

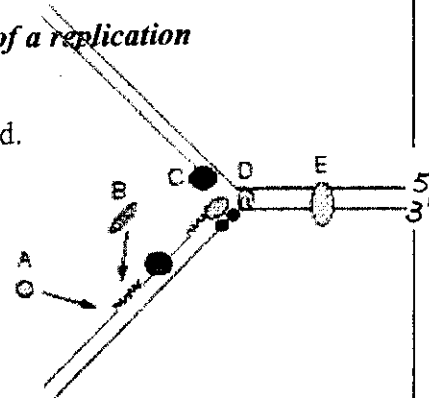
本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

I. 選擇題 (單選或多選 每題 2 分)

1. In what direction does biological DNA replication take place?
- Always in the 3' to 5' direction
 - Always in the 5' to 3' direction
 - Always in both the 3' to 5' and 5' to 3' directions
 - Sometimes in both the 3' to 5' and the 5' to 3' directions
 - All of the above

Questions 2-4 refer to the schematic diagram, on the right, of a replication fork.

2. The enzyme labeled "C" is _____ synthesizing the _____ strand.
- spontaneously; DNA
 - discontinuously; lagging
 - discontinuously; leading
 - continuously; lagging
 - continuously; leading



3. The enzyme labeled "B" represents _____, which digests primers and replaces them with DNA, and the enzyme labeled "A" represents _____, which covalently links adjacent nucleotides to seal nicks.
- DNA polymerase III, DNA polymerase II
 - DNA polymerase I, helicase
 - DNA polymerase I, DNA ligase
 - DNA polymerase III, topoisomerase
 - none of the above
4. The enzyme labeled "E" represents topoisomerase which
- unwinds double-stranded DNA
 - relieves supercoiling
 - stabilizes single-stranded DNA
 - possesses 3' to 5' exonuclease activity
 - none of the above
5. When does DNA replication occur in cells?
- Between G₀ and G₁ phases of the cell cycle
 - Between G₁ and G₂ phases of the cell cycle
 - Immediately before transcription
 - Immediately after transcription
 - At any time during cell division

(背面仍有題目,請繼續作答)

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6. There are repeat DNA sequences scattered throughout the human genome. Which of the following is found at the end of chromosomes?
- A. Microsatellite DNA repeat sequence
 - B. Minisatellite DNA repeat sequence
 - C. Telomere DNA repeat sequence
 - D. None of the above
7. In addition to DNA polymerase, DNA mismatch repair system also ensures the fidelity of DNA replication. What feature(s) in prokaryotes and eukaryotes allows this repair system to recognize and correct a mismatched nucleotide in newly replicated DNA but not in parent DNA molecules?
- A. Methylated parent DNA versus unmethylated newly synthesized DNA
 - B. Acetylated parent DNA versus deacetylated newly synthesized DNA
 - C. Un-nicked parent DNA versus nicked newly synthesized DNA
 - D. Dephosphorylated parent DNA versus phosphorylated newly synthesized DNA
 - E. All of the above
8. The mutation rate is approximately 1 nucleotide change per 10^9 nucleotides each time when DNA is replicated. This mutation rate is about the same in all organisms ranging from bacteria to humans. Since the human genome contains 3×10^9 nucleotide pairs, how many nucleotides might be mutated after one round of DNA replication?
- A. 1 nucleotide
 - B. 2 nucleotides
 - C. 3 nucleotides
 - D. 4 nucleotides
 - E. 6 nucleotides
9. What are the main sources of DNA damage?
- A. Hydrolysis
 - B. Chemicals
 - C. Radiation
 - D. DNA replicative errors
 - E. All of the above

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10. What systems are available for repairing breaks that occur on both DNA strands in cells?
- A. Base excision repair system
 - B. Nucleotide excision repair system
 - C. Homologous end-joining
 - D. Non-homologous end-joining
 - E. All of the above
11. Imagine an error occurring during DNA replication in a cell, which changes the existing (T)₆ to the (T)₇ in the coding region of a DNA repair gene. What effect will this probably have on the cell?
- A. Create a point mutation in this gene product
 - B. Create a truncated gene product
 - C. Decrease in the mutation rate
 - D. Increase in the mutation rate
 - E. All of the above
12. Although the short-term survival of a cell needs to decrease its DNA mutation rate, the long-term survival of a species needs to increase its genetic variability. Which genetic process is best for providing the genetic variability and allowing organisms to evolve in response to a changing environment?
- A. Point mutations in genes
 - B. Deletion/insertion of several nucleotides
 - C. DNA rearrangements
 - D. General recombination
 - E. Site-specific recombination
13. Which of the following processes allow large sections of the DNA double helix to move from one chromosome to another?
- A. Point mutations in genes
 - B. Deletion/insertion of several nucleotides
 - C. General recombination
 - D. Site-specific recombination
 - E. All of the above
14. Which of the following processes result in the exchange of alleles between chromosome and not the order of genes on the chromosomes?

(背面仍有題目,請繼續作答)

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- A. Point mutations in genes
- B. Deletion/insertion of several nucleotides
- C. General recombination
- D. Site-specific recombination
- E. All of the above

15. Cancer is a genetic disease, involving the following genetic changes

- A. Point mutations in genes
- B. Deletion/insertion of several nucleotides
- C. General recombination
- D. Site-specific recombination
- E. All of the above

II. 問答題

16. Briefly explain the following terms (2.5 points each, total 10 points)

- a. Anticodon
- b. Amber mutation
- c. Group II introns
- d. GAL4

17. Present a model to explain attenuation in the *trp* operon. (10 points)

18. Please describe Rho-dependent termination of transcription. (10 points)

19. You are given a linear double-stranded DNA sample which has absorbance of 0.5 at 260 nm. If this sample was prepared by mixing 1 μ l of an original DNA sample with 49 μ l of water, what is the DNA concentration in the original sample? (4 points)

If this DNA is 1 kb long, how many moles of 5' end can 1 μ l of the original DNA generate? (6 points) **Note:** 1 A₂₆₀ unit of double-stranded DNA = 50 μ g/ml. Average MW of a dsDNA base = 660 **You must write down key steps of your calculations to get full points.**

20. What is chromatin? (2 points) List major types of chromatin during interphase, and distinguish them by properties and modifications. (8 points)

21. Describe some major differences in initiation of protein synthesis between bacteria and eukaryotes regarding RNA structure, first AUG positioning, first amino acid, factors involved and regulation. (15 points)

22. Describe one major enzyme which carries out the following processes. (1 point each) (1) 18S rRNA synthesis in eukaryotic cells. (2) RNA splicing. (3) PCR in vitro. (4) enzyme digests RNA hybridized to DNA. (5) peptide formation