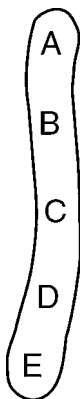


Genetics 3-star Test

Name: _____

Date: _____

1. The letters in the accompanying diagram represent genes on a particular chromosome.



Gene *B* contains the code for an enzyme that cannot be synthesized unless gene *A* is also active. Which statement best explains why this can occur?

- A. A hereditary trait can be determined by more than one gene.
- B. Genes are made up of double-stranded segments of DNA.
- C. All the genes on a chromosome act to produce a single trait.
- D. The first gene on each chromosome controls all the other genes on the chromosome.

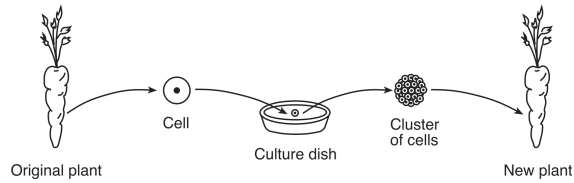
2. At warm temperatures, a certain bread mold can often be seen growing on bread as a dark-colored mass. The same bread mold growing on bread in a cooler environment is red in color. Which statement most accurately describes why this change in the color of the bread mold occurs?

- A. Gene expression can be modified by interactions with the environment.
- B. Every organism has a different set of coded instructions.
- C. The DNA was altered in response to an environmental condition.
- D. There is no replication of genetic material in the cooler environment.

3. As male children get older, some begin to closely resemble their fathers and have no resemblance to their mothers. Which statement best explains this observation?

- A. Several sperm fertilized the egg, so the fertilized egg contained more genes from their father.
- B. More genes are inherited from the sperm cell of their father than from the egg cell of their mother, so most traits will be like those of their father.
- C. More genes from their father are expressed in traits that can be seen, and more genes from their mother are expressed in traits that cannot be seen, such as blood type or enzyme function.
- D. Genes from their father are stronger than genes from their mother, so the genes from their mother are not expressed.

4. The diagram below represents the cloning of a carrot plant.



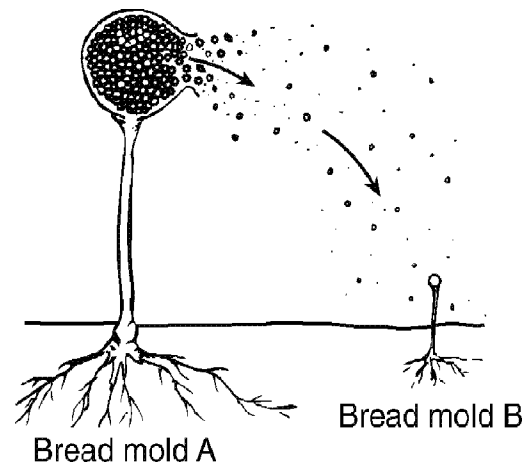
Compared to each cell of the original carrot plant, each cell of the new plant will have

- A. the same number of chromosomes and the same types of genes
- B. the same number of chromosomes, but different types of genes
- C. half the number of chromosomes and the same types of genes
- D. half the number of chromosomes, but different types of genes
5. To determine the identity of their biological parents, adopted children sometimes request DNA tests. These tests involve comparing DNA samples from the child to DNA samples taken from the likely parents. Possible relationships may be determined from these tests because the
- A. base sequence of the father determines the base sequence of the offspring
- B. DNA of parents and their offspring is more similar than the DNA of nonfamily members
- C. position of the genes on each chromosome is unique to each family
- D. mutation rate is the same in closely related individuals

6. People with cystic fibrosis inherit defective genetic information and cannot produce normal CFTR proteins. Scientists have used gene therapy to insert normal DNA segments that code for the missing CFTR protein into the lung cells of people with cystic fibrosis. Which statement does *not* describe a result of this therapy?

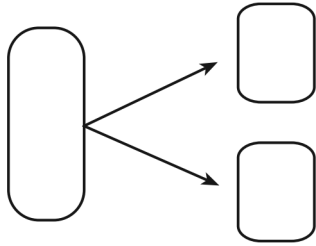
- A. Altered lung cells can produce the normal CFTR protein.
- B. Altered lung cells can divide to produce other lung cells with the normal CFTR gene.
- C. The normal CFTR gene may be expressed in altered lung cells.
- D. Offspring of someone with altered lung cells will inherit the normal CFTR gene.

7. The diagram below illustrates asexual reproduction in bread mold. Reproductive structures known as spores were released from bread mold A. One of these spores developed into bread mold B.



State how the genetic information in the nuclei of cells in bread mold B compares to the genetic information in the nuclei of cells in bread mold A.

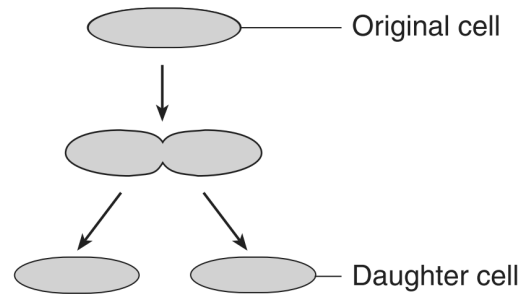
8. An antibiotic is effective in killing 95% of a population of bacteria that reproduce by the process shown below.



Which statement best describes future generations of these bacteria?

- A. They will be produced by asexual reproduction and will be more resistant to the antibiotic.
- B. They will be produced by sexual reproduction and will be more resistant to the antibiotic.
- C. They will be produced by asexual reproduction and will be just as susceptible to the antibiotic.
- D. They will be produced by sexual reproduction and will be just as susceptible to the antibiotic.

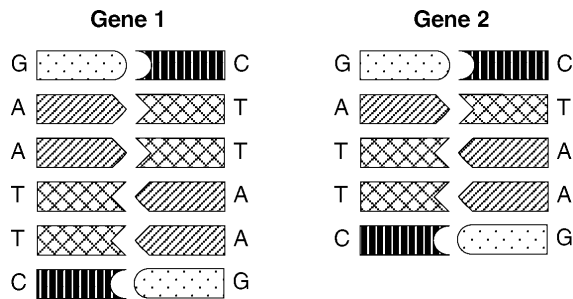
9. The diagram below represents division of a cell that produces two daughter cells.



Which statement most likely describes the daughter cells produced?

- A. The daughter cells will pass on only half of the genetic information they received from the original cell.
- B. The daughter cells will each produce offspring that will have the same genetic information as the original cell.
- C. The daughter cells will each undergo the same mutations as the original cell after reproduction has occurred.
- D. The daughter cells will not pass on any of the genes that they received from the original cell.

10. The accompanying diagrams represent portions of the genes that code for wing structure in two organisms of the same species. Gene 1 was taken from the cells of a female with normal wings, and gene 2 was taken from the cells of a female with abnormal wings.



The abnormal wing structure was most likely due to

- | | |
|-----------------|-----------------------|
| A. an insertion | B. a substitution |
| C. a deletion | D. normal replication |

11. Base your answer(s) to the following question(s) on the passage and on your knowledge of biology.

The number in the parenthesis () at the end of a sentence is used to identify that sentence.

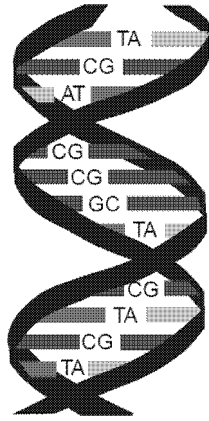
They Sure Do Look Like Dinosaurs

When making movies about dinosaurs, film producers often use ordinary lizards and enlarge their images thousands of times (1). We all know, however, that while they look like dinosaurs and are related to dinosaurs, lizards are not actually dinosaurs (2).

Recently, some scientists have developed a hypothesis that challenges this view (3). These scientists believe that some dinosaurs were actually the same species as some modern lizards that had grown to unbelievable sizes (4). They think that such growth might be due to a special type of DNA called repetitive DNA, often referred to as “junk” DNA because scientists do not understand its functions (5). These scientists studied pumpkins that can reach sizes of nearly 1,000 pounds and found them to contain large amounts of repetitive DNA (6). Other pumpkins that grow to only a few ounces in weight have very little of this kind of DNA (7). In addition, cells that reproduce uncontrollably have almost always been found to contain large amounts of this type of DNA (8).

State *one* reason why scientists formerly thought of repetitive DNA as “junk.”

12. The type of molecule represented is found in organisms.



Which statement correctly describes the sequence of bases found in this type of molecule?

- A. It changes every time it replicates.
- B. It determines the characteristics that will be inherited.
- C. It is exactly the same in all organisms.
- D. It directly controls the synthesis of starch within a cell.

13. Base your answer(s) to the following question(s) on the passage and on your knowledge of biology.

The number in the parenthesis () at the end of a sentence is used to identify that sentence.

They Sure Do Look Like Dinosaurs

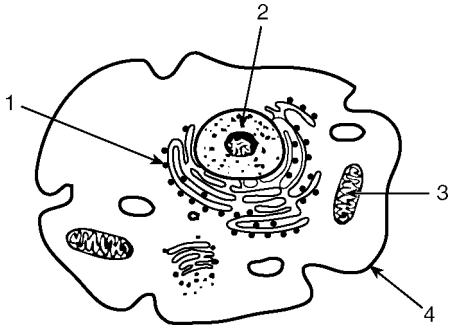
When making movies about dinosaurs, film producers often use ordinary lizards and enlarge their images thousands of times (1). We all know, however, that while they look like dinosaurs and are related to dinosaurs, lizards are not actually dinosaurs (2).

Recently, some scientists have developed a hypothesis that challenges this view (3). These scientists believe that some dinosaurs were actually the same species as some modern lizards that had grown to unbelievable sizes (4). They think that such growth might be due to a special type of DNA called repetitive DNA, often referred to as “junk” DNA because scientists do not understand its functions (5). These scientists studied pumpkins that can reach sizes of nearly 1,000 pounds and found them to contain large amounts of repetitive DNA (6). Other pumpkins that grow to only a few ounces in weight have very little of this kind of DNA (7). In addition, cells that reproduce uncontrollably have almost always been found to contain large amounts of this type of DNA (8).

Which kind of cells would most likely contain large amounts of repetitive DNA?

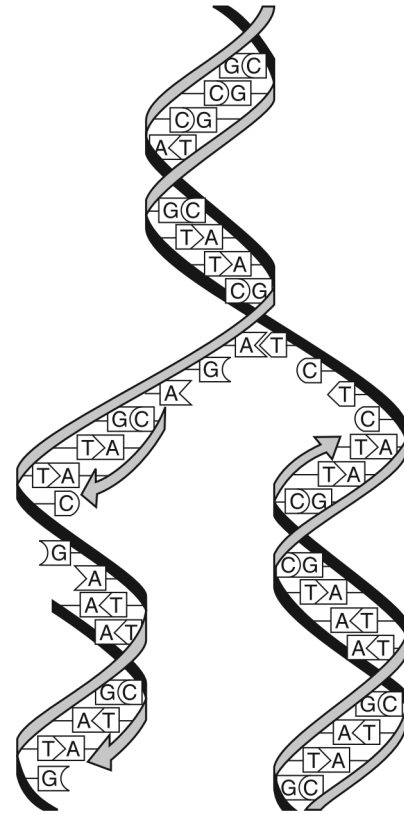
- A. red blood cells
- B. cancer cells
- C. nerve cells
- D. cells that are unable to reproduce

14. Base your answer(s) to the following question(s) on the diagram of a cell below.



Describe how structures 1 and 2 interact in the process of protein synthesis.

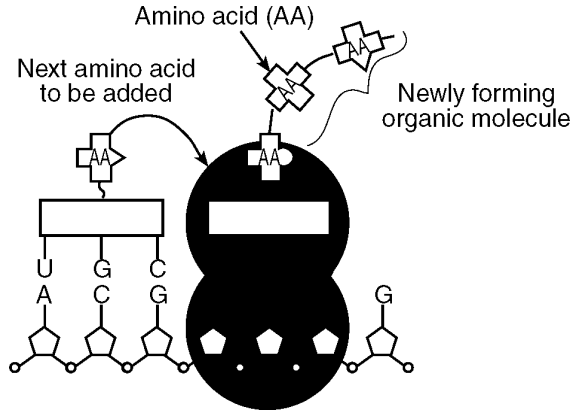
15. The process represented in the diagram below occurs in many cells.



The main function of this process is to

- A. provide an exact copy of the genetic code
- B. ensure genetic variation in a species
- C. synthesize cellular proteins
- D. produce antibodies to combat disease

16. The accompanying diagram represents a process that occurs within a cell in the human pancreas.



This process is known as

- A. digestion by enzymes
- B. protein synthesis
- C. energy production
- D. replication of DNA

17. Base your answer(s) to the following question(s) on the information below and on your knowledge of biology.

Mutations are often referred to as the “raw materials” of evolution.

State one reason that mutations are often referred to as the “raw materials” of evolution.

18. Base your answer to the following question on the portion of the mRNA codon chart and information below.

AUU } AUC } AUA }	ILE (Isoleucine)	ACU } ACC } ACA }	THR (Threonine)	AAU } AAC } AAA }	ASN (Asparagine)	AGU } AGC }	SER (Serine)
AUG }	MET (Methionine)	ACG }		AAG }	LYS (Lysine)	AGA } AGG }	ARG (Arginine)

Series I represents three mRNA codons. Series II includes a mutation of series I.

Series I AGAUCGAGU

Series II ACAUCGAGU

How would the amino acid sequence produced by the mutant strand (series II) compare to the amino acid sequence produced by series I?

- A. The amino acid sequence would be shorter.
- B. One amino acid in the sequence would change.
- C. The amino acid sequence would remain unchanged.
- D. More than one amino acid in the sequence would change.

19. A characteristic of mutations is that they usually

- A. are caused only by the events of mitosis
- B. do not occur at random
- C. result in different genetic sequences
- D. occur to meet the needs of a species

20. Base your answer(s) to the following question(s) on the Universal Genetic Code Chart below and on your knowledge of biology. Some DNA, RNA, and amino acid information from the analysis of a gene present in five different species is shown in the chart on the next page.

Universal Genetic Code Chart
 Messenger RNA Codons and Amino Acids for Which They Code

		Second base				
		U	C	A	G	
F i r s t b a s e	U	UUU } PHE UUC } UUA } LEU UUG }	UCU } UCC } SER UCA } UCG }	UAU } TYR UAC } UAA } STOP UAG }	UGU } CYS UGC } UGA } STOP UGG } TRP	U C A G
	C	CUU } CUC } LEU CUA } CUG }	CCU } CCC } PRO CCA } CCG }	CAU } HIS CAC } CAA } GLN CAG }	CGU } CGC } ARG CGA } CGG }	U C A G
	A	AUU } AUC } ILE AUA } AUG } MET or START	ACU } ACC } THR ACA } ACG }	AAU } ASN AAC } AAA } LYS AAG }	AGU } SER AGC } AGA } ARG AGG }	U C A G
	G	GUU } GUC } VAL GUA } GUG }	GCU } GCC } ALA GCA } GCG }	GAU } ASP GAC } GAA } GLU GAG }	GGU } GGC } GLY GGA } GGG }	U C A G

Species A	DNA strand: TAC CGA CCT TCA mRNA strand: AUG GCU GGA AGU Amino acid sequence: _____
Species B	DNA strand: TAC TTT GCA GGA mRNA strand: _____ Amino acid sequence: MET LYS ARG PRO
Species C	DNA strand: _____ mRNA strand: AUG UUU UGU CCC Amino acid sequence: MET PHE CYS PRO
Species D	DNA strand: TAC GTA GTT GCA mRNA strand: AUG CAU CAA CGU Amino acid sequence: MET HIS GLN ARG
Species E	DNA strand: TAC TTC GCG GGT mRNA strand: AUG AAG CGC CCA Amino acid sequence: MET LYS ARG PRO

Using the Universal Genetic Code Chart, fill in the missing amino acids in the amino acid sequence for species A in the chart provided.

21. The way a protein molecule is folded determines the shape of the molecule, which determines the
- function of that protein
 - structure of ATP containing that protein
 - type of simple sugars in that protein
 - amino acids in that protein

22. Base your answer(s) to the following question(s) on the information below and on your knowledge of biology.

Stem Cells

If skin is cut, the wound closes within days. If a leg is broken, the fracture will usually mend if the bone is set correctly. Almost all human tissue can repair itself to some extent. Much of this repair is due to the activity of stem cells. These cells resemble those of a developing embryo in their ability to reproduce repeatedly, forming exact copies of themselves. They may also form many other different kinds of cells. Stem cells in bone marrow offer a dramatic example. They can give rise to all of the structures in the blood: red blood cells, platelets, and various types of white blood cells. Other stem cells may produce the various components of the skin, liver, or intestinal lining.

The brain of an adult human can sometimes compensate for damage by making new connections among surviving nerve cells (neurons). For many years, most biologists believed that the brain could not repair itself because it lacked stem cells that would produce new neurons.

A recent discovery, however, indicates that a mature human brain does produce neurons routinely at one site, the hippocampus, an area important to memory and learning. This discovery raises the prospect that stem cells that make new neurons in one part of the brain might be found in other areas. If investigators can learn how to cause existing stem cells to produce useful numbers of functional nerve cells, it might be possible to correct a number of disorders involving damage to neurons such as Alzheimer's disease, Parkinson's disease, stroke, and brain injuries.

What is the process by which stem cells produce exact copies of themselves?

- A. cell division by mitosis
- B. cell division by meiosis
- C. sexual reproduction
- D. glucose synthesis

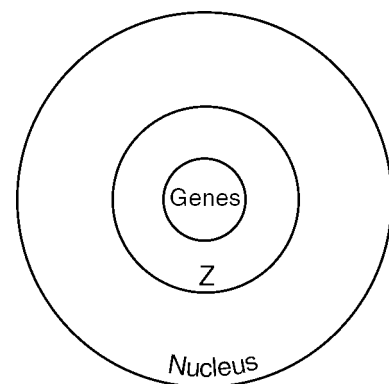
23. Although a liver cell and a muscle cell in a human developed from the same single cell, their appearance and functions are different. This is because the liver cell

- A. contains different genes than the muscle cell
- B. expresses different genes than the muscle cell
- C. destroys the muscle cell genes it contains
- D. lacks the genes found in muscle cells

24. Although all of the cells of a human develop from one fertilized egg, the human is born with many different types of cells. Which statement best explains this observation?

- A. Developing cells may express different parts of their identical genetic instructions.
- B. Mutations occur during development as a result of environmental conditions.
- C. All cells have different genetic material.
- D. Some cells develop before other cells.

25. The accompanying diagram represents the organization of genetic information within a cell nucleus.



The circle labeled Z most likely represents

- A. amino acids
- B. chromosomes
- C. vacuoles
- D. molecular bases

26. A great deal of information can now be obtained about the future health of people by examining the genetic makeup of their cells. There are concerns that this information could be used to deny an individual health insurance or employment.

These concerns best illustrate that

- A. scientific explanations depend upon evidence collected from a single source
- B. scientific inquiry involves the collection of information from a large number of sources
- C. acquiring too much knowledge in human genetics will discourage future research in that area
- D. while science provides knowledge, values are essential to making ethical decisions using this knowledge

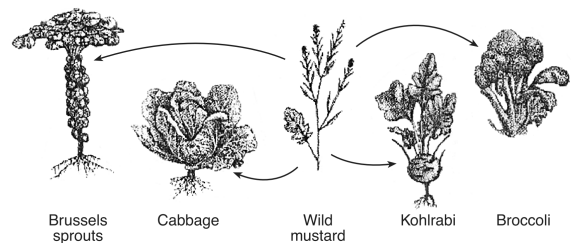
27. In an experiment, DNA from dead pathogenic bacteria was transferred into living bacteria that do not cause disease. These altered bacteria were then injected into healthy mice. These mice died of the same disease caused by the original pathogens. Based on this information, which statement would be a valid conclusion?

- A. DNA is present only in living organisms.
- B. DNA functions only in the original organism of which it was a part.
- C. DNA changes the organism receiving the injection into the original organism.
- D. DNA from a dead organism can become active in another organism.

28. In order to produce the first white marigold flower, growers began with the lightest yellow- flowered marigold plants. After crossing them, these plants produced seeds, which were planted, and only the offspring with very light- yellow flowers were used to produce the next generation. Repeating this process over many years, growers finally produced a marigold flower that is considered the first white variety of its species. This procedure is known as

- A. differentiation
- B. cloning
- C. gene insertion
- D. selective breeding

29. The arrows in the diagram below indicate the development of four different varieties of vegetable plants from wild mustard.



Each of these varieties was most likely produced as a result of

- A. asexual reproduction in the wild for many years
- B. changes in light availability
- C. competition between plants
- D. selective breeding over many generations

30. The Old English Bulldog is extinct. To produce a new English Bulldog, dogs having the desired physical features, but not the aggressive nature of the old bulldogs, were mated. The result was a bulldog that was similar in appearance to the extinct bulldog, but without its fierce nature. Which technique was most likely used to develop this new variety of dog?
- A. cloning B. inducing mutations
C. genetic engineering D. selective breeding

31. Base your answer(s) to the following question(s) on the passage and on your knowledge of biology.

Plastics Produced by Plants

Plastics are generally thought of as materials made exclusively by human technology. However, some plants and bacteria naturally make small amounts of plastics. Furthermore, unlike synthetic plastics, plastics produced by plants and bacteria break down easily in the environment. Synthetic plastics, which are produced from petroleum, are the fastest growing type of waste in the United States. Researchers are learning how to greatly increase the amount of plastic made by plants. One day farmers may grow crops of plastic-producing plants in addition to wheat and corn crops.

A researcher at the Carnegie Institution of Washington was one of the first to attempt to use plants to make plastics. He knew that a common bacterium, known as *Alcaligenes eutrophus*, naturally produced a plastic called polyhydroxybutyrate (PHB), which resembles the type of plastic used to make garbage bags.

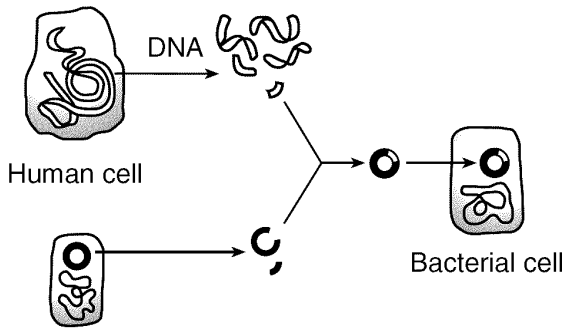
However, growing bacteria to produce plastic can be expensive. In order to determine if genetically engineered plants could make plastic, genes were isolated from *A. eutrophus* and inserted into plants. After a few tries, the researchers were able to produce healthy plastic-producing plants.

By what process were the plastic-producing plants developed?

32. A biotechnology firm has produced tobacco plants that synthesize human antibodies that prevent bacterial diseases. One of the first steps in the production of these plants required
- A. using natural selection to increase the survival of antibody-producing tobacco plants
B. inserting human DNA segments into the cells of tobacco plants
C. using selective breeding to increase the number of antibody genes in tobacco plants
D. growing tobacco plants in soil containing a specific fertilizer

33. One variety of wheat is resistant to disease. Another variety contains more nutrients of benefit to humans. Explain how a new variety of wheat with disease resistance and high nutrient value could be developed. In your answer, be sure to:
- identify *one* technique that could be used to combine disease resistance and high nutrient value in a new variety of wheat
 - describe how this technique would be carried out to produce a wheat plant with the desired characteristics
 - describe *one* specific difficulty (other than stating that it does not always work) in developing a new variety using this technique

34. The diagram below represents a common laboratory technique in molecular genetics.



Bacterial cell

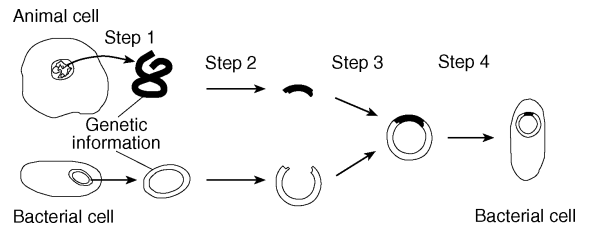
One common use of this technology is the

- A. production of a human embryo to aid women who are unable to have children
- B. change of single-celled organisms to multicellular organisms
- C. introduction of a toxic substance to kill bacterial cells
- D. production of hormones or enzymes to replace missing human body chemicals

35. The flounder is a species of fish that can live in very cold water. The fish produces an “antifreeze” protein that prevents ice crystals from forming in its blood. The DNA for this protein has been identified. An enzyme is used to cut and remove this section of flounder DNA that is then spliced into the DNA of a strawberry plant. As a result, the plant can now produce a protein that makes it more resistant to the damaging effects of frost. This process is known as

- A. sorting of genes
- B. genetic engineering
- C. recombination of chromosomes
- D. mutation by deletion of genetic material

36. Base your answer(s) to the following question(s) on the diagram below, which illustrates some steps in genetic engineering and on your knowledge of biology.



What is the result of step 3?

- A. a new type of molecular base is formed
- B. different types of minerals are joined together
- C. DNA from the bacterial cell is cloned
- D. DNA from different organisms is joined together

37. Base your answer(s) to the following question(s) on the passage below and on your knowledge of biology.

Better Rice

The production of new types of food crops will help raise the quantity of food grown by farmers. Research papers released by the National Academy of Sciences announced the development of two new superior varieties of rice—one produced by selective breeding and the other by biotechnology.

One variety of rice, called Nerica (New Rice for Africa), is already helping farmers in Africa. Nerica combines the hardiness and weed resistance of rare African rice varieties with the productivity and faster maturity of common Asian varieties.

Another variety, called Stress-Tolerant Rice, was produced by inserting a pair of bacterial genes into rice plants for the production of trehalose (a sugar). Trehalose helps plants maintain healthy cell membranes, proteins, and enzymes during environmental stress. The resulting plants survive drought, low temperatures, salty soils, and other stresses better than standard rice varieties.

Why is the production of new varieties of food crops necessary?

- A. Essential food crops are rapidly becoming extinct.
- B. Technology for producing fresh water for agriculture has improved.
- C. Burning fossil fuels has decreased agricultural areas.
- D. World population continues to increase.

38. Scientists have genetically altered a common virus so that it can destroy the most lethal type of brain tumor without harming the healthy tissue nearby. This technology is used for all of the following *except*

- A. treating the disease
- B. curing the disease
- C. controlling the disease
- D. diagnosing the disease

39. Base your answer(s) to the following question(s) on the information below and on your knowledge of biology.

To demonstrate techniques used in DNA analysis, a student was given two paper strip samples of DNA. The two DNA samples are shown below.

Sample 1: ATTCCGGTAATCCCGTAATGCCGGATAAFACTCCGGTAATATC
Sample 2: ATTCCGGTAATCCCGTAATGCCGGATAAFACTCCGGTAATATC

The student cut between the C and G in each of the shaded CCGG sequences in sample 1 and between the As in each of the shaded TAAT sequences in sample 2. Both sets of fragments were then arranged on a paper model of a gel.

The action of what kind of molecules was being demonstrated when the DNA samples were cut?

Genetics 3-star Test 05/19/2014

- | | |
|---|---|
| <p>1.
Answer: A</p> <p>2.
Answer: A</p> <p>3.
Answer: C</p> <p>4.
Answer: A</p> <p>5.
Answer: B</p> <p>6.
Answer: D</p> <p>7.
Answer: The nuclei of cells in mold B are genetically identical to the nuclei of cells in mold A.</p> <p>8.
Answer: A</p> <p>9.
Answer: B</p> <p>10.
Answer: C</p> <p>11.
Answer: Scientists formerly thought of repetitive DNA as “junk” because they did not understand its functions.</p> <p>12.
Answer: B</p> <p>13.
Answer: B</p> <p>14.
Answer: Structure 2 provides the code for assembling a protein at structure 1.</p> <p>15.
Answer: A</p> <p>16.
Answer: B</p> <p>17.
Answer: Mutations may result in variations that may promote survival. OR A mutation can result in the production of a new variation that could be passed on to offspring. OR Mutations cause variations.</p> | <p>18.
Answer: B</p> <p>19.
Answer: C</p> <p>20.
Answer: MET or START ALA GLY SER</p> <p>21.
Answer: A</p> <p>22.
Answer: A</p> <p>23.
Answer: B</p> <p>24.
Answer: A</p> <p>25.
Answer: B</p> <p>26.
Answer: D</p> <p>27.
Answer: D</p> <p>28.
Answer: D</p> <p>29.
Answer: D</p> <p>30.
Answer: D</p> <p>31.
Answer: genetic engineering, recombinant DNA, gene splicing, gene manipulation, or biotechnology</p> <p>32.
Answer: B</p> |
|---|---|

33.

Answer:

- genetic engineering OR selective breeding (cross-pollinating)
- Genetic engineering involves moving the genes for one of the desired traits into a plant with the other desired trait. OR Selective breeding (cross-pollinating) involves mating plants with one desired characteristic with plants with the other desired characteristic.
- The moved gene may not be expressed. OR It is difficult to isolate the gene. OR The trait may be recessive. OR There may be unintended adverse qualities.

34.

Answer:

D

35.

Answer:

B

36.

Answer:

D

37.

Answer:

D

38.

Answer:

D

39.

Answer:

enzymes, restriction enzymes, proteins, or biological catalysts