Sample Question Paper
Session 2015 - 16
Class – XII
Biotechnology (045)

Marking Scheme

SECTION-A

1. Methylation

   Student will add a methyl group to one or two bases within the sequence recognized by enzyme. 1

2. A gene whose product can identify the host cells containing the vector. 1

3. Protein Efficiency Ratio ½
   PER is used as a measure of growth expressed in terms of weight gain of an adult by consuming 1g of food protein. ½

4. (a) 4 & 8 with L & E 1
   (b) 7 with five different amino acids 1

5. Log Phase ½
   Cell number increases exponentially ½

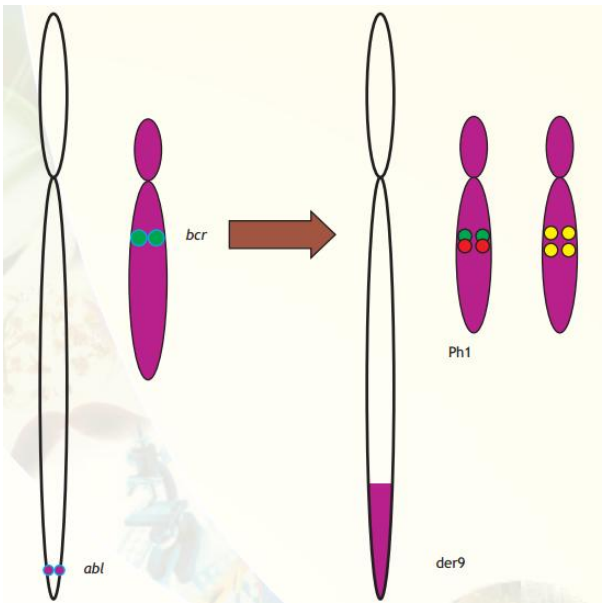
6. CHO is a eukaryotic host cell so it is used to clone eukaryotic gene. 1

SECTION-B

7. In pUC19 –two bands ½
   Linear DNA ½
   Because restriction endonuclease cleaves the DNA internally 1

8. The negatively charged oxygen anion is able to make a nucleophilic attack on the carbonyl carbon of the peptide bond of its substrate. 1
   It loosens the carbonyl carbon, so that a water molecule can hydrolyse the bond. 1

9. Nick translation is used to detect CML i.e., Chronic Mylogenus Leukemia 1



1

10. It shows inaccuracy in gene prediction ½

There is no correlation between the intuitive complexity of an organism and of other eukaryotes ½

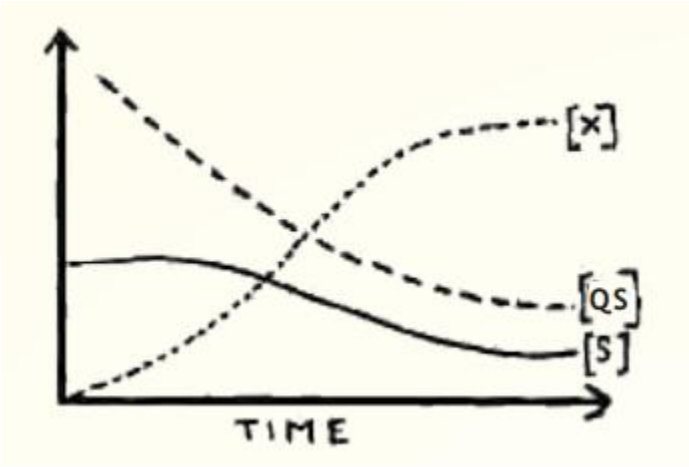
Yeast encodes 70 percent of proteins whereas warm and fruit fly encode 20-25% 1

OR

Biological homology can be detected by BLAST- basic local alignment search tool
Homologues represent the similarity due to common ancestory and they will have same function Paralogs similarities due to random chance and may differ in function.

1+1

11. Graph of batch culture Fig.5.Pg No.91 NCERT 1



Graph of continuous culture Fig.7. Pg No.92 NCERT 1

12. Advantages of *Pichia pastoris* as a eukaryotic expression host:

(i) Has strong inducible promoters

(ii) Is capable of making post-translational modifications

(iii) Downstream processing is simpler as *Pichia* does not secrete its own proteins into the fermentation medium.

(Any two of the above advantages) 1+1

13. Biosynthetic pathway which leads to the production of secondary metabolites are being engineered for their over-production to reduce the cost. 1

The over expression of the gene which encodes for the first enzyme in the pathway which results in higher levels of desired end products. 1

14. Advantages of animal cell culture:

Homogenous genetic population, Controlled physico-chemical environment, Easy to add genes, Available in adequate numbers, Easy production, No ethical clearance required, Cost effective.

(any two of the above points) ½ x 2

Disadvantages of animal cell culture:

small size sensitive to detect the changes, challenging scale up, may not represent *in vivo* phenotype and genotype.

(any two of the above points) ½ x 2

SECTION-C

15. Steps of rDNA : Isolation of DNA from firefly ½

Cut it with restriction enzyme and by using probe take out desired gene after doing electrophoresis ½

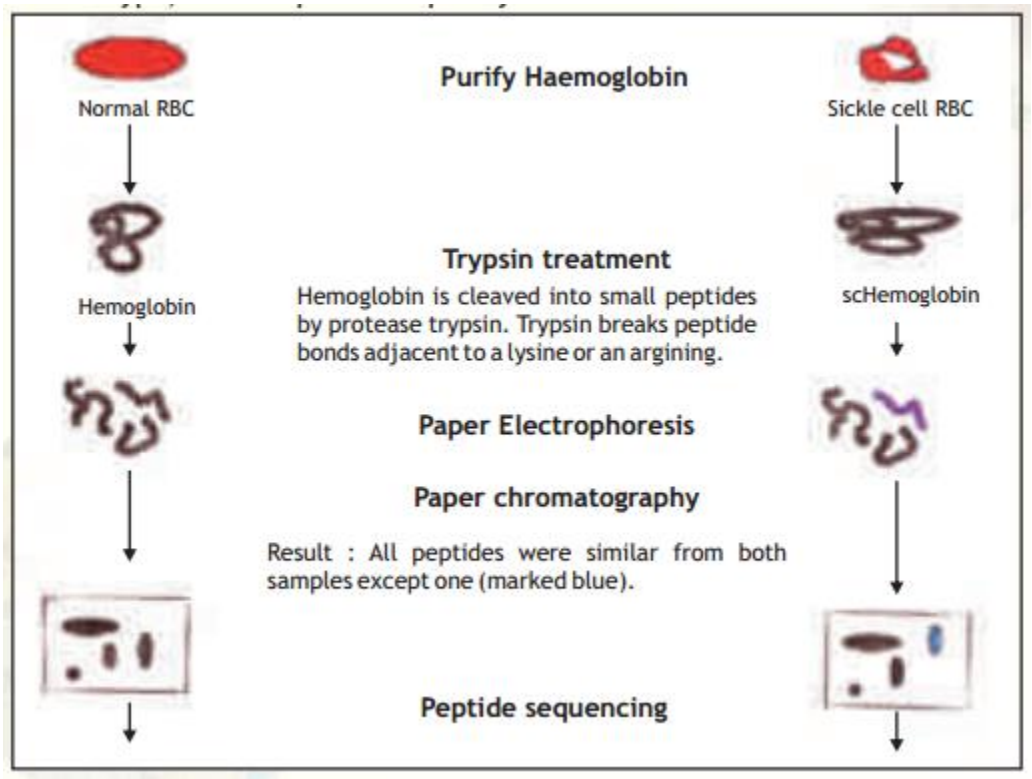
According to size of desired DNA select vector ½

Insert vector in appropriate host cell ½

Co-cultivation of host with explants ½
Transfer the explants with desired gene in culture medium ½

16. Ribonuclease gene from *Brassica* is used as probe. ½
Then isolate DNA from *Oryza* ½
Cut this DNA into fragments ½
Then isolate DNA fragments on gel electrophoresis ½
Transfer the assembly to Nylon membrane ½
Then use probe to search the given gene ½
(steps of Southern Blotting)

17. Protein fingerprinting/peptide mapping ½

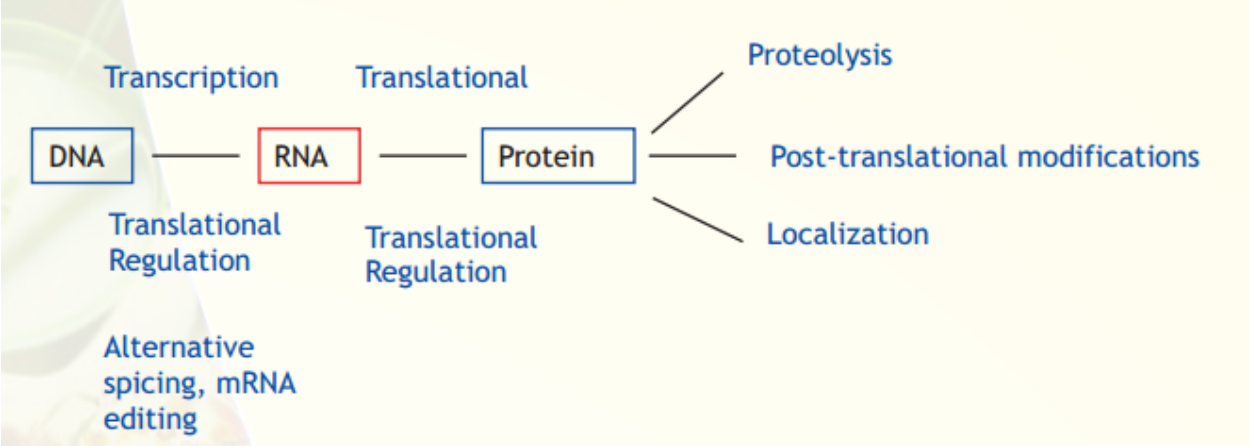


for each step - ½ x 5

18. m/z= M+ nH^+/n
m/z=20,005/5=4001 ½
m/z=20,004/4= 5001 ½
m/z=20,003/3=6668 ½
m/z=20,002/2=10,001 ½
m/z=20,001/1=20,001 ½
Sequence—It detects protein ions at m/z=4001, 5001, 6668, 10001 and 20,001 respectively. ½

19. FISH- fluorescent *insitu* hybridization technique involves- introducing fluorescent colours into chromosome 9 and 22 using nick translation (red in 9 and green in 22) and then 1
counting the number of yellow cells (i.e having blood cancer) and 1
following their decrease with chemo and radiotherapies. 1

20.



2

There is non- linear relationship between number of genes and proteins 1

21. Specific growth rate- 1.1515 hr^{-1}
Doubling time- 0.693/1.1515=0.6 hours=36 minutes
Exponential phase 1+1+1

22. No 1
It may cause infections leading to health problems 1
(Mutations may convert even harmless strains to potentially dangerous ones)
Cleanliness is the primary responsibility of every citizen 1

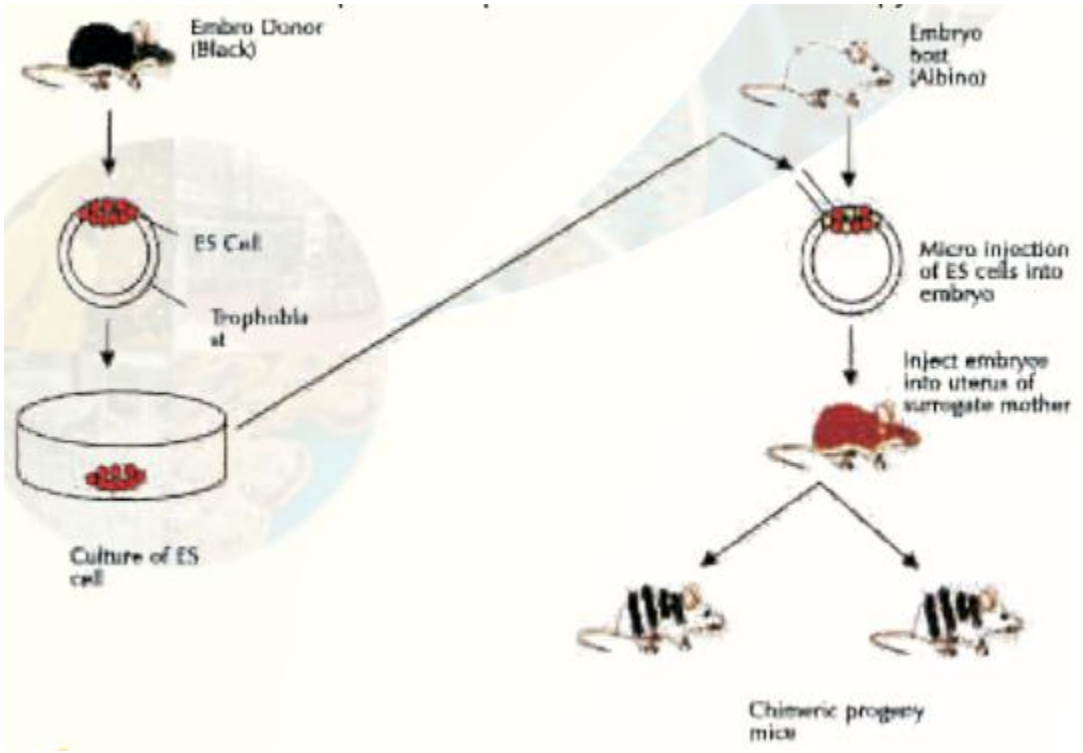
23. Somatic cell hybridization/ parasexual hybridization 1
First interspecific hybrid developed between *Nicotiana glauca* and *Nicotiana langsdorfii* in 1972 1
First intergeneric hybrid developed between *Solanum tuberosum* and *Lycopersicon esculentum* and the hybrids are known as 'Pomatoes or Topatoes' 1

OR

Herbicide and other chemicals affect the crops which can be resolved by introducing modified gene for the over production of herbicide target enzyme 1
This enzyme expresses in chloroplast in plants 1

So that it becomes insensitive to the herbicide 1

24.



½ x 6

25. Monoclonal antibodies are specific to a single epitope of the antigen due to which the results obtained by using them are clear cut 1

Herceptin is targeted therapy of HER 2+ i.e., Human epidermal growth factor Receptor-2 positive 1

And used for treatment of early stage breast cancer 1

SECTION-D

26. Basic steps should include:

Denaturation ½

Annealing ½

Extension/Polymerization ½

Explanation / diagram of each step 1

Selectively amplify by designing suitable primers to include the sequence which is to be amplified. ½

Any two of following applications:

-DNA fingerprinting/Forensic Science

-Detection of infective agents

-Identification of genetic diseases 1+1

OR

(i) dNTP & ddNTP

dNTP used in DNA replication ½

ddNTP used in chain termination ½

Structural differences can also be shown

(ii) pBR322 & pUC19

pBR322-contains two antibiotic resistant genes ½

pUC19- contains MCS ½

(iii) M-13 & lambda phage

M-13: Circular and single stranded ½

Lambda phage: Linear double stranded ½

(iv) Cosmid & plasmid

Cosmid : having features of plasmid and cos sites of phage lambda ½

Plasmid: small, circular, extra-chromosomal self replicating naturally present in bacteria ½

(v) Transformation and transfection

Transformation: Cold $CaCl_2$ treated competent bacterial cells to introduce rDNA ½

Transfection: Transfer rDNA into host cells by mixing foreign DNA with charged substances like calcium liposomes/calcium phosphate/DEAE dextran ½

27. (i) Subtilisin ½

(ii) Residues are Ser 221, His 64 and Asp 32 1½

(iii) Oxidation of amino acid Methionine at position 222 1

(iv) Substitution of Met 222 by Ala 1

using site directed mutagenesis 1

OR

(i) OKT-3 is monab-CD3 an immunosuppressant drug given intravenously to reverse acute rejection. 1

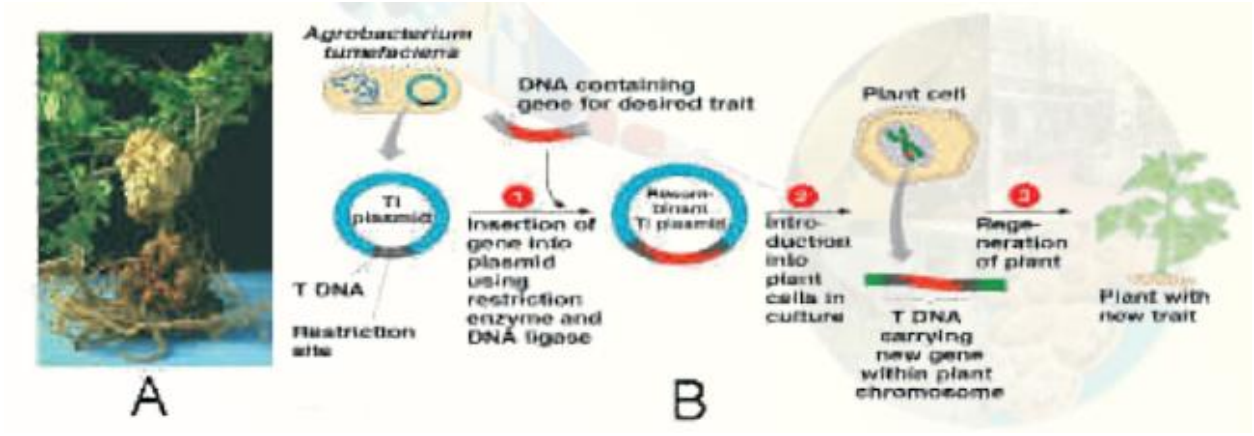
(ii) kappa casein contains a lipid molecule. 2/3 of the protein is hydrophobic 1

(iii) Whey protein results in elevation of a tripeptide glutathione in cells which detoxifies xenobiotics. 1

(iv) Curd is a good source of beneficial bacteria which can colonise the intestinal tract. 1

(v) BCAA is an essential for biosynthesis of muscle proteins as its carbon part is used as fuel and nitrogen converts into Alanine which changes into glucose in liver. 1

28.



(1 mark for each step) 1x5

OR

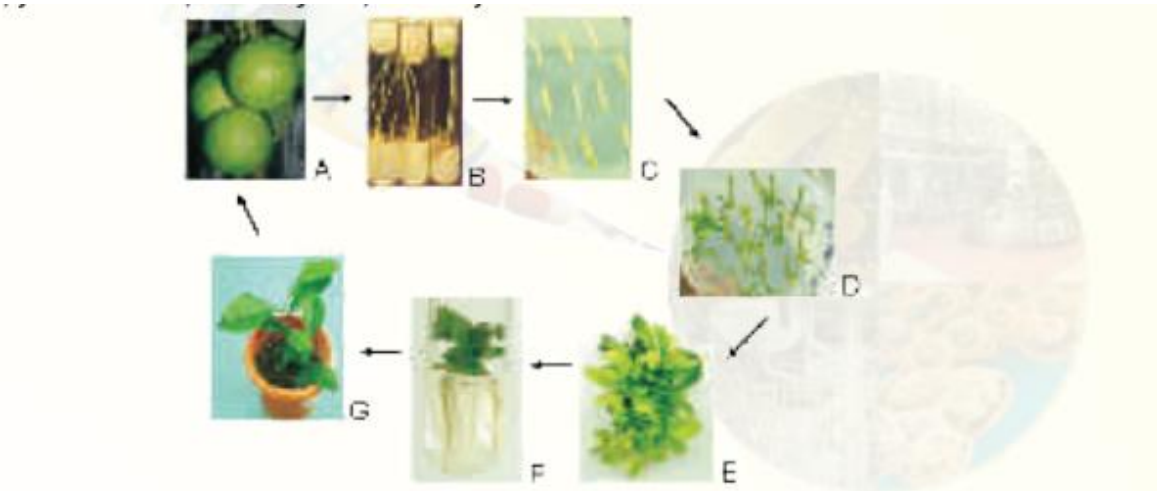


Fig. . Various steps involved in the regeneration of whole plants using tissue culture techniques. (A) Citrus plant with fruits, (B) Seedlings raised by germinating Citrus seeds on nutrient medium, (C) Transfer of epicotyl explants onto shoot regeneration medium, (D) Induction of shoots from explants, (E) Elongation of shoots, (F) Rooting of *in vitro* shoot, (G) Regenerated plant in a pot.

(1 mark for each step) 1x5
