

## Transcription & Translation 2015-16

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Plants and animals are composed of organic compounds. Which of the following are the common elements found in organic compounds?
  - A. iron, oxygen, nickel, copper
  - B. sodium, potassium, gold, hydrogen
  - C. helium, neon, argon, krypton
  - D. carbon, hydrogen, oxygen, nitrogen
  
2. What characteristic of carbon (C) makes it essential to living organisms?
  - A. Carbon forms crystal structures under certain conditions.
  - B. Carbon can exist as a solid, liquid, or gas.
  - C. Carbon bonds in many ways with itself to form chains.
  - D. Carbon exists in radioactive forms.
  
3. There are many different enzymes located in the cytoplasm of a single cell. How is a specific enzyme able to catalyze a specific reaction?
  - A. Different enzymes are synthesized in specific areas of the cytoplasm.
  - B. Most enzymes can catalyze many different reactions.
  - C. An enzyme binds to a specific substrate (reactant) for the reaction catalyzed.
  - D. Enzymes are transported to specific substrates (reactants) by ribosomes.
  
4. Although there are a limited number of amino acids, many different types of proteins exist because the
  - A. size of a given amino acid can vary.
  - B. chemical composition of a given amino acid can vary.
  - C. sequence and number of amino acids is different.
  - D. same amino acid can have many different properties.

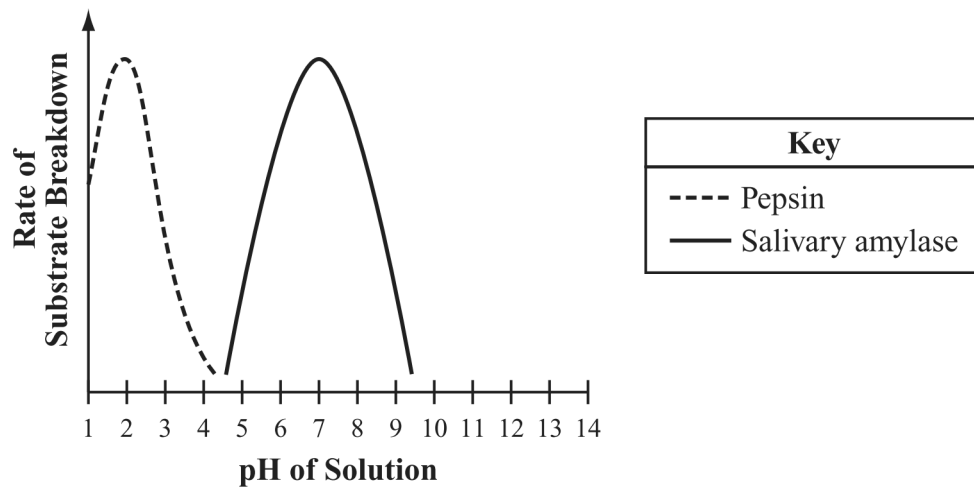
5. The clear protein of an egg white becomes opaque and firm when cooked because the heat
- A. mutates the DNA.
  - B. turns the protein into carbohydrates.
  - C. stops protein formation.
  - D. changes the protein structure.
6. Many aquatic birds secrete waxy organic substances that repel water. The birds use these substances to coat their feathers. An analysis of these substances would reveal that they are composed mostly of
- A. lipids.
  - B. proteins.
  - C. carbohydrates.
  - D. nucleic acids.
7. In red blood cells, the compound carbonic anhydrase increases the rate at which carbon dioxide is converted to bicarbonate ions for transport in the blood. In red blood cells, carbonic anhydrase acts as which of the following?
- A. an enzyme
  - B. a hormone
  - C. a lipid
  - D. a sugar
8. Ovalbumin is a protein found in eggs. Which of the following *best* describes the molecular structure of ovalbumin?
- A. a group of six carbon atoms joined in a ring
  - B. a chain of amino acids folded and twisted into a molecule
  - C. a set of three fatty acids attached to a molecule of glycerol
  - D. a sequence of nitrogenous bases attached to a sugar-phosphate backbone
9. Which of the following *best* describes the composition of a nucleotide?
- A. a pair of six-carbon rings attached to each other
  - B. a carbon atom joined to hydrogen and three functional groups
  - C. a chain of carbon atoms with a carboxyl group bonded to one end
  - D. a five-carbon sugar attached to a phosphate group and a nitrogenous base
10. Which of the following *best* explains why enzymes are necessary for many cellular reactions?
- A. Enzymes supply the oxygen necessary for the reactions.
  - B. Enzymes change reactants from solid to liquid during the reactions.
  - C. The reactions take up too much space in the cell if enzymes are missing.
  - D. The reactions are too slow to meet the needs of the cell if enzymes are missing.

Biology students investigated various human digestive enzymes. The table below summarizes the functions of several different digestive enzymes.

Enzyme	Function
salivary amylase	begins to break down starch into smaller polysaccharides or the disaccharide maltose
pepsin	begins to break down proteins into small polypeptides
pancreatic amylase	continues to break down starch and smaller polysaccharides into disaccharides
lipase	breaks down fats into glycerol, fatty acids, or glycerides
aminopeptidase	breaks down small polypeptides into amino acids

The students conducted experiments to study digestive enzyme activity. In the first experiment, the students observed the rate at which salivary amylase breaks down starch (the substrate) in solutions with different pH values. The students then performed the same type of experiment with pepsin. The graph below shows the students' results for the two experiments.

### Pepsin and Salivary Amylase Activity at Different pH Values

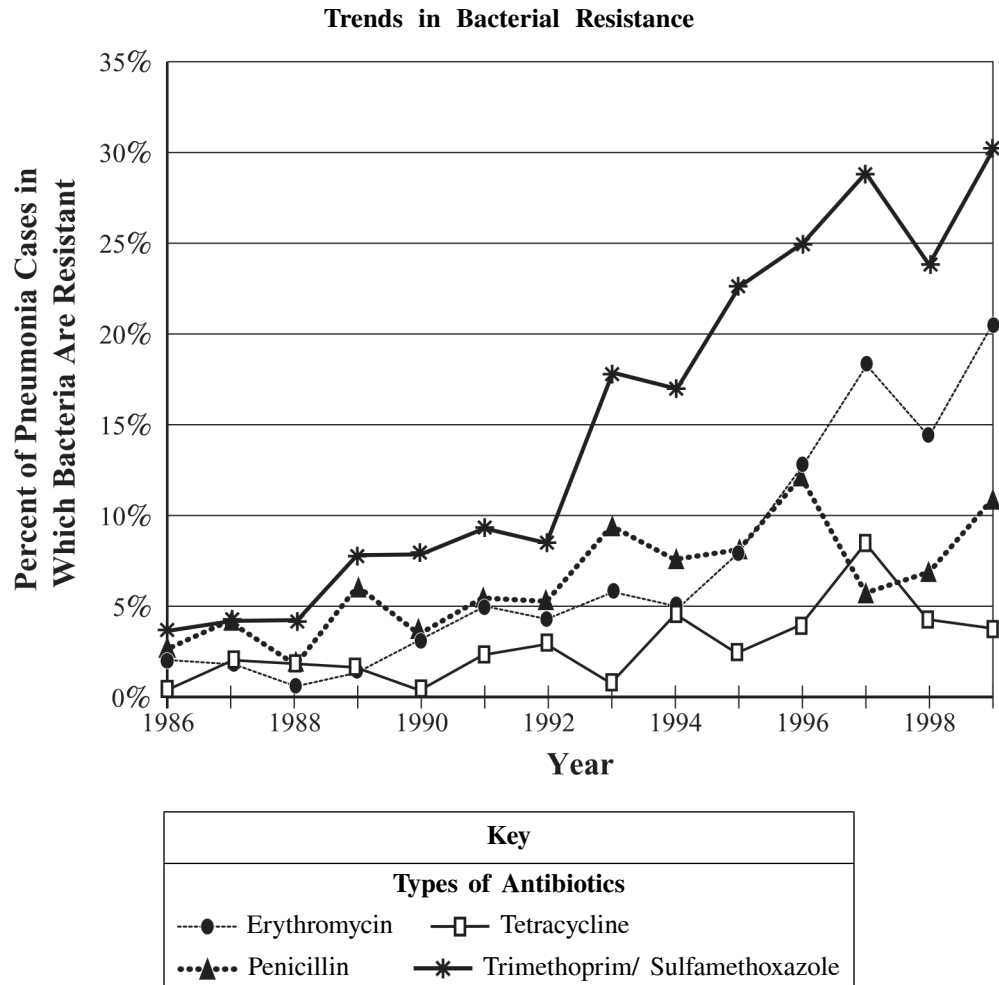


11. Which of the following statements *best* describes an effect of pH on the functioning of salivary amylase?
- A. Salivary amylase functions most effectively at a pH of about 4.
  - B. Salivary amylase functions most effectively at a pH of about 7.
  - C. Salivary amylase cannot break down starch into maltose at pH values less than 7.
  - D. Salivary amylase breaks down protein instead of starch at pH values greater than 9.

The following section focuses on bacterial resistance to several antibiotics.

One of the most important developments in modern medicine was the discovery of antibiotics. Antibiotics are used to treat infections caused by bacteria. However, strains of bacteria that are resistant to antibiotics are emerging. The rate of increase in infections caused by these antibiotic-resistant strains of bacteria is a concern for human health.

The bacterium *Streptococcus pneumoniae* is a major cause of the respiratory disease pneumonia. The graph below shows trends in bacterial resistance to different antibiotics in pneumonia cases from 1986 to 1999.



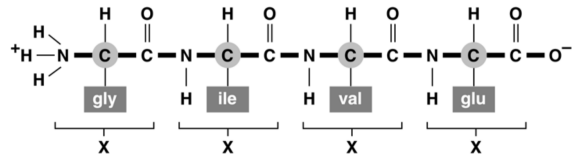
12. Resistance to antibiotics results from variations in the genetic code of *Streptococcus pneumoniae*. Which type of molecule encodes genetic information in *Streptococcus pneumoniae*?

- A. carbohydrate
- B. fatty acid
- C. nucleic acid
- D. protein

13. What do disaccharides, such as sucrose, and polysaccharides, such as starch, have in common?

- A. They are lipids made of fatty acids.
- B. They are proteins made of amino acids.
- C. They are nucleic acids made of nucleotides.
- D. They are carbohydrates made of simple sugars.

14.



A diagram of a protein molecule is shown above. The units labeled “X” which bond together to form the protein molecule are called—

- A. amino acids.
- B. fatty acids.
- C. monosaccharides.
- D. nucleotides.

15. Which molecule is correctly paired with the class of molecule to which it belongs?

- A. Lactose – lipid
- B. Collagen – protein
- C. Hemoglobin – carbohydrate
- D. Hydrochloric acid – nucleic acid

Use the information to answer the the following question(s).

### DNA

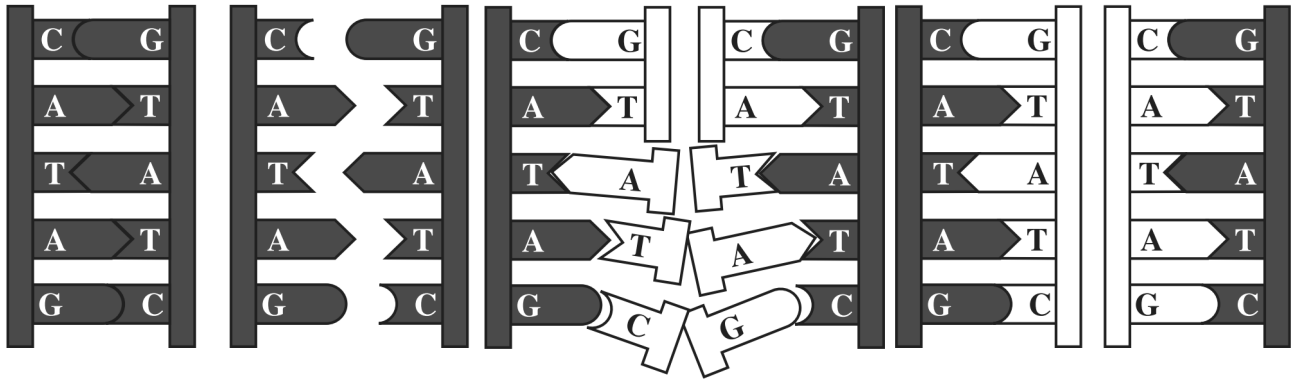
Scientists study DNA to understand heredity, disease, and the evolutionary history of organisms. During these studies, DNA must first be separated into two complementary strands. Next, the appropriate nucleotides are attached to the nucleotides in each original strand to produce two new complete DNA strands. The diagram below shows a simple model of this process. The letters A, T, C, and G represent the four nucleotides.

**Original DNA Molecule**

**Stage 1**  
Original molecule is separated into two complementary strands.

**Stage 2**  
Nucleotides are attached to original strands.

**Stage 3**  
The result is two complete DNA molecules.



16. Which table correctly compares the DNA, cell shape, and proteins produced by a liver cell and a nerve cell from the same organism?

A.

	DNA	Cell Shape	Proteins Produced
Liver and nerve cells	same	different	different

B.

	DNA	Cell Shape	Proteins Produced
Liver and nerve cells	same	same	different

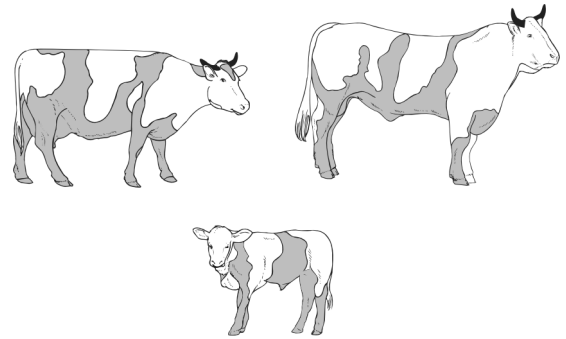
C.

	DNA	Cell Shape	Proteins Produced
Liver and nerve cells	different	different	different

D.

	DNA	Cell Shape	Proteins Produced
Liver and nerve cells	different	different	same

17. The pictures below show a cow and a bull and their calf. All three animals have coats of the same colors.



This calf developed from a zygote. During the development of this zygote, a mutation occurred in a coat color gene.

Which of the following *best* explains why the calf's phenotype is the same as its parents'?

- A. The mutation is not present in the parent animals.
- B. The mutated gene is passed on during reproduction.
- C. The mutated allele is dominant over the parental allele.
- D. The mutation does not affect the expression of the color trait.

18. A portion of one strand of a DNA molecule has the sequence shown below.

**ACCTGAAGG**

Assuming there are no mutations in this portion of the DNA, what is the corresponding sequence on the complementary DNA strand?

- A. **ACCTGAAGG**
- B. **GTTCAGGAA**
- C. **TGGA CTTC**
- D. **UGGACUCC**



19. Partial amino acid sequences for a particular protein in three animal species are shown below. Each letter in the sequence stands for an amino acid. For example, Q stands for glutamine, and L stands for leucine.

Species	Amino Acid Sequence
Green junglefowl (bird)	QHEPHERKRM
Nile crocodile (reptile)	SHDPAQQKRL
Domestic chicken (bird)	QHEPHKRKRM

Which of the following statements *best* explains how these sequence data are evidence for evolution?

- A. All species translate the amino acid sequences of their proteins in a similar way.
- B. The species that are most closely related have the most similar amino acid sequences.
- C. Individual organisms acquire changes in their amino acid sequences over their lifetimes.
- D. The organisms that evolved at the same time in geologic history have identical amino acid sequences.

20. The table below shows small portions of the amino acid sequences of a particular protein in four animal species.

Animal Species	Portion of Amino Acid Sequence
1	Met-His-Leu-Ala-Pro
2	Met-His-Leu-Glu-Glu
3	Met-Tyr-Leu-Ala-Pro
4	Met-Ala-Leu-Arg-Trp

- a) Based on the data in the table, which two species are most closely related? Explain your answer.
- b) Describe and explain *three* other forms of scientific evidence that could be used to study the relatedness of these four animal species.

21. A parent and a child share several characteristics. Both individuals are tall, have curly hair, are good cooks, and have freckles.

Which of these characteristics is a learned behavior?

- A. being tall
- B. having curly hair
- C. being a good cook
- D. having freckles

22. The wings of fruit flies curl if the flies live at a temperature of 25° Celsius. The wings are straight if the flies live at a temperature less than 25° Celsius. This is an example of—

- A. the fruit flies' need for cool temperatures.
- B. the negative effects of heat on fruit fly protein.
- C. the effect of the environment on genetic expression.
- D. the superiority of straight wings in desert environments.

23. The table below is a codon chart.

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	<sup>(start)</sup> methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

What is the likely effect of a mutation that causes the sequence CGC to become CGG?

- A. The reading frame will be shifted.
- B. The protein formed will be unchanged.
- C. The protein will be translated incorrectly.
- D. The translation process will stop prematurely.

24. A strand of DNA has these bases:

AGC CAT GTA TAC

What is the complementary DNA strand?

- A. ACG GAT CTA TAG
- B. TCG GTA CAT ATG
- C. TGC CTA GAT ATC
- D. UCG CUA CAU AUG

25. A segment of DNA has this sequence:

ATA GCA CAT GTA

What is the mRNA sequence transcribed from this segment?

- A. TAT CGT GTA CAT
- B. TAT GCT CTA GAT
- C. UAU CGU GUA CAU
- D. UAU GCU CUA CAU

26. This chart shows which amino acids are coded for by different combinations of mRNA nucleotides.

Codons in mRNA									
First Base	Second Base						Third Base		
	U	C	A	G					
	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	<b>U</b>
<b>U</b>	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	<b>C</b>
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	<b>A</b>
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	<b>G</b>
	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	<b>U</b>
<b>C</b>	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	<b>C</b>
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	<b>A</b>
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	<b>G</b>
	AUU	Isoleucine	ACU	Threonine	AUU	Asparagine	AGU	Serine	<b>U</b>
<b>A</b>	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	<b>C</b>
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	<b>A</b>
	AUG	Methionine or start	ACG	Threonine	AAG	Lysine	AGG	Arginine	<b>G</b>
	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	<b>U</b>
<b>G</b>	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	<b>C</b>
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	<b>A</b>
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	<b>G</b>

Which amino acids are coded for by an mRNA segment that reads CAG GUG?

- A. arginine and valine
  - B. isoleucine and arginine
  - C. glutamine and valine
  - D. valine and isoleucine
27. A genetic mutation resulted in a change in the sequence of amino acids of a protein, but the function of the protein was not changed. Which statement *best* describes the genetic mutation?
- A. It was a silent mutation that caused a change in the DNA of the organism.
  - B. It was a silent mutation that caused a change in the phenotype of the organism.
  - C. It was a nonsense mutation that caused a change in the DNA of the organism.
  - D. It was a nonsense mutation that caused a change in the phenotype of the organism.

28. Some events that take place during the synthesis of a specific protein are listed.

- A) Messenger RNA attaches to a ribosome.
- B) DNA serves as a template for RNA production.
- C) Transfer RNA bonds to a specific codon.
- D) Amino acids are bonded together.
- E) RNA moves from the nucleus to the cytoplasm.

The correct order of these events is

- A. B → E → A → C → D
- B. D → A → E → C → B
- C. B → C → E → D → A
- D. C → B → A → E → D

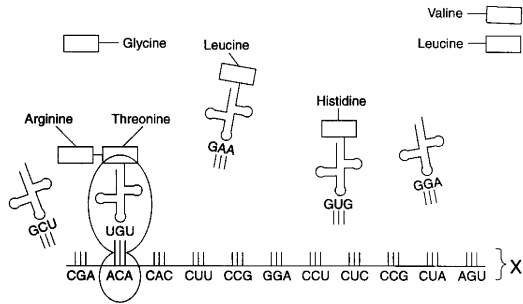
29. Messenger RNA (mRNA) Codes for Selected Amino Acids

Amino Acid	mRNA Code
Leucine	C-C-A
Arginine	C-G-A
Phenylalanine	U-U-U
Valine	G-U-U
Lysine	A-A-A

Which amino acid will be carried to a ribosome by a transfer RNA molecule containing the triplet code A-A-A?

- A. valine
- B. lysine
- C. leucine
- D. phenylalanine

30. The synthesis of structure X occurred in the

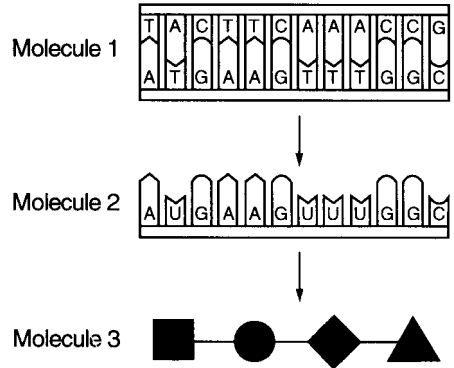


- A. nucleus
- B. cytoplasm
- C. lysosome
- D. vacuole

31. The biochemical process represented in the diagram is most closely associated with the cell organelle known as the

- A. nucleolus
- B. ribosome
- C. chloroplast
- D. mitochondrion

32. The diagram represents molecules involved in protein synthesis.



Where do the chemical reactions that are coded for by molecule 2 take place?

- A. in the vacuole
- B. on the plasma membrane
- C. in the lysosome
- D. at ribosomes