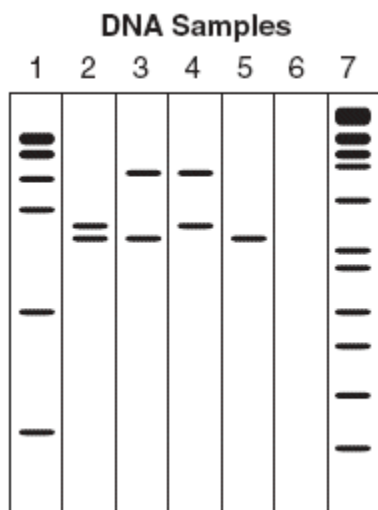


Practice Questions 1: Genetics

1. In one variety of corn, the kernels turn red when exposed to sunlight. In the absence of sunlight, the kernels remain yellow. Based on this information, it can be concluded that the color of these corn kernels is due to the
 - A. process of selective breeding
 - B. rate of photosynthesis
 - C. effect of environment on gene expression
 - D. composition of the soil
2. In some people, the lack of a particular enzyme causes a disease. Scientists are attempting to use bacteria to produce this enzyme for the treatment of people with the disease. Which row in the chart below best describes the sequence of steps the scientists would most likely follow?

Row	Step A	Step B	Step C	Step D
A.	identify the gene	insert the gene into a bacterium	remove the gene	extract the enzyme
B.	insert the gene into a bacterium	identify the gene	remove the gene	extract the enzyme
C.	identify the gene	remove the gene	insert the gene into a bacterium	extract the enzyme
D.	remove the gene	extract the enzyme	identify the gene	insert the gene into a bacterium

3. Base your answer to the question on the diagram below and on your knowledge of biology. The diagram shows the results of a technique used to analyze DNA.



This technique used to analyze DNA directly results in

- A. synthesizing large fragments of DNA
- B. separating DNA fragments on the basis of size
- C. producing genetically engineered DNA molecules
- D. removing the larger DNA fragments from the samples

4. Base your answer to the question 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.

Which substance from bacteria was most likely inserted into rice plants in the development of the trehalose-producing rice?

- A. sugar
- B. enzymes
- C. DNA
- D. trehalose

5. Two proteins in the same cell perform different functions. This is because the two proteins are composed of

- A. chains folded the same way and the same sequence of simple sugars
- B. chains folded the same way and the same sequence of amino acids
- C. chains folded differently and a different sequence of simple sugars
- D. chains folded differently and a different sequence of amino acids

6. To produce large tomatoes that are resistant to cracking and splitting, some seed companies use the pollen from one variety of tomato plant to fertilize a different variety of tomato plant. This process is an example of

- A. selective breeding
- B. DNA sequencing
- C. direct harvesting
- D. cloning

7. Which nuclear process is represented below?

A DNA molecule → The two strands of → Molecular bases → Two identical DNA
untwists. DNA separate. pair up. molecules are produced.

- A. recombination
- B. fertilization
- C. replication
- D. mutation

8. A single gene mutation results from

- A. a change in a base sequence in DNA
- B. recombination of traits
- C. the failure of chromosomes to separate
- D. blocked nerve messages

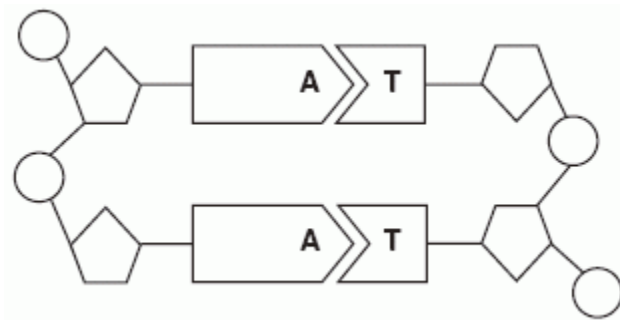
9. A certain bacterial colony originated from the division of a single bacterial cell. Each cell in this colony will most likely

- A. express adaptations unlike those of the other cells
- B. replicate different numbers of genes
- C. have a resistance to different antibiotics
- D. synthesize the same proteins and enzymes

10. Which scientists developed the double helix model of the DNA molecule?

- A. Watson and Crick
- B. Hardy and Weinberg
- C. Darwin and Lamarck
- D. Weismann and Miller

11. A portion of a molecule is shown in the diagram below.



Which statement best describes the main function of this type of molecule?

- A. It is a structural part of the cell wall.
- B. It stores energy for metabolic processes.
- C. It determines what traits may be inherited.
- D. It transports materials across the cell membrane.

12. Scientists have cloned sheep but have not yet cloned a human. The best explanation for this situation is that

- A. the technology to clone humans has not been explored
- B. human reproduction is very different from that of other mammals
- C. there are many ethical problems involved in cloning humans
- D. cloning humans would take too long

13. In all organisms, the coded instructions for specifying the characteristics of the organism are directly determined by the arrangement of the

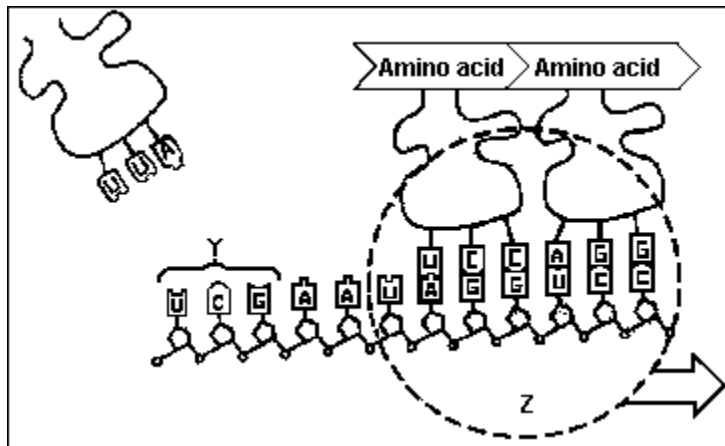
- A. twenty kinds of amino acids in each protein
- B. twenty-three pairs of genes on each chromosome
- C. strands of simple sugars in certain carbohydrate molecules
- D. four types of molecular bases in the genes

14. Which statement best explains the change shown in the diagram below?



- A. Gene expression in an organism can be modified by interactions with the environment.
- B. Certain rabbits produce mutations that affect genes in specific areas of the body.
- C. Sorting and recombination of genes can be influenced by very cold temperatures.
- D. Molecular arrangement in existing proteins can be altered by environmental factors.

15.



Base your answer on the diagram which represents a biochemical process that occurs in a cell and your knowledge of biology. A change in the region labeled Y from U-C-G to U-G-C would most likely cause

- A. the synthesis of a different protein
- B. polyploidy
- C. the formation of recombinant DNA
- D. crossing-over

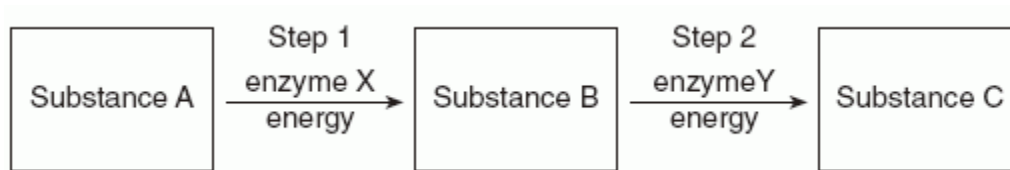
16. In 1910, Thomas Morgan discovered a certain pattern of inheritance in fruit flies known as sex linkage. This discovery extended the ideas of inheritance that Gregor Mendel had discovered while working with garden peas in 1865. Which principle of scientific inquiry does this illustrate?

- A. A control group must be part of a valid experiment.
- B. Scientific explanations can be modified as new evidence is found.
- C. The same experiment must be repeated many times to validate the results.
- D. Values can be used to make ethical decisions about scientific discovery.

17. Mutations that occur in skin or lung cells have little effect on the evolution of a species because mutations in these cells

- A. usually lead to the death of the organism
- B. cannot be passed on to offspring
- C. are usually beneficial to the organism
- D. lead to more serious mutations in offspring

18. The diagram below represents the chemical pathway of a process in a human liver cell.



A particular liver cell is unable to make substance *C*. One possible explanation for the inability of this cell to make substance *C* is that

- A. excess energy for step 2 prevented the conversion of substance *B* to substance *C*
- B. an excess of enzyme *X* was present, resulting in a decrease in the production of substance *B*
- C. nuclear DNA was altered resulting in the cell being unable to make enzyme *Y*
- D. a mutation occurred causing a change in the ability of the cell to use substance *C*

19. Base your answer to the question on the Universal Genetic Code Chart below and on your knowledge of biology.

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

Second Base					
	U	C	A	G	
First Base	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 } LEU CUC } CUA } CUG }	CCU } CCC } PRO CCA } CCG }	CAU } HIS CAC } CAA } GLN CAG }	CGU } CGC } ARG CGA } CGG }	U C A G
	A AUU } ILE AUC } 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 } VAL GUC } GUA } GUG }	GCU } GCC } ALA GCA } GCG }	GAU } ASP GAC } GAA } GLU GAG }	GGU } GGC } GLY GGA } GGG }	U C A G
Third Base					

Some DNA, RNA, and amino acid information from four similar sequences of four plant species is shown in the chart below.

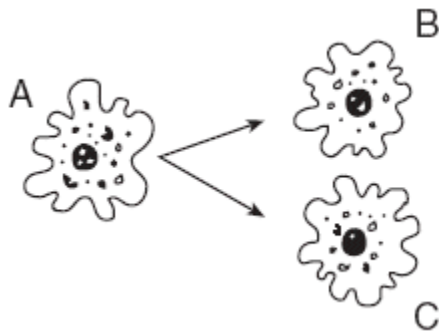
Using the Universal Genetic Code Chart, fill in the missing amino acid sequence for species *C* in the chart below.

Species <i>A</i>	DNA base sequence	CCG	TGC	ATA	CAG	GTA
	mRNA base sequence	GGC	ACG	UAU	GUC	CAU
	Amino acid sequence	GLY	THR	TYR	VAL	HIS
Species <i>B</i>	DNA base sequence	TGC	TGC	ATA	CAG	GTA
	mRNA base sequence	_____	_____	_____	_____	_____
	Amino acid sequence	THR	THR	TYR	VAL	HIS
Species <i>C</i>	DNA base sequence	CCG	TGC	ATA	CAG	GTT
	mRNA base sequence	GGC	ACG	UAU	GUC	CAA
	Amino acid sequence					
Species <i>D</i>	DNA base sequence	CCT	TGT	ATG	CAC	GTC
	mRNA base sequence	GGA	ACA	UAC	GUG	CAG
	Amino acid sequence	GLY	THR	TYR	VAL	GLN

20. A random change in the base sequence of DNA resulting in the production of a defective protein is called

- A. translocation
- B. addition
- C. deletion
- D. gene mutation

21. The diagram below represents single-celled organism *A* dividing by mitosis to form cells *B* and *C*.



Cells *A*, *B*, and *C* all produced protein *X*. What can best be inferred from this observation?

- A. Protein *X* is found in all organisms.
- B. The gene for protein *X* is found in singlecelled organisms, only.
- C. Cells *A*, *B*, and *C* ingested food containing the gene to produce protein *X*.
- D. The gene to produce protein *X* was passed from cell *A* to cells *B* and *C*.

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

AUU } AUC } ILE AUA } (Isoleucine) AUG } MET (Methionine)	ACU } ACC } THR ACA } (Threonine) ACG }	AAU } ASN AAC } (Asparagine) AAA } LYS AAG } (Lysine)	AGU } SER AGC } (Serine) AGA } ARG AGG } (Arginine)
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Series I represents three mRNA codons. Series II includes a mutation of series I.

Series I AGAUCGAGU

Series II ACAUCGAGU

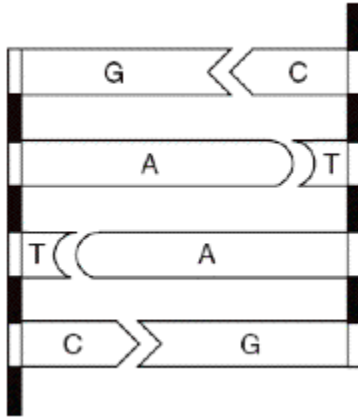
How would the amino acid sequence produced by the mutant strand (series II) compare to the amino acid sequence produced by series I?

- 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.
23. A human liver cell and a human skin cell in the same person have the same genetic sequences. However, these cells are different because the liver cell
- A. has more dominant traits than the skin cell
 - B. can reproduce but the skin cell cannot
 - C. carries out respiration but the skin cell does not
 - D. uses different genes than the skin cell
24. A change in the base subunit sequence during DNA replication can result in
- A. variation within an organism
 - B. rapid evolution of an organism
 - C. synthesis of antigens to protect the cell
 - D. recombination of genes within the cell
25. The shape of a protein is most directly determined by the
- A. amount of energy available for synthesis of the protein
 - B. kind and sequence of amino acids in the protein
 - C. type and number of DNA molecules in a cell
 - D. mistakes made when the DNA is copied

26. Genetic engineering has been utilized for the production of

- A. salivary amylase
- B. human growth hormone
- C. hydrochloric acid
- D. uric acid crystals

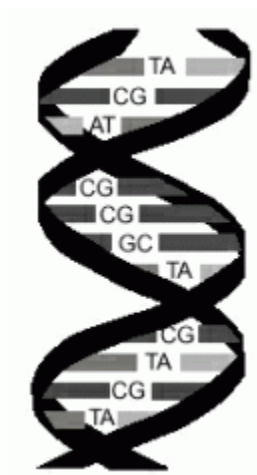
27. The diagram below represents a portion of a type of organic molecule present in the cells of organisms.



What will most likely happen if there is a change in the base sequence of this molecule?

- A. The molecule will be converted into an inorganic compound.
- B. The amino acid sequence may be altered during protein synthesis.
- C. The chromosome number will decrease in future generations.
- D. The chromosome number may increase within the organisms.

28.



The type of molecule represented above is found in organisms.

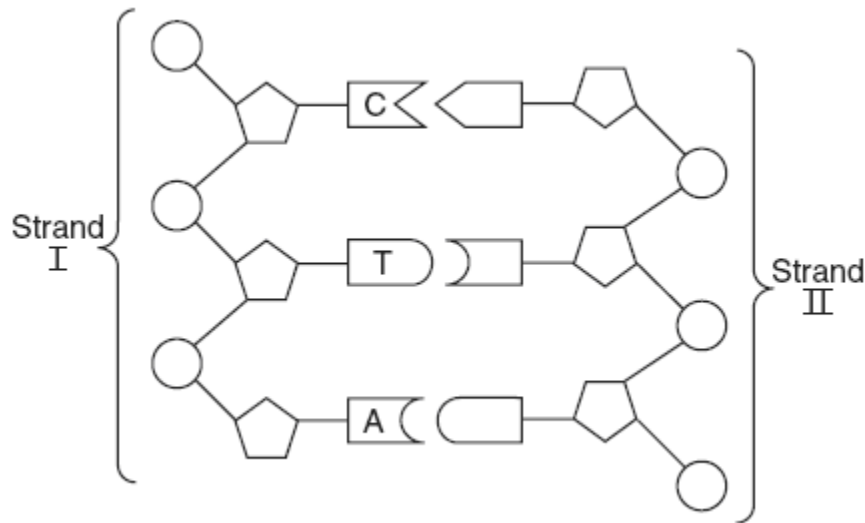
Which statement correctly describes the sequence of bases found in this type of molecule?

- 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.

29. A small amount of DNA was taken from a fossil of a mammoth found frozen in glacial ice. Genetic technology can be used to produce a large quantity of identical DNA from this mammoth's DNA. In this technology, the original DNA sample is used to

- A. stimulate differentiation in other mammoth cells
- B. provide fragments to replace certain human body chemicals
- C. act as a template for repeated replication
- D. trigger mitosis to obtain new base sequences

30. In the diagram below, strands I and II represent portions of a DNA molecule.



Strand II would normally include

- A. AGC
- B. TCG
- C. TAC
- D. GAT

Answer Key 1: Genetics

- | | |
|-------|-----------------------------|
| 1. C | 16. B |
| 2. C | 17. B |
| 3. B | 18. C |
| 4. C | 19. GLY, THR, TYR, VAL, GLN |
| 5. D | 20. D |
| 6. A | 21. D |
| 7. C | 22. B |
| 8. A | 23. D |
| 9. D | 24. A |
| 10. A | 25. B |
| 11. C | 26. B |
| 12. C | 27. B |
| 13. D | 28. B |
| 14. A | 29. C |
| 15. A | 30. D |