(Key)

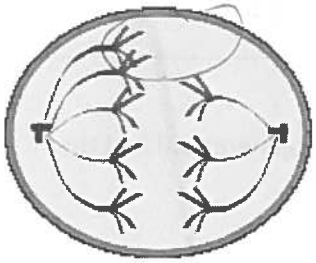
1. Cancer cells are especially prone to have genetic mutations and develop abnormal phenotypes. Thus as cancerous lumps grow they may begin to take on weird shapes, colors and textures. In fact, recent studies have discovered cancerous cells are 100x as likely to mutate as normal cells. The best explanation for the high rate of mutations in cancer cells is

A. cancerous cells disobey checkpoints and are prone to proceeding in mitosis before DNA is copied accurately
B. cancerous cells are more prone to going through crossing over and exchanging genetic material than normally dividing cells
C. cancerous cells produce toxins which interfere with normal copying of genes
D. cancerous cells undergo meiosis as significantly higher rates than normal cells which will increase the likelihood of genetic mutations

2. Polyploidy is often taught as the doubling of plants' chromosome number, however in some cases (such as in the seedless watermelon), the chromosome number changes from diploid (2n) to triploid (3n). The most likely explanation for this change is

A. A pair of homologous chromosomes failed to separate properly during meiosis in one of the parents
B. An error occurred in meiosis of both the sperm producing and egg producing plants
C. An error in meiosis produces gametes with a full complement of homologous chromosomes
D. Sister chromatids failed to separate properly during meiosis II in one parent

Mom - 2n + n from dad = 3n



3. The diagram to the left shows a cell undergoing nuclear division. This picture represents

A. a way in which a parent expressing a dominant phenotype could pass on a recessive allele to an offspring
B. the separation of identical copies of chromosomes
C. the production of new identical cells for growth
D. an error in which offspring may end up with too many or too few chromosomes

4. Eye color is a relatively complex genetic trait, but it does the majority of time follow simple Mendelian patterns. For example two parents with green eyes have a daughter with blue eyes. This suggests

A. that the green eye allele and blue allele are on different chromosomes
B. that one copy of an allele is sufficient to have green eyes but two copies are necessary to have blue eyes
C. that the gene for eye color is located on the X chromosome
D. that two parents with blue eyes could have a child with green eyes

5. Mutations and crossing over are similar in that

A. both happen very rarely though with enough cell divisions they can be significant
B. both are usually harmful to the organism
C. both produce new genetically unique chromosomes
D. both occur primarily during prophase of meiosis

6. Dominant genetic disorders are very rare compared to the prevalence of recessive conditions. Dominant conditions in the population must

A. be located on the sex (X or Y) chromosomes
B. not significantly adversely affect an individual until after reproductive age
C. only appear in individuals who possess two dominant alleles or males with one version of the allele
D. be more common in males than in females

7. A brown-furred cat and a black furred cat mate. They produce a litter that is the following:

Phenotype	Black	Brown	Gray
Number	2	4	3

Which of the following is the *least* plausible explanation for the observed litter?

A. Fur color is controlled by genes at more than one locus

B. Environmental factors play a role in in fur color development

no way to get this

Aa
a | F
a

C. The gene exhibits incomplete dominance where heterozygotes have intermediate phenotypes

D. A second gene controls expression of the fur color gene

8-10. A curly-winged black bodied female fruit fly is crossed with a straight-winged yellow-bodied male fruit fly. The offspring are all curly-winged and yellow-bodied. An F1 male is crossed with a straight-winged black-bodied female, and the F2 generation is shown below

	Curly-Winged Black Bodied	Curly-winged Yellow Bodied	Straight-winged Black Bodied	Straight-winged yellow Bodied
# of Males	321	28	36	317
# of Females	315	36	30	326

8. Let W/wcode for the wing gene and B/b code for the body gene. The original father (of the P generation) had the genotype of

A. WWbb B. WwBb C. wwBB D. Wwbb

9. The best explanation for the small number of Curly-winged Yellow Bodied males in the F2 generation is

A. the fact that these genes are on the X chromosome and males only have on X chromosome

B. the fact that both traits are recessive and show up less than the dominant phenotypes

C. the fact that these alleles are located far apart on the same chromosome means they are rarely inherited together

D. the fact that this combination only comes about when homologous chromosomes cross over

10. If the F1 generation had been mated with each other we would expect

A. a 1:1:1:1 ratio of all four possible phenotypes

B. a 2:1:1 ratio of Curly-Winged Yellow-Bodied fruit flies to Curly-Winged Black Bodied Fruit Flies to Straight-Winged Yellow-Bodied fruit flies with a few Straight-winged Black-Bodied fruit flies

C. a 9:3:3:1 ratio of Curly-Winged Yellow-Bodied fruit flies to Curly-Winged Black-Bodied fruit flies to Straight-Winged Yellow-Bodied fruit flies to Straight-Winged Black-Bodied fruit flies

D. A 3:1 ratio of Curly-winged Yellow-Bodied fruit flies to Straight-Winged Black-Bodied fruit flies with small numbers of the other phenotypes

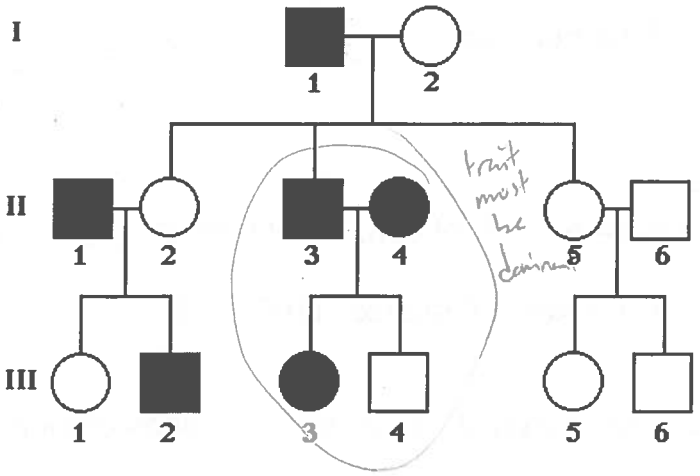
Parents: WWbb + wwBB

F1 = WbwB

	Wb	wB
Wb	WWbb	WwBb
wB	WwBb	wwBB

wwbb only due to crossing over

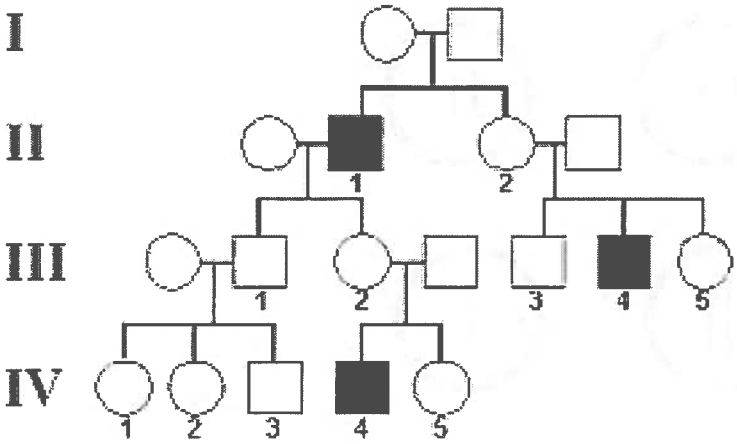
11-12 use the following pedigree, generated fur an unknown new disease thought to be genetic



11. Based on the pedigree, you would suggest that the trait is
A. not genetic and is determined by environmental issues
B. a sex-linked recessive genetic disorder
C. an autosomal dominant genetic disorder
D. an autosomal recessive genetic disorder

12. Individual 4's genotype is (in order to have recessive offspring)
A. not able to be determined B. AA B. Aa C. aa D. X^AY E. X^aY

13-14 use the pedigree below:



13. The pedigree above represents a deviation from typical Mendelian inheritance. It most plausibly exhibits
A. A situation in which multiple alleles can be expressed simultaneously
B. A situation in which multiple genes combine to form a phenotype
C. A situation in which one gene affects the expression of another
D. A situation in which a gene is located on a sex chromosome (only males have it)

14. Individual number 2 of Generation III most likely has a genotype of
A. X^AX^a B. X^aY C. aa D. AaBb
has affected son but is not affected

15. A male has the genotype AaBBCcDdEEFfggHh. Assume all genes are on separate chromosomes. How many genetically unique sperm can he produce?
1 2 3 4 5
A. 25 B. 32 C. 64 D. 256
5 genes they can vary in, 2 options for each $= 2^5$ possibilities

16. Synapsis occurs during Prophase I of meiosis and is important in the production of genetic diversity. What occurs during synapsis? □
A) The chromosomes move to the opposite ends of the nucleus
B) The pairing of two homologous chromosomes.□
C) The pairing of two sister chromatids.□
D) The chromatin is being replicated.

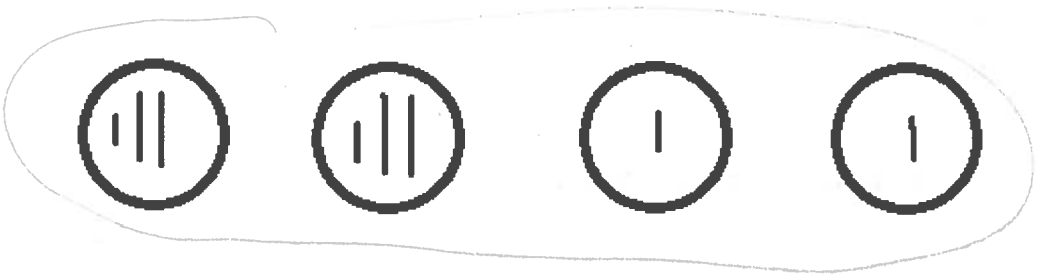
17. A six foot male marries a four foot female and have a five foot son. What kind of dominance is this an example of?□
A) Co-Dominance□ B) Incomplete Dominance□C) Recombinance□D) Complete Dominance

18. A mother that is AaBB and a father that is aabb have a child. What are□The odds of their child being aabb?□
A) 1/16□B) 1/4□C) 1/8□D) ¾ E O

19. Which of the following shows an error in Meiosis I?

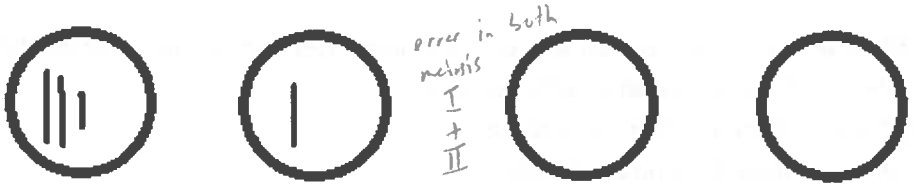
A)

B)



C)

D)



20. Two individuals have a child. One parent has blue eyes and one parent has green eyes. Both parents are heterozygous for this gene what color eyes might the child have?

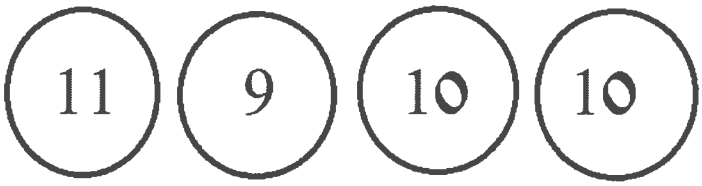
A) The child will have blue eyes because blue is dominant
B) The child will express both blue and green eyes
C) The child will have a blended shade of blue and green eyes
D) This situation is not possible

or there is another gene involved

21. Sketch the chromosome map for the genes listed below based on the number of recombinants

AB-10%	AG-50%	BD-25%	CF-10%
FG-50%	AE-20%	CD-5%	DF-40%
BE-10%	AC-30%	AF-40%	BF-30%

22. Which situation would be most likely to lead to the following chromosome results?



A) Error in meiosis 1
B) Error in meiosis 2
C) Error in both meiosis 1 and 2
D) No errors occurred

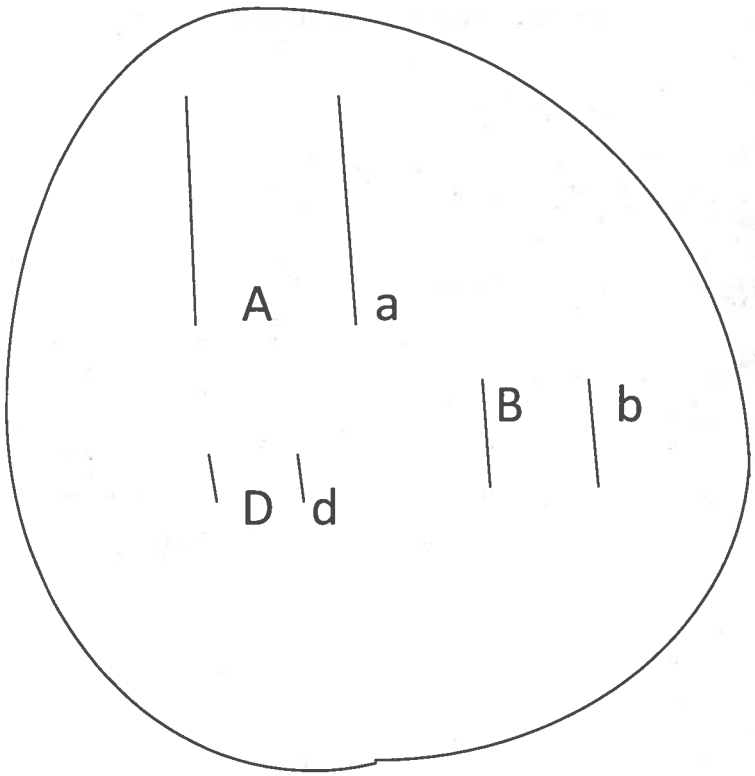
23. A child with wavy hair has a mother with curly hair and a father with straight hair. Which situation could have caused this?

A) Incomplete dominance
B) Complete dominance
C) Co-dominance
D) None of the above

24. What are possible recombinance frequencies based on the order of genes on the chromosome?

A) ZB – 10% HZ – 20% JB – 30%
B) ZB – 10% HZ – 40% JB – 30%
C) ZB – 10% HZ – 40% JB – 50%
D) ZB – 20% HZ – 20% JB – 50%

25.



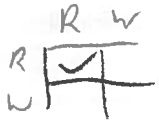
What are the possible outcomes for this cell after Meiosis II?

ABD A B d AbD Abd

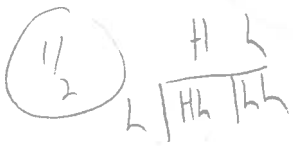
aBD aBd abD abd

26. A red flower was crossed with a white flower and all the offspring were pink. If two pink flowers were crossed what percent of the offspring would be red?

A) 25% B) 0% C) 100% D) 42%



27. Both parents are homozygous for blue eyes (bb) but the mother is heterozygous for brown hair (Hh) and the father is homozygous for blonde hair (hh). What is the probability that their next child will have blue eyes and blonde hair?



28.Meiosis helps diversify a cell's genetic makeup by crossing over and replicating into different diploid cells. If there are 6 sister chromatids after the duplication stage (in interphase) how many chromosomes will be in each cell at the end of meiosis II?

A) 6 B) 3 C) 9 D) 2

impossible

XXX XY XY → X X + X

29. Dumpy wings are recessive to wild Type wings. A male with dumpy wings mates with a female fly with wild type wings. The F1 generation results with all the males and females displaying the dominant trait. What would the F2 generation display if a male and female were chosen to mate with each other?

A) 75% display dominant; 25% display recessive
B) 50% display dominant; 50% display recessive
C) 25% display dominant; 75% display recessive
D) 87% display dominant; 13% display recessive

heterozygous

30. A male heterogeneous fly, heterogeneous in both traits, mates with a female fly of an unknown genotype. The F1 generation displays 50% of the off-spring displaying 1 of the dominant traits while the other 50% display the other dominant trait. What is the genotype of the mother?
A) (aabb) B) (Aabb) C) (AABB) D) (AaBb)

+ genes linked

31. In most cases, an organism will use mitosis to pass on its genes. In what case is an organism unable to use mitosis to divide its DNA?
a) An organism with no nucleus
b) An organism that produces two identical daughter cells
c) An organism without ribosomes probably also true
d) An organism that helps the body repair itself and grow

32. In Huntington's disease, there is a 50/50 chance an individual will receive the mutated gene from an affected parent. If an individual has the gene, they will express it at some time during their life. Because of this information we know:
a) the Huntington gene is recessive
b) the Huntington gene is dominant
c) the Huntington gene is sex-linked
d) the Huntington gene is dependent on environmental factors

33. Which of the following contributes to alleles ending up on different chromosomes?
a) Mitosis b) Meiosis I c) Meiosis II d) None of the above

crossing over

34. The daughter cells resulting from meiosis contain the following number of chromosomes: 22 22 24 24. An error likely occurred in
A. Mitosis B. Meiosis I C. Meiosis II D. Meiosis III

35. Which pairing would result in exactly half of the offspring being homozygous recessive?
A. AA x aa B. Aa x Aa C. aa x aa D. Aa x aa

36. Which pairing would result in exactly 1/4 of the offspring expressing both dominant traits, assuming genes are not linked?
A.AaBb x aabb B.AABB x AaBb C.aabb x aabb D.AABB x AABB

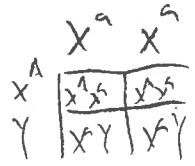
37. A gardener plants a plot of blue flowers on one of her house and a plot of red flowers beneath those. a year goes by and when the new flowers bloom in the spring there are some purple flowers mixed in with the red and blue ones. Explain what happened.

incomplete dominance

38. Describe the differences between the final products of meiosis and mitosis and what that means in terms of gene expression.

meiosis - haploid reproduction mitosis - diploid growth/repair

39. A hemophilic woman mates with a normal man. They plan to have three children, but are unaware of how genes and heredity work. Make an argument to them about the likelihood of their children inheriting the mothers disease, using at least one cross.



all sons hemophiliac

40. Which is not responsible for genetic diversity?
A. Recombinance of chromosomes in meiosis.
B. Independent Assortment of allele pair.
C. Two Divisions in Meiosis producing four daughter cells.
D. One division of mitosis producing two daughter cells.

41. A white eyed black bodied fly is mated with a purple eyed black bodied fly. If purple eyes are dominant and the fly with purple eyes is heterozygous, what are the expected outcomes?
A. 50 % expressing dominant and 50% expressing recessive B. 25% heterozygous 25% homozygous recessive 50% homozygous dominant
C.100% heterozygous D. 50% homozygous recessive, 50% homozygous recessive

42. If two gametes come together to from a zygote, what process does the zygote go through to become an infant?
A. Meiosis B. Mitosis C. Meiosis 2

43. A AaBbCc parent and a AABbCC parent have a child what are the odds of the child expressing the dominant in all three genes.
A.1/2 B. 9/64 C. ¾ D. 6/16
1 · ¾ · 1

44. How does meiosis yield better chances for genetic diversity than mitosis?
a) Because it has two stages of meiosis there are more combinations and more chances for recombinance to occur
b) Because it has check points that it needs to pass through to make sure the stages are progressing correctly
c) Meiosis is used to create gametes which are supposed to be diverse, and mitosis just replicates the cell
d) Mitosis has the opportunity to cross over and meiosis does not so mitosis is more diverse

45. If you have a cell with 100 chromosomes during G1, how many chromosomes will there be after meiosis?
A. there will be two identical cells with 50 chromosomes in each
B. there will be four haploid cells, that are all identical, with 50 chromosomes in each
C. there will be two haploid cells
D. there will be four haploid cells with 50 chromosomes each

46. The genotypes of a man and woman are IAi and IAIB. What are the possible genotypes and phenotypes?
A. 4 genotypes; 3 phenotypes
B. 3 genotypes; 3 phenotypes
C. 4 genotypes; 2 phenotypes
D. 2 genotypes; 1 phenotypes

¼ · 1 · ½ · ½ · ¼ = 1/64 · 500 students

47. Assume the 5 genes are on 5 separate chromosomes. An AabbccDdEe father and AabbCcddEe mother have had 500 children (its okay, she had octuplets 50 times). How many of those children express the recessive phenotype in all 5 genes?
A. about 15 kids B. about 8 kids C. about 22 kids D. about 12 kids

48. In a species of flowers where one of the parents is blue and the other is red, all of the f1 generation is purple. Predict what the f2 generation will be.
A. 100% purple B. 50% red 50% blue C. 25% red, 25% blue and 50% purple

49. What are the odds that a heterozygotes parent and a homozygous dominate parent will have a child that expresses the recessive trait.
A. ½ B. ¼ C. 0

50. Pick the most correct answer about mitosis and meiosis in humans
A. Mitosis creates 4 daughter cells with 46 chromosomes each
B. Meiosis creates 4 daughter cells with 46 chromosomes each
C. Mitosis creates 2 daughter cells with 23 chromosomes each
D. Meiosis creates 4 daughter cells with 23 chromosomes each

51. What causes incomplete dominance on a protein level?
A. One set of instructions produces a few proteins but not enough to show the homozygous phenotype
B. Both sets of instructions code for functional proteins which are both expressed
C. One set of instructions codes for a functional set of proteins which is sufficient to equal the homozygous phenotype
D. None of the above

52. What is the importance of crossing over?
a. It produces the protein similar to the DNA in the chromosomes.
b. It reduces the number of chromosomes (from 2n to n).
c. It increases the chances for daughter cells to contain different genetic material.
d. It provides new genetic materials for the daughter cells.

53. Curly hair is dominant over straight hair. If a homozygous dominant male mates with a straight haired female, which of the following is true?
a. half of the offspring would have curly hair.
b.all are expected to have straight hair.
c. all are expected to have curly hair.
d. the offspring have 25% chance of inheriting both straight haired alleles.

54. Hunter syndrome is a sex linked recessive trait. A male with hunter syndrome and a normal female have a girl with hunter syndrome. All of the following is true except:
a. The girl inherited the dominant allele from the mother.
b. The girl inherited recessive alleles from both parents.
c. The mother is a carrier for hunter syndrome.
d. The genotype of the father is X^h Y.

55. During meiosis the resulting gametes have _____ the number of chromosomes as the parent cell.
a) double b) triple c) half d) equal

56. A Blue flower and a Red flower are mated together. If these alleles are both incomplete dominant, then you would expect to see their offspring to be _____
a) red b)red and blue striped c)blue d)purple

57. A homozygous dominant fruit fly with curly wings and black body color mates with a homozygous recessive fruit fly that has straight wings and an ebony body color and these genes are linked, you would expect their offspring to _____
a) all be curly winged and black b) all be straight winged and ebony
c) be half curly winged and black and half straight winged and ebony d) all curly winged and ebony

58. What are the odds an AaBbDd father and an AAbbDd mother producing a child expressing a dominant phenotype in all three traits? (Unlinked)

$1 \cdot \frac{1}{2} \cdot \frac{3}{4} = \frac{3}{8}$

59. **A couple has 8 children. 2 of them are homozygous dominant in a gene, 4 of them are heterozygous and 2 of them are homozygous recessive. What are the odds their 9th child will be identical to one of their parents?**
A. 0% B. 25% C. 50% D. 75% E. 100%

60. In llamas, coat color is controlled by a gene that exists in two allelic forms. If a homozygous yellow llama is crossed with a homozygous brown llama, the offspring have gray coats. If a yellow llama is mated with a gray llama, what % of the offspring should be brown?
A. 100% B. 75% C. 50% D. 25% E. 0%

61. In rabbits, the allele for short hair (H) is dominant and the allele for long hair (h) is recessive. The allele for green eyes (G) is dominant and the allele for blue eyes (g) is recessive. A cross between two rabbits produces a litter of four short haired rabbits with green eyes and four long haired rabbits with green eyes. What is the most likely genotype of the parent rabbits in this cross?
A. hhgg x hhgg B. HHGG x HHGG C. HhGg x HhGg D. HhGg x HHGg E. HhGG x hhGG

62. If a man and a woman have a daughter who is affected with hemophilia, which of the following is definitely true?

A. The mother is a carrier for hemophilia B. The father has hemophilia C. The mother must have hemophilia

D. Both parents must have hemophilia E. A and B must both be true

64-65. You have B blood, your mother had blood type A

64. Your father must have which of the following blood types?

A. A, B or O B. AB or A C. AB only D. AB or B E. O only

65. Your mother must have the genotype

A. AA B. AB C. AO D. OO E. A or B

66. Two yellow mice with the genotype Yy are mated. After many offspring 1/3rds are homozygous dominant and 2/3rds are heterozygous. This does not match the pattern Mendelian genetics would suggest. Which of the following causes would best explain the observed data?

A. The mice did not have enough offspring for the ratio to be specific B. The recessive trait is lethal

C. Non-disjunction occurred D. A mutation masked the effect of the Y allele

67. During meiosis II

A. Homologous chromosomes separate B. Sister chromatids are generated

C. Non-sister chromatids separate from each other D. DNA replication occurs E. Homologous chromosomes pair up

68. A cell with a diploid number of 4 could produce gametes with how many different combinations of chromosomes?

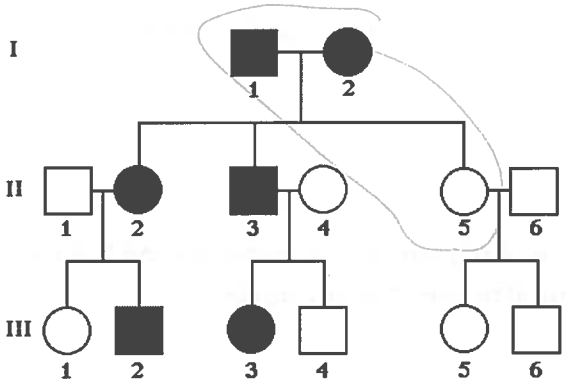
A. 4 B. 8 C. 12 D. 64 E. 128

69. Meiosis II differs from mitosis in that

A. Meiosis II begins with twice as many chromosomes B. Meiosis II immediately follows interphase

C. Meiosis II occurs in somatic cells D. Meiosis II begins with half as many chromosomes

E. Meiosis II is involved with asexual reproduction



70-71 refer to the pedigree above

70. The most plausible mode of inheritance for this disease is

A. Codominance B. Autosomal dominant C. Autosomal recessive D. Sex-linked dominant E. Sex-linked recessive

71. If individual 2 from generation III were to mate with individual 3 from the same generation we would expect

A. None of their offspring to have the disease B. All of their offspring to show have the disease

C. Each offspring to have a 75% chance of having the disease D. Each offspring to have a 50% chance of having the disease E. Each offspring to have a 25% chance of having the disease

72. A biologist counted 2,500 cells from an embryo in a microscope slide and recorded the following data:

Stage	# of Cells
Prophase	125
Metaphase	50
Anaphase	50
Telophase	25
Interphase	2,250

If these cells had been dividing randomly, it could be reasonably concluded that

A. The duration of anaphase is approximately one-half that of telophase
B. Prophase is approximately three times as long as telophase
C. Metaphase is the shortest stage of the cell cycle
D. Interphase is the longest stage of the cell cycle
E. The chromosomes can first be seen in prophase

73. Which of the following best describes the cells that result from the process of meiosis in mammals?

A. They are diploid B. They can be used to repair injuries C. They are genetically different from the parent cell
D. They are genetically identical to all other cells in the body E. They are identical to each other

74. Coat color in mice is determined by genes in two loci. When black mice from a particular population mate, they produce offspring in the following ratios: 9 black: 3 brown: 4 white. These results suggest that white coat color is expressed as a result of

A. dominance B. incomplete dominance C. codominance D. a sex-linked trait E. epistasis

75. Which of the following helps explain the results in 24?

A. Brown color is dominant to black color B. White color is dominant to black color
C. The second gene controls whether brown or black color is expressed at all D. Heterozygotes show the white condition

76-77 use the following. Assume independent assortment

A. 0 B. 1/16 C. ¼ D. ½ E. ¾

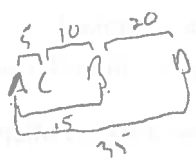
76. Probability the son of X^AY x X^AX^a will express trait a D

77. Probability that a child with the dominant phenotype will be produced by the parents Aa x Aa E

78. Probability that the genotype ccdd will be produced by the parents CcDd x CcDd B

79. Using the recombinant frequencies below, determine the order of genes A-D on a chromosome.
AB- 15 AC-5 AD-35 BC-10 BD-20 CD-30

A. ABCD
B. ADBC
C. ACDB
D. DBCA
E. DACB



80. Two brown-haired individuals mate. 3/4ths of their offspring are brown-haired while the remaining fourth are red-haired. Which of the following IS NOT supported by the above data?

A. Brown hair is a dominant trait B. The parents are heterozygous C. All red-haired offspring are homozygous D. All brown-haired offspring are homozygous E. Heterozygotes show brown hair

81-84 are examples of inheritance patterns. Select a pattern for each example.

A. Epistasis B. Pleiotropy C. Polygenic inheritance D. Co-dominance E. Incomplete dominance

= 1 gene has multiple phenotypic affects

81. Individuals with a straight haired allele and individuals with a curly haired allele express the wavy hair phenotype E

82. One gene affects whether or not another gene is expressed. A

83. A defective PKU gene causes mental retardation, balding, reduced skin pigmentation and other phenotypic affects B

84. Individuals with an A allele and a B allele express them both simultaneously but individuals with an A allele and an O allele only express the A allele D

85. If 91% of a non-evolving population express the dominant trait of not having sickle-cell, what % would we expect to be carriers?

$p^2 + 2pq = 0.91$ $q^2 = 0.09$ $q = 0.3$ $p = 0.7$

$2pq = 2 \cdot 0.3 \cdot 0.7 = 0.42$

A. 9 B. 18 C. 30 D. 42 E. 70

86. We can infer all of the following about the above population EXCEPT

A. There is no natural selection occurring B. The population must be small (large) C. The population must be isolated D. Individuals must select mates randomly E. There must not be mutations

no gene flow

87. 2 DNA molecules that contain the same genes but not necessarily the same alleles can best be defined as

A. Chromatin B. Sister chromatids C. Homologous chromosomes D. Sex chromosomes

88. A color-blind male marries a woman. Half of their kids (both male and female) are color blind. The mother must have

A. Been color-blind B. Been heterozygous in the color-blind gene

C. Been homozygous dominant for the color blind gene D. Only had 1 X chromosome E. A and B

89. A cell normally has 10 chromosomes. After Meiosis I each daughter cell will have

A. 10 chromosomes made of 10 chromatids B. 10 chromosomes made of 20 chromatids

C. 5 chromosomes made of 5 chromatids D. 5 chromosomes made of 10 chromatids

E. 20 chromosomes made of 40 chromatids

42-44. A brown-haired freckled boy mates with a red haired freckle-less female. After having exactly 100 offspring, they notice that their offspring have the following phenotypes:

Brown-Hair Freckles	Brown hair No Freckles	Red Hair freckles	Red Hair no freckles
47	3	6	44

42. Based on the above we can conclude

A. Both genes are sex- linked B. The hair and eye color genes are linked

C. The genes are located on separate chromosomes D. Both parents were heterozygous in both traits

43. The best explanation for the brown-haired freckle-less offspring and the red-haired freckled offspring is

A. Independent assortment B. Random fertilization C. Mitosis D. Crossing over E. Mutations