Previous Year Question Paper

of

G.A.T.E. (BT) 2001

BIOTECHNOLOGY

Examination

(Original Question Paper with Answer Key)

GRADUATE APTITUDE TEST IN ENGINEERING

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K : Biotechnology

K1 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 × 1 = 25)

1.1 The limiting factor in the production of large quantities of ethanol as bio-fuel is

(A) Lack of a balanced medium
(B) Ethanol toxicity to cells
(C) Expensive downstream processing steps
(D) Only (B) and (C) of the above

1.2 Gel retardation assay is routinely used to monitor interactions between

(A) Proteins
(B) Drug and nucleic acid
(C) Nucleic acids
(D) Protein and nucleic acid

1.3 Efficient expression of a heterologous protein product is influenced by

(A) Transcriptional efficiency
(B) Copy number of the plasmid
(C) Codon bias
(D) All of the above

1.4 The fundamental feature of the genetic code which allows the expression of a protein in any host is its

(A) Triplet nature
(B) Universality
(C) Degeneracy
(D) Redundancy

1.5 When thymidine synthesis is inhibited, eukaryotic cells will be arrested at

(A) End of S phase
(B) End of M phase
(C) G1/S interphase
(D) G2/M interphase

1.6 To PCR amplify the sequence

ATCTTCTACG .... AAGCTTGCGG
TAGAAGATGC .... TTCGAACGCC

the required primers are

(A) ATCTTCTA and CGAACGCC
(B) ATCTTCTA and CCGCAAGC
(C) TAGAAGAT and CGAACGCC
(D) TAGAAGAT and CCGCAAGC

1.7 The major groove of DNA is lined by

(A) N3 of purine and N1 of pyrimidine
(B) N7 of purine and O2 of pyrimidine
(C) N7 of purine and C4 of pyrimidine
(D) None of the above

1.8 The heterozygosity of any locus can be ascertained by

(A) RFLP analysis
(B) SNPs
(C) FISH analysis
(D) Either RFLP analysis or SNPs

1.9 BAC, which can be used to clone large DNA fragments, is derived from

(A) ColE plasmid
(B) F plasmid
(C) 2μ
(D) Mu phage

1.10 Antibody diversity is generated by

(A) Protein splicing
(B) Somatic mutation
(C) Allelic exclusion
(D) Inter-chromosomal recombination

1.11 Resistance to herbicide chlorsulfuron in plants is due to a change in

(A) Glutamine synthetase
(B) Threonine deaminase
(C) Acetolactate synthase
(D) DNA polymerase

1.12 A heterologous protein for its expression in the milk of a transgenic animal should be under the control of the promoter of the gene coding for

(A) β-Globin
(B) β-Lactoglobulin
(C) Preproinsulin
(D) *lac*Z

1.13 To isolate a gene coding for glucagon, the cDNA library has to be constructed using mRNA isolated from

(A) Intestine
(B) Pancreas
(C) Pituitary
(D) Brain

1.14 If the fractional recovery at each step of unit operation is 0.8, the recovery after 4 ste[ps] will be

(A) 0.24
(B) 3.23
(C) 0.41
(D) 0.82

1.15 The factor(s) likely to increase the rate of reaction catalyzed by a surface immobilized enzyme is/are

(A) Increased agitation of the bulk liquid containing the substrate
(B) Continued replacement of the bulk liquid containing the substrate
(C) Increased concentration of the substrate in the bulk liquid
(D) All of the above

1.16 Which of the following cases are likely to lead to faster rates of catalysis by an enzyme immobilized on a negatively charged support?

(A) A positively charged substrate and a negatively charged product
(B) A negatively charged substrate and a positively charged product
(C) A positively charged substrate and a positively charged product
(D) None of the above

1.17 The essential component of Ti plasmid required for integration into plant genome is

(A) Origin of replication
(B) Tumor inducing gene
(C) Nopaline utilization gene
(D) All of the above

1.18 Positional cloning approach exploits information

(A) On the location of the gene in the genome
(B) On the status of its expression
(C) About the position of promoter relative to MCS
(D) About the position of the restriction sites

1.19 Hormone pairs required for a callus to differentiate are

(A) Auxin and cytokinin
(B) Auxin and gibberellin
(C) Ethylene and gibberellin
(D) Cytokinin and gibberellin

1.20 Reverse genetics means

(A) Finding the function of a ORF
(B) Finding the gene responsible for a trait
(C) RNA dependent DNA synthesis
(D) Converting somatic cell to a germ cell

1.21 Which of the following statements applies to the operation of a fed-batch process?

(A) The volume of the culture increases with time
(B) It helps controlling repressive effects of the nutrient being fed
(C) It eliminates the need for oxygen supply
(D) Only (A) and (B) of the above

1.22 A gene can not be isolated from a human genomic DNA library by functional complementation in *E. coli* because of

(A) Non-functional promoter
(B) The absence of splicing machinery
(C) Coupled transcription and translation
(D) Codon bias

1.23 In large-scale fermentation, the preferred method of sterilization is

(A) Chemicals
(B) Radiation
(C) Filtration
(D) Heat

1.24 Embryo rescue is a useful technique to

(A) Grow/generate hybrids between different plant species
(B) Complete the growth of embryos susceptible to defects in seed development
(C) Break the dormancy of seeds
(D) All of the above

1.25 Which of the following is not true of aerobic digestion?

(A) It generates most sludge
(B) It generally incurs higher running cost
(C) It may generate a usable fuel
(D) Requires a shorter residence time

K2 Match the products in **Column A** with their corresponding organisms in **Column B**

Column A	Column B
A. *Aspergillus niger*	1. Lysine
B. *Saccharomyces cerevisiae*	2. Citric acid
C. *Penicillium chrysogenum*	3. Acetone/ butanol
D. *Lactobacillus casei*	4. Vitamin B_{12}
E. *Corynebacterium glutamicum*	5. Erythromycin
	6. β-Lactam
	7. Diacetyl
	8. Ethanol

K3 Match the unit operations in **Column A** with the most appropriate recovery stage in **Column B** (5)

Column A	**Column B**
A. Drying	1. Pretreatment
B. Sedimentation	2. Purification
C. Membranes	3. Formulation
D. Cell disruption	4. Solid/liquid separation
E. Chromatography	5. Solid/solid separation
	6. Concentration

K4 (a) A chemostat is operating at steady state at a dilution rate of 0.1hr $^{-1}$ and a limiting nutrient concentration of 10 μM. If the μ_{max} for the organism is 0.5 hr $^{-1}$, calculate the Monod constant for the nutrient. (3)

(b) Why asparaginase is used in anticancer therapy? (2)

K5 (a) Write the reaction catalyzed by penicillin G acylase. (1)

(b) Name any two techniques by which penicillin G acylase may be immobilized. (2)

(c) Why are mammalian cells cultured in CO_2 incubators? (1)

(d) Mention an important post-translational modification absent in prokaryotes making them unsuitable hosts for expressing human genes. (1)

K6 (a) The sequences at the cloning site of three vectors are given below. The *Bam*HI (GGATCC) and *Hind*III (AAGCTT) sites are underlined. Only the sequences around the restriction sites are shown. The symbol "———" indicates rest of the sequence.

Vector 1: ——— Promoter … ATGGGTCGCGGATCCGGCTGC .. AAGCTT ———

Vector 2: ——— Promoter … ATGGGTCGGGATCCGGCTGCT .. AAGCTT ———

Vector 3: ——— Promoter … ATGGGTCGGATCCGGCTGCTA .. AAGCTT ———

Which one of the above three vectors is appropriate to clone the following ORF

——— **ATGCCCAACACCCGGATCCCG .. TAAAAGCTT** ———

for expression? Give the reason in **one** sentence. (2)

(b) Draw the restriction map of the plasmid given the following data (**the gel pattern** shown below is not to scale). The size of each DNA fragment (in kb) is indicated next to it. (3)

EcoRI	*SalI*	*HindIII*	*EcoRI* & *HindIII*	*SalI* & *HindIII*	*EcoRI* & *SalI*
5.4 —	5.4 —				
					3.6 —
		2.1 —	2.1 —		
		1.9 —		1.9 —	1.8 —
		1.4 —	1.4 —	1.4 —	
			1.3 —	1.2 —	
				0.9 —	
			0.6 —		