Directions: Please choose the best answer choice for each of the following questions.

1. Cytochrome c is a protein found in all organisms that respire aerobically. Studies on the cytochrome c of monkeys, cows, and fish revealed that the cytochrome c of monkeys was more similar to that of cows than that of fish. Which of these BEST describes how these species are related based on the cytochrome c studies?

   A. It indicates that there is no relationship between different species.

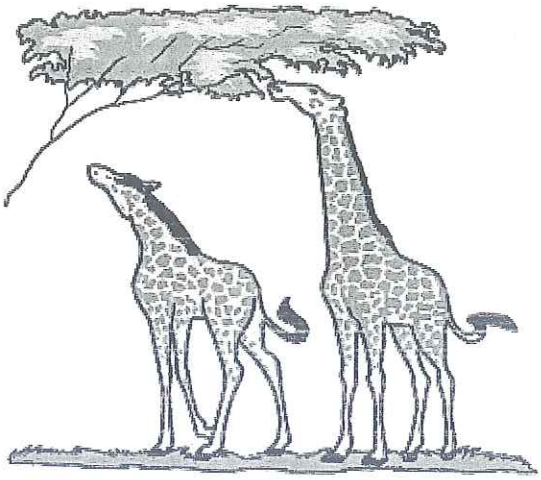
   B. It suggests that all of the organisms share a recent common ancestor.

   C. It suggests that monkeys and cows share a more recent common ancestor.

   D. It proves that an evolutionary relationship is nonexistent between monkeys and fish.

Cytochrome c lab WS

2. Jean Baptiste Lamarck and Charles Darwin disagreed on the idea of how giraffes acquired their long necks and passed them on to their offspring. The diagram below illustrates what Lamarck believed was the force behind the development of giraffes' long necks.



Which statement best represents what Lamarck thought happened?

   A. A short-necked giraffe stretches to reach food, causing a long neck to develop and to be passed to the offspring.

   B. For each generation, predators are able to catch and eat all of the short-necked giraffes before they can reproduce.

   C. Giraffes born with long necks will chase short-necked giraffes away from their habitat so they eat less and produce fewer offspring.

   D. Giraffes with short necks are more prone to disease than those with longer necks, and only long-necked giraffes live to reproduce.

Go on to the next page »

3. The table below summarizes the number of differences in amino acids between humans and four other species.

Amino Acid Differences Between Species

Species	Amino Acid Differences
Humans and Species 1	1
Humans and Species 2	13
Humans and Species 3	21
Humans and Species 4	51

Which conclusion would be the BEST to make based on these data?

A. Species 1 is most closely related to humans.

B. Species 2 is most closely related to humans.

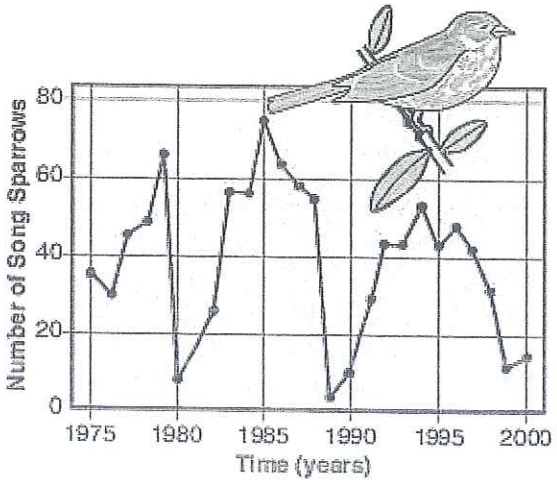
C. Species 2 is most closely related to species 4.

D. Species 3 is most closely related to species 4.

Survival based upon Variation

4. A population of song sparrows is periodically reduced by environmental changes as shown in the graph below.

A Population of Song Sparrows During a 25-Year Period



Which of these descriptions MOST LIKELY explains how the species survives such drastic reductions in the population?

A. Lack of mutation creates a population with no genetic variation.

B. Some individual birds survive by evolving to the environmental changes.

C. Genetic diversity within the bird population allows enough birds to survive and reproduce.

D. A low migration rate after hard winters keeps members of the same species in the area to increase mating efficiency.

5. Which statement BEST describes how the study of fossil evidence supports the theory of evolution?

A. Fossils show that animals have always existed on Earth.

B. Fossils provide consistent evidence of descent with modification.

C. Fossils help to determine the biochemical relatedness of all species.

D. Fossils prove that organisms that lived a long time ago can also live today.

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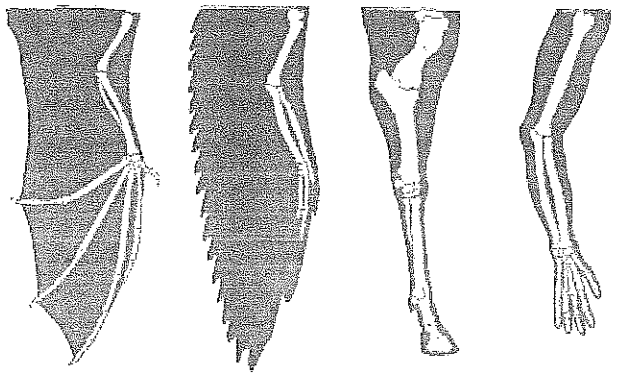
6. A scientist discovers an organism that is an absorptive heterotroph and has chitin in its cell walls. Into which kingdom should the scientist classify the organism?

   A. Animalia
   B. Eubacteria
   C. Fungi
   D. Plantae

7. The diagram below shows the forelimb structure of four organisms.



Organism 1 Organism 2 Organism 3 Organism 4

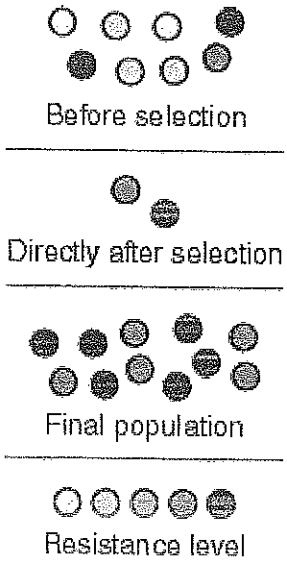
What can MOST LIKELY be inferred from the diagram?

   A. All four organisms are related to each other as they share analogous structures.
   B. Organism 3 is not related to the other organisms as it has a reduced number of bones.
   C. Organisms 3 and 4 are not related to Organisms 1 and 2 as they are not used for flying.
   D. All four organisms are related to each other as they share the same homologous structure evolved from a common ancestor.

8. Anna is preparing a presentation comparing the structures and evolutionary history of eukaryotes and prokaryotes. Which statement would be BEST for Anna to include in her presentation?

   A. Eukaryotes are more simple and are thought to have evolved from prokaryotes.
   B. Prokaryotes are more simple and are thought to have evolved from eukaryotes.
   C. Eukaryotes are more complex and are thought to have evolved from prokaryotes.
   D. Prokaryotes are more complex and are thought to have evolved from eukaryotes.

9. A scientist is studying the effect of a new antibiotic on a population of Staphylococcus aureus. He subjects the bacteria to the antibiotic over three days and observes the following pattern.



Which statement BEST describes what occurred to the bacteria as a result of natural selection?

   A. Individual bacteria changes genes to adapt to the antibiotic environment.
   B. Within one generation, there is successful reproduction of resistant bacteria.
   C. More antibiotic resistance emerges due to the surviving bacterial reproduction.
   D. Bacteria use other environmental resources to increase their survival with antibiotics.

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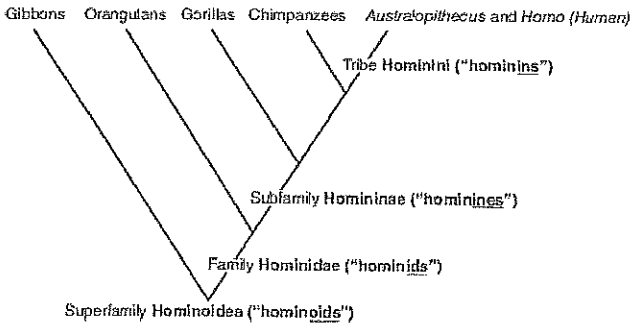
10. The cladogram below shows the hypothetical evolution that led to modern humans.



Based on the diagram, which is true?

A. Chimpanzees are most closely related to humans.

B. Gibbons are most closely related to humans.

C. All organisms shown are hominines.

D. Most of the organisms are hominins.

11. The modern theory of the mechanism of evolution differs from Darwinism in some aspects. Which aspect describes how the modern theory differs from Darwinism?

A. The modern theory recognizes only natural selection as the mechanism of evolution.

B. The modern theory recognizes only random genetic drift as the mechanism of evolution.

C. The modern theory explains that characteristics are not inherited as the distinct bodies called genes.

D. The modern theory explains that speciation is usually because of the gradual accumulation of small genetic changes.

12. The table below shows base sequences for a certain gene in five different species.

Species	Base Sequence
X	TTA CAA CCG GGG TGC
A	TTA CAA CCG GCG TGC
B	TAT CTA CCG GCG TGC
C	TTA CTA CCG GCG TGC
D	TAT CTA CCG GCC TGC

According to these data, which species is MOST closely related to Species X?

A. Species A

B. Species B

C. Species C

D. Species D

13. Human blood contains the protein hemoglobin, which carries oxygen. Scientists have also found hemoglobin in almost every living multicellular organism. The molecule varies slightly among different groups of organisms, with closely related species having very similar hemoglobin molecules. Which concept does the study of hemoglobin support?

A. Biochemical evidence supports the theory of evolution.

B. Fossil evidence is the only support for the theory of evolution.

C. Living organisms have molecules in common due to random chance.

D. Biochemical evidence cannot be used to determine if organisms are related.

14. A marine biologist is studying several species of fish. Which type of molecule would be BEST to use to compare the evolutionary relationships among the different species of fish?

A. protein

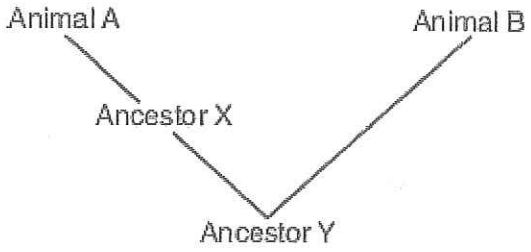
B. nucleic acid

C. carbohydrate

D. phospholipid

Go on to the next page »

15. The phylogenetic tree below shows the evolutionary relationship among two modern animal species and two ancestors of modern animals.



Which conclusion can be inferred from the diagram?

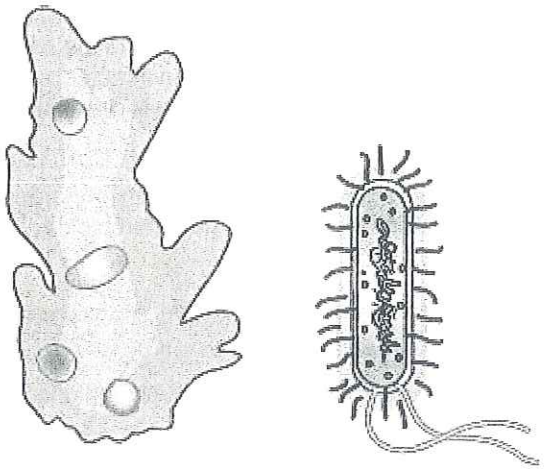
A. Animal A has more genes in common with Animal B than with Ancestor X.

B. Animal A has more genes in common with Animal B than with Ancestor Y.

C. Animal A has more genes in common with Ancestor Y than with Ancestor X.

D. Animal A has more genes in common with Ancestor X than with Ancestor Y.

16. The cells of two organisms belonging to two different kingdoms are shown below.



Cell 1 Cell 2

Which statement BEST relates these cells to the kingdom to which they belong?

2 A. Cell 1 lacks a cell wall and therefore belongs to the Kingdom Animalia, while Cell 2 contains a rigid cell wall and therefore belongs to the Kingdom Plantae.

8 B. Cell 1 has a nucleus enclosing the cell's genetic material and therefore belongs to the Kingdom Protista, while Cell 2 lacks a nucleus and therefore belongs to the Kingdom Eubacteria.

2 C. Cell 1 contains mitochondria that breaks down food and therefore belongs to the Kingdom Animalia, while Cell 2 lacks mitochondria and therefore belongs to the Kingdom Plantae.

D. Cell 1 lacks internal organelles and therefore belongs to the Kingdom Protista, while Cell 2 contains all the internal organelles and therefore belongs to the Kingdom Achaebacteria.

10/22 prokaryote

17. Tuberculosis, a disease caused by bacteria, occurs worldwide but most commonly in developing countries. It is potentially lethal. Researchers have discovered several distinct strains of tuberculosis bacteria. However, only 30% of people exposed to the bacteria show evidence of infection. Of those infected, only 10% become ill. Those who become ill can be treated with antibiotics.

Which of these statements is *most likely* the greatest concern scientists have about the tuberculosis bacteria?

A. The bacteria will stop mutating.

B. The bacteria will mutate into a type of virus.

C. A strain of the bacteria could evolve that would be resistant to all drugs.

D. The bacteria will become more infectious by producing their own antibodies.

18. A scientist observes that when a pesticide is continuously used to kill insects, the pesticide becomes less effective over a period of time. Which statement BEST explains why some insects are able to survive the use of pesticides?

A. Some individuals are able to successfully mate numerous times before dying.

B. Selective individuals choose mates based on the survivability of their genetic traits.

C. Successful individuals mate randomly to develop biological resistance in the population.

D. Some individuals with more favorable genetic traits due to random mutations are able to reproduce.

19. There were two types of peppered moths in Manchester, England. One type of moth was darker than the other, but they were the same species. Pollution during the industrial revolution darkened the tree bark. Eventually there were far more dark moths than light moths.

What is the *most likely* reason for the increased number of dark moths?

A. The lighter moths hatched only where tree bark was light in color.

B. The darker color was advantageous, so the lighter moths changed color over time.

C. The lighter moths selected darker moths to mate with so that offspring would be dark.

D. The darker moths survived and reproduced in greater numbers because they were camouflaged from predators.

20. The various species of finches found in the Galapagos Islands evolved with beaks of different sizes and shapes.

Different Species of Finches

Which factor MOST LIKELY led to these variations in the species of finches?

A. The species of finches adapted to a variety of feeding conditions.

B. The species of finches lived in regions with different temperatures.

C. The species of finches mated with a variety of other bird species in different regions.

D. The species of finches adapted to protect themselves from predators of different sizes.

21. A species of organism is in an environment undergoing change. Which of these would MOST help a species to adapt to the changes through natural selection?

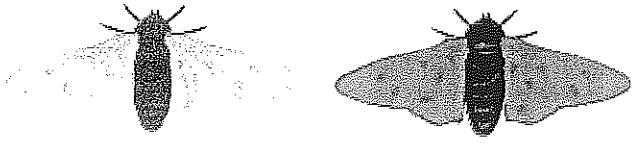
A. a low birthrate

B. a diverse gene pool

C. a very specific niche

D. a long generation time

22. Before increased carbon dioxide emissions, the peppered moth found in a certain area of Great Britain was white in color. Over time, this peppered moth became darker gray, as shown below.



Very few white peppered moths now exist in this area. Which of these MOST LIKELY contributed to the change in color of this peppered moth?

A. variation and increased mating

B. mutation and selective breeding

C. adaptation and natural selection

D. selective breeding and adaptation

Go on to the next page »

23. A population of rabbits lives in a field, where it is preyed upon by foxes. Which of the following would select for rabbits that have the adaptation to run away from the foxes more quickly?

A. Rabbits who can run faster live longer and are able to pass on their fast-running trait to offspring.

B. Some rabbits eat higher-energy food, allowing them to run faster and produce faster-running offspring.

C. A population of rabbits gains access to more field space in which to run, and the offspring learn to run faster in the larger area.

D. The need to outrun the foxes causes some rabbits to become faster runners, who then survive to pass down their new fast-running trait to offspring.

24. Which is the BEST example of natural selection?

A. A heat wave kills most E. coli strains, although some strains survive and multiply.

B. An individual organism changes its genes to be better adapted to the environment.

C. Dairy farmers breed cattle to have an inherited trait that makes them produce more milk.

D. In one generation, green crickets have increased survival rates compared to brown crickets.

25. Natural selection acts

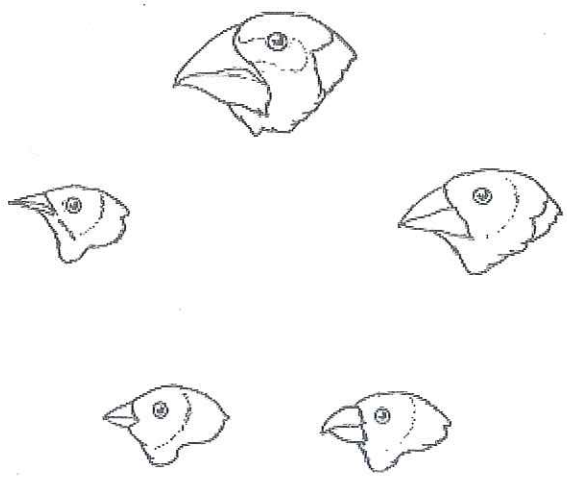
A. on all mutations.

B. only on recessive alleles.

C. on phenotypes that are expressed.

D. only on heterozygous genotypes.

26. The diagrams below show five different species of birds that each live on a different island.



Which of these BEST explains why each island's native bird has a beak with a unique shape?

A. Each island attracts new populations of birds of one particular beak type from all over the world.

B. Each island's unique set of conditions selects for a beak shape that is best suited for survival on that island.

C. Birds with different beaks are randomly distributed throughout the islands and survive unchanged over many generations.

D. Birds with different beaks come to an island, whose unique set of conditions causes their beaks to change within their lifetimes.

27. Which statement BEST describes a species that is changing due to natural selection?

A. All individuals are equally adapted for survival.

B. The species produces fewer offspring than the environment can support.

C. The genetic information in each individual can change throughout its life span.

D. Some individuals are better adapted to their environment and successfully reproduce as a result of inherited traits.

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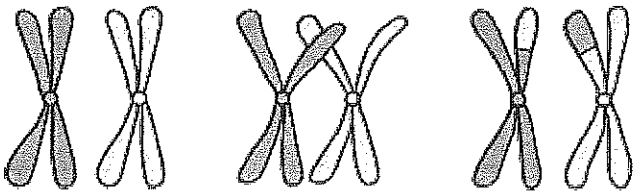
28. The diagram below shows an interaction occurring between two homologous chromosomes.



What is the term given to this interaction?

A. conjugation

B. mitosis

C. crossing over

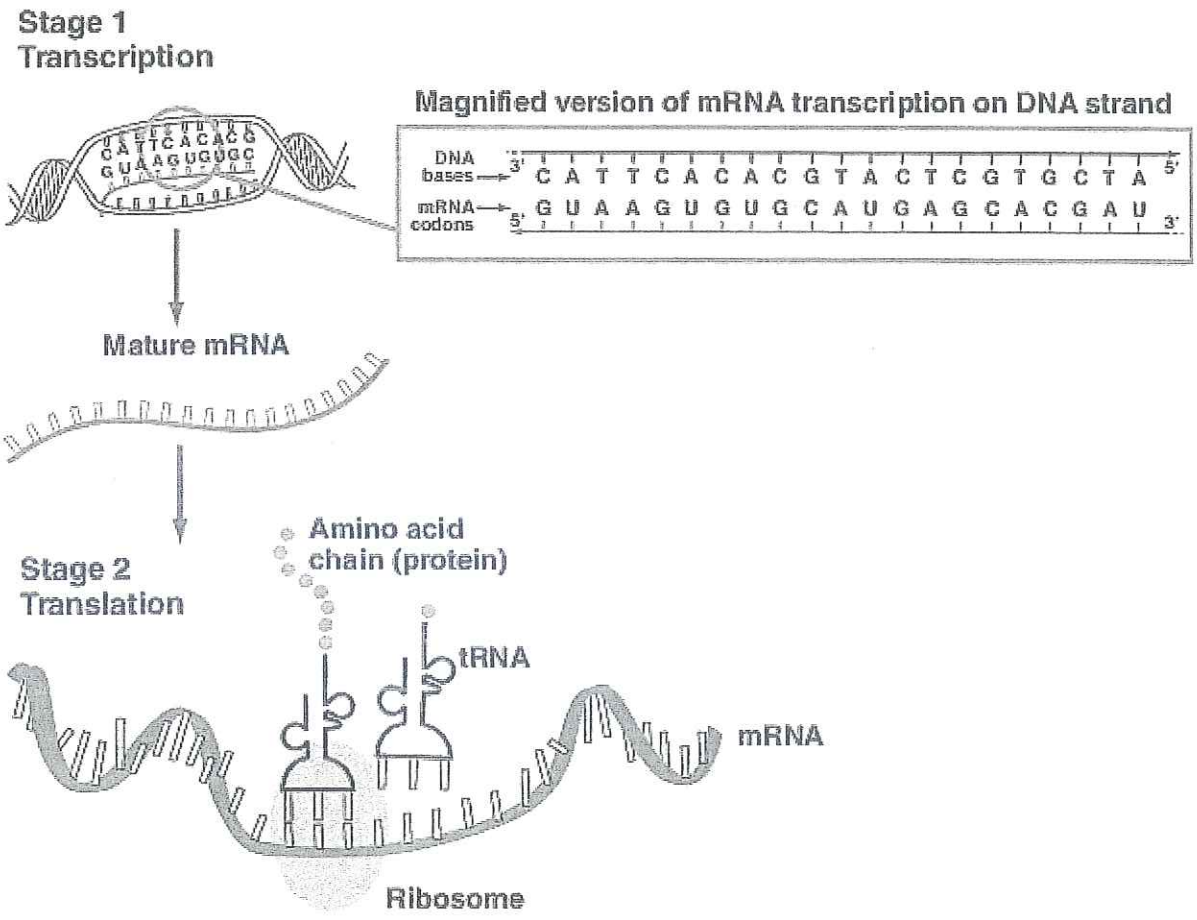
D. transcription

Go on to the next page »

Directions: Review the content below and answer the questions that follow

Protein Synthesis

Traits in DNA are expressed through the process of protein synthesis, several stages of which are shown below. The expression of traits in DNA can be affected by external agents, such as chemicals or high-energy radiation.



29. Which of these MOST LIKELY would occur as a result of a deletion in the third base of the original DNA code?

A. A mutation would occur because the amino acid sequence changes from the third base, C, to the end.

B. A mutation would occur because the third base, T, of the second code pairs with its adjacent base, C.

C. The third base, A, on the mRNA codon would be deleted and cause the abnormal functioning of proteins.

D. The proteins would not function normally because the amino acid sequence changes from the third base, T, to the end.

30. Which of these MOST LIKELY would occur if cytosine (C) was inserted at the fourth base of the original DNA code?

A. The fourth base on the DNA code, T, would be replaced by the inserted base, C, causing a mutation in the gene.

B. The fourth base, A, on the mRNA codon would complement the inserted cytosine, C, causing a mutation in the gene.

C. The amino acids formed from the fourth base onward would be identical, causing the appearance of a new trait in the organism.

D. The amino acid sequence would change, starting from the fourth base onward, causing the proteins made by the gene to function improperly.

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31. What MOST LIKELY would happen if the eleventh DNA base, thymine (T), of the original DNA code was substituted by the base guanine (G)?

A. A mutation would occur, as an altered codon at the point of substitution would alter the amino acid histamine.

B. The appearance of a new trait would occur, as the entire amino acid sequence would be substituted by new amino acids.

C. Guanine on the DNA code at the point of substitution would complement adenine on the mRNA codon, causing a mutation.

D. The amino acid sequence would change from the point of substitution onward, causing the abnormal functioning of protein.

Go on to the next page »

Directions: Please choose the best answer choice for each of the following questions.

32. How could a substitution of a single base in a chromosome cause a cell to produce mutant forms of a protein?

A. The base is located within a non-coding section of DNA.

B. The substitution causes a frameshift mutation, which changes all codons that follow it.

C. The new codon codes form a different amino acid and change the shape of the resulting protein.

D. The substitution changes the codon to one that codes for the same amino acid as the original codon.

33. Which statement is a major concern related to radioactivity?

A. It is unable to provide a usable source of energy.

B. It is unable to occur naturally in the environment.

C. It can cause DNA mutations in living organisms.

D. It can change the rate at which organisms evolve.

34. A plant breeder crosses a hybrid yellow dominant seed plant with a pure green recessive seed plant. He uses the Punnett square below to predict the results of this cross.

	Y	y
y	Yy	yy
y	Yy	yy

Which percentage of offspring MOST LIKELY will be pure green seed plants?

A. 0%

B. 25%

C. 50%

D. 75%

35. The table below shows the genetic code used to translate RNA sequences into amino acid sequences.

Genetic Code

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

The figure below shows the first 10 nucleic acids in a strand of RNA.

A U G A A G G C G C . . .

Position 6

Below are some possible mutations at position 6 of the given strand. Which mutation would not change the amino acid sequence of the resulting protein?

A. if G is deleted

B. if G is changed to A

C. if G is changed to C

D. if an extra G is inserted

36. Two pink-flowering plants are crossed. The offspring that result have the following ratio of flower colors: 1 red : 2 pink : 1 white. What pattern of inheritance does this trait in plants follow?

A. dominance

B. multiple alleles

C. incomplete dominance

D. polygenic traits

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37. During DNA replication, a complementary strand of DNA is made for each original strand. If the original strand is TCTAGCC, then new strand will be

A. GTGCATG.

B. AGAUTAC.

C. AGAUCGC.

D. AGATCGG.

38. What is the general pathway by which proteins are synthesized?

A. DNA --> mRNA --> tRNA --> protein

B. mRNA --> DNA --> rRNA --> protein

C. rRNA --> tRNA --> mRNA --> protein

D. tRNA --> rRNA --> mRNA --> protein

39. What is the function of a transfer RNA molecule?

A. to move genetic information from the nucleus to the cytoplasm

B. to move a completed protein from the ribosome to the cell membrane

C. to match one mRNA codon to one amino acid during protein synthesis

D. to cut out extra information from mRNA strands before they are translated into proteins

40. How are proteins synthesized within cells?

A. A DNA sequence in the nucleus is transcribed into mRNA, which is then transported to the ribosomes, where it is translated into proteins.

B. A DNA sequence in the nucleus is transcribed into mRNA, which is then transported to the smooth endoplasmic reticulum, where it is translated into proteins.

C. An mRNA sequence in the ribosomes is transcribed into DNA, which is then transported to the nucleus, where it is translated into proteins.

D. An mRNA sequence in the lysosomes is transcribed into DNA, which is then transported to the ribosomes, where it is translated into proteins.

41. The DNA code AAAGAAGTC transcribes into which code of mRNA?

A. UUUCUUCAG

B. AAAGAAGUC

C. CCCTCCTGA

D. GGGAGGACT

42. The Punnett Square below shows the potential outcome of a mating between two heterozygous black guinea pigs (Bb).

	B	b
B	BB	Bb
b	Bb	bb

Which of these does the Punnett Square demonstrate?

A. the role of mitosis in inheritance

B. the role of meiosis in inheritance

C. a mutation taking place in the animal

D. Mendel's law of independent assortment

43. When roan cattle are mated, 25% of the offspring are red, 50% are roan and 25% are white. Upon examination, it can be see that the coat of a roan cow consists of both red and w hite hairs. This trait is one contralled by

A. multiple alleles

B. co-dominant alleles

C. sex-linked genes

D. polygenic inheritance

44. Refinement in recombinant DNA techniques has created new treatments for patients with genetic disorders. How does DNA technology help treat diseases caused by having a defective gene?

A. by replacing the patient's defective gene with one from a healthy person

B. by inserting similar genes from bacteria into patients with defective genes

C. by altering the defective gene inside the patient with the help of high-energy radiation

D. by inserting genes from humans into bacteria and later injecting patients with proteins produced by the bacteria.

Go on to the next page »

45. A type of corn was genetically engineered to be resistant to a herbicide. How was the resistant corn *most likely* created?

A. A fertilizer resistant to the herbicide was applied to the corn.

B. Antigens resistant to the herbicide were introduced into the corn.

C. Chemicals were used to produce mutated corn DNA that results in herbicide resistance.

D. A gene that results in herbicide resistance was found in another organism and transferred into the corn's DNA.

46. Which characteristic distinguishes bacteria from protists, fungi, plants, and animals?

A. They are nonmotile.

B. They are unicellular.

C. They are autotrophic.

D. They are prokaryotic.

47. Although Darwin's theory of natural selection was universally accepted, objections and criticisms were raised against Darwinism, leading to the development of a modern theory. Which criticism led to the development of this new theory?

A. The existence of useful variations was not described.

B. The struggle for existence of organisms was not explained.

C. The mechanism for the variations was not described.

D. The progressive improvement of the existing organisms was not explained.

48. A woman is homozygous for Type A blood. A man has Type AB blood. What is the probability that this couple could produce a child with Type B blood?

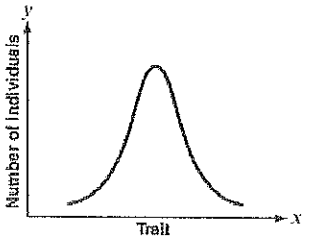
A. 0%

B. 25%

C. 75%

D. 100%

49. Flooding in an area has caused a river to be rerouted. A local population of butterflies became separated on either side of the new river path. The graph in figure (I) represents the data collected before the flood and indicates that the majority of the butterflies are of the same particular trait, as shown by the peak in the middle of the curve. The graph in figure (II) represents the data collected after the flood and indicates that two populations of butterflies exist, each with a different trait present in the majority of the butterflies.



Which of these is the MOST LIKELY conclusion based on the data in the graphs?

A. The population of insects decreased as the organisms on either side of the river were not able to interbreed.

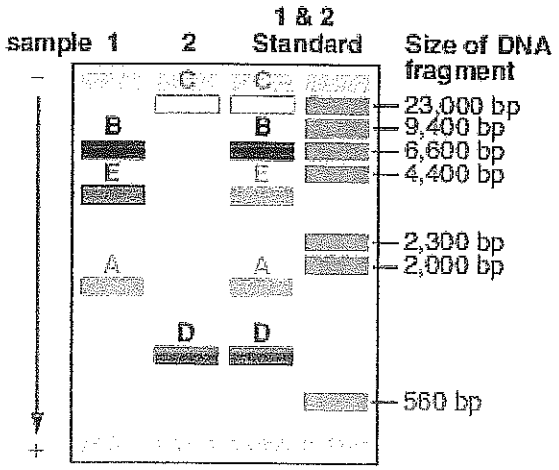
B. The change in the habitat caused mutations in the insect DNA, causing them to develop different traits.

C. Interbreeding between two new populations of insects on both sides of the river occurred, resulting in offspring with new traits.

D. Geographic isolation of the two new insect populations prevented interbreeding, resulting in the development of two separate species of insects.

Go on to the next page »

50. A forensic scientist uses gel electrophoresis to compare two samples of DNA. Chemicals of the same size form bars in the same places on the gel. Sample 1 comes from a crime scene, and sample 2 comes from a suspect. The results are shown in the diagram below.



Based on the diagram, what conclusion can the forensic scientist make?

A. The results were inconclusive.

B. Sample 1 came from the suspect.

C. Sample 1 is different from the suspect.

D. Both samples were contaminated with other chemicals.

51. The table below shows the genetic code. Below the table is a section of mRNA.

Genetic Code

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

Section of mRNA

G U C C A A A C G

Based on the information in the table, which of these amino acid sequences is coded for by the mRNA section?

A. Val-Gln-Thr

B. Cys-Thr-Gln

C. Phe-Ser-Tyr

D. Val-Pro-Asn

Stop! You have finished this exam.