure?

- A) 5' – AGGCUAUAGGGAGCCU – 3'
- B) 5' – AGCGUAUAGGGAGCCU – 3'
- C) 5' – AGGCUAUAGGGAAAAA – 3'
- D) 5' – AGGCTATAGGGAGCCT – 3'

28. (1.00 pts) Which of the following happens when a cell divides?

- A) The cell's volume increases.
- B) It becomes more difficult for the cell to get enough oxygen and nutrients.
- C) The cell has DNA overload.
- D) Each daughter cell receives its own copy of the parent cell's DNA.

29. (1.00 pts) Who was Oswald Avery?

- A) Helped discover that DNA replication occurs via semiconservative methods
- B) One of the first researchers to propose the "one gene, one protein (enzyme)" hypothesis
- C) One of the first researchers to suggest that DNA was the "transforming principle" after confirming the results of prior experiments
- D) Discovered that the proportion of adenine/thymine and cytosine/guanine residues are equal to one another, and that A+G=C+T

30. (1.00 pts) Who was Erwin Chargaff?

- A) First to associate genes to chromosomes, and identified some of the first few mutations associated to chromosomal defects
- B) Discovered that the proportion of adenine/thymine and cytosine/guanine residues are equal to one another, and that A+G=C+T
- C) Helped discover the genetic code using synthetic ribonucleotide sequences
- D) Helped determine that DNA - as opposed to proteins - were the molecules responsible for heredity

31. (1.00 pts) Who was Frederick Griffith?

- A) Helped discover the structure of DNA
- B) Helped discover the genetic code using synthetic ribonucleotide sequences
- C) Helped determine that DNA - as opposed to proteins - were the molecules responsible for heredity
- D) Discovered that bacteria can absorb a "transforming factor" that gave it characteristics of recently killed bacteria

32. (1.00 pts) Who was Matthew Meselson?

- A) First to extract and characterize DNA
- B) Helped discover the genetic code using synthetic ribonucleotide sequences
- C) Helped discover that DNA replication occurs via semiconservative methods
- D) One of the first researchers to suggest that DNA was the "transforming principle" after confirming the results of prior experiments

33. (1.00 pts) Who was Kary Mullis?

- A) Helped discover the genetic code using synthetic ribonucleotide sequences
- B) In addition to discovering the structure of DNA, helped discover that DNA is transcribed via a three-nucleotide set called "codons"
- C) Helped develop the process of in vitro replication and amplification of DNA sequences
- D) Coined "Father of Genetics" - discovered that genes assort separately and independently, leading to the famous 3:1 ratio of observable traits in a monohybrid cross

34. (1.00 pts) What are the stop codes?

- A) ATT, ATC, ATG
- B) AGG, AGT, ACT
- C) AGT, ACT, AAC
- D) ATT, ATC, ACT

35. (1.00 pts) Which two choices are correct descriptions of a karyotype?

(Mark ALL correct answers)

- A) the numbered chromosomes pairs termed autosomes are arranged longest to shortest
- B) bent chromosomes are abnormal
- C) normal males having XX
- D) the sex (X&y) chromosomes are placed last

36. (1.00 pts) Name all nucleotides

(Mark ALL correct answers)

- A) Adenine
- B) Thymine
- C) Cytosine
- D) Guanine
- E) Guanine
- F) Uracil

37. (1.00 pts) An RNA-dependent RNA polymerase is likely to be present in the virion of a

(Mark ALL correct answers)

- A) DNA virus that multiplies in the cytoplasm
- B) DNA virus that multiplies in the nucleus
- C) minus-strand RNA virus
- D) plus-strand RNA virus
- E) transforming virus

38. (1.00 pts) All of the following statements are true about damage by ultraviolet light to DNA in living cells EXCEPT:

(Mark ALL correct answers)

- A) The damage blocks normal DNA replication.
- B) The most damaging wavelength is about 260 nm

- C) Covalent bonds are formed that join neighboring pyrimidines.
- D) Neighboring phosphodiester bonds are cleaved.
- E) Most cells can synthesize proteins capable of repairing UV damage.

**39. (1.00 pts)** If the genetic code consisted of four bases per codon rather than three, the maximum number of unique amino acids that could be encoded would be

(Mark **ALL** correct answers)

- A)  $16-1=15$
- B)  $64-1=63$
- C)  $128-1=127$
- D)  $256-1=255$
- E)  $512-1=511$

**40. (1.00 pts)** Products made from microRNA genes

(Mark **ALL** correct answers)

- A) bind directly to DNA and alter its transcription
- B) bind directly to mRNA and alter its translation
- C) bind directly to ribosomes and alter their ability to make protein
- D) none of the above

**41. (1.00 pts)**

DNA fingerprints are used to determine whether Sam could be the father of Becky's baby. Sam is not the father if \_\_\_\_ genetic fingerprint shows some bands not present in \_\_\_\_ genetic fingerprint.

- A) Sam's ... the baby's
- B) Becky's ... the baby's
- C) the baby's ... Sam's
- D) the baby's ... Becky's
- E) the baby's ... Sam's or Becky's

**42. (1.00 pts)** Gene therapy involves

- A) replacing defective human genes with the correct human gene.
- B) adding genes to plants to make them pesticide resistant
- C) making "pharm" animals that secrete drugs.
- D) adding genes to bacteria so they can digest toxic waste
- E) sequencing the human genome.

**43. (1.00 pts)**

Two individuals, each heterozygous for four different genes, A, B, C, and D, are mated. How many different phenotypes do you expect in the progeny if strict dominance is involved for each gene?

- A) 4
- B) 8

- C) 16
- D) 24

**44. (1.00 pts)**

White eyes is X-linked recessive and short bristles is autosomal recessive. A true breeding white, long female is crossed with a true breeding red, short male. If the F1s are allowed to interbreed, what fraction of the F2 males will be white and short?

- A) 1/8
- B) 1/4
- C) 3/4
- D) 3/8

**45. (1.00 pts)** A dog with black hair mates with a dog with tan hair. The pups are 3 black and 2 tan. What can be concluded from this cross?

- A) Black is dominant and tan is recessive
- B) Tan is dominant and black is recessive
- C) Both parents are heterozygous
- D) One parent is heterozygous and one is homozygous
- E) A and C
- F) B and D

**46. (1.00 pts)** A population has 49 AA individuals, 42 Aa individuals, and 9 aa individuals. What are the allele frequencies?

- A)  $p = 0.91$  and  $q = 0.09$
- B)  $p = 0.75$  and  $q = 0.25$
- C)  $p = 0.7$  and  $q = 0.3$
- D)  $p = 0.5$  and  $q = 0.5$

**47. (1.00 pts)**

White eyes is X-linked recessive and red is X-dom. A true breeding white eyed female is mated to a red eyed male. Which of the following correctly lists the expected F1 progeny?

- A) All red eyes of both sexes
- B) All white eyes of both sexes
- C) All red females and all white males
- D) All white female and all red males

**48. (1.00 pts)**

If two normal individuals have three children, each of whom is affected by the same genetic disorder, the probability that their fourth child will also have the disorder is less than 1/10.

- True
- False

**49. (1.00 pts)** A karyotypic analysis of a developing fetus will reveal if it has a disorder such as Tay-Sachs, cystic fibrosis, or sickle cell anemia.

- True
- False

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**50. (1.00 pts)** An X-linked recessive trait will be passed from father to all of his sons.

True  False

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**51. (1.00 pts)** If all the homozygous recessive individuals die each generation, the recessive allele will be completely eliminate within three generations.

True  False

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