Question No. 1 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

1. Which of the following statements is NOT true?

(A) Transposable elements can cause chromosome rearrangements.
(B) Transposons can cause deletions or insertions.
(C) Transposons end in inverted repeats and are often flanked by direct repeats.
(D) All transposons have a transposase gene.
(E) Ac and Ds are plant transposable elements.

Feedback

A. Incorrect!
This statement is true. Transposable elements can cause chromosome rearrangements.

B. Incorrect!
This statement is true. Transposons can cause deletions or insertions in a gene.

C. Incorrect!
This statement is true. This is the structural characteristics of transposons.

D. Correct!
This statement is NOT true. Retrotransposons do not have transposase. Instead, they have integrase and reverse transcriptase.

E. Incorrect!
Ac and Ds are the earliest transposons observed by Barbara McClintock.

Solution

Transposable elements are also called “jumping genes” and transposons. Transposons are a heterogeneous class of genetic elements that can insert at new locations within chromosomes. They vary in: structure, choice of target site, fate of donor element, and the mechanism of transposition.

(D) All transposons have a transposase gene.

Question No. 2 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
 **Question**	**2.** Retrotransposons can rapidly increase the genome size because _____. (A) They often are large in size. (B) They are transcribed into RNA and then reverse-transcribed back to DNA. (C) They are similar to a retrovirus. (D) They can copy and paste themselves into the genome. (E) They undergo non-replicative transposition.
 **Feedback**	A. Incorrect! The statement is true, but this is not the reason why retrotransposons increase genome size.
	B. Incorrect! Again, the statement is true, but this is not related to the genome size.
	C. Incorrect! Again, the statement is true, but this is not related to the genome size.
	D. Correct! Retrotransposons copy and pastes themselves into the genome, making the genome size increase rapidly.
	E. Incorrect! Only DNA transposons undergo non-replicative transposition.
 **Solution**	Retrotransposons can make up large portions of a genome. **(D)They can copy and paste themselves into the genome.**

Question No. 3 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
 **Question**	**3.** Transposons CANNOT be used for_____. (A) Gene isolation and cloning. (B) Gene knockout. (C) Gene mapping. (D) Gene delivery. (E) Mechanism of insertion/deletion mutation.
 **Feedback**	A. Incorrect! Transposons are used for gene isolation and cloning in transposon tagging.
	B. Incorrect! Transposons are used for gene knockout, especially in yeast and Drosophila.
	C. Correct! Transposons cannot be used for gene mapping because it occurs in multiple loci (mobile).
	D. Incorrect! Transposons are used for gene delivery in transgenic organisms.
	E. Incorrect! This is also correct; insertion/deletion mutations can be caused by transposons.
 **Solution**	Key point: transposons are mutagens; they also have many applications in genetics. **(C)Gene mapping.**

Question No. 4 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

4. Ds element cannot move around the genome by itself because _____.

(A) It does not contain an inverted repeat sequence at its end.
(B) It does not have direct repeat flanking sequences.
(C) It is completely linked to its surrounding genes.
(D) It does not contain an active DNA polymerase.
(E) It does not contain an active transposase.

Feedback

A. Incorrect!
Ds have inverted repeats identical to Ac element.

B. Incorrect!
All Ds elements have direct repeat flanking sequences.

C. Incorrect!
All genes are “linked” to its surrounding genes, so do transposons; they are continuous double-stranded DNA molecules, but this is not the reason why Ds cannot jump around.

D. Incorrect!
Transposition of a transposon does not require a DNA polymerase.

E. Correct!
Ds cannot jump around because it does not contain an active transposase.

Solution

DNA transposons translocate through transposase.

(E) It does not contain an active transposase.

Question No. 5 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
 **Question**	**5.** Ty3 element belongs to ____. (A) Class III transposons (B) LTR retrotransposons (C) Non-LTR retrotransposons (D) Class II DNA transposons (E) Drosophila transposons
 **Feedback**	A. Incorrect! Class III is MITEs, miniature inverted-repeat transposable elements.
	B. Correct! Ty3 has LTR and is a retrotransposon.
	C. Incorrect! Non-LTR retrotransposon only have two groups: LINEs and SINEs.
	D. Incorrect! Class II is DNA transposon, Ty3 is a retrotransposon, which translocates through an RNA intermediate.
	E. Incorrect! Ty3 is found in yeast, not Drosophila.
 **Solution**	There are three classes of transposons: Class I retrotransposon, Class II DNA transposon, and Class III MITEs. **(B)LTR retrotransposons**

Question No. 6 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

6. A bacterial composite transposon _____.

(A) Contains two insertion sequences, which code genes for transposition.
(B) Contains one insertion sequence, which codes for structural genes necessary for transposition.
(C) Has two flanking repeat sequences, 2-13kbp in length.
(D) Moves along with the flanking direct repeat sequences to a new location.
(E) Is also flanked by structural genes, which have no known function.

Feedback

A. Correct!
Contains two insertion sequences, which code genes for transposition.

B. Incorrect!
Contains two insertion sequences, which code genes for transposition.

C. Incorrect!
The flanking repeat sequences are between 3-12 base pairs in length.

D. Incorrect!
The flanking repeats are not part of the transposon and do not travel with it.

E. Incorrect!
The flanking structural genes code for a variety of proteins or enzymes.

Solution

A bacterial transposon, for example, is made up of two insertion sequences, which code for genes involved in transposition. It also has flanking structural genes, which code for a variety of proteins or enzymes, including antibiotic resistance. The structure of a transposon includes a 3 – 12 base pair long-flanking region of direct repeats. These are on both sides of the transposon. The flanking regions are not part of the transposon and do not travel with the transposon.

(A) Contains two insertion sequences, which code genes for transposition.

Question No. 7 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
 **Question**	**7.** Which of the following statements about the transposition of a retrotransposon is not correct? (A) A retrotransposon is transcribed into DNA in the first step. (B) A retrotransposon is transcribed into RNA by reverse transcriptase. (C) Reverse transcriptase copies the RNA intermediate into DNA. (D) After the RNA intermediate, the double-stranded DNA is inserted into a new location within the genome. (E) Retrotransposons movement utilizes both RNA and DNA.
 **Feedback**	A. Correct! A retrotransposon is transcribed into RNA.
	B. Incorrect! The RNA is transcribed from DNA by RNA polymerase.
	C. Incorrect! Reverse transcriptase does copy the RNA back into DNA.
	D. Incorrect! This does occur; this is the transposition.
	E. Incorrect! The DNA is converted to an RNA intermediate and then copied back into DNA.
 **Solution**	Transposition of a retrotransposon: The retrotransposon is transcribed by RNA polymerase into RNA. Reverse transcriptase then copies the RNA back to DNA. The double-stranded DNA is then inserted into a new position in the genome. **(A)A retrotransposon is transcribed into DNA in the first step.**

Question No. 8 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

8. Which of the following statements about the mechanism, in general, of transposition is correct?

(A) Transposition is the stationary location of a movable segment of DNA.
(B) Staggered breaks are made in the target DNA.
(C) The mechanism of transposition is different in all cases; no similarities can be generalized.
(D) The transposons are joined to double-stranded ends of DNA.
(E) The entire DNA flanking the new transposon location is replicated.

Feedback

A. Incorrect!
Transposition is the act of movement within the genome.

B. Correct!
Staggered breaks are made in the target site.

C. Incorrect!
While there is variation, there are general steps that are similar.

D. Incorrect!
The DNA insertion point includes single-stranded DNA.

E. Incorrect!
Only DNA at the single-stranded gap is replicated to fill in the gaps.

Solution

Transposition is the movement of transposons from one location to another. The mechanism of this movement varies, but there are some general similarities.
1. Staggered breaks are made on the target DNA.
2. The transposons are joined to single-stranded ends of the target DNA.
3. DNA is replicated at the single-stranded gap.

(B) Staggered breaks are made in the target DNA.

Question No. 9 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

9. Replicative transposition _____.

(A) Takes place with both class I and class II transposons.
(B) Is the only mechanism for class II transposons.
(C) Results in only 1 transposon.
(D) Involves transposase, which catalyzes the movement of the transposon.
(E) Leads to the potential loss of the donor replicon, unless the DNA break is repaired.

Feedback

A. Incorrect!
Replicative transposition takes place with class II transposons.

B. Incorrect!
Class II transposons can undergo replicative or non-replicative transposition.

C. Incorrect!
In replicative transposition, the end result is two copies of the transposon.

D. Correct!
Transposase does catalyze the movement of the transposon.

E. Incorrect!
There is no break left behind because the original and the copied transposable element are present.

Solution

There are two different mechanisms for transposition: Replicative and Non-replicative.
1. Non-replicative transposition is characterized by a transposase cutting a target site and the transposon moving to the new site.
2. Staggered flanking sequence fills in, creating direct repeats.
3. The end result is that the transposon moved from A to B.

(D) Involves transposase, which catalyzes the movement of the transposon.

Question No. 10 of 10

Instructions: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question

10. Which of the following statements about the genetic effects of transposons is correct?

(A) When a transposon is inserted into the coding sequence of a gene, it has no effect on gene function.
(B) A transposon can affect the new location in the genome, as well as where it came from.
(C) A transposon can affect a single gene but not a segment of DNA on a chromosome.
(D) Transposons affect only Maize.
(E) Transposons affect only Maize and Drosophila.

Feedback

A. Incorrect!
The gene can be inactivated by the transposon in this location.

B. Correct!
A transposon can cause a deletion mutation at its origin in the genome, when it jumps without precise excision.

C. Incorrect!
Multiple regions can be lost from a chromosome via recombination.

D. Incorrect!
Transposons exist in Maize, Drosophila, Yeast and Bacteria.

E. Incorrect!
Transposons exist in Maize, Drosophila, Yeast and Bacteria.

Solution

Transposon effects: Observation: hybrid dysgenesis: Drosophila male (P cytotype) are crossed with females (M cytotype), progeny exhibit a complex of abnormal traits, which is termed hybrid dysgenesis. Male sterility, frequent mutations, chromosome breaks and rearrangements and distorted chromosomal segregation are seen.
There are two major maize transposon types:
Ac Element: Autonomous transposition, regardless of genetic background, and carry transposase.
Ds: Non-autonomous need Ac to transpose.
In yeast - Ty elements: 1. Retrotransposons 2. Terminal imperfect direct repeats of about 330 bp, along with delta elements. 3. Two open-reading frames related to retroviral gag and pol.

(B)A transposon can affect the new location in the genome, as well as where it came from.