

## Mendelian Genetics Review

- The principles of dominance, segregation, and independent assortment were first described by
  - Watson
  - Linnaeus
  - Mendel**
  - Morgan
- Gregor Mendel formulated some basic principles of heredity from the results of his experiments with
  - Drosophila*
  - bacteria
  - four-o'clock plants
  - pea plants**
- The puppies shown in the photograph below are all from the same litter.

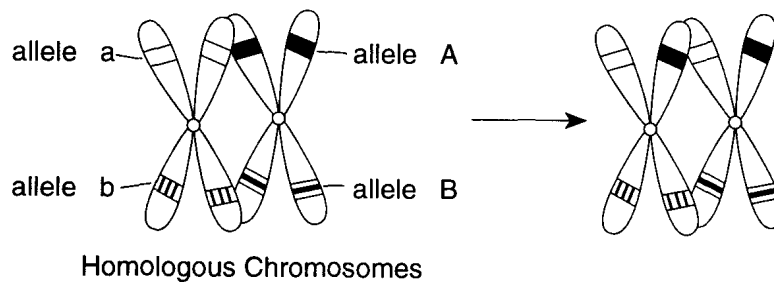


The differences seen with this group of puppies are most likely due to

- overproduction and selective breeding
  - mutations and elimination of genes
  - evolution and asexual reproduction
  - sorting and recombination of genes**
- Which genetic concepts best explain the fact that hybrid parents can produce offspring with recessive phenotypes?
    - codominance and polyploidy
    - intermediate inheritance and segregation
    - segregation and recombination**
    - polyploidy and recombination
  - In squirrels, the gene for gray fur ( $G$ ) is dominant over the gene for black fur ( $g$ ). If 50% of a large litter of squirrels are gray, the parental cross that produced this litter was most likely
    - $GG \times Gg$
    - $GO \times GO$
    - $Gg \times gg$**
    - $gg \times gg$
  - In screech owls, red feathers are dominant over gray feathers. If two heterozygous red-feathered owls are mated, what percentage of their offspring would be expected to have red feathers?
    - 25%
    - 50%
    - 75%**
    - 100%

- Two mice that are heterozygous for black coat color are mated. Assuming coat color in mice is controlled by a single pair of genes, which genotypic ratio for coat color is expected in the offspring?
  - 1:2:1**
  - 9:7
  - 3:1
  - 1:3:1
- In watermelon plants the allele for solid green fruit ( $G$ ) is dominant over the allele for striped fruit ( $g$ ). Pollen from a flower of a homozygous green watermelon plant is used to pollinate a flower from a heterozygous green watermelon plant. What percent of the offspring of this cross will bear striped watermelons?
  - 0%**
  - 25%
  - 50%
  - 100%
- In a certain species of plant, the allele for tallness is dominant over the allele for shortness. To determine whether a tall plant is heterozygous or homozygous, it should be crossed with a
  - short plant**
  - tall plant
  - medium-sized plant
  - different species of plant
- Which is a true statement about people with the genotype  $I^A I^B$  for blood type?
  - They have two alleles that are codominant.**
  - They exhibit a type O phenotype.
  - They are homozygous for blood type A.
  - They can have only type O children.
- When roan cattle are crossed, 25% of the offspring produced will have white coats, 50% will have roan coats, and 25% will have red coats. What do these results illustrate?
  - polyploidy
  - crossing-over
  - codominance**
  - sex linkage
- The genes for red hair and freckles are usually inherited together because these genes are
  - homologous
  - sorted independently
  - linked**
  - hybrid traits
- If a man has type B blood and his sister has type A blood, which combination represents the genotypes of their parents?
  - type O father and a homozygous A mother
  - type O father and a homozygous B mother
  - type AB father and type O mother**
  - both mother and father with type O blood
- In a human population, the inheritance of the ABO blood group is explained by assuming that, within the population, the number of different kinds of alleles responsible for blood type is
  - 6
  - 2
  - 3**
  - 4
- Which blood type would *not* appear in the offspring of parents who had genotypes  $I^A I^B$  and  $I^A i$ ?
  - A
  - B
  - AB
  - O**
- The transfer of genes from parents to their offspring is known as
  - differentiation
  - heredity**
  - immunity
  - evolution

17. The results of a genetic process are represented in the diagram below.



Which process most likely produced these results?

- A) chromosomal mutation during mitosis  
 B) nondisjunction during meiosis  
 C) independent assortment during mitosis  
 D) **crossing-over during meiosis**

18. Which diagram correctly illustrates the fusion of normal gametes that will most likely produce a human male?

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

19. The development of a normal human zygote into a male or female is determined by

- A) an autosome contributed by the egg  
 B) a sex chromosome contributed by the egg  
 C) an autosome contributed by the sperm  
 D) **a sex chromosome contributed by the sperm**

20. Which diagram represents a sperm that can unite with a normal egg to produce a zygote that will develop into a normal human male embryo?

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

21. Which term *best* describes genes carried only on the X-chromosome?

- A) hybrid  
 B) codominant  
 C) autosomal  
 D) **sex-linked**

22. In humans, normal color vision ( $N$ ) is dominant over color blindness ( $n$ ). A man and woman with normal color vision produced two colorblind sons and two daughters with normal color vision. The parental genotypes must be

- A)  $X^N Y$  and  $X^N X^N$   
 B)  $X^n Y$  and  $X^N X^N$   
 C)  $X^N Y$  and  $X^n X^n$   
 D)  $X^n Y$  and  $X^n X^n$

23. The best method for determining if a woman may be a carrier of the trait for color blindness is to

- A) give her an eye examination  
 B) analyze a sample of her red blood cells  
 C) analyze a sample of her urine  
 D) **check her family pedigree for the trait**

24. Barbara, who is not colorblind, and her husband Bill had a colorblind baby girl. Which statement about this situation is true?

- A) Barbara's mother must have been colorblind.  
 B) Bill's mother must have been colorblind.  
 C) Barbara's father must have been colorblind.  
 D) **Bill must be colorblind.**

25. Mendel developed the basic principles of heredity by

- A) examining chromosomes with microscopes  
 B) using x-rays to induce mutations  
 C) **analyzing large numbers of offspring**  
 D) observing crossing-over during meiosis

26. Gregor Mendel developed heredity principles from his

- A) **mathematical analysis of the results of pea plant crosses**  
 B) working model of the structure of DNA  
 C) mapping of the locations of human genes on chromosomes  
 D) extensive study of breeding *Drosophila*

27. Using the results of his experiments with pea plant crosses, what did Gregor Mendel discover?

- A) **the principles of dominance, segregation, and independent assortment**  
 B) that pea plants develop mutations after exposure to radiation  
 C) intermediate inheritance and gene linkage  
 D) that DNA is involved in the inheritance of dominant traits

28. Many years ago, a scientist grew pea plants that produced wrinkled peas. The peas from these plants produced new plants that also produced wrinkled peas. The scientist concluded that something in the parent plants was being transmitted to the next generation. This discovery is now known as

- A) genetic engineering      B) biological evolution  
C) **heredity**                      D) natural selection

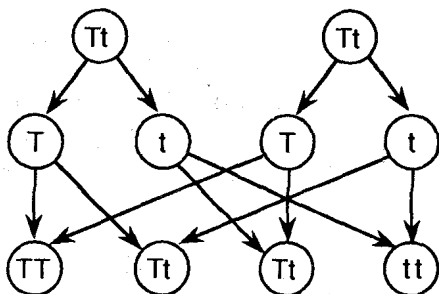
29. Information about patterns of human heredity is more difficult to obtain than information about patterns of heredity in fruit flies because

- A) humans have shorter life cycles and more offspring than fruit flies  
B) most humans have offspring with hidden dominant traits  
C) **humans have longer life cycles and fewer offspring than fruit flies**  
D) most mating in humans is carefully controlled by genetic engineering

30. After observing the offspring of many generations of pea plant crosses, Gregor Mendel formulated the principle of

- A) **dominance**                      B) polyploidy  
C) crossing-over                  D) mutation

31. The diagram below represents the inheritance of stem height in garden peas.



The diagram best illustrates

- A) intermediate inheritance  
B) **segregation and recombination**  
C) sex linkage and codominance  
D) independent assortment

32. What term would *best* be used to describe an organism possessing two identical genes for a trait?

- A) heterozygous                  B) hybrid  
C) **homozygous**                  D) incompletely dominant

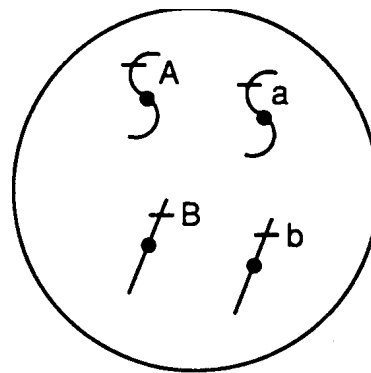
33. A cross between two mice with long tails and brown fur produced the four types of offspring listed below:

long tailed with brown fur  
long tailed with white fur  
short tailed with brown fur  
short tailed with white fur

Which genetic mechanism best explains the results of this cross?

- A) intermediate inheritance    B) gene linkage  
C) **independent assortment**    D) crossing-over

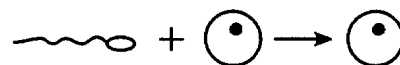
34. The diagram below shows a diploid cell with two homologous pairs of chromosomes.



Due to independent assortment what possible normal allelic combinations could be found in gametes produced from this cell by meiosis?

- A)  $Aa$ ,  $Bb$ ,  $AA$ , and  $bb$       B)  $AaBb$  and  $ABab$   
C)  $AB$  and  $Ab$ , only          D)  **$AB$ ,  $Ab$ ,  $aB$ , and  $ab$**

35. Base your answer to the following question on The diagram below represents a reproductive process that takes place in humans.



Which statement does *not* correctly describe this process?

- A) The normal species chromosome number is restored.  
B) Males and females each contribute DNA to the offspring.  
C) **The zygote will develop to become identical to the dominant parent.**  
D) The sex of the zygote is determined by DNA in the gametes.

36. When red-flowered snapdragons are crossed with white-flowered snapdragons, all the  $F_1$  plants will have pink flowers. If Mendel had used snapdragons instead of pea plants, he would have had difficulty in formulating his principle of

- A) **dominance**                      B) sex-linked traits  
C) multiple alleles              D) mutation

37. The sorting and recombination of genes during reproduction is important to evolution because these processes

- A) decrease variation and help maintain a stable population  
B) **increase variation that enables species to adapt to change**  
C) decrease the chances of producing offspring that are adapted to the environment  
D) increase the ability of all the offspring to adapt to the environment

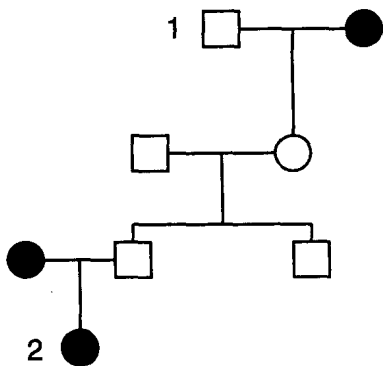
38. A pair of male Holstein (black-and-white) calves that have the same parents display many similarities but also exhibit some variations. Which process best explains these variations?

- A) gene linkage                  B) sex linkage  
C) **independent assortment**    D) dominance

39. Only red tulips result from a cross between homozygous red and homozygous white tulips. This illustrates the principle of

- A) independent assortment    B) **dominance**  
C) segregation                  D) incomplete dominance

40. Base your answer to the following question on the pedigree chart below, which shows a history of ear lobe shape, and on your knowledge of biology.



# KEY

**E** = Allele for free ear lobes (dominant)  
**e** = Allele for attached ear lobes (recessive)

□ = Male with free ear lobes

○ = Female with free ear lobes

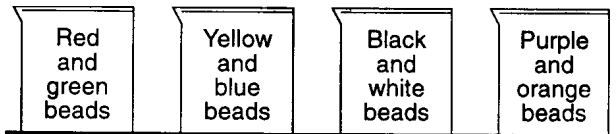
■ = Male with attached ear lobes

● = Female with attached ear lobes

What could the genotype of individual 1 be?

- A) *EE*, only      B) *Ee*, only      C) *ee*      D) *EE* or *Ee*

41. The diagram below represents four beakers, each containing an equal number of two colors of beads.



One bead was removed at random from each of the four beakers, and the colors were recorded. The beads were then returned to the original beakers. When the procedure was repeated several times, different combinations of colored beads were obtained. This activity could best be used to illustrate

- A) mitotic cell division      B) sex linkage  
 C) crossing-over      D) independent assortment

42. In chickens, rose comb (*R*) is dominant over single comb (*r*). When a heterozygous rose-combed rooster is mated with several single-combed hens, what is the expected phenotypic ratio of the offspring?

- A) 100% rose-combed  
 B) 100% single-combed  
 C) 75% rose-combed and 25% single-combed  
 D) 50% rose-combed and 50% single-combed

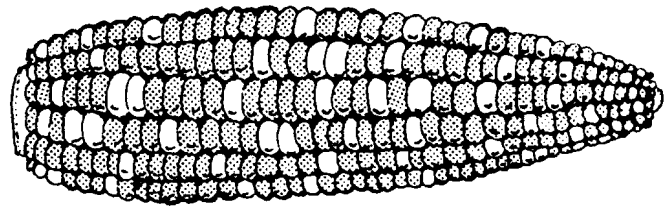
43. In canaries, the gene for singing (*S*) is dominant over the gene for non-singing (*s*). When hybrid singing canaries are mated with non-singing canaries, what percentage of the offspring is likely to possess the singing trait?

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

44. In minks, the gene for brown fur (*B*) is dominant over the gene for silver fur (*b*). Which set of genotypes represents a cross that could produce offspring with silver fur from parents that both have brown fur?

- A) *Bb* × *Bb*      B) *BB* × *bb*  
 C) *BB* × *Bb*      D) *Bb* × *bb*

45. Kernel color in corn is a trait determined by two alleles. The dominant allele (*P*) produces a purple color, and the recessive allele (*p*) produces a yellow color. The diagram below shows an ear of corn produced by crossing two corn plants. The shaded kernels are purple, and the unshaded ones are yellow.



What can the yellow kernels *best* be described as?

- A) homozygous dominant      B) heterozygous  
 C) hybrid      D) homozygous recessive

46. In a certain species of mouse, gray fur (*G*) is dominant over cream-colored fur (*g*). If a homozygous gray mouse is crossed with a cream-colored mouse, the genotype of the *F*<sub>1</sub> generation will most likely be

- A) 100% *Gg*  
 B) 50% *GG* and 50% *gg*  
 C) 25% *GG*, 50% *Gg*, and 25% *gg*  
 D) 75% *Gg* and 25% *gg*

47. *B* represents the dominant allele for a trait and *b* represents the recessive allele. In which pair of crosses must all of the offspring produced have the same phenotype?

- A) *Bb* × *bb* and *Bb* × *Bb*      B) *Bb* × *bb* and *BB* × *Bb*  
 C) *BB* × *Bb* and *BB* × *bb*      D) *BB* × *BB* and *Bb* × *Bb*

48. In dogs, wire hair (*D*) is dominant over smooth hair (*d*). If two wire-haired dogs produce a smooth-haired pup, the genotypes of the parent dogs are most likely

- A) *DD* and *Dd*      B) *Dd* and *Dd*  
 C) *DD* and *DD*      D) *Dd* and *dd*

49. Two pea plants, hybrid for a single trait, produce 60 pea plants. Approximately how many of the pea plants are expected to exhibit the recessive trait?  
A) 15      B) 45      C) 30      D) 60
50. The gene for tallness ( $T$ ) is dominant over the gene for shortness ( $t$ ) in pea plants. A homozygous dominant pea plant is crossed with a heterozygous pea plant, and 200 seeds are produced. Approximately how many of these seeds can be expected to produce plants that are homozygous dominant?  
A) 0      B) 50      C) 100      D) 200
51. In summer squash, white-colored fruit is dominant over yellow-colored fruit. If homozygous yellow-fruited plants are crossed with heterozygous white-fruited plants, what is the expected percentage of fruit color produced in the offspring?  
A) 100 % yellow      B) 100% white  
C) 50% yellow, 50% white      D) 25% yellow, 75% white
52. In certain rats, black fur is dominant over white fur. If two rats, both heterozygous for fur color, are mated, their offspring would be expected to have  
A) four different genotypes and two different colors  
B) two different genotypes and three different colors  
C) three different genotypes and two different colors  
D) three different genotypes and three different colors
53. In a population of dogs, curly hair is dominant over straight hair. If two parents are heterozygous for this trait, what is the probability that any of their offspring will have straight hair?  
A) 0%      B) 25%      C) 75%      D) 100%
54. In rats, black coat color is dominant over white coat color. If some of the offspring of a cross between a black rat and a white rat are white, the black rat must have been  
A) a polyploid      B) homozygous  
C) heterozygous      D) a mutation
55. Base your answer to the following question on the Punnett square below which shows the cross between two squash plants.

	D	D	
d	Dd	Dd	<b>KEY</b> DD = Disc-shaped squash Dd = Disc-shaped squash dd = Round squash
d	Dd	Dd	

Which genetic principle is *best* illustrated by the phenotype of the offspring?

- A) codominance      B) intermediate inheritance  
C) independent assortment      D) dominance
56. In pea plants, the trait for tall stems is dominant over the trait for short stems. If two heterozygous tall plants are crossed, what percentage of the offspring would be expected to have the same *phenotype* as the parents?  
A) 25%      B) 50%      C) 75%      D) 100%

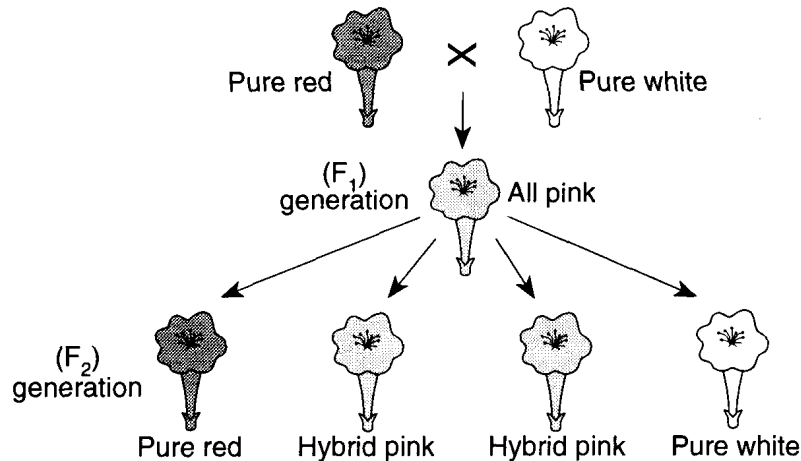
57. When a brown mink and a silver-blue mink were crossed, all of the offspring produced were brown. When these offspring were mated, they produced 60 brown minks and 20 silver-blue minks. Of the 60 brown minks, the number that are heterozygous should be closest to  
A) 10      B) 20      C) 40      D) 60
58. The chart below indicates a method of representing traits in pea plants.

Symbol for Gene	Trait Represented
$T$	tall
$t$	short
$Y$	yellow
$y$	green

Some offspring of a cross in pea plants were tall and green. According to the chart, these plants could be represented by

- A)  $TTYy$       B)  $TtYy$       C)  $ttYy$       D)  $TtYy$
59. In pea plants, the long-stem trait ( $L$ ) is dominant and the short-stem trait ( $l$ ) is recessive. Two pea plants were crossed, producing seeds that yielded 165 long-stem plants and 54 short-stem plants. The genotypes of the parent plants were most likely  
A)  $Ll$  and  $LL$       B)  $ll$  and  $ll$   
C)  $Ll$  and  $Ll$       D)  $LL$  and  $ll$
60. Which genotype illustrates codominance of alleles that control blood type in humans?  
A)  $ii$       B)  $I^A i$       C)  $I^B I^B$       D)  $I^A I^B$
61. If two roan cattle are crossed, what percent of the offspring are expected to show the parental phenotype for coat color?  
A) 25%      B) 50%      C) 75%      D) 100%
62. When two four-o'clock plants are crossed, 48 pink four-o'clocks and 52 white four-o'clocks are produced. The phenotypes of the parents are  
A) pink and white      B) pink and red  
C) pink and pink      D) red and white
63. When round squash are crossed with long squash, all offspring are oval in shape. How many different genotypes are expected when round squash are crossed with oval squash?  
A) 1      B) 2      C) 3      D) 4
64. In intermediate inheritance, a cross between two heterozygotes will usually produce offspring that exhibit which phenotypic ratio?  
A) 1:2:1      B) 3:1      C) 1:1      D) 9:3:3:1

65. Base your answer to the following question on Two generations of offspring of four o'clock plants are shown in the diagram below.



The phenotypic ratio of the  $F_2$  generation is

- A) 3:1      B) 2:1:2      C) 2:1      D) 1:2:1
66. Base your answer to the following question on the keyed diagram below which represents chromosomes that carry genes for a plant's height and seed shape.
- |   |  |
|---|--|
| CHROMOSOME THAT CARRIES THE DOMINANT ALLELE FOR HEIGHT      |  |
| CHROMOSOME THAT CARRIES THE RECESSIVE ALLELE FOR HEIGHT     |  |
| CHROMOSOME THAT CARRIES THE DOMINANT ALLELE FOR SEED SHAPE  |  |
| CHROMOSOME THAT CARRIES THE RECESSIVE ALLELE FOR SEED SHAPE |  |
- Which diagram represents those chromosomes that are responsible for the heterozygous genotype for height?
- A)      B)      C)      D)
67. In a certain variety of chicken, the genes for black feather color and the genes for white feather color are codominant. Which characteristics will this variety of chicken *most likely* have?
- A) three possible phenotypes for feather color  
 B) white feather color, only  
 C) only two genotypes for feather color  
 D) black feather color, only
68. A cross between two plants that have pink flowers produced plants that have red, pink, or white flowers. Which is the most likely explanation for these results?
- A) Intermediate inheritance involved alleles that were not clearly dominant or recessive.  
 B) Mutations occurred during gametogenesis.  
 C) Crossing-over of white and red alleles occurred during meiosis.  
 D) Nondisjunction of homologous pairs of chromosomes resulted in the production of abnormal offspring.
69. Heterozygous pink snapdragons are an example of intermediate inheritance in plants. These pink-flowered plants may be produced as a result of
- A) a cross between parent plants whose flower color is different from that of their offspring  
 B) the expression of a dominant gene  
 C) the expression of a recessive gene  
 D) a cross between parent plants, both of which have flowers with red petals
70. In many breeds of cattle, the polled condition (absence of horns) is dominant over the presence of horns, and homozygous red coat color crossed with homozygous white coat color produces roan. Which cross will produce only horned roan offspring?
- A) polled red  $\times$  horned white  
 B) horned roan  $\times$  horned roan  
 C) horned red  $\times$  horned white  
 D) polled roan  $\times$  horned roan

**Answer Key**  
**Mendel Review**

- |     |          |     |          |
|-----|----------|-----|----------|
| 1.  | <u>C</u> | 41. | <u>D</u> |
| 2.  | <u>D</u> | 42. | <u>D</u> |
| 3.  | <u>D</u> | 43. | <u>C</u> |
| 4.  | <u>C</u> | 44. | <u>A</u> |
| 5.  | <u>C</u> | 45. | <u>D</u> |
| 6.  | <u>C</u> | 46. | <u>A</u> |
| 7.  | <u>A</u> | 47. | <u>C</u> |
| 8.  | <u>A</u> | 48. | <u>B</u> |
| 9.  | <u>A</u> | 49. | <u>A</u> |
| 10. | <u>A</u> | 50. | <u>C</u> |
| 11. | <u>C</u> | 51. | <u>C</u> |
| 12. | <u>C</u> | 52. | <u>C</u> |
| 13. | <u>C</u> | 53. | <u>B</u> |
| 14. | <u>C</u> | 54. | <u>C</u> |
| 15. | <u>D</u> | 55. | <u>D</u> |
| 16. | <u>B</u> | 56. | <u>B</u> |
| 17. | <u>D</u> | 57. | <u>C</u> |
| 18. | <u>D</u> | 58. | <u>B</u> |
| 19. | <u>D</u> | 59. | <u>C</u> |
| 20. | <u>B</u> | 60. | <u>D</u> |
| 21. | <u>D</u> | 61. | <u>B</u> |
| 22. | <u>C</u> | 62. | <u>A</u> |
| 23. | <u>D</u> | 63. | <u>B</u> |
| 24. | <u>D</u> | 64. | <u>A</u> |
| 25. | <u>C</u> | 65. | <u>D</u> |
| 26. | <u>A</u> | 66. | <u>A</u> |
| 27. | <u>A</u> | 67. | <u>A</u> |
| 28. | <u>C</u> | 68. | <u>A</u> |
| 29. | <u>C</u> | 69. | <u>A</u> |
| 30. | <u>A</u> | 70. | <u>C</u> |
| 31. | <u>B</u> |     |          |
| 32. | <u>C</u> |     |          |
| 33. | <u>C</u> |     |          |
| 34. | <u>D</u> |     |          |
| 35. | <u>C</u> |     |          |
| 36. | <u>A</u> |     |          |
| 37. | <u>B</u> |     |          |
| 38. | <u>C</u> |     |          |
| 39. | <u>B</u> |     |          |
| 40. | <u>D</u> |     |          |
-