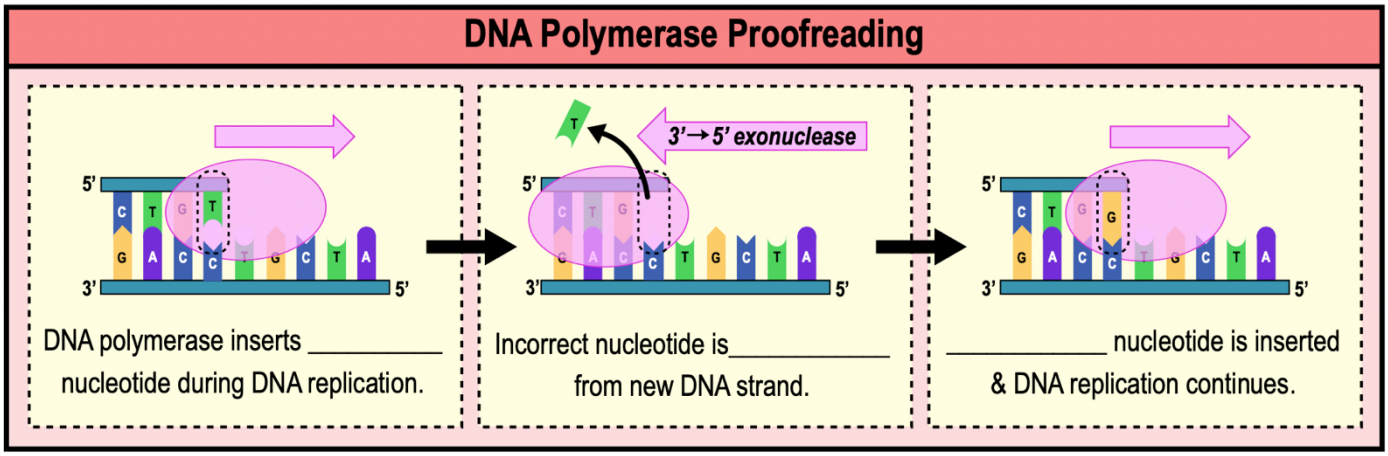
CONCEPT: DNA REPAIR MECHANISMS

DNA Polymerase Proofreading

●DNA polymerase can identify & correct _____ when synthesizing DNA by the process of *DNA proofreading.*

- □ **DNA** _____**:** self-correcting process of DNA polymerase during DNA replication.
- □ Corrects errors by "backtracking" in a 3' to 5' direction & _____ (removes) the incorrect nucleotide.
  - □ Referred to as 3' to 5' _____*nuclease* activity (cleavage of a nucleotide from the end of DNA).
- □ Once incorrect nucleotide is removed, DNA polymerase adds _____ nucleotide & replication continues.



●While very effective, DNA proofreading is not perfect & the cell requires other types of repair mechanisms.

PRACTICE: Which of the following reactions is required for proofreading during DNA replication by DNA polymerase?

a) 3' - 5' exonuclease activity.
b) 5' - 3' exonuclease activity.
c) 3' - 5' endonuclease activity.
d) 5' - 3' endonuclease activity.

PRACTICE: DNA polymerase proofreading works by removing a mismatched base in the _____ direction, then replaces it with the correct base synthesized in the _____ direction.

a) 5' to 3' ; 5' to 3'.
b) 3' to 5' ; 5' to 3'.
c) 3' to 5' ; 3' to 5'.
d) 5' to 3' ; 3' to 5'.

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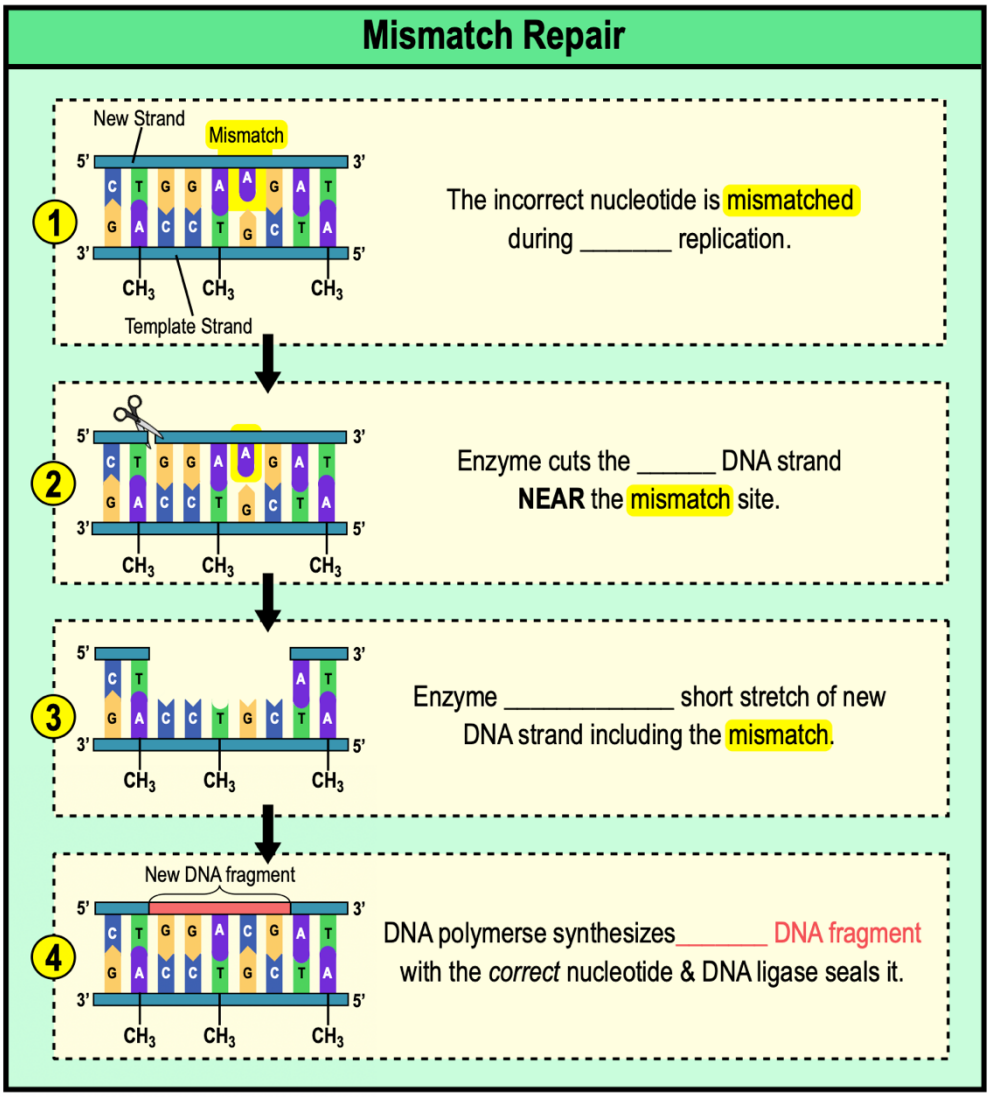
Mismatch Repair

- When proofreading by DNA polymerase fails to correct a mutation, the cell resorts to _____ *repair.*
  - □ **Mismatch Repair:** fixes mismatched nucleotides by _____ & *re-synthesizing* regions of DNA.
- *Recall:* The DNA template can be distinguished from new strand via *methylation* (template is methylated & new is not).
- *Mismatch repair* occurs in a series of _____ steps:



PRACTICE: Why is methylation important for the mismatch repair mechanism of DNA?

a) They mark the new strand of DNA.

b) They mark where proteins need to bind and remove the damaged DNA.

c) They mark the template strand of DNA.

d) They are removed to repair the mutation.

e) They mark where degradation of the new strand must take place.

CONCEPT: DNA REPAIR MECHANISMS

PRACTICE: What kind of DNA damage is repaired using the mismatch repair mechanism?

a) Point mutations made during DNA replication.

b) Point mutations caused by chemical mutagens.

c) Point mutations caused by irradiation.

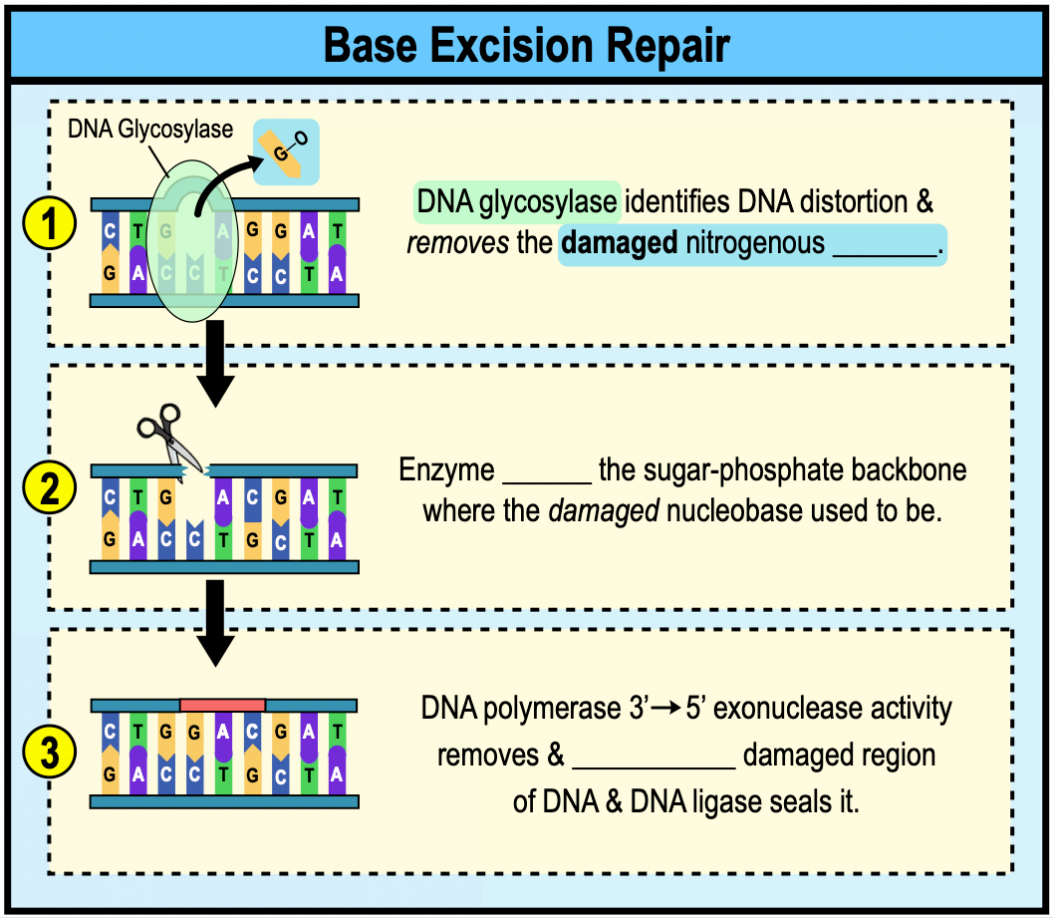
d) Double-strand breaks in DNA made during replication.

Base Excision Repair

●_____ **Excision Repair:** mechanism that replaces/repairs damaged nitrogenous bases.

□ Uses enzymes called *glycosylases* to identify damaged bases & remove them.

●Occurs in a series of ____ steps:



PRACTICE: What is the function of DNA glycosylase during base excision repair?

a) Addition of the correct nucleotide.

b) Cleavage of the phosphodiester bond.

c) Addition of the correct nucleobase.

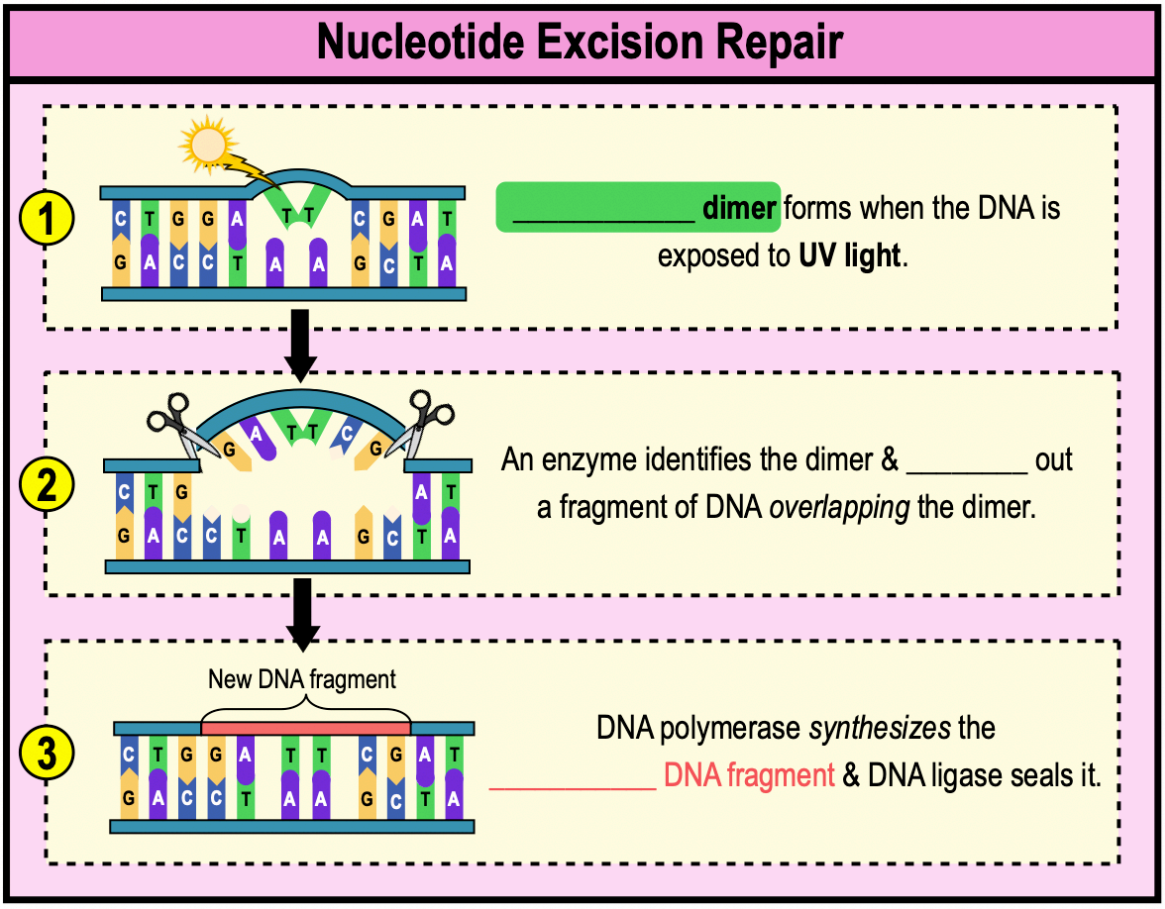
d) Removal of the incorrect nucleotide.

e) Removal of the incorrect nucleobase.

CONCEPT: DNA REPAIR MECHANISMS

Nucleotide Excision Repair

- *Recall:* Thymine dimers occur when covalent bonds form between _____ thymine bases in DNA.
- Thymine dimers can be repaired in two ways: ***Nucleotide Excision Repair*** & ***Photoreactivation***.
- **Nucleotide Excision Repair:** repairs *thymine* _____ by removing a region of DNA overlapping the dimer.
- Occurs in a series of ____ steps:



PRACTICE: Which of the following statements about nucleotide excision repair and base excision repair is true?

a) Nucleotide excision repair fixes bulky, helix distorting mutations which encompass multiple nucleotides.

b) Base excision repair fixes small, non-helix distorting mutations which only include a single, damaged base.

c) DNA glycosylase proteins are used to fix the DNA in base excision repair.

d) Thymine dimers are mutations which are commonly repaired using nucleotide excision repair.

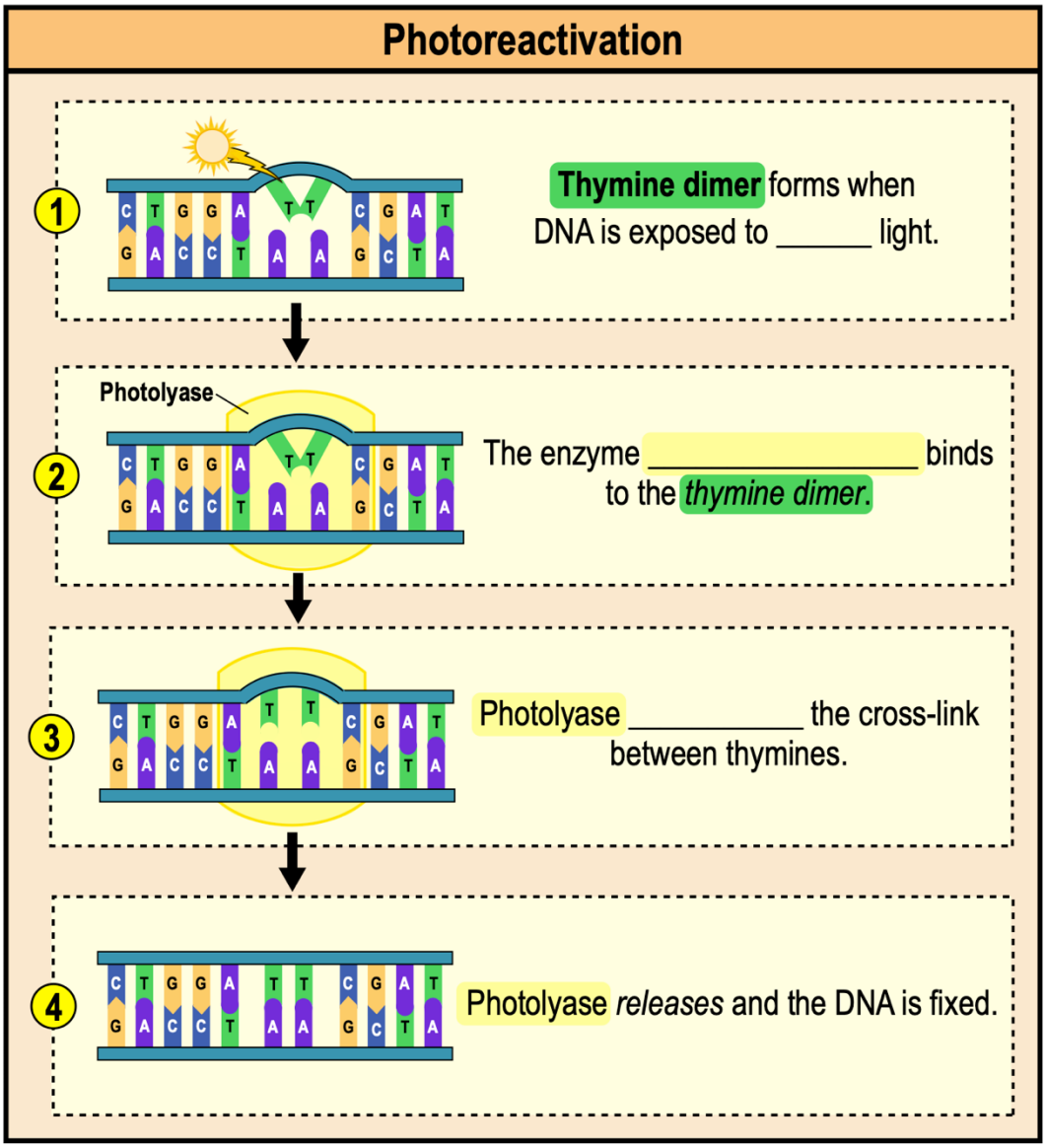
e) All of the above statements are true.

CONCEPT: DNA REPAIR MECHANISMS

Photoreactivation

●*Recall:* Thymine dimers may be repaired using *photoreactivation.*

□ **Photoreactivation:** repairing thymine dimers using the _____-responsive enzyme ***photolyase***.



PRACTICE: _____ is the enzyme involved in repairing thymine dimers during photoreactivation.

a) DNA Polymerase. b) DNA ligase. c) Photoligase. d) Photolyase. e) DNA lyase.

PRACTICE: Photoreactivation is able to remove what type of mutation?

a) UV induced double strand breaks in DNA.
b) UV induce thymine dimers.
c) Mismatches in DNA.
d) Single strand breaks in DNA.

CONCEPT: DNA REPAIR MECHANISMS

SOS Repair System

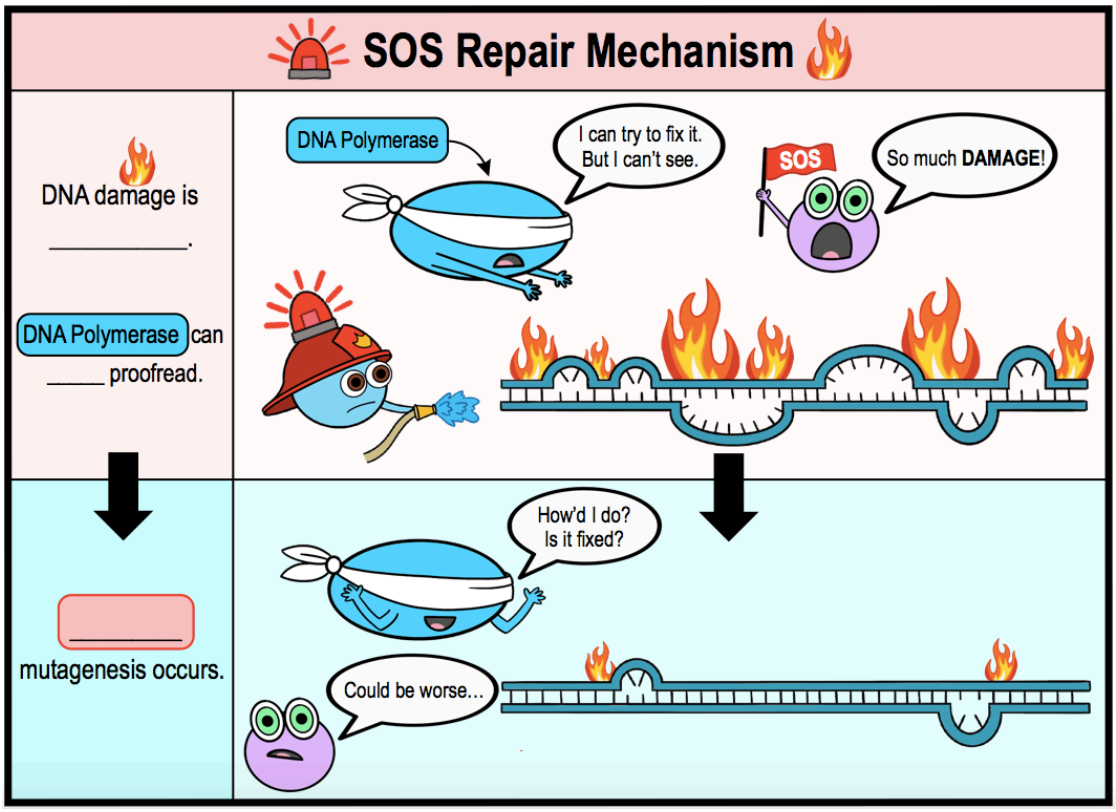
●Despite having many repair mechanisms, an organism with extensively damaged DNA expresses the _____ *system*.

□ **SOS system:** complex repair mechanism activated by the cell when the DNA is extensively damaged.

□ Acts as a _____-effort attempt to repair *extensively* damaged DNA.

●Involves expression of *several* genes including a special *DNA polymerase* that is *error prone* causing **SOS mutagenesis**.

□ **SOS mutagenesis:** mutations or errors caused by the DNA polymerase of the SOS DNA repair system.



PRACTICE: SOS repair is mediated by a _____ DNA polymerase:

a) Proofreading.
b) Mutation-resistant.
c) Single-stranded ongoing synthesis.
d) Error-prone.
e) Photoactivated.

PRACTICE: When the DNA is extensively damaged the cell needs to repair the DNA with the SOS repair mechanism. What is the negative side effect of the cell using SOS repair?

a) SOS repair mechanism can make errors in the DNA while attempting to repair larger mutations in the DNA.
b) SOS repair mechanism consumes an extremely large amount of energy.
c) SOS repair mechanism stops all other mechanisms in the cell from happening.