

B - Heredity B - December 19 SO Practice - 12-19-2020

For Multiple-Choice questions, choose the ONE answer choice that BEST completes the sentence or answers the question. For Fill-In-The-Blank questions, type in the name, word, or phrase that best completes the sentence or answers the question. For short answer and short essay questions, provide your answer using complete sentences.

1. (1.00 pts) What is the IMMEDIATE (not evolutionary) purpose of mitosis?

- A) to create two genetically identical copies of a cell
- B) to allow an organism to grow and develop from a fertilized egg to an adult
- C) to separate chromosomes and generate two identical nuclei from one nucleus
- D) to allow an organism to reproduce asexually
- E) all of the above

2. (1.00 pts)

An organism has a haploid chromosome number of 14. A nerve cell in that organism will have _____ chromosomes, a sperm cell will have _____ chromosomes, and a cell in the prophase II stage of meiosis will have _____ chromosomes.

- A) 14, 7, 14
- B) 28, 14, 28
- C) 14, 7, 7
- D) 28, 14, 14

3. (1.00 pts) The scientific name for body cells is

- A) germ cells
- B) somatic cells
- C) corporeus cells
- D) diploid cells

4. (1.00 pts) In humans, haploid sex cells are formed in the gonads. The scientific names for the gonads in males and females are

- A) penis and vagina
- B) testicles and uterus
- C) penis and uterus
- D) testes and ovaries

5. (1.00 pts) The haploid chromosome number for humans is

- A) 23
- B) 23 for females, 22 for males
- C) 26
- D) 46

- E) 46 for males, 26 for females

6. (1.00 pts) Put the following terms in the correct order, from smallest to largest:

- A) gene, nucleotide, genome, chromosome
 B) nucleotide, gene, genome, chromosome
 C) nucleotide, gene, chromosome, genome
 D) gene, chromosome, nucleotide, genome

7. (1.00 pts) When Mendel carried out one of his original monohybrid crosses, his results were

- A) all yellow peas
 B) a 3:1 ratio of yellow peas to green peas
 C) all green peas
 D) a 1:1 ratio of green peas to yellow peas
 E) a 3:1 ratio of green peas to yellow peas

8. (1.00 pts) To figure out the likely outcomes of a genetic cross, scientists and students use a graphic device called a

- A) pedigree
 B) Mendelian Box
 C) Punnett Square
 D) Meiotic Diagram

9. (1.00 pts) A dihybrid cross is a genetic cross between two individuals with which genotypes?

- A) Both individuals are heterozygous for two different genes.
 B) One individual is homozygous recessive for two different gene pairs, the other is homozygous dominant for those gene pairs.
 C) Both individuals are homozygous hybrids for different genes.
 D) One individual is homozygous recessive for two genes, the other is heterozygous for those two genes.

10. (1.00 pts)

In pea plants, purple flowers are dominant to white flowers and tall plants are dominant to dwarf plants. A botanist crossed a pea plant with the genotype PpTt with a second plant that is PpTt. In the offspring, he expected _____ different phenotypes and _____ different genotypes.

- A) 3, 4
 B) 4, 4
 C) 6, 3
 D) 4, 6

11. (3.00 pts)

Sperm and ova are collectively known as sex cells or _____. The specialized cells that give rise to them have the scientific name _____ cells. When a sperm fertilizes an ovum, this creates a cell with the scientific name _____.

gametes

germ

zygote

12. (2.00 pts)

When Mendel carried out his original crosses with pea plants, he called the plants he started with the _____ generation and he called their offspring the _____ generation. (Use words, not abbreviations.)

parental

first filial

13. (2.00 pts) The different forms of a gene are called _____. The site of a gene on a chromosome is its _____.

alleles

locus

14. (4.00 pts)

Prophase I of meiosis includes all of the processes that occur during Prophase and Prometaphase of mitosis. There are also two additional important processes that occur during Prophase I of meiosis that do not occur during mitosis. Explain these two processes and why they are important in meiosis.

Expected Answer: Synapsis of homologous chromosomes, so they can separate properly during meiosis I. Crossing over between homologous chromatids, which provides genetic variation.

15. (3.00 pts) Why were pea plants a good choice of organism for Mendel to use for his genetics experiments? Provide three reasons.

Expected Answer: Lots of offspring, short generation time, can control breeding, can grow many in not much space, had several +/- characters to study

16. (1.00 pts) The dominant phenotype is the one that

- A) is most common
- B) is the normal, or wildtype version
- C) is the most beneficial version
- D) is displayed by a heterozygote

17. (1.00 pts) Jose and Brianna have three children together, all sons. If they have a fourth child, what is the likelihood that child will be a girl?

- A) 100%
- B) 75%
- C) 50%

D) 25%

18. (1.00 pts)

Hannah has a sibling with cystic fibrosis, a genetic disorder that involves one gene. Neither of her parents have the disorder, nor does she. Hannah marries Ryan, who was previously married and had a child with cystic fibrosis. If Hannah and Ryan have a child, what is the likelihood that child will have cystic fibrosis, given the information provided?

- A) 1/2
- B) 1/3
- C) 1/4
- D) 1/6

19. (1.00 pts)

Achondroplasia is a dominant genetic disorder that causes dwarfism in humans. Individuals with the condition are always heterozygous, because homozygous dwarves are either miscarried or stillborn. If two individuals with the condition have a child together, and that child grows to adulthood, what is the chance that child will have Achondroplasia?

- A) 100%
- B) 75%
- C) 67%
- D) 50%

20. (1.00 pts) Andalusian chickens display co-dominance in their feather color. Therefore, when a black fowl is crossed with a white fowl,

- A) some of the offspring have black feathers and some offspring have white feathers
- B) all the offspring have gray feathers
- C) Some of the offspring have gray feathers, some have white feathers, and some have black feathers
- D) all the offspring have black feathers and gray feathers and white feathers
- E) all the offspring have both black feathers and white feathers

21. (1.00 pts) A 9:3:3:1 ratio of phenotypes in a cross indicates

- A) there are four genes involved in determining the phenotype of each individual
- B) this is a cross between two individuals who are both heterozygous for two traits
- C) there are three alleles possible for one gene and therefore four phenotypes
- D) this is a trihybrid cross

22. (1.00 pts) Snapdragons display incomplete dominance for flower color. Therefore, if two pink flowers are crossed, the expected ratio of offspring phenotypes is

- A) 1 red : 2 (red:2) pink: 1 white
- B) 1 red : 1 (red:1) white
- C) all pink
- D) 1 red : 1 (red:1) pink : 1 (pink:1) white

23. (1.00 pts) Human ABO blood type is determined by ___ alleles. There are ___ phenotypes possible and ___ genotypes possible.

- A) 4, 6, 12
- B) 3, 4, 6
- C) 3, 6, 4
- D) 4, 12, 8

24. (1.00 pts) If a woman with type AB blood has a child with a man that has type O blood, what are the possible blood types for that child?

- A) types A and B
- B) types A, B, and AB
- C) types A, B, and O
- D) types A, B, AB, and O

25. (1.00 pts)

A woman has type A blood and her child has type O. There are three possible fathers: Jonathan with type AB blood, Deonte with type A blood, and Ramon with type O blood. The blood type information allows us to RULE OUT which of the men as the father?

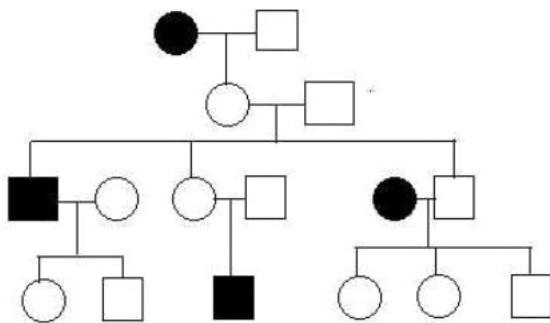
- A) All of the men can be ruled out.
- B) None of the men can be ruled out.
- C) Jonathan can be ruled out.
- D) Jonathan and Deonte can be ruled out.

26. (1.00 pts) Humans have a pair of sex chromosomes. The other chromosomes collectively are called _____.

autosomes

27. (2.00 pts)

Pedigree A:



In Pedigree A, does shading indicate a dominant phenotype or a recessive phenotype? How can you tell?

Expected Answer: recessive; two parents with no shading have a child with shading.

28. (1.00 pts) In pedigree A, is the youngest child of the third generation male or female? _____. How many children does that individual have?

male

3

29. (1.00 pts) In humans, gender is generally determined by chromosomes. Males have the sex chromosome pair _____ and females have the sex chromosome pair _____.

XY

XX

30. (3.00 pts) In humans, why are sex-linked traits more common in males than females?

Expected Answer: Males have only one X chromosome, so if they have a recessive allele on that chromosome, it determines the phenotype. Females have two X chromosomes, so if they have a recessive allele on one of those X chromosomes, it is likely that the other will have the dominant allele.

31. (1.00 pts)

The gene for red-green colorblindness is on the X chromosome in humans. Worldwide, approximately 7% of males are red-green colorblind. What percent of females are expected to be red-green colorblind?

- A) 0.5%
- B) 1.7%
- C) 3.5%
- D) There are no red-green colorblind females.

32. (1.00 pts) Which of the following is NOT a sex-linked trait?

- A) Royal hemophilia
- B) Duchenne muscular dystrophy
- C) Cystic fibrosis
- D) Male-pattern baldness

33. (1.00 pts) Who first observed and figured out sex-linked inheritance?

- A) Gregor Mendel
- B) Hershey and Chase
- C) Charles Darwin
- D) Thomas Morgan

34. (1.00 pts)

A human female who is heterozygous for red-green colorblindness marries a normal-vision male. What percent of their male progeny are expected to be red-green colorblind?

- A) 0%
- B) 25%
- C) 50%
- D) 75%
- E) 100%

35. (1.00 pts) What are Chargaff's rules?

- A) A = T; G = C
- B) The amount of adenine equals the amount of thymine, and the amount of guanine equals the amount of cytosine
- C) the two DNA strands are complementary
- D) All organisms use DNA as their genetic material

36. (1.00 pts)

The structure of DNA was figured out by Watson and Crick. One of the most important pieces of information they used for this was x-ray crystallography results. The scientist who had generated these results was

- A) James Watson
- B) Martha Chase
- C) Francis Crick
- D) Rosalind Franklin
- E) Erwin Chargaff

37. (1.00 pts) In DNA, the pyrimidines are

- A) cytosine and thymine
- B) cytosine and guanine
- C) adenine and guanine
- D) adenine and cytosine
- E) guanine and thymine

38. (1.00 pts)

For the first half of the 20th century scientists weren't sure what molecule in a cell carried genetic information. Eventually the candidates were narrowed down to nucleic acids and proteins. The scientists who demonstrated that genetic information is carried in DNA were

- A) Meselson and Stahl
- B) Watson and Crick
- C) Hershey and Chase
- D) Franklin and Wilkins

39. (1.00 pts) Which of the following is NOT a difference between DNA and RNA?

- A) DNA has phosphodiester bonds; RNA does not.
- B) DNA has deoxyribose; RNA has ribose
- C) DNA uses thymine; RNA uses uracil

- D) DNA is double-stranded; RNA is single-stranded

40. (1.00 pts) The idea that DNA carries the instructions to make RNA, and RNA carries the instructions to make proteins, is called the

- A) core belief of all biologists
- B) law of genetics and DNA
- C) principle of independent assortment
- D) central dogma of molecular biology

41. (1.00 pts) If a sample of DNA includes 33% adenine, what is the percentage of guanine?

17

42. (2.00 pts)

DNA is double stranded. Because the two strands pair up perfectly and specifically, and the sequence of nucleotides on one strand dictates the sequence on its partner strand, we say the two strands are _____. For DNA replication, the two strands are separated and each strand serves as a _____ to make its new partner strand.

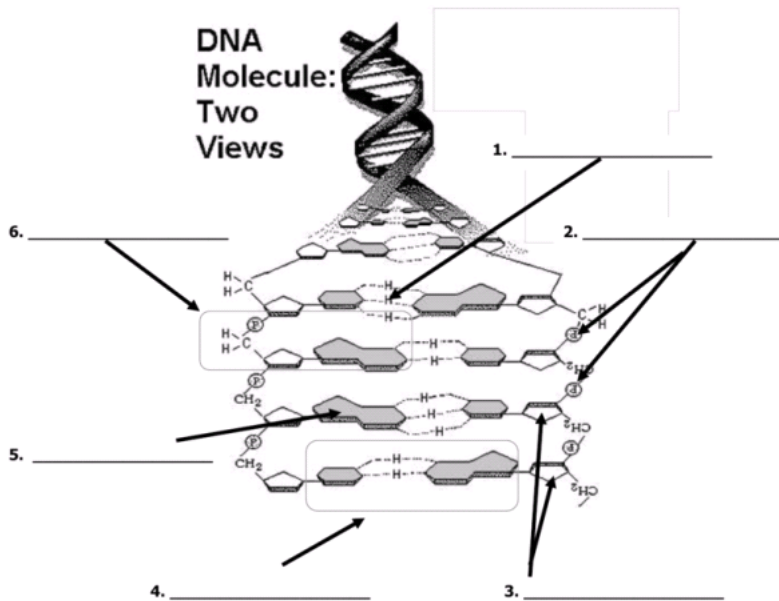
complementary template

43. (2.00 pts)

When double-stranded DNA replicates, each new double helix is comprised of one intact "old" strand and one intact "new" strand. This is called _____ replication. The scientists who demonstrated this to be true were _____.

semi-conservative Meselson and Stahl

44. (1.00 pts) Use this diagram to answer the following six questions:



44. What does the dotted line indicated by #1 represent?

hydrogen bond

45. (1.00 pts) What is the name of the covalent bond between nucleotides that is represented by #2?

phosphodiester bond

46. (1.00 pts) What is the name of the ring structure that #3 indicates?

deoxyribose

47. (1.00 pts) #4 indicates a box. What is the name of the structure within that box?

base pair

48. (2.00 pts) What is the name of the shaded molecule that #5 indicates? (1 pt for the general name, 2 pts for the specific name.)

nitrogenous base

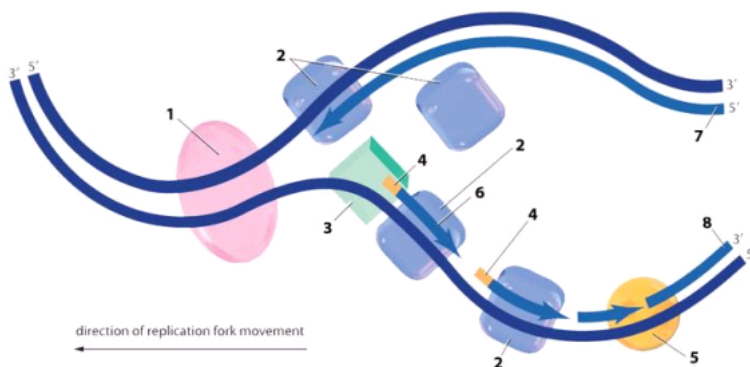
49. (1.00 pts) #6 indicates a box. What do we call the structure within that box?

nucleotide

50. (1.00 pts) What does "DNA" stand for? (Spelling counts!)

deoxyribonucleic acid

51. (1.00 pts) Use this diagram of DNA replication to answer the following five questions:



The upper strand that is being synthesized is referred to as the _____ strand

- A) processing
- B) lagging
- C) leading
- D) primary

52. (1.00 pts) Refer to the diagram in question 51. #6 indicates a piece of DNA that is called

- A) a primer
- B) a Fujiyama fragment
- C) a Meselson fragment
- D) an Okazaki fragment

53. (1.00 pts) Refer to the diagram in question 51. #1 indicates an enzyme called

- A) topoisomerase
- B) helicase
- C) DNA polymerase
- D) primase
- E) DNA ligase

54. (1.00 pts) Refer to the diagram in question 51. #4 indicates

- A) an RNA primer
- B) a single-stranded binding protein
- C) RNA polymerase
- D) a telomere

55. (1.00 pts) Refer to the diagram in question 51. #5 indicates an enzyme called

- A) topoisomerase
- B) helicase
- C) DNA polymerase
- D) primase
- E) DNA ligase

56. (1.00 pts) In DNA replication, the reason that the lagging strand must be synthesized in pieces is that

- A) RNA polymerase can build a new strand that is a partner to only one of the original strands
- B) Helicase can only make one of the two DNA strands accessible at the replication fork
- C) DNA polymerase can only add new nucleotides onto a 3'OH group
- D) The replication fork can move outward in only one direction

57. (1.00 pts) Which of the following statements is true?

- A) The order of genes on a chromosome determines the order of polypeptides in a protein.
- B) The order of amino acids in the transcription enzymes determines the order of nucleotides in the RNA.
- C) The order of nucleotides in a gene determines the order of genes on a chromosome.
- D) The order of nucleotides in a gene determines the order of amino acids in a protein.

58. (1.00 pts) Which of the following pairings is inaccurate?

- A) transcription: RNA
- B) DNA replication: double helix
- C) mitosis: two nuclei
- D) translation: amino acid

59. (1.00 pts) Which of the following is a mutation?

- A) A protein with an altered amino acid sequence
- B) A gene with an altered base pair
- C) An RNA with a missing nucleotide
- D) An enzyme that folds improperly
- E) A, B, and C are all correct answers

60. (1.00 pts) Which of the following pairings is inaccurate?

- A) DNA replication: nucleus
- B) transcription: cytoplasm
- C) translation: cytoplasm
- D) crossing over: nucleus

61. (1.00 pts) The DNA region that serves as a binding site for RNA polymerase is called

- A) the promoter
- B) the operator
- C) the activator
- D) the transcribase

62. (1.00 pts) Mutations often result from the formation of thymine dimers that are not repaired. These thymine dimers are usually caused by exposure to

- A) x-rays from space
- B) cigarette smoke or other air pollutants
- C) uv light in sunlight
- D) anti-oxidants in our food

63. (1.00 pts) For a given gene, how many possible reading frames are there?

- A) one
- B) two
- C) three
- D) four
- E) six

64. (1.00 pts) Ribosomes are composed of

- A) RNA and DNA
- B) proteins and RNA
- C) DNA and enzymes
- D) lipids and proteins

65. (1.00 pts) Part of a DNA strand is being read by RNA polymerase to make a messenger RNA. The DNA sequence for this region is

3' GTCTAAGCTACCGATTACCGCTA 5'

What is the sequence of the transcribed mRNA?

- A) 5' GTCTAAGCTACCGATTACCGCTA 3'
- B) 5' UAGCGGUAUUCGGUAGCUUAGAC 3'
- C) 5' UAGCGGUAATCGGUAGCTTAGAC 3'
- D) 5' CAGAUUCGAUGGCUAAUGGCGAU 3'

66. (1.00 pts)

	U	C	A	G	
U	UUU } Phe UUC } UUA } Leu UUG }	UCU } Ser UCC } UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G
C	CUU } Leu CUC } CUA } CUG }	CCU } Pro CCC } CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } Arg CGC } CGA } CGG }	U C A G
A	AUU } Ile AUC } AUA } AUG Met	ACU } Thr ACC } ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
G	GUU } Val GUC } GUA } GUG }	GCU } Ala GCC } GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } Gly GGC } GGA } GGG }	U C A G

Below is the beginning of a messenger RNA molecule. Use the Genetic Code Table provided to determine the sequence of amino acids that this section of mRNA codes for.

5' GCGUAUGCGGUGCCCUUGUCCA.....3'

- A) Ala-Tyr-Ala-Val-Pro-Leu-Ser
- B) Met-Arg-Cys-Pro-Cys-Pro
- C) Thr-Cys-Ser-Arg-Gly-Val-Cys
- D) Arg-Ile-Arg-His-Gly-Asn-Arg

67. (1.00 pts) This sequence is at the beginning of the coding region of a messenger RNA:

5' AUGGCUUCCGAGGACUUGCGC...3'

Various mutations could occur in this region to give the following mRNA sequences:

- A. 5' AUGGCUUCCGAGGACUAGCGC...3'
- B. 5' AUGGCUUCAGAGGACUUGCGC...3'
- C. 5' AUGGCUUCCGCAGGACUUGCGC...3'
- D. 5' AUGGCUACCGAGGACUUGCGC...3'

Which of these altered mRNA sequences represents a silent mutation?

- A) A
- B) B
- C) C
- D) D

68. (1.00 pts) Referring to the information presented in question 67, which RNA sequence represents a nonsense mutation?

- A) A
- B) B
- C) C
- D) D

69. (1.00 pts) Referring to the information presented in question 67, which RNA sequence represents a missense mutation?

- A) A
- B) B
- C) C
- D) D

70. (1.00 pts) Referring to the information presented in question 67, which RNA sequence represents a frameshift mutation?

- A) A
- B) B
- C) C
- D) D

71. (1.00 pts) A stop codon is a signal to

- A) RNA polymerase, to stop transcription.

- B) DNA polymerase, to stop replication.
- C) the spliceosome, to ligate at that site.
- D) the ribosome, to stop translation.

72. (1.00 pts) What is a polysome?

- A) A pair of homologous chromosomes that are tightly connected along their length
- B) A number of ribosomes, all translating a messenger RNA simultaneously
- C) A set of ribosomes that stay attached to the ER membrane, all in a line
- D) A number of DNA polymerases attached to each other as DNA moves through

73. (1.00 pts) From an evolutionary standpoint, why is a codon three nucleotides long?

- A) So it can fit into the binding sites of the ribosome
- B) So the average gene is at least 500 bp long and can be visualized
- C) So there are enough combinations to specify the 20 common amino acids
- D) So mutations are less likely to actually cause problems

74. (1.00 pts) Which end of a protein is assembled first in the ribosome?

- A) the 5' end
- B) the 3' end
- C) the amino terminus
- D) the carboxy terminus

75. (3.00 pts) Note the following double-stranded DNA sequence. Does it melt (denature) at a higher or lower temperature than the typical DNA sequence in humans, and why?

GCTTCAGTTATAATGTACAATGA
CGAAGTCAATATTACATGTTACT

Expected Answer: Lower temperature because an AT pair has only two hydrogen bonds and a GC pair has three. This DNA has more AT pairs than typical human DNA.

76. (2.00 pts) The Initiator tRNA carries the amino acid _____ to the ribosome. The _____ of the tRNA binds specifically with the codon in the A site of the ribosome.

met

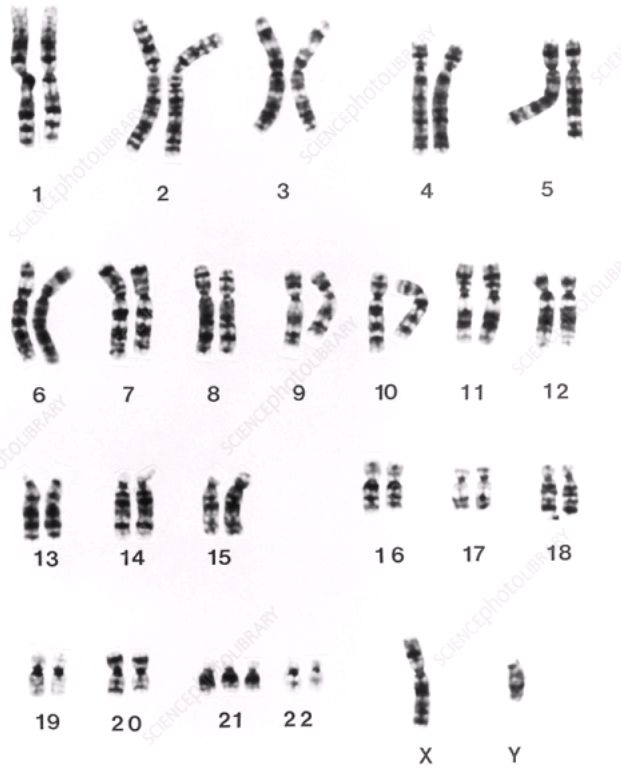
anticodon

77. (2.00 pts) Chromosomal abnormalities usually arise because _____ occurs during the process of _____ in one of the parents.

nondisjunction

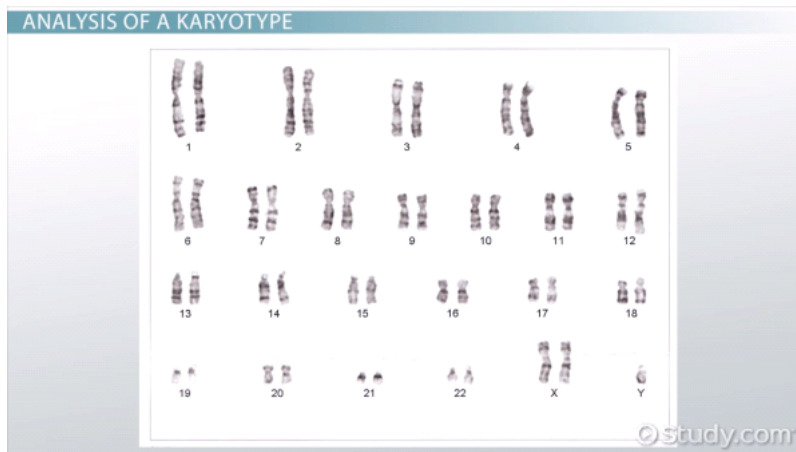
meiosis

78. (3.00 pts) Below is a human karyotype. Is this individual male or female? If the individual has a chromosomal abnormality, what is it called and what are the symptoms?



Expected Answer: Male. Has Trisomy 21 or Down Syndrome. Symptoms = mental retardation, short stature, slanted eyes, many others

79. (3.00 pts) Below is a human karyotype. Is this individual male or female? If the individual has a chromosomal abnormality, what is it called and what are the symptoms?



Expected Answer: Male with Klinefelter Syndrome. Symptoms = reduced fertility, some feminine contours, delayed puberty, others

80. (5.00 pts) Explain all the steps involved in creating a karyotype for an individual.

Expected Answer: Take dividing cells, treat with colchicine to arrest them in prophase of mitosis, squash the cells onto a slide so chromosomes are spread out. Stain the chromosome so the bands show. Take digital photograph and arrange the chromosomes by size and banding pattern.