

College Admission

*IB-Biology
International Baccalaureate Diploma Programme*

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Question: 1

How many chromosomes does a human cell have after meiosis I?

- A. 92
- B. 46
- C. 23
- D. 22
- E. 12

Answer: C

Explanation:

The diploid chromosome number for humans is 46. After DNA duplication but before the first cell division of meiosis, there are 92 chromatids (46 chromosomes). After meiosis I is completed, the chromosome number is halved and equals 23. Each daughter cell is haploid, but the chromosomes are still paired (sister chromatids). During meiosis II, the two sister chromatids of each chromosome separate, resulting in 23 haploid chromosomes per germ cell.

Question: 2

In plants and animals, genetic variation is introduced during

- A. Crossing over in mitosis
- B. Chromosome segregation in mitosis
- C. Cytokines is of meiosis
- D. Prophase I of meiosis
- E. Anaphase II of meiosis

Answer: D

Explanation:

In prophase I, homologous chromosomes pair up and form tetrads. The arms of the chromosomes can break and recombine to create new genetic variations, a process called crossing over. At the end of meiosis, in Telophase I and cytokines is, the tetrads split up. The cell divides into two daughter cells that each contain one chromosome from each pair. Each daughter cell contains a unique combination of chromosomes that is different from both the mother cell and its cognate daughter cell.

Question: 3

DNA replication occurs during which of the following phases?

- A. Prophase I
- B. Prophase II
- C. Interphase I
- D. Interphase II
- E. Telophase I

Answer: C

Explanation:

Although there are two cell divisions in meiosis, DNA replication occurs only once. It occurs in interphase I, before M phase begins.

Question: 4

The synaptonemal complex is present in which of the following phases of the cell cycle?

- A. Metaphase of mitosis
- B. Prophase of meiosis I
- C. Telophase of meiosis I
- D. Metaphase of meiosis II
- E. Telophase of meiosis II

Answer: B

Explanation:

The synaptonemal complex is the point of contact between homologous chromatids. It is formed when non-sister chromatids exchange genetic material through crossing over. Once prophase of meiosis I has completed, crossovers have resolved and the synaptonemal complex no longer exists. Rather, sister chromatids are held together at their centromere prior to separation in anaphase II.

Question: 5

A length of DNA coding for a particular protein is called a (n)

- A. Allele
- B. Genome
- C. Gene
- D. Transcript
- E. Codon

Answer: C

Explanation:

Genes code for proteins, and genes are discrete lengths of DNA on chromosomes. An allele is a variant of a gene (different DNA sequence). In diploid organisms, there may be two versions of each gene.

Question: 6

In DNA replication, which of the following enzymes is required for separating the DNA molecule into two strands?

- A. DNA polymerase
- B. Single-strand binding protein
- C. DNA gyrase
- D. Helicase
- E. Primase

Answer: D

Explanation:

The enzyme Helicase unwinds DNA. It depends on several other proteins to make the unwinding run smoothly, however. Single-strand binding protein holds the single-stranded DNA in place, and Topoisomerase helps relieve tension at the replication fork.

Question: 7

Which of the following chemical moieties forms the backbone of DNA?

- A. Nitrogenous bases
- B. Glycerol
- C. Amino groups
- D. Pentose and phosphate
- E. Glucose and phosphate

Answer: D

Explanation:

DNA is composed of nucleotides joined together in long chains. Nucleotides are composed of a pentose sugar, a phosphate group, and a nitrogenous base. The bases form the "rungs" of the ladder at the core of the DNA helix and the pentose-phosphates are on its outside, or backbone.

Question: 8

Which of the following is required for the activity of DNA polymerase?

- A. Okazaki fragments

- B. RNA primer
- C. Single-strand binding protein
- D. Leading strand
- E. Replication fork

Answer: B

Explanation:

DNA replication begins with a short segment of RNA (not DNA). DNA polymerase cannot begin adding nucleotides without an existing piece of RNA (a primer).

Question: 9

Which of the following is the substrate for DNA ligase?

- A. Okazaki fragments
- B. RNA primer
- C. Single-strand binding protein
- D. Leading strand
- E. Replication fork

Answer: A

Explanation:

DNA synthesis on the lagging strand forms short segments called Okazaki fragments. Because DNA polymerase can only add nucleotides in the 5'→3' direction, lagging strand synthesis is discontinuous. The final product is formed when DNA ligase joins Okazaki fragments together.

Question: 10

Which of the following is true of the enzyme telomerase?

- A. It is active on the leading strand during DNA synthesis
- B. It requires a chromosomal DNA template
- C. It acts in the 3' → 5' direction
- D. It adds a repetitive DNA sequence to the end of chromosomes
- E. It takes the place of Primase at the ends of chromosomes

Answer: D

Explanation:

Each time a cell divides, a few base pairs of DNA at the end of each chromosome are lost. Telomerase is an enzyme that uses a built-in template to add a short sequence of DNA over and over at the end of chromosomes—a sort of protective "cap". This prevents the loss of genetic material with each round of DNA replication.

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