



Previous Year Question Paper  
of

**G.A.T.E. (BT) 2000**

**BIOTECHNOLOGY**

**Examination**

*(Original Question Paper with Answer Key)*

**GRADUATE APTITUDE TEST IN ENGINEERING**



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## K : Biotechnology

- M) For each sub-question given below, four alternatives are provided of which only one is correct. Write the correct answer in the answer book by writing A, B, C, or D along with the corresponding sub-question number (25 x 1 = 25)

1.1 The substrate for restriction enzyme is

- (A) Single stranded RNA (B) Partially double stranded RNA  
(C) Cell wall proteins (D) Double stranded DNA

1.2 The G + C content of bacteriophage  $\lambda$  double stranded DNA is 68%. What would you expect the G + C content of its mRNA?

- (A) About 68% (B) About 34%  
(C) About 32% (D) About 86%

1.3 DNA helicases catalyse the reaction

- (A) DNA supercoiling  
(B) DNA unwinding  
(C) Cleavage of DNA helix  
(D) Interconversion of DNA topoisomers

1.4 In human populations, 4% of the individuals are homozygous recessive to a specific RFLP marker. What percentage of individuals do you expect to be heterozygous for this trait?

- (A) 4% (B) 8%  
(C) 16% (D) 32%

1.5 Rho-dependent and rho-independent transcription termination mechanisms operate in prokaryotes. Rho independent termination mechanism involves

- (A) Binding of the rho protein upstream of the termination element  
(B) No protein factors and only RNA secondary structure and run of 'U's  
(C) Presence of UGA or UAA stop codons  
(D) Binding of accessory factors at termination signal

1.6 Many plasmids have Amp<sup>r</sup> marker. This implies

- (A) The plasmids contain genes for ampicillin biosynthesis  
(B) Ampicillin is required for bacterial growth after transformation  
(C) The plasmid contains the gene encoding  $\beta$ -lactamase  
(D) Ampicillin is essential for cell survival

- 1.7 Choose the correct completion of the following statement.  
A fermenter sterilisation in situ is less efficient than continuous heat sterilisation because
- (A) it uses higher temperature for longer time
  - (B) it uses longer heating time during which heat is lost
  - (C) it uses larger volume and hence takes longer to cool the medium
  - (D) it uses steam as the heating source
- 1.8 Which of the following has been produced commercially from mammalian cell cultures?
- (A) Plasminogen activator
  - (B) Antibacterial antibiotics
  - (C) Insulin
  - (D) Renin
- 1.9 Mung bean nuclease could be used for
- (A) DNA synthesis
  - (B) nucleotide hydrolysis
  - (C) trimming single stranded regions in DNA
  - (D) removal of phosphate groups from the ends of the DNA
- 1.10 Phage T7 promoter containing plasmids are used for overexpression of cloned genes because
- (A) their convenient size
  - (B) their single stranded nature
  - (C) Exquisite specificity of T7 RNA polymerase to phage promoters
  - (D) T7 infects *E. coli* and lysogenizes the cell
- 1.11 In eukaryotes the ribosomal RNA genes are transcribed by
- (A) Reverse transcriptase
  - (B) RNA dependent RNA polymerase
  - (C) RNA polymerase I
  - (D) RNA polymerase III
- 1.12 Yeast artificial chromosome (YAC) is used for
- (A) cloning large segments of DNA
  - (B) cloning only yeast genomic sequences
  - (C) cloning of only cDNA sequences
  - (D) all DNA except plant DNA sequences
- 1.13 The term protein splicing refers to
- (A) Removal of intervening sequences between the genes
  - (B) Splicing out of introns from RNA
  - (C) Removal of intervening protein sequences from the translated protein
  - (D) Joining (splicing) of two different gene products to generate a novel protein

- 1.14 Which one of the following is not a requirement for a PCR reaction?
- (A) DNA template (B) Taq polymerase  
(C) NTPs (D)  $MgCl_2$
- 1.15 In secondary metabolism two distinct phases - trophophase and idiophase refer respectively to
- (A) Growth and production phase  
(B) Early and late phase  
(C) Primary and secondary metabolism  
(D) Lag phase and log phase
- 1.16 Which of the following eukaryotic organisms has been proven to be of great industrial importance?
- (A) *Penicillium chrysogenum* (B) *Saccharomyces cerevisiae*  
(C) *Bacillus subtilis* (D) *Streptomyces griseus*
- 1.17 Plant breeders have an advantage over animal breeders in reproducing a desired type offspring because the plant breeders can employ
- (A) Gene mutations (B) Hybridization  
(C) Clonal propagation (D) Selection
- 1.18 Which one of the following options related to the following statement is incorrect? In comparison to physical/chemical methods of clean up, bioremediation methods
- (A) Use relatively simple techniques  
(B) Generally end up with hazardous waste material  
(C) Are relatively slow  
(D) Are unobtrusive and non-disruptive
- 1.19 Abzymes are
- (A) Enzymes that are highly specific like antibodies  
(B) Antibodies that have catalytic activities  
(C) Also referred to as zymogens  
(D) Enzymes which hydrolyse antibodies
- 1.20 cDNA made from the mRNA of an organism was used to make a cDNA library in a vector that allows the expression as a fusion with a reporter tag. What percentage of the cDNA clones is likely to give rise to correct gene products?
- (A) 10% (B) 30%  
(C) 50% (D) 100%

1.21 Commonly used reporter gene in plant expression vectors is

- (A) Ti gene of *Agrobacterium tumefaciens*
- (B) GUS gene
- (C)  $\beta$ -lactamase gene
- (D)  $\alpha$ -amylase gene

1.22 Which one of the following is not a protease?

- (A) Proteasome
- (B) Trypsin
- (C) Chymotrypsin
- (D) Peptidyl tRNA hydrolase

1.23 The Pasteur Effect is

- (A) Inhibition of glucose utilization and lactate accumulation in glycolysis
- (B) Sterilisation of milk
- (C) Vaccine production
- (D) Heat treatment of bacteria

1.24 Detection of which hormone is the commonly used test for pregnancy in humans?

- (A) LH
- (B) FSH
- (C) Chorionic gonadotropin
- (D) Estrogen

1.25 PKU is one of the best known hereditary disorders in amino acid metabolism. The defect is attributed to a lesion in one of the following enzymatic activities

- (A) Phenylalanine ammonia lyase
- (B) Phenylalanine hydroxylase
- (C) Tyrosine hydroxylase
- (D) Phenylalanine transaminase

M2 (a) Match the column A with those in column B

- |                                |                                 |
|--------------------------------|---------------------------------|
| (A) Chemical sequencing of DNA | (1) Southern                    |
| (B) DNA blotting               | (2) Temin, Baltimore & Dulbecco |
| (C) Monoclonal antibodies      | (3) F. Sanger                   |
| (D) Reverse transcription      | (4) Maxam and Gilbert           |
| (E) Protein sequencing         | (5) Kohler and Milstein         |
| (F) Polymerase chain reaction  | (6) K. Mullis                   |
- (3)

(b) If all the steps in a PCR reaction were to work at 100% efficiency, how many micrograms of 1Kb product will be generated from 1 p mole of DNA template after 10 cycles (1 bp = 660 Da)

(2)

M3 Write whether the following statements are true or false

- (a) Three important characteristics in performance of biosensors are selectivity, sensitivity and stability
- (b) Activated sludge process is one of the most common anaerobic sewage treatment method
- (c) In a fermentor, impellers increase oxygen demand by producing high shear forces
- (d) A pressure cycle is a type of air lift fermentor
- (e) Monoclonal antibodies are used extensively in diagnosis of haematopoietic cancers (5)

M4 (a) Explain in one sentence why you can not have monoclonal antibodies which can react with mast cells (2)

(b) What are bispecific monoclonal antibodies? (1)

(c) How bispecific monoclonal antibodies can be generated. (Give two methods) (2)

M5 (a) What is somatic embryogenesis? (1)

(b) What is the difference between direct and indirect somatic embryogenesis? (2)

(c) State two methods for direct DNA transfer into plant cells (2)

M6  
6.1 The double stranded DNA molecule of a virus was found by electron microscopy to have a length of 34  $\mu\text{M}$ .

- (a) How many nucleotide pairs are there in one molecule? (1)
- (b) How many complete turns of the two polynucleotide chains are present in such a double helix? (1)

6.2 A protein PZ is present in genetically engineered bacteria at 5% of the total protein (0.1 pico gram) per cell. 1 ml of log phase culture contains  $2 \times 10^8$  cells while stationary phase culture contains  $1 \times 10^9$  cells. The molecular weight of the protein is 30,000 Da and the Avagadro number is  $6.02 \times 10^{23}$  molecules/mole. What is the number of molecules of PZ per cell? Calculate the amount of protein in milligrams in one litre each of log phase and stationary phase cultures. (3)

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