

Virtual University of Pakistan

Bio302

Molecular Biology

Midterm past papers solved

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Bio302 today paper 10:30 a.m.

Total 26 Qs of 40 marks.

20 MCQs.

2Qs of 2 marks , 2 of 3 marks and 2 of 5 Marks.

Q:1. How DNA replication initiates? 2 marks

Ans: The proteins that initiate DNA replication bind to DNA sequences at a replication origin to catalyze the formation of a replication bubble with two outward-moving replication forks. The process begins when an initiator protein–DNA complex is formed that subsequently loads a DNA helicase onto the DNA template.

Q:2. How and what cross linkage by alkylating agents? Exact wording yad nahi 2 marks

Ans: Alkylating agents utilize selective alkylation by adding the desired aliphatic carbon chain to the previously chosen starting molecule. This is one of many known chemical syntheses. Alkylating agents are a highly reactive group of electrophiles which transfer methyl, ethyl or alkyl groups to the electron-rich atoms in the DNA and damage it.

Q:3. Why wrongly incorporated nucleotide while DNA replication results in permanent mutation? 3 marks

Ans: If DNA polymerase incorporates the wrong nucleotide into a newly synthesized DNA strand a single base pair substitution will occur. Another kind of error called strand slippage happens when DNA polymerase adds an extra nucleotide or skips a nucleotide in the newly synthesized DNA strand, which results respectively in an insertion or deletion. Strand slippage often occurs in regions of the genome with repetitive DNA sequence.

Q:4. Why C-N bond of peptide bond can't rotate freely? 3 marks

Ans: The stability of the peptide bond is due to the resonance of amides. With resonance, the nitrogen is able to donate its lone pair of electrons to the carbonyl carbon and push electrons from the carbonyl double bond towards the oxygen, forming the oxygen anion. This resonance effect is very stabilizing because the electrons can be delocalized over multiple atoms, with one especially stable resonance structure containing the highly electronegative oxygen as an anion. The double bond character of the C-N bond results in a relatively short bond. The double bond resonance form of the peptide bond helps to increase stability and decrease rotation about that bond. The partial double bond character is either strengthened or weakened depending upon the environment that it is in.

Q:5. How many standard amino acids are there? Name any 5. 5 marks

Ans: In eukaryotes, there are only 21 proteinogenic amino acids, the 20 of the standard genetic code, plus selenocysteine. Humans can synthesize 12 of these from each other or from other molecules of intermediary metabolism.

Examples:

- Alanine
- Tryptophan
- Glutamine
- Aspartic acid
- Histidine

Q:6. Write the mechanism of CPD photolyases in repair of DNA.. 5 marks

Ans: CPD photolyase can bind to DNA in the dark by recognizing the altered DNA structure caused by a CPD formation rather than a specific nucleotide sequence.

This binding is about 10⁵ tighter when a DNA segment contains a CPD than when it does not.

· Half of the binding energy appears to come from interactions between enzyme and the DNA back bone.

· The other half of energy comes from interactions between the FADH at the active site and the CPD.

· However, the light harvesting antenna pigment does not influence binding.

· Once the enzyme – DNA complex is formed, the CPD is flipped out of the DNA double helix and into the enzyme's active site.

· After the CPD flips into the enzyme's active site, the energy of an absorbed photon is

transferred from the light harvesting antenna pigment to the FADH

- FADH then transfers an electron to the CPD to induce cyclobutane ring cleavage.
- The catalytic cycle is completed when the electron is transferred back from the repaired thymine to the FADH cofactor.

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Q:1 Salient feature of DNA polymerase

Ans: The DNA polymerases are enzymes that create DNA molecules by assembling nucleotides, the building blocks of DNA.

This region of DNA polymerase binds two divalent metal ions (Mg^{2+} or Zn^{2+}).

DNA polymerase is required to help duplicate the cell's DNA, so that a copy of the original.

DNA molecule can be passed to each of the daughter cells. In this way, genetic information is transmitted from generation to generation.

DNA polymerase adds new free nucleotides to the 3' end of the newly-forming strand, elongating it in a 5' to 3' direction.

The DNA is therefore "proofread" by DNA polymerase after it has been copied so that misplaced base pairs can be corrected.

Q:2 Structure of influenza virus,

Ans: The structure of the influenza virus is somewhat variable, but the virion particles are usually spherical or ovoid in shape and 80 to 120 nanometers in diameter. Sometimes filamentous forms of the virus occur as well, and are more common among some influenza strains than others.

Q:3 Name three proteins that catalyse DNA

Ans: 1) O⁶-alkylguanine DNA alkyltransferase I

2) O⁶-alkylguanine DNA alkyltransferase II

3) O⁶-alkylguanine DNA alkyltransferase I

Q:4 Types of uv rays also define

Ans: Cells are exposed to three types of high energy electromagnetic radiations which can damage their DNA.

These radiations include:-

Ultraviolet light (wavelength 100-400nm)

X-rays (wavelength 0.01-100nm)

Gamma rays (wavelength <0.01nm)

Later two are ionizing radiations.

Ultraviolet light is divided into three bands:

UV –A (321-400nm)

UV –B (296-320nm)

UV –C (100-295nm)

Q:5 Contribution of Franklin and Wilkins

Ans: Wilkins and Franklin work on DNA

Maurice Wilkins and Rosalind Franklin, together with Ray Gosling, Alec Stokes and Herbert Wilson and other colleagues at the Randall Institute at King's, made crucial contributions to the discovery of DNA's structure in 1953.

Wilkins began using optical spectroscopy to study DNA in the late 1940s. In 1950 he and Gosling obtained the first clearly crystalline X-ray diffraction patterns from DNA fibres. Alec Stokes suggested that the patterns indicated that DNA was helical in structure.

The discovery of the structure of DNA in 1953 revealed the physical and chemical basis of how characteristics are passed down through the generations and how they are expressed in individual organisms.

X-ray diffraction pattern of DNA

Q:6 Cross linking alkylating.

Ans: Answer above

Bio302 okazaki fragment difference between pentose sugars and ribse and doxy ribose end replication in DNA RNA and its types

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1. Polarity of DNA helicase

Ans: DNA helicases found at replication forks exhibit high processivity because they encircle the DNA. They associate with the DNA and unwind multiple base pairs of DNA. Release of the

helicase from the DNA therefore requires the opening of the hexameric protein ring, which is a rare event. However, the helicase can dissociate when it reaches the end of the DNA strand. Of course, this arrangement of enzyme and DNA poses problems for the binding of the DNA helicase to the DNA strand in the first place. Thus, there are specialized mechanisms that open the DNA helicase (hexameric) ring and place it around the DNA before re-forming the ring. Each DNA helicase moves along ssDNA in a defined direction. This property is referred to as the polarity of the DNA helicase. DNA helicases can have a polarity of either 5' → 3' or 3' → 5'. This direction is always defined according to the strand of DNA bound rather than the strand that is displaced.

2. Function of CPD photolyase

Ans: Answer above

3. Advancmnt of molecubr bio in agriculture science

Ans:

- Cultivar Identification and Analysis of Seed Purity
- Evaluation of Germplasm Resource
- Construction of Genetic Map
- Gene Information Describing the Crop Phenology
- Prevention and Control of Agricultural Disease and Pest

4. Standrd amino acids 5 name

Ans: Answer above

5. 2 Mutations which cause one base change

Ans: A substitution is a mutation that exchanges one base for another (i.e., a change in a single "chemical letter" such as switching an A to a G). Such a substitution could:

1. change a codon to one that encodes a different amino acid and cause a small change in the protein produced. For example, sickle cell anemia is caused by a substitution in the beta-hemoglobin gene, which alters a single amino acid in the protein produced.
2. change a codon to one that encodes the same amino acid and causes no change in the protein produced. These are called silent mutations.
3. change an amino-acid-coding codon to a single "stop" codon and cause an incomplete protein. This can have serious effects since the incomplete protein probably won't function.

6. Types of uv light

Ans: Answer above

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