

Optional Practice

1) If a gene normally codes for the amino acid sequence Met-Tyr-Phe-Ala-Lys-Ser-Asp-Gln, which of the following best illustrates the result of a nonsense mutation?

- a) Met-Tyr-Phe-Ala-Lys c) Met-Tyr-Phe-Ala-Lys-Ser-Asp-Gln
b) Met-Tyr-Phe-Ala-Glu-Ser-Asp-Gln d) Met-Tyr-Phe-Leu-Val-His-Asn-Trp

2) Use this template strand from the coding region of a gene for the next three questions.

3' -AGCAGTACGCTCAGAGGTCGATTAACTG-5'

a) If the first nucleotide in the third codon is changed to a different nucleotide due to a point mutation, what amino acid(s) could the third codon now produce?

b) Which type of point mutation occurred above?

c) What would happen to the protein if the underlined guanine nucleotide is deleted?

- a) Protein will not be changed. c) Protein will be longer than normal.
b) Protein will be shorter than normal. d) Protein will not be produced.
e) Protein will contain many incorrect amino acids.

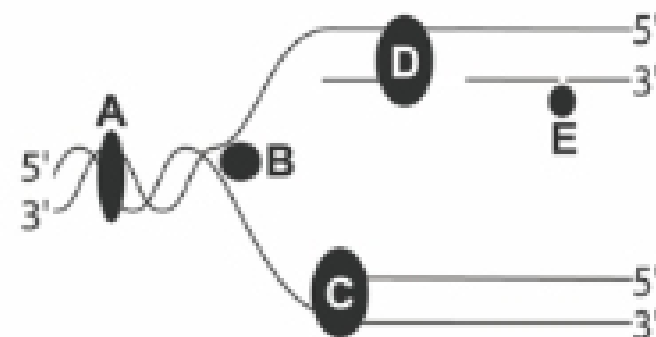
3) Expression of Gene X is enabled when a specific transcription factor binds to its promoter in response to an environmental signal. If a frameshift mutation in the gene that encodes the transcription factor results in a non-functional protein, how will expression of Gene X be affected with or without the environmental signal?

4) A DNA molecule shown at right is replicated once in the presence of labeled thymine nucleotides. Write out the DNA molecules present after replication has been completed, including directionality. Underline labeled nucleotides.

5' -ACCA-3'
3' -TGGT-5'

5) Identify the enzymes represented in the figure of a replication fork shown below.

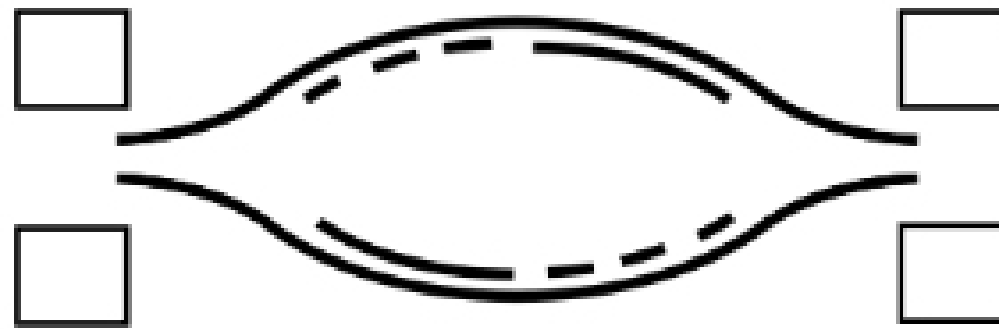
- A)
B)
C)
D)
E)



6) Which of these enzymes construct nucleotide strands from 5' to 3' (select all that apply)?

- a) topoisomerase b) helicase c) primase d) DNA polymerase e) telomerase

7) A region of DNA undergoing replication is observed with an electron microscope as shown below. Label the 5' and 3' ends of the DNA strands used as templates for replication.



8) A mutation prevents cells from making functional helicases. Which of the following would be the most direct effect of this mutation?

- a) DNA will twist too tightly during replication.
- b) Cells will only be able to replicate the leading strand.
- c) New replication forks will not be able to form.
- d) Cells will only be able to replicate the lagging strand.
- e) DNA will have unrepaired breaks in the backbone.

9) Which of these are differences between replication in a cell and PCR (select all that apply)?

- a) RNA is needed for replication in a cell but not for PCR.
- b) Replication in a cell makes one copy, while PCR makes many copies.
- c) Replication in a cell copies all of the DNA, while PCR copies part of the DNA.
- d) Okazaki fragments are needed for replication in a cell but not for PCR.
- e) Primers are needed for replication in a cell but not for PCR.

10) Select primers that are five nucleotides long to amplify the indicated region below using PCR.



11) You grow bacteria in the presence of ^{15}N , let the bacteria replicate their DNA and divide once in the presence of ^{14}N , extract the DNA, and use a centrifuge to examine the DNA density. If the conservative model of replication was correct, what would you expect to see for a result?

12) Dogs have 78 chromosomes (39 pairs) in their somatic cells as shown in the figure below. How many chromosomes would be in a somatic cell immediately after replication occurs?

