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University Examinations 2023/2024

THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MEDICAL LABORATORY

HML 3328: MEDICAL BIOTECHNOLOGY

DATE: APRIL 2024 **TIME: 2 HOURS**

INSTRUCTIONS: Answer ALL questions in section one and two and any other TWO questions in section three.

SECTION ONE: 20 MARKS

1. Thermostable DNA polymerases are very important in PCR. How are they obtained?
    a) They are obtained by heating the bacteria manually over high temperatures
    b) They are isolated from extremely stable thermophilic bacteria which are often found growing in oceanic vents
    c) They are found everywhere in nature
    d) They are obtained by genetically modifying the E. coli bacteria with thermal stability property
2. Which of the following is the name of the three-base sequence in the mRNA that binds to tRNA molecule?
    a) P site
    b) Codon
    c) Anticodon
    d) CCA binding site

3. The F plasmid is involved in which of the following processes?
    a) conjugation
    b) transduction
    c) transposition
    d) transformation
4. What is incorrect about plasmids?
    a) Helps in reproduction
    b) Contains stress resistant genes
    c) Serves as the transformation vehicle
    d) They are the genetic material of the bacteria
5. What be the consequence of not having an origin of replication (ori) in the vector?
    a) If an ori is absent, replication of vector would not take place
    b) As the cells divide after taking up the vector, both the daughter cells would be having the vector
    c) A colony of transformed colonies is observed
    d) The vector won't be taken up by the cell
6. A plasmid has two antibiotic resistant genes; ampicillin resistant gene and chloramphenicol resistant gene. If the plasmid grows in ampicillin containing medium but not in chloramphenicol containing medium, the correct conclusion would be?
    a) The insert is not present in any of the gene
    b) The insert is present in ampicillin gene but not in chloramphenicol gene
    c) insert is present in choramphenicol gene but not in ampicillin gene
    d) The insert is present between both of the genes
7. Which of the following enzymes is reverse transcriptase?
    a) DNA dependent DNA polymerase
    b) RNA dependent RNA polymerase
    c) RNA dependent DNA polymerase
    d) DNA dependent RNA polymerase
8. What are cosmid vectors?
    a) Hybrid between phage and plasmid
    b) Hybrid between M13 and lambda phage

c) Modified lambda vector

d) Modified M13 vector

9. Choose the correct statement for genomic libraries.

a) Genomic libraries include the representation of the whole genome of the organism

b) Sequences such as telomeres are also represented

c) Telomeres can be readily cloned

d) The larger the size of the insert of genomic DNA in recombinants the more is the number of recombinants required to represent the genome in the library

10. The process of finding a particular member of the library which is having some defined properties is called?

a) searching

b) screening

c) locating

d) narrowing

11. The PCR technique was developed by?

a) Kohler

b) Altman

c) Milstein

d) Kary Mullis

12. Which of the following statements are true regarding PCR?

a) Primer extension occurs at 72 ^{0}C

b) Denaturation involves heating at 90 to 98 ^{0}C

c) Annealing involves the binding of primer between 40 to 60C^{O}C

d) All of the above

13. Which of the following is used for the analysis of compositional properties of DNA?

a) Southern blotting

b) Northern blotting

c) PCR

d) CHEF

14. Which of the following is incorrect with respect to mutation?

a) Sudden

b) Continuous

c) Change in chromosomes and genes

d) Leads to variation in DNA

15. Which of the following is also known as the removal of one or more bases from the nucleotide chain?

a) Deletion

b) Insertion

c) Transition

d) Transversion

16. Which of the following does not act as a restriction enzyme?

a) Ecorl

b) BarnHI

c) HindIII

d) polydeoxyribonucleotide synthase

17. E.corl is a?

a) DNA ligase enzyme

b) Restriction endonuclease

c) A vector used for insulin synthesis

d) A plasmid used as a vector

18. Which of the following enzyme is required for end to end joining of DNA?

a) DNA ligase

b) Restriction endonuclease

c) RNA polymerase

d) DNA polymerase

19. Recombinant DNA molecule is produced by ligating?

a) Two DNA segments

b) Two rn-RNA molecules

c) One m-RNA with one t-RNA

d) One m-RNA with DNA segment

20. Arrange the following steps involved in Gene cloning in the correct order.

i) Insertion of isolated gene to the vector

ii) Expression of recombinant gene in host

iii) Extraction of recombinant gene product

iv) Isolation of desired gene

v) Introduction of recombinant vector to the host

a) i,ii, iii, iv, v

b) v, iv, iii, ii, i

c) iv, i, v, ii, iii

d) iv, v, ii, i, iii

SECTION TWO: 40 MARKS

1. A 20 base primer has a 60% G + C content. What will be the Tm assuming a 20C Tm for A+T content and a 40C Tm for G+C content (6 marks)
2. Differentiate between transversion and transitions point mutations with appropriate illustrations (6 marks)
3. Outline the advantages of plaque hybridization as applied in the screening of DNA libraries (6 marks)
4. Explain the different ways through which transposable genetic elements can damage the host cell genome (6 marks)
5. Differentiate between stringent and relaxed plasmids (6 marks)
6. Describe the difference between sticky ends and cohesive ends produced by restriction enzymes on a DNA molecule using diagrams where applicable (6 marks)
7. Outline the problems associated with E. coli in production of heterologous proteins due to the sequence of the gene of interest (6 marks)

SECTION THREE: 40 MARKS

1) i) Discuss the desirable features that should be possessed by a plasmid to make it ideal for cloning (12 marks)

ii) Outline the steps involved in isolation of plasmids from bacterial cells (8 marks)

2) Discuss in detail the processes of cloning a DNA molecule using plasmids (20 marks)

3) Discuss the various applications of recombinant DNA technology (20 marks)