

المستوي الثالث / البيولوجيا الجزيئية
مقرر: بيولوجيا جزيئية (1) (301 ح)

Date: 29-12-2025

Time: 2 Hours

Marks: 70

الإمتحان في صفتين:

Answer ALL the following questions:

QUESTION (1):

(15 Marks)

Answer the following:

1. Outline how metaphase chromosomes are formed.
2. Summarize the mechanism of mRNA translation.

(6 marks)

(9 marks)

QUESTION (2):

(20 Marks)

Complete the following with suitable words:

DO NOT copy the sentences to your answer sheet

- Each histone octamer contains _____(1)_____ histone subunits, 2 copies each of _____(2)_____ different histone proteins.
- _____(3)_____ elements are segments of DNA that have the ability to move within a genome.
- _____(4)_____ assembly is the process in which complex viruses assemble by the help of proteins not found within the mature virus particle itself.
- The genes encoding RNAs that are never translated are called _____(5)_____ genes.
- Arginines within the histone proteins form electrostatic and hydrogen bonding with the _____(6)_____ along the DNA backbone.
- _____(7)_____ is a small RNA molecule that is necessary in the splicing of eukaryotic pre-mRNA.
- _____(8)_____ rRNA can detect any incorrect binding of tRNA to the A site within the ribosome and prevents elongation until the mispaired tRNA is released from the A site.
- _____(9)_____ is the scientist who proposed ball and stick model.
- An incorrect amino acid is incorporated into the growing polypeptide at a rate of approximately _____(10)_____.
- In most cases, the third base in the codon is the degenerate base and it is sometimes referred to as the _____(11)_____ base.
- Kozak's rule states the importance of G at the position _____(12)_____ and a purine, preferably an adenine, at the position _____(13)_____ for start codon selection.
- Regulation of DNA replication involves the modification of GATC sites within *oriC* by the enzyme _____(14)_____.
- The 5' end of the precursor tRNA is modified by an endonuclease known as _____(15)_____.
- The coding sequences within eukaryotic genes are called _____(16)_____.
- The codons in mRNA are recognized by the _____(17)_____ in tRNA molecules.
- The enzyme _____(18)_____ removes supercoils ahead of the replication fork.
- The exchange of DNA polymerase α for δ or ϵ is called _____(19)_____.
- The transcription factor _____(20)_____ phosphorylates the CTD of RNA polymerase II leading to the break of the contact between the factor TFIIB and RNA polymerase.

QUESTION (3):**(15 Marks)**

Which of the following statements is probably true (✓) and which is probably false (x)?

DO NOT copy the sentences to your answer sheet

- 1- Whether or not the host cell is destroyed during viral replication and release depends on the life cycle of the virus.
- 2- Barr body is heterochromatic form of X chromosomes.
- 3- During interphase, most of chromosomal DNA is found in the euchromatin form.
- 4- All eukaryotes contain mitochondrial DNA.
- 5- An endonuclease cleaves the precursor tRNA to remove a 170-nucleotide segment from its 5' end.
- 6- The force of positive supercoiling may promote DNA strand separation in small regions, which enhances replication and transcription.
- 7- DNA synthesis occurs with relatively few errors. Another way of saying this is that DNA replication exhibits a high degree of stability.
- 8- Arginines within the histone proteins form covalent bonds with the phosphate groups along the DNA backbone.
- 9- Adenosine is a nucleotide that exists in both DNA and RNA.
- 10- Avery, MacLeod, and McCarty were the first to suggest that something from the dead type III S *S. pneumoniae* can transform the type IIR bacteria.
- 11- Base modification refers to the change of RNA sequence after its transcription.
- 12- Chargaff assumed that the chemical linkage between two nucleotides is always the same.
- 13- Frederik Griffith's experiment proved that the live type III S can transform the dead type IIR bacteria into type III S.
- 14- It is easier to separate two DNA strands at a GC-rich region than at an AT-rich region.
- 15- Silencers are specific sequences that can repress the translation of a given gene.

QUESTION (4):**(20 Marks)**

Answer the following:

1. Discuss the contribution of Rosalind Franklin to the discovery of the double helix. (6 marks)
2. Discuss the experiment that proved correctness of the semi-conservative DNA replication model. (6 marks)
3. To synthesize DNA in vitro, single-stranded DNA can be used as a template. As described in figure 11.17, you also need to add DNA polymerase, deoxyribonucleotides, and a primer in order to synthesize a complementary strand of DNA. The primer can be a short sequence of DNA or RNA. The primer must be complementary to the template DNA. Let's suppose a single-stranded DNA molecule is 46 nucleotides long and has the following sequence:
Left **GCCCCGGTACCCCGTAATATACGGGACTAGGCCGGAGGTCCGGGCG** Right
This template DNA is mixed with a primer with the sequence 5'-CGCCCCGGACC-3', DNA polymerase, and deoxyribonucleotides. In this case, a double-stranded DNA molecule is made. However, if the researcher substitutes a primer with the sequence 5'-CCAGGCCCGC-3', a double-stranded DNA molecule is not made.
 - A. Which is the 5' end of the DNA molecule shown, the left end or the right end?
 - B. If you added a primer that was 10 nucleotides long and complementary to the left end of the single-stranded DNA, what would be the sequence of the primer? You should designate the 5' and 3' ends of the primer. Could this primer be used to replicate single-stranded DNA?

(8 marks)

Best Wishes,,,,,

Examiner: Prof. Ahmed M. Ghoneim