Marking Scheme of Sample Question Paper
Class: XII
Biotechnology (Theory) (2017-18)
Sub Code: 045

<table>
<tr><td></td><td>SECTION A</td><td></td></tr>
<tr><td>1.</td><td>“cos” sites are important for packaging DNA into phage head.</td><td>1</td></tr>
<tr><td>2.</td><td>Protein Efficiency Ratio

PER is used as a measure of growth expressed in terms of weight gain of an adult by consuming1g of food protein.</td><td>½

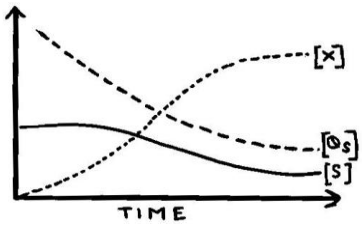
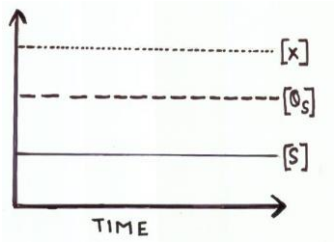
½</td></tr>
<tr><td>3.</td><td>The bond strength decreases due to the insulating properties / dielectric strength of water.</td><td>1</td></tr>
<tr><td>4.</td><td>Gene is transferred with the help of tiny vesicles of bipolar phospholipids that fuse with the cell membrane, releasing the DNA into the cytoplasm.</td><td>1</td></tr>
<tr><td>5.</td><td>Rous and Jones.</td><td>1</td></tr>
<tr><td>6.</td><td><table><tr><td>BAC</td><td>YAC</td></tr><tr><td>Effective in Bacteria</td><td>Effective in Yeast</td></tr><tr><td>It has genes for maintenance and replication of F-factor</td><td>It has telomere, centromere and ARS from yeast chromosome</td></tr><tr><td>Can accommodate up to 300kb of DNA</td><td>can be used for cloning DNA upto 1 MB in size.</td></tr></table>(Any two)</td><td>½

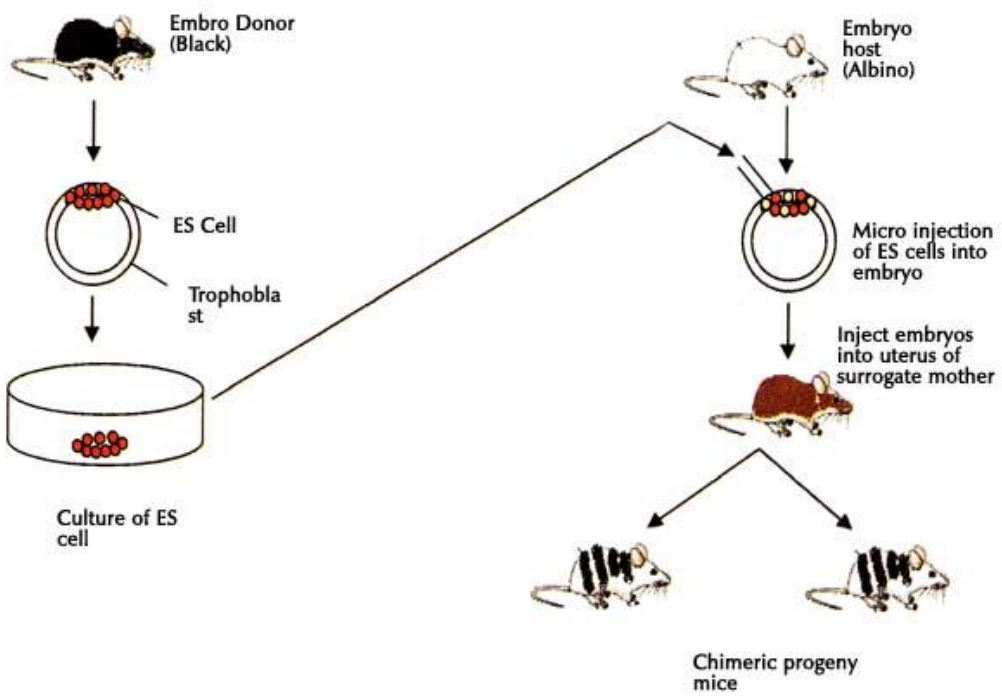
½</td></tr>
<tr><td></td><td>SECTION B</td><td></td></tr>
<tr><td>7.</td><td>Tissue engineering :Naturally derived or synthetic materials may be engineered into "scaffolds" that when implanted in the body could provide a template that allows the body’s own cells to grow and form new tissues
Such implants could function without triggering immune responses.
Genetically-modified animals may also provide a source of cells, tissues, and organs for xenografts</td><td>1

½

½</td></tr>
</table>

8.	Metagenomics approach has been developed to identify and select microbial genes synthesizing novel molecules. This approach directly utilizes the large number of microbial genomes present in an environmental niche, for example in soil, in water such as ocean or in human gut. These genomes are contributed by both the culturable and the non-culturable variety of microbes and together constitute what has been termed as metagenome The collective DNA is extracted from a sample of soil, water or any other environmental niche. It is subjected to restriction digestion using restriction endonucleases and the fragments are cloned into suitable vectors. The clones are then screened for presence of a variety of molecules.	1 1
9.	**Plant regeneration pathways** The plants can be regenerated by either **organogenesis** and **somatic embryogenesis**. **Organogenesis** means formation of organs like shoots from the cultured explants .Miller and Skoog experimentally proved that formation of shoot or root first on the cultured tissue depends on the relative concentration of auxin and cytokinin. If auxins are high in the medium, then it promotes rooting while if cytokinins are high, shoot formation is promoted. In **somatic embryogenesis**, the totipotent cells may undergo embryogenic pathway to form somatic embryos ,which can be grown to regenerate into complete plants. Generally, somatic embryos resemble the zygotic embryos (seed embryos) except in their place of origin and larger size. For the first time, Steward in 1958 and Reinert in 1959 independently reported the somatic embryogenesis from carrot cultures.	 1 1
10.	1. Transformation : In this technique. we put the recombinant DNA in the medium having host cells .Host cells will uptake the desired DNA provided the host cells are competent . If they are not competent , we make them competent by treating it with the cold calcium chloride. Mandel and Higa proposed the technique in 1970. 2.Trasfection : The desired DNA is mixed with the cationic liposome's or dextran and layered on the host cells and is then taken inside by the host cells. 3.Electroporation :We pass electricity of desired voltage through the culture of the cells resulting in transient (temporary) pores in the cell membrane and through these pores DNA enters.	 1 1

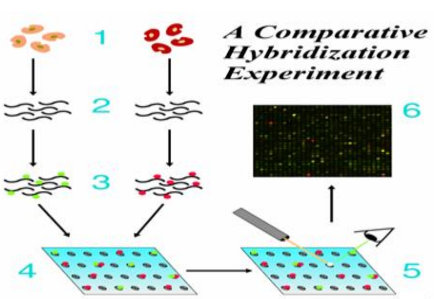
	4.Biolistics (Use of gene gun) : We use gold or tungsten particles and layer the DNA on them and bombard these bullets into the culture of the cells. 5.Use of modified bacteriophages to deliver the desired gene in the bacterial cell Use of modified *Agrobacterium tumefaciens* to deliver the desired gene in the plant cell (ANY TWO)	
11	Plants regenerated from long-term callus and cell suspension culture are often associated with chromosomal variations known as **somaclonal variation**. If the tissue from which the variants have been obtained is having gametophytic origin such as pollen or egg cell, **such variation is called Gamaetoclonal variation.** Larkin and Scowcroft (1981) proposed the term '**somaclones**' for plant variants obtained from tissue cultures of somatic tissues	½ ½ 1
12	It shows inaccuracy in gene prediction There is no correlation between the intuitive complexity of an organism with that of other eukaryotes Yeast encodes 70 percent of proteins whereas worm and fruit fly encode 20- 25%	½ ½ 1
13	Graph of batch culture Fig.5.Pg No.91 C.B.S.E  Graph of continuous culture Fig.7. Pg No.92 C.B.S.E  	1 1

14.	i)Maintenance of pH ii)Maintenance of physiological conditions (%CO_2, temperature) iii)Use of inhibitors to prevent the action of proteolytic enzymes iv)Avoidance of agitation or addition of chemicals which may denature the protein v)Minimize processing time (Any two)	1 1
	SECTION C	
15.	The non-covalent interaction involved in organizing the structure of a protein molecule. Proteins fold into secondary structure, α – helix, β- pleats. Secondary Structure undergo further folding into domains, motifs called tertiary structures. Multimeric proteins organized as Quaternary structures. Various forces responsible for these structures. Hydrophobic interactions , electrostatic interactions., Hydrogen bonding , van der waals forces are the non-covalent forces . (Any two)	2 1
16.	 	1 1 1
17.	DNA Probe: It is a small sequence of DNA that recognizes and blinds to its complementary sequence.	1

	Sanger's Method : Whenever ddNTP comes in the DNA synthesis , further synthesis of DNA stops. It must indicate the following reagents: - Single strand DNA which needs to be sequenced. -A primer with a free 3'-OH. -DNA polymerase -dNTPs -ddNTPs -Primer extension in 4 different tubes each containing a specific ddNTP at low concentration. -Termination at the point where ddNTP is incorporated. -Gel electrophoresis	2
18	BLAST :Basic Local Alignment Search Tool Homologues represent the similarity due to common ancestory and they will have same function Paralogs represent similarities due to random chance and may differ in function	1 1 1
19	Mass spectrometry. Principle of Mass spectrometer : It determines the molecular weight of chemical compounds by separating molecular ions according to mass/charge ratio (m/z). MALDI –Matrix Assisted laser Desorption Ionization Protein sample is dissolved in matrix and then laser beam is applied which results in the ionization of the proteins which are then analyzed. Charged protein accelerated through evacuated tubes and separated by m/z ratio .	1 1 1
20.	*Roller bottles* In roller bottles, the cells adhere to the total curved surface area of the micro carrier beads, thereby markedly increasing the available space for growth. These tissue culture bottles can be used in specialized CO_2 incubators with attachments that rotate the bottles along the long axis. After each complete rotation of the bottle, the entire cell monolayer has transiently been exposed to the medium. The volume of medium need only be sufficient to provide a shallow covering over the monolayer . *Micro carrier beads* These beads are used to increase the number of adherent cells per flask and are either dextran or glass-based and come in a range of densities and sizes. The beads are	1 1

	buoyant and therefore can be used with spinner culture flasks. The surface area available for cell growth on these beads is huge Microcarrier beads when re-suspended at the recommended concentration provide 0.24 m^2 for every 100 ml of culture flasks. Under these conditions adherent cells can be grown to very high densities before crowding becomes a problem. Cells growing at such high densities will rapidly exhaust the medium, which may need replacing during culture. *Spinner cultures* Spinner cultures are used for scaling up the production of suspension cells. They consist of a flat surface glass flask with a suspended central teflon paddle that turns and agitates the medium when placed on a magnetic stirrer. Commercial versions incorporate one or more side arms for sampling and/or decantation. The cells are not allowed to settle to the bottom of the flask and thus cell crowding occurs only at very high densities. Stirring the medium improves gas exchange .	1
21	Advantages of *Pichia pastoris* as a eukaryotic expression host: a)Has strong inducible promoters b) Is capable of making posttranslational modifications c) Downstream processing is simpler as *Pichia* does not secrete its own proteins into the fermentation medium	 1 1 1
22	Selective amplification of microbial gene (in test water sample) using microbe specific primers by PCR. Principle of PCR: Selective Amplification by designing suitable primers to include the sequence which is to be amplified. It was invented by Kary Mullis. Basic steps should include Denaturation: It involves the heating of DNA above 80 degree Celsius which results in the breaking of hydrogen bonds present between two strands , resulting in two different individual strands. Annealing: It involves the hybrization of two primers at 3' region of each strand. Extension/Polymerization – It involves the addition of ddNTP to the 3' region of each strand with the help of Taq polymerase(DNA Polymerase) resulting in complete DNA molecule.	 1 1 1
23	a)Thioesterase b)Weed control c)DuPont	1 1 1
24	No It may cause infections leading to health problems Mutations may convert even harmless strains to potentially dangerous ones	1 1 1

25.	The genes encoding antigenic proteins can be isolated from pathogens and expressed in plants. Such transgenic plants or their tissues producing antigens can be eaten for vaccination / immunization. These are called edible vaccines. Edible vaccines offer following advantages over conventional vaccines. (Any two) 1. Low cost 2.Alleviation of storage problems 3.Easy delivery system by feeding (any other relevant point) OR Plants raised by tissue culture of somatic hybrid cells formed by fusion of plant cell protoplasts are called as somatic hybrids. Procedure: Isolation of plant cell protoplasts and their fusion. Selection of hybrid cells and raising by plant tissue culture	1 1 1 1 2
	SECTION D	
26.	R.E. type II recognize a specific DNA sequence and cut within the sequence generating sticky/flush ends. In recombinant DNA technology , we use type II RE as they are highly specific in their action. Alu I with the restriction site 5' - AGCT'-3 (Make it double stranded) Nomenclature: • Eco R I with the restriction site 5'-GAATTC-3' (Make it double stranded) • Nomenclature with one example • The first letter indicates the genus of the organism • The second two letter indicates the species name. • The next letter indicates the strain name • The next roman letter indicates the order of discovery. • Eco R I - E indicates the genus" Escherichia" • The second two letter indicates the species "coli" name. • The next letter indicates the strain "Rd " name • The next roman letter i.e. I indicates the order of discovery The functions of a) Alkaline phosphatase/ b) DNA ligase. The role of alkaline phosphatase is to prevent self re-ligation of the vector /The role of DNA ligase is to make 3'-5' phosphodiester bond. (Any one)	 1 1 2 1

27.	2D – Gel electrophoresis	1
	As two components (IEF and SDS –PAGE) are carried at right angle to each other , thereby increasing the resolution .	1
	Principle of IEF- Separation of the proteins is on the basis of their pIs.	1
	Ampholytes (Polyamino-Polycarboxylic acids) are used in generating the pH gradient.	½
	SDS-PAGE- Separation of the proteins is on the basis of their molecular mass	1
	Silver stain is used as a staining dye	½
	OR	
	i) Blood products and vaccines e.g. Factor IX for treating hemophilia ii)Therapeutic antibodies and enzymes e.g. Monoclonal antibodies OKT3 for preventing graftness. iii) Therapeutic hormones and growth factors e.g. Insulin to treat diabetes. iv) Regulatory factors e.eg. Interferons for antiviral properties. v) Analytical applications e.g. Horse radish peroxidase for ELISA. vi) Industrial enzymes e.g. Papain for meat tenderization. vii) Fuctional non catalytic proteins e.g. Kappa casein for milk protein stabilization. viii) Nutraceutical proteins eg. Infant food formulation to provide adequate nutrition for infant . These products are of commercial value to the Biotechnology industry. (Any five) 1x5	5
28.	Cellular response to the environment can be studied by comparing the amounts of many different mRNA in normal and affected cells(eg. Cancerous cells) (Explanation of preparation of microarray and cDNA microarray technique) 	2

	Major steps involved in comparative microarray hybridization experiments between normal and affected (for example cancerous cells) :Indicate through diagram and label it and explain in points (Steps should include) 1. Choosing cell population and extracting m RNA. 2. Reverse transcribing the m RNA to get c DNA . 3. Flourescent labelling of c DNA. 4. Hybridization to a DNA microarray . 5. Scanning the hybridized array . 6. Interpretation of scanned image. ½ x 6(For steps) OR a) i) EMBL-Nucleotide sequence ii) PDB -3D structure of proteins iii)PALI -Phylogenetic analysis and alignment of proteins b) Provides a means of discovery of all the genes/ shows relationship between genes/ tools for future experimentation/ organizes all genetic information about organisms (Any two points)	3 1 1 1 2