THE VILLAGE
INTERNATIONAL SCHOOL
"We Nurture Dreams"
AIM HIGH, TOGETHER WE FLY

Date:08/11/24 | MONTHLY TEST-03 (2024-25) | Max marks:20

Grade:XII | BIOLOGY(044) | Time:50min

General Instructions:

1. There are 9 questions in the question paper. All questions are compulsory.

Qn. No	SECTION A	Marks allocated
1	The enzyme used to produce complementary DNA (cDNA) from an mRNA template is: a) DNA polymerase b) Reverse transcriptase c) DNA ligase d) Restriction enzyme	1
2	Which restriction site is not present in pBR322 plasmid? a) EcoRI b) Hind III c) Hind II d) Sal I	1
3	The genetically modified brinjal in India has been developed for a. Drought resistance b. Enhancing mineral content c. Enhancing shelf life d. Insect resistance	1

4	1. Both *A* and *B* are true and the *B* is the correct explanation of *A* 2. Both *A* and *B* are true but the *B* is not the correct explanation of *A* 3. *A* is true but *B* is false 4. Both *A* and *B* are false Assertion : All three RNAs (mRNA, tRNA and rRNA) are needed to synthesise a protein in a cell. Reason : The mRNA provides the template, rRNA brings aminoacids and reads the genetic code, and tRNA play structural and catalytic role.	1
5	SECTION B Explain about the dna polymerase present in E.coli • The DNA dependent DNA polymerases have both exonuclease and polymerase activity. • The polymerase has proofreading activity in 3′ to 5′ direction and removes the mismatched nucleotides with exonuclease activity. It has the ability to repair the damage caused to DNA by UV rays. • The DNA dependent polymerase adds nucleotides complementary to the template DNA in the new strand	2
6	What is an operon? Explain an inducible operon An operon is a functional unit of genomic DNA that consists of a cluster of genes under the control of a single promoter. It is a regulatory mechanism in prokaryotic cells that allows for the coordinated expression of genes that are involved in a related function. The classic example of an inducible operon is the lac operon found in *Escherichia coli* (E. coli). The lac operon is responsible for the metabolism of lactose. When lactose is present in the environment, it acts as an inducer that binds to the repressor protein, causing it to release from the operator. This allows RNA polymerase to bind to the promoter and initiate transcription of the structural genes needed for lactose metabolism	3
7	Explain the steps of DNA fingerprinting that will help in processing of the two blood samples A and B picked up from the crime scene	3

	DNA Fingerprinting: This technique was discovered by Alec Jaffery in 1985. The technique involves following steps: i Isolation and extraction of DNA from the cell by centrifugation. ii By the help of enzyme restriction endonuclease DNA molecules are digested. The fragment also contains VNTRs. iii The small DNA fragments are separated through gel electrophoresis set-up that contain agarose polymer gel. iv The separated DNA fragments are transferred from electrophoresis plate to synthetic membranes like nitrocellulose or nylon membrane sheet called southern blotting. v The DNA probes are added which target a specific nucleotides sequence which is complementary to them and this process is called hybridisation Southern blotting. vi The nylon membrane is exposed to an X-ray film and dark orange coloured bands developed at sites where probes have bound to the DNA fragments. This is known as autoradiography. On comparing the DNA prints of blood samples A and B it can be confirmed that the blood sample picked up from the crime scene belongs to the same individual or to two different individuals.	
8	A DNA segment has a total of 1500 nucleotides, out of which 410 are Guanine containing nucleotides. How many pyrimidine bases this DNA segment possesses?	3
9	SECTION C a)What is the PCR technique? What are the many phases in this approach described? Polymerase chain reaction or PCR is a reaction that is utilised to amplify a gene or fragment of DNA of interest. It is done in vitro using a primer. This technique is used in labs to make billions of copies of the desired gene for research, diagnostic and therapeutic purposes. 1. **Denaturation:** The first step in PCR is denaturation. Denaturation is required to separate the double-stranded DNA sample. It is done at 94-98 ℃ for 20-30 seconds. It breaks the hydrogen bonds present between base pairs. Denaturation leads to the formation of single strands of DNA. 2. **Annealing:** The second step is the annealing of the primer. Here the reaction temperature is lowered to allow the complementary base pairing between the primer and the complementary part of the single strands of the DNA template. A proper temperature needs to be maintained in order to allow highly specific and proper primer hybridisation. Then DNA polymerase binds to the template-primer hybrid and starts the DNA synthesis. 3. **Extension:** A thermostable DNA polymerase is used for this purpose. Taq polymerase is commonly used for this purpose. It is done at a temperature of 75-80 ℃ (72℃). The DNA polymerase adds nucleotides	5

in the 5’-3’ direction and synthesises the complementary strand of the DNA template

b)What function(s) do each of the following play in biotechnology?

- Gel-electrophoresis
- Restriction endonuclease
- pBR322’s selectable markers
- a) The cutting of DNA at specific locations became possible with the discovery of the so-called molecular scissors-restriction enzymes. The cut place of DNA was then linked with the plasmid DNA.
- b) The cutting of DNA by restrictions endonucleases results in the fragments of DNA. These fragments can be separated by a technique known as gel electrophoresis.
- c) In addition to 'ori' the vector requires a selectable marker, which helps in identifying and eliminating non-transformants and selectively permitting the growth of the transformants.
- Transformation is a procedure through which, a piece of DNA is introduced in a host bacterium. Normally, the genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline or kanamycis, etc. are considered useful selectable markers of E.coli. The normal E.coli cells do not carry resistance against any of these antibiotics.
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