

**IOWA**  
**End-of-Course**  
**Assessment**  
**Programs**  
**Released Items**

**BIOLOGY**

**1** Based on the table, which of the following sequences in a template DNA strand would be transcribed into an mRNA sequence that would be translated into the amino acid sequence Met-Leu-Tyr-Leu-Phe?

**A** 3'-AUGUUAUAUUUCUUU-5'

INCORRECT: This sequence cannot be in a DNA template strand because it contains uracil, which is only found in RNA.

**B** 3'-TACAACATTAAGAAA-5'

INCORRECT: This DNA template strand sequence would not be transcribed into an mRNA sequence that would be translated into the given amino acid sequence.

**C** 3'-TACGAAATAAACAAA-5'

CORRECT: The DNA template strand sequence 3'-TACGAAATAAACAAA-5' would be transcribed into the mRNA sequence 5'-AUGCUUUUAUUUGUUU-3', which would be translated into the amino acid sequence Met-Leu-Tyr-Leu-Phe.

**D** 3'-TACUUCAUUUUGAUU-5'

INCORRECT: This sequence cannot be in a DNA template strand because it contains uracil, which is only found in RNA.

		Second mRNA base								
		U		C		A		G		
First mRNA base	U	UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys	U
		UUC	Phe	UCC	Ser	UAC	Tyr	UGC	Cys	C
		UUA	Leu	UCA	Ser	<b>UAA Stop</b>		<b>UGA Stop</b>		A
		UUG	Leu	UCG	Ser	<b>UAG Stop</b>		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
		<b>AUG Met or start</b>		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	

(Note: The first and third bases of a codon represent the 5' and 3' ends, respectively.)

**ICC Essential Concept:**

Molecular Basis of Heredity

**ICC Underlying Skill:**

Genetic Information in Cells

**2 The light reactions of photosynthesis convert light energy into chemical energy in the form of ATP and:**

**A** NADPH.

CORRECT: The light reactions of photosynthesis use light energy to form ATP and NADPH, which provide chemical energy and reducing power, respectively, to the Calvin cycle.

**B** NADH.

INCORRECT: NADH is an electron carrier in cellular respiration.

**C** CO<sub>2</sub>.

INCORRECT: CO<sub>2</sub> is incorporated into organic molecules in the Calvin cycle.

**D** sugar.

INCORRECT: Sugar is the end product of the Calvin cycle.

**ICC Essential Concept:**

Matter, Energy, and Organization in Living Systems

**ICC Underlying Skill:**

Sunlight Energy Conversion

**3 The gray wolf belongs to the order Carnivora. Given this, the gray wolf and the tiger most likely belong to different:**

**A** families.

CORRECT: Tigers and gray wolves both belong to the kingdom Animalia, phylum Chordata, class Mammalia, and order Carnivora. After order, the classification becomes more specific placing tigers and gray wolves into different families.

**B** kingdoms.

INCORRECT: Tigers and gray wolves belong to the kingdom Animalia because they are both animals.

**C** phyla.

INCORRECT: Tigers and gray wolves belong to the phylum Chordata because they both have a notochord at some point in their development.

**D** classes.

INCORRECT: Tigers and gray wolves belong to the class Mammalia because they both have mammary glands.

**ICC Essential Concept:**

Biological Evolution

**ICC Underlying Skill:**

Biological Classification

**4 Tissues and organs are two of the levels of biological organization. Skin and blood are:**

**A** both tissues.

INCORRECT: Skin is a group of tissues, which makes it an organ. Skin is the largest organ in the human body.

**B** both organs.

INCORRECT: Blood is a group of similar cells, which makes it a tissue. Blood is a liquid connective tissue.

**C** a tissue and an organ, respectively.

INCORRECT: Skin is a group of tissues, which makes it an organ and blood is a group of similar cells, which makes it a tissue.

**D** an organ and a tissue, respectively.

CORRECT: An organ is a group of tissues that work together to perform a specific function. A tissue is a group of similar cells that perform a particular function. Skin is a group of tissues, which makes it an organ, and blood is a group of similar cells, which makes it a tissue.

**ICC Essential Concept:**

Matter, Energy, and Organization in Living Systems

**ICC Underlying Skill:**

Matter and Energy Flow and Conservation

**5** When ATP is hydrolyzed to form ADP and Pi, energy is:

**A** released.

CORRECT: Hydrolysis of ATP to form ADP and Pi is exergonic.

**B** absorbed.

INCORRECT: The reaction is not endergonic.

**C** created.

INCORRECT: The first law of thermodynamics states that energy cannot be created.

**D** destroyed.

INCORRECT: The first law of thermodynamics states that energy cannot be destroyed.

**ICC Essential Concept:**

Matter, Energy, and Organization in Living Systems

**ICC Underlying Skill:**

Sunlight Energy Conversion

**6** If a person is suffering from severe dehydration and does not have enough water in his or her cells, a physician might give the person an intravenous (IV) solution to rehydrate the cells. This solution is most likely:

**A** isotonic to the cells.

INCORRECT: An isotonic solution will have the same solute concentration as the person's cells. As a result, there will not be a concentration gradient to replenish water in the person's cells.

**B** hypotonic to the cells.

CORRECT: A hypotonic solution will have a lower solute concentration than the person's cells. A lower solute concentration means more water, which will cause water to diffuse into the person's cells.

**C** hypertonic to the cells.

INCORRECT: A hypertonic solution will have a higher solute concentration than the person's cells. A higher solute concentration means less water, which will cause water to diffuse out of the person's cells.

**D** non-tonic to the cells.

INCORRECT: The IV solution must be hypotonic to the person's cells for successful treatment of the person for dehydration.

**ICC Essential Concept:**

The Cell

**ICC Underlying Skill:**

Structures and Functions

**7 Glucagon, a polypeptide hormone, has a G protein-coupled receptor that is most likely located in(on) the target cell's:**

**A** nucleus.

INCORRECT: Receptors of peptide hormones are not likely to be located in the nucleus.

**B** cytosol.

INCORRECT: Receptors of peptide hormones are not likely to be located in the cytosol.

**C** Golgi apparatus.

INCORRECT: Receptors of peptide hormones are not likely to be located in the Golgi apparatus.

**D** surface.

CORRECT: Receptors of peptide hormones are most likely to be located on the surface of the target cell. Because peptide hormones are not very lipophilic, they cannot cross the membrane.

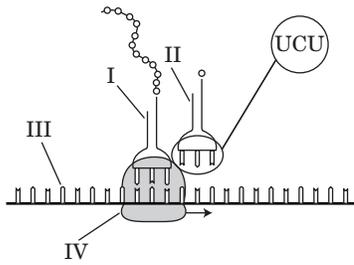
**ICC Essential Concept:**

The Cell

**ICC Underlying Skill:**

Structures and Functions

8



**In the figure, the structure labeled I is which of the following?**

**A** mRNA

INCORRECT: The mRNA strand is labeled III.

**B** Amino acid

INCORRECT: The amino acids are not identified with a label. They are represented by the small circles in the figure.

**C** tRNA

CORRECT: The figure depicts the process of translation. The structures labeled I and II are tRNAs.

**D** DNA template strand

INCORRECT: There is no DNA template strand in the figure.

**ICC Essential Concept:**

Molecular Basis of Heredity

**ICC Underlying Skill:**

Genetic Information in Cells

**9 The overall chemical equation for the most prevalent pathway of cellular respiration is which of the following?**



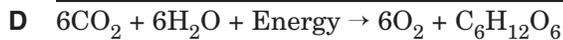
CORRECT: The most prevalent pathway of cellular respiration is the aerobic pathway in which oxygen and sugar react to yield carbon dioxide and water with release of energy. The equation is balanced correctly.



INCORRECT: Energy is released in aerobic cellular respiration, not absorbed.



INCORRECT: Carbon dioxide and water react to yield oxygen and sugar in photosynthesis, which requires light energy.



INCORRECT: This is the correct overall chemical equation for photosynthesis, not for aerobic cellular respiration.

**ICC Essential Concept:**

Matter, Energy, and Organization in Living Systems

**ICC Underlying Skill:**

Sunlight Energy Conversion

**Directions:** Questions 10 through 12 are based on the information provided.

In mice, the allele for black coat color is dominant ( $B$ ) and the allele for tan coat color is recessive ( $b$ ). Also, in mice, the allele for short tail is dominant ( $T$ ) and the allele for long tail is recessive ( $t$ ). A black short-tailed ( $BBTT$ ) mouse is crossed with a tan long-tailed ( $bbtt$ ) mouse.

**10 Which of the following best describes the  $F_1$  offspring of this cross?**

**A** 50% black short-tailed; 50% tan long-tailed

INCORRECT: One parent is homozygous dominant and the other parent is homozygous recessive. Therefore, all offspring will have the dominant traits (black coat color and short tail, genotype  $BbTt$ ) in the  $F_1$  generation.

**B** 50% black long-tailed; 50% tan short-tailed

INCORRECT: One parent is homozygous dominant and the other parent is homozygous recessive. Therefore, all offspring will have the dominant traits (black coat color and short tail, genotype  $BbTt$ ) in the  $F_1$  generation.

**C** 100% black short-tailed

CORRECT: One parent is homozygous dominant and the other parent is homozygous recessive. Therefore, all offspring will have the dominant traits (black coat color and short tail, genotype  $BbTt$ ) in the  $F_1$  generation.

**D** 100% tan long-tailed

INCORRECT: One parent is homozygous dominant and the other parent is homozygous recessive. Therefore, all offspring will have the dominant traits (black coat color and short tail, genotype  $BbTt$ ) in the  $F_1$  generation.

**ICC Essential Concept:**

Molecular Basis of Heredity

**ICC Underlying Skill:**

Basic Inheritance Patterns

**Directions:** Questions 10 through 12 are based on the information provided.

In mice, the allele for black coat color is dominant ( $B$ ) and the allele for tan coat color is recessive ( $b$ ). Also, in mice, the allele for short tail is dominant ( $T$ ) and the allele for long tail is recessive ( $t$ ). A black short-tailed ( $BBTT$ ) mouse is crossed with a tan long-tailed ( $bbtt$ ) mouse.

**11 Which of the following is closest to the phenotypic ratio of the  $F_2$  generation of this cross?**

- A** 1 black short-tailed:1 black long-tailed:1 tan short-tailed:1 tan long-tailed

INCORRECT: The four phenotypes are correct but for three of them, the corresponding numbers in the ratio are not correct.

- B** 9 black short-tailed:3 black long-tailed:3 tan short-tailed:1 tan long-tailed

CORRECT: According to the law of independent assortment, each pair of alleles segregates independently of each other pair of alleles during gamete formation. Crossing two  $F_1$  dihybrids will produce  $F_2$  generation in 9 black short-tailed:3 black long-tailed:3 tan short-tailed:1 tan long-tailed ratio.

- C** 9 tan long-tailed:3 tan short-tailed:3 black long-tailed:1 black short-tailed

INCORRECT: The four phenotypes are correct but for two of them, the corresponding numbers in the ratio are not correct.

- D** 1 black short-tailed:1 tan long-tailed

INCORRECT: Four phenotypes will be produced in 9:3:3:1 ratio.

**ICC Essential Concept:**  
Molecular Basis of Heredity

**ICC Underlying Skill:**  
Basic Inheritance Patterns

**Directions:** Questions 10 through 12 are based on the information provided.

In mice, the allele for black coat color is dominant ( $B$ ) and the allele for tan coat color is recessive ( $b$ ). Also, in mice, the allele for short tail is dominant ( $T$ ) and the allele for long tail is recessive ( $t$ ). A black short-tailed ( $BBTT$ ) mouse is crossed with a tan long-tailed ( $bbtt$ ) mouse.

**12** What will be the coat color of a mouse with the genotype  $Bb$ ?

A Tan

INCORRECT: The genotype of a mouse with a tan coat will be  $bb$ .

B Gray

INCORRECT: Based on the information provided, gray will not be an option for coat color.

C Black

CORRECT: The genotype of a mouse with a black coat will be either  $BB$  or  $Bb$  since the allele for black coat color is dominant ( $B$ ).

D Black with tan spots

INCORRECT: Based on the information provided, black with tan spots will not be an option for coat color.

**ICC Essential Concept:**

Molecular Basis of Heredity

**ICC Underlying Skill:**

Basic Inheritance Patterns

**13 Which of the following base pairings is found in DNA?**

**A** AG

INCORRECT: In DNA, adenine (A) pairs only with thymine (T).

**B** GT

INCORRECT: In DNA, guanine (G), a purine, pairs only with cytosine (C), a pyrimidine.

**C** AT

CORRECT: Only a purine–pyrimidine pairing accounts for the observed diameter of the DNA double helix. Also, adenine (A), a purine, appropriately hydrogen bonds only with thymine (T), a pyrimidine.

**D** CA

INCORRECT: In DNA, cytosine (C) pairs only with guanine (G).

**ICC Essential Concept:**

Molecular Basis of Heredity

**ICC Underlying Skill:**

Genetic Information in Cells

**14** When breeding animals such as cattle and horses, humans intentionally allow individuals with certain traits to breed, while not breeding other individuals who lack these traits. This process is best described as:

**A** natural selection.

INCORRECT: In natural selection, humans do not determine which traits will be passed on to future generations of animals.

**B** artificial selection.

CORRECT: In artificial selection, humans determine which traits will be passed on to future generations of animals by breeding for desired characteristics.

**C** adaptive radiation.

INCORRECT: In adaptive radiation, rapid evolutionary change is not determined by humans.

**D** coevolution.

INCORRECT: Selective breeding of animals by humans is not coevolution.

**ICC Essential Concept:**

Biological Evolution

**ICC Underlying Skill:**

Species Evolution