

7.1 DNA Structure & Replication

Question Paper

Course	DP IB Biology
Section	7. Nucleic Acids (HL Only)
Topic	7.1 DNA Structure & Replication
Difficulty	Medium

Time allowed: 20
Score: /10
Percentage: /100

Question 1

Which of the following are correct statements about nucleosomes?

- I. They contain histone proteins
- II. They help supercoil the DNA to form a compact structure
- III. They are found in both eukaryotes and prokaryotes
- IV. They consist of both DNA and chromatin

- A. I only
- B. I and II
- C. I, II and III
- D. I, II and IV

[1 mark]

Question 2

When DNA polymerase adds a new nucleotide to a growing DNA strand, which part of the last nucleotide does it form a bond with?

- A. Nitrogenous base
- B. 5' phosphate group of a pentose sugar
- C. 1' Carbon of a pentose sugar
- D. 3' -OH group of a pentose sugar

[1 mark]

Question 3

Okazaki fragments are short sections of DNA formed during DNA replication.

Which of the following statements correctly describes why they form?

- A. To help the DNA helix unwind
- B. To enable replication of the leading strand
- C. To act as a template for DNA polymerase
- D. To enable replication of the lagging strand

[1 mark]

Question 4

What is the correct sequence of events during DNA replication?

- I. DNA gyrase releases the strain within supercoiled areas of DNA.
- II. Helicase unwinds the DNA double helix.
- III. DNA Primase catalyses the synthesis of a short RNA primer.
- IV. DNA polymerase I replaces RNA primers with DNA.
- V. DNA polymerase III adds nucleotides to the template strand.

	first	→	→	→	last
A	I	II	III	IV	V
B	II	I	III	V	IV
C	I	II	V	III	IV
D	II	III	IV	V	I

[1 mark]

Question 5

The majority of the eukaryotic genome contains non-coding regions of DNA.

Which of the following are functions of non-coding DNA?

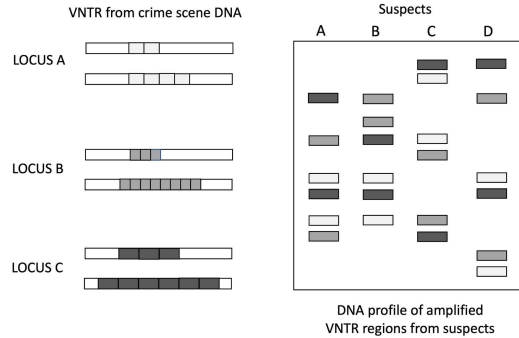
- I. Code for functional RNA molecules
- II. Regulate gene expression
- III. Allow alternative proteins to be expressed from a gene
- IV. Act as telomeres

- A. I and II
- B. II and III
- C. I, II and III
- D. I, II, III and IV

[1 mark]

Question 6

The shaded boxes in the diagram below (left) indicate Variable Number Tandem Repeats (VNTR) from three different loci that were amplified (via PCR) from DNA found at a crime scene. The diagram on the right shows DNA profiles of fragments amplified from the VNTR regions of four suspects.



Which of these suspects was most likely at the crime scene?

[1 mark]

Question 7

The dideoxy chain-termination method of DNA sequencing developed by Fredrick Sanger uses dideoxynucleotides. These modified nucleotides lack a 3'-hydroxyl group.

Which of the following best describes the effect of lacking a 3'-hydroxyl group.

- A. It allows the dideoxynucleotide to be labelled with a radioactive or fluorescent tag
- B. It increases the efficiency of the sequencing reactions
- C. The dideoxynucleotide cannot form a covalent bond with an incoming nucleotide
- D. It prevents a thymine base from being incorporated into the developing DNA strand - which terminates the strand

[1 mark]

Question 8

In the 1950s, Hershey and Chase demonstrated that DNA, not protein, is a factor of heredity responsible for carrying genetic information from one generation to another. They used viruses that were labelled with either radioactive sulphur (^{35}S) or radioactive phosphorus (^{32}P) to infect bacteria.

Which of these statements correctly describes the results of their experiment?

- A. Only bacteria infected by ^{32}P labelled viruses were shown to be radioactive
- B. ^{32}P was only detected in the supernatant
- C. Only bacteria infected by ^{35}S labelled viruses were shown to be radioactive
- D. ^{35}S was detected in the pellet after centrifugation

[1 mark]

Question 9

Rosalind Franklin's X-ray diffraction investigations provided crucial evidence that DNA was a double helix - this was instrumental to Crick and Watson developing their model of the structure of DNA.

Which statements about the structure of DNA were **not** answered by Franklin's work?

- A. The distance between nucleotides
- B. The arrangement of the nitrogenous bases
- C. The pitch of the helix
- D. Phosphates were located on the outside of the molecule

[1 mark]

Question 10

Molecular visualisation software can be used to look at the three-dimensional structure of complex macromolecules such as the nucleosome.

Which of the following statements about molecular visualisation software are correct?

- I. Can help relate structure to chemical or biological behaviour.
- II. Can support the design of pharmaceutically active compounds.
- III. Can be used to study the interactions between proteins.
- IV. Is primarily used to identify if a DNA sequence encodes for a gene.

- A. I and II
- B. I, II and III
- C. I and IV
- D. I, II, III and IV

[1 mark]