

Answer ALL the following questions:

QUESTION (1):

(15 Marks)

Complete the following with suitable words:

DO NOT copy the sentences to your answer sheet

- Reverse transcriptase is an enzyme that is normally encoded in the genomes of a group of viruses called ____ (1) ____.
- ____ (2) ____ vector is the plasmid vector that can replicate in two different species.
- ____ (3) ____ are DNA sequences that are recognized by transcription factors that inhibit transcription.
- When the two ends of vector ligate back together restoring the vector to its original circular structure, this is called a ____ (4) ____ vector.
- ____ (5) ____ DNA technology is the use of in vitro molecular techniques to manipulate fragments of DNA to produce new arrangements.
- A PCR cycle involves 3 steps: ____ (6) ____, ____ (7) ____ and ____ (8) ____.
- An ____ (9) ____ vector is designed to clone the coding sequence of genes so they will be transcribed and translated correctly.
- At the beginning of transcription, RNA polymerase slides along the DNA, forming a small bubble-like structure known as the ____ (10) ____.
- Contaminating ____ (11) ____ is removed from a nucleic acid preparation by treatment with phenol.
- DNA ____ (12) ____ refers to a method used to identify one or more regions of DNA that interact with a DNA-binding protein.
- During a sequence reaction, the incorporation of a dideoxyribonucleotide into a growing DNA strand is referred to as ____ (13) ____.
- One colony of bacteria can contain as much as ____ (14) ____ gene copies.
- The sugar-phosphate backbones within DNA strands can be covalently linked together by an enzyme called ____ (15) ____.

QUESTION (2):

(20 Marks)

Which of the following statements are probably true (✓) and which are probably false (x).

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DO NOT copy the sentences to your answer sheet

- 1- Contaminating RNA is removed from a preparation by treatment with phenol.
- 2- DNA damage proportionally increases electrophoretic DNA migration.
- 3- Dolly and the donor sheep were genetically 100% identical in the same way that identical twins are.
- 4- Gel retardation assay must be carried out under denaturing conditions.
- 5- In 1985, Mullis published the first application of PCR using beta-Globin gene.
- 6- Each bacterial colony is a mound of genetically identical cells.
- 7- For better annealing, the preferred GC content in a primer should be 40-60%.
- 8- In an operon, transcription of several genes is driven under the same promoter.

- 9- In reverse transcriptase PCR, RNA is used as the initial template and a double-stranded cDNA is produced.
- 10- A protein can recognize a specific gene via hydrogen bonding to the bases within the major groove and thus affecting the gene's ability to be transcribed.
- 11- In DNA electrophoresis, Ethidium bromide migrates in the same direction, with DNA fragments.
- 12- In most cases, a transgenic cow can produce approximately 1mg/L of the transgenic protein in its milk.
- 13- Increasing the agarose concentration of a gel increases migration speed and enables separation of smaller DNA molecules.
- 14- Taq DNA Polymerase is a proofreading enzyme with 5'-3' exonuclease activity.
- 15- Southern blotting can be used to identify a specific RNA within a mixture of many RNA molecules.
- 16- The presence of glycerol ensures that the DNA in the ladder and sample forms a layer at the top of the well.
- 17- SV40 viral DNA is used as a vector for the cloning and expression of genes in insect cells grown in the lab.
- 18- Many plasmid selectable markers are genes that confer antibiotic resistance to the host cell.
- 19- PCR can be used for amplification of a region of DNA whose sequence is not known.
- 20- When a gene is inserted into a viral genome, the gene will be replicated whenever the viral DNA is replicated.

QUESTION (3):

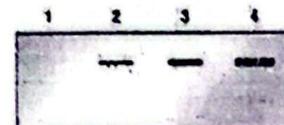
(20 Marks)

Answer the following questions:

- (A) Outline a method to screen a DNA Library to identify a cloned gene. (8 marks)
- (B) What are the features and main components that exist in any plasmid vector. (7 marks)
- (C) In the Western blotting experiment shown here, proteins were extracted from red blood cells obtained from tissue samples at different stages of human development. An equal amount of total cellular proteins was added to each lane. The primary antibody recognizes the β -globin polypeptide that is found in the hemoglobin protein. Comment on the results obtained. (5 marks)

Lane 1: Embryonic red blood cells
Lane 3: Newborn red blood cells

Lane 2: Fetal red blood cells,
Lane 4: Adult red blood cells



(15 marks)

QUESTION (4):

Answer the following questions:

- (A) Outline a method for producing human insulin by Biotechnology. (10 marks)
- (B) The following figure shows a gel for manual Sanger sequencing of a gene segment using radiolabeled ddNTPs. Determine the sequence of this segment. (5 marks)



Best Wishes,
Examiner: Prof. Ahmed M. Ghoneim