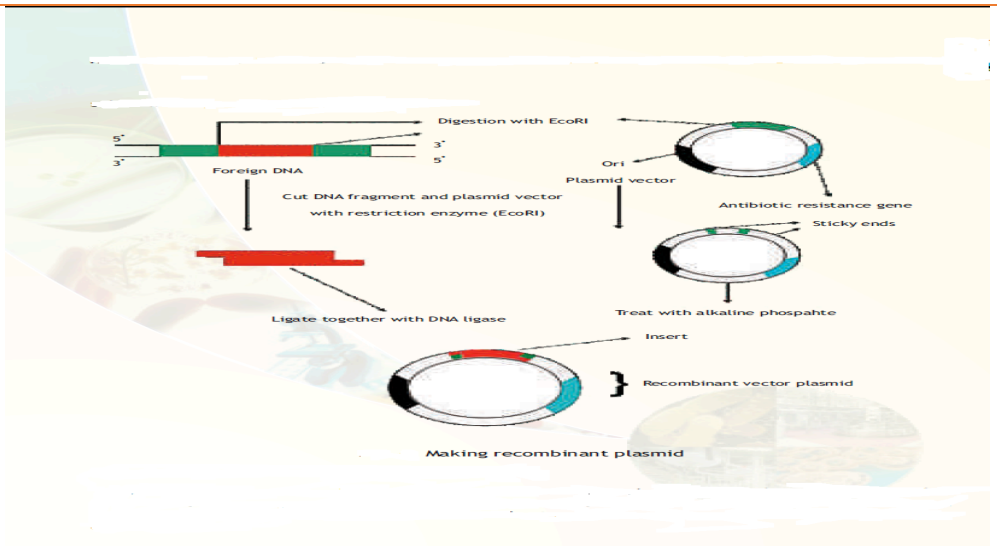
**Sample Question paper**
**CLASS- XII**
**BIO-TECHNOLOGY**
**2019-20**

**MARKING SCHEME**

| | **SECTION A** | |
|---|---|---|
| 1 | Paul Berg, Herbert Boyer, Annie Chang and Stanley Cohen. *(Any two)* | ½ *2 |
| 2 | Properties for thermal and pH stability/ solvent tolerance and solubility/ catalytic potency etc. *(Any two)* | ½ *2 |
| 3 | By the production of stress-related osmolytes like sugars (e.g. trihalose and fructans)/ sugar alcohols (e.g. mannitol) / amino acids (e.g. proline), glycine betaine/ certain proteins (e.g. antifreeze proteins). *(Any one)* | 1 |
| 4 | Simian Virus 40<br>**OR**<br>Methylation | 1 |
| 5. | To make series of maps of each human chromosome at increasingly finer resolutions. | 1 |
| 6. | Serum/FCS, an essential component of animal cell culture media was missing.<br>**OR**<br>Trophoblast | 1 |
| 7 | Amino acids were not replaced at random but were altered with specific preferences./ Some amino acids such as tryptophan, was generally not replaced by any other amino acid / Based on several homologous sequences, a point accepted mutation (PAM) matrix could be developed. *(Any one)*<br>**OR**<br>Functionally related or homologous protein sequences are similar. | 1 |
| 8 | b) NMR | 1 |
| 9 | b) 5.7 | 1 |
| 10 | d) Y and N | 1 |

| | | |
|---|---|---|
| 11. | a) SCID | 1 |
| 12 | (i) d) > $10^6$ cells /ml | 1 |
| | (ii) d) Acclimatization to the new environment. | 1 |
| | (iii) a) Log phase | 1 |
| | (iv) d) Antibiotics don't have any affect on animal cells | 1 |
| | **SECTION B** | |
| 13 | **Synthetic media** - Full composition of the medium is known.<br><br>**Semi-synthetic media** - These media contain highly complex components such as peptone, beef extract, yeast extract or casein digest.<br>Nutrient broth/ Typticase soya broth (TSB) / Brain heart infusion (BHI) broth | 1<br><br>1 |
| 14 | *LEU2* gene codes for an enzyme required for the synthesis of amino acid leucine.<br>Yeast cells having this plasmid can grow on a medium lacking leucine and hence can be selected.<br><br>e.g. Yep | 1<br>½<br><br>½ |
| 15 | No simple correlation between the intuitive complexity of an organism and the number of genes in its genome.<br>Relatively small number of genes in a human genome in comparison to worm /*Drosophila melanogaster*. | 1<br>1 |
| 16 | While somaclones are plant variants obtained from tissue cultures of somatic tissues, gametoclones are plant variants with gametophytic origin obtained from tissue such as pollen or egg cell.<br>Larkin and Scowcroft (1981) proposed the term 'somaclones' | 1<br>1 |
| 17 | A balance between the stabilizing (mainly hydrophobic) interactions and destabilization interactions.<br><br>By substituting amino acids that either favour stabilizing interactions in a folded protein or destabilizing interactions in an inactive protein. | 1<br><br>1 |
| 18 | Potential of genetically modified organisms (GMO) or recombinant strains to infect other organisms./Toxicity and allergy associated with the use of recombinant molecules./ Increasing the environmental pool of antibiotic resistant microorganisms or transfer of antibiotic resistant genes./Problems associated with the disposal of spent microbial biomass./Safety aspects associated with contamination, infection or mutation of process strains. | 1*2 |

| | | |
|---|---|---|
| | (Any two)<br>**OR**<br>• Bulk purchase of chemicals and other raw materials would bring down costs.<br>• The labour cost decreases sharply with increase in production. | |
| 19. | Negatively charged Asp 102 partially borrow hydrogen ion from His-57.<br>His-57 attracts hydrogen ion from adjacent Ser 195<br>Serine 195 gets negative charge.<br>Serine 195 makes a nucleophilic attack on the protein substrate.<br>**OR**<br>Normal and thallasaemic erythrocytes obtained and their lysates analysed<br>Protein fingerprinting/ 2-D gel electrophoresis/ MALDI/ SDS-PAGE can identify if alpha or beta chain is absent<br><br>Protein fingerprinting:<br>• Trypsin digestion of Purified haemoglobin<br>• Paper electrophoresis followed by paper chromatography.<br>• Spray with ninhydrin.<br>( Student should be awarded marks if he/she describes any of the above mentioned technique.) | ½<br>½<br>½<br>½<br><br>½<br><br>½*3 |
| | **SECTION C** | |
| 20. | (a) Insulin production is 100 mg/L; so fermentor volume needed for 1 Kg of insulin is 1 Kg /100mg = 1000, 000mg/100,g = 10,000mg = 10,000L.<br>(b) Cell concentration is increased 50 times, we need 200 L reactor.<br>(c) Insulin yield per litre of culture is 500 X 50 = 25, 000 mg / L which is 25 gram/L. We need a 40 L reactor (1000g/25g) . | 1<br>1<br>1 |
| 21 |  | 3 |

OR

| | | |
|---|---|---|
| | *Haemophilus Aegyptus* *HaeIII* 5'G-G-C-C 3'<br>3'C-C-G-G 5' | 1 |
| | *Providencia stuartii* *Pst*I 5'C-T-G-C-A-G 3'<br>3'G-A-C-G-T-C 5' | 1 |
| | *Streptomyces albus* *Sal*I 5'G-T-C-G-A-C 3'<br>3'C-A-G-C-T-G 5' | 1 |
| 22 | | 3 |

| Functional Property | Mode of action |
|---|---|
| Whipping/Foaming | Forms stable film (A) |
| Emulsification (B) | Formation and stabilization of fat emulsions |
| Gelation(C) | Protein matrix formation and setting |
| Viscosity | Thickening, water binding(D) |
| Water binding(E) | Hydrogen bonding of water; entrapment of water |
| Solubility | Protein salvation(F) |

| | | |
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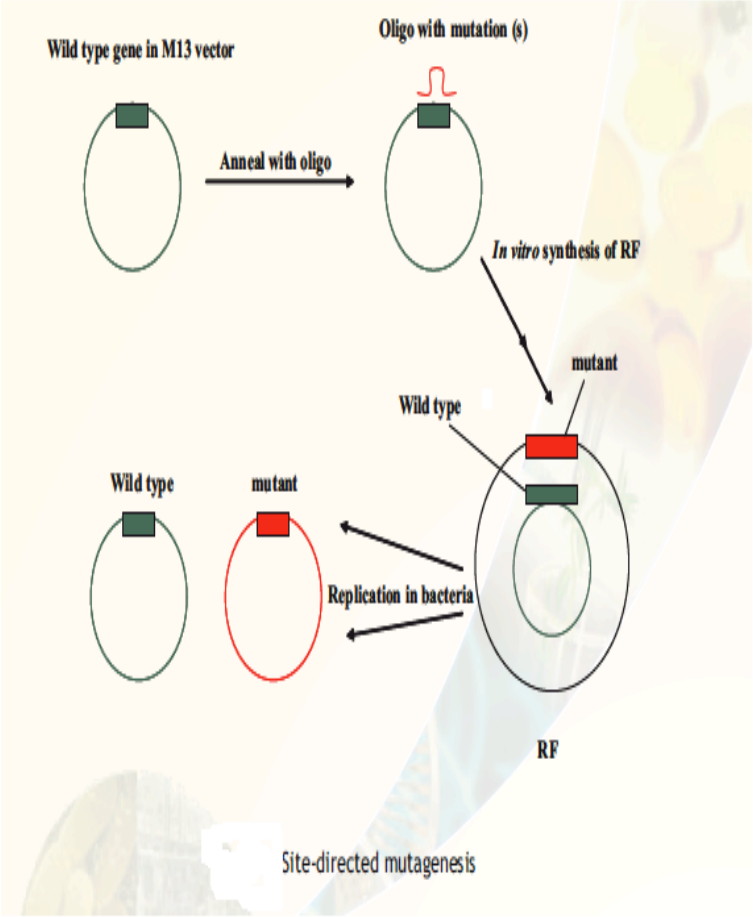
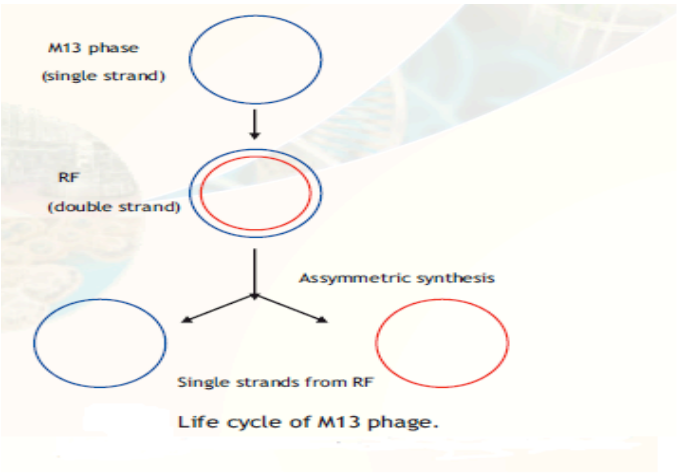
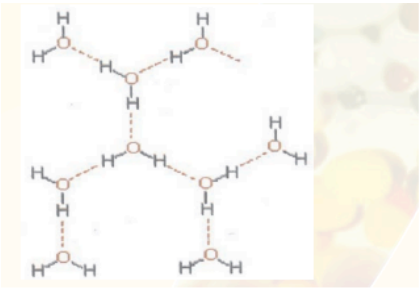
| 23 | **Replica plating.**<br>• Host cells are first plated (master plate) on solid media with the desired antibiotic overnight.<br>• Velvet paper is aligned, pressed on master plate.<br>• With the same alignment it is pressed onto the replica plate.<br>• Keep it overnight ,transformed colonies will not grow in replica plate<br>• The colonies having insert can easily be scored off from master plate by comparing the two plates. | ½<br>½*5 |
| 24 | • Production of healthy oils with altered fatty acid profiles.<br>• Modification of starch properties for specific uses.<br>• Favourable change of grain storage products and their chemical composition to improve the processing of bread making with wheat flour, malting of barley and brewing of beer.<br>• Removal of undesirable toxic compounds in certain plants.<br>• Development of blue roses/ blue coloured cotton which is otherwise not possible by conventional plant breeding because of the absence of blue pigment in roses/ cotton<br>• Development of tear-less onions, caffeine-free coffee and low nicotine tobacco. *(Any three)* | ½ * 6 |
| 25 | The collective DNA(from various environmental niche) is subjected to restriction digestion using restriction endonucleases and the fragments are | 1 |

| | | |
|---|---|---|
| | cloned into suitable vectors. | 1 |
| | The clones are then screened for presence of a variety of molecules. | |
| | The clones expressing novel molecules or molecules with improved characteristics are used for large-scale production by fermentation techniques. | 1 |
| | **OR** | |
| | Pilot plant: Mini version of the commercial plant. | 1 |
| | Direct production of microbes on a large or commercial scale has the risk of not only large investments, but also producing products, which may not be of appropriate quality so that there are problems in their commercialization. | 2 |
| 26 | | ½ * 6 |

| Crop | Gene | Improved character |
|---|---|---|
| Canola | **(A)** Thioesterase EPSP *synthase/ Any relevant gene* | Hybrid production |
| Corn | **(B)**Bt cry I Ac /any other | Insect resistance |
| Cotton | **( C)** Acetolactate synthase Nitrilase EPSP synthase Bt CryIA(c) | Insect resistance |
| Papaya | **(D)**Coat protein/ Any relevant gene | Virus resistance |
| Potato | **(E)**Bt CryIIIA and coat protein/ Any relevant gene | Insect and Virus control |
| Soyabean | **(F)**EPSP synthase/ Any relevant gene | Weed control |

**SECTION D**

| | | |
|---|---|---|
| 27 |  | 5 |
| | **OR** | |
| | Foreign DNA can be inserted into bacteriophage single stranded, circular DNA of 6407 bp without disrupting any of the essential genes. | 1 |
| |  | 1 |

| | | |
|---|---|---|
| | Its genome is less than 10 kb in size. | 1 |
| | RF can be purified and manipulated exactly like a plasmid. | 1 |
| | Genes cloned into M13 based vectors can be obtained in the form of single stranded DNA. | 1 |
| 28 | Ionic bonds: | 1 |
| | Interactions between the oppositely charged groups also known as **salt bridges** | 1 |
| | Hydrogen bonds: | |
| | Hydrogen bonds are formed by "sharing" of a hydrogen atom between two electronegative atoms such as Nitrogen and Oxygen. | 1 |
| |  Hydrogen Bonding | |
| | Van der Waals forces: | 1 |
| | The Van der Waals types of forces are essentially contact forces, proportional to the surface areas in contact. | |
| | Hydrophobic interactions: | 1 |

| | | |
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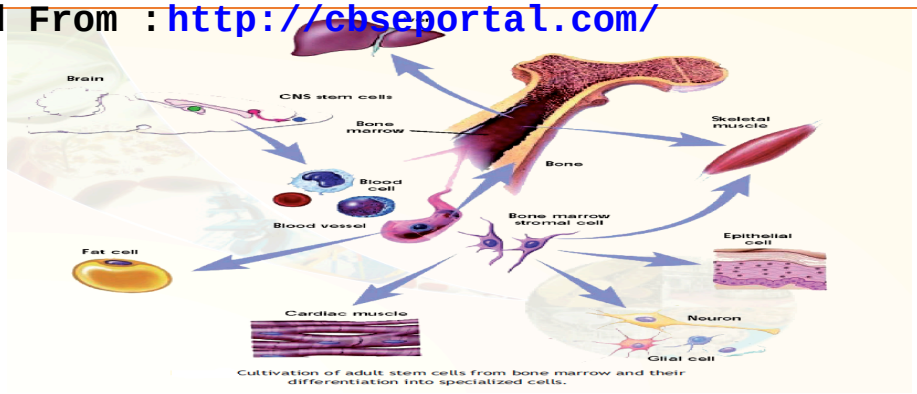
| | The hydrophobic interaction is a manifestation of hydrogen bonding network in water. In water, each molecule is potentially bonded to four other molecules through H-bonds | |
| 29 | **Directed sequencing of Bacterial Artificial Chromosome (BAC) contigs** | ½ |
| | Bacterial Artificial Chromosome (BAC) vectors are used to make genomic libraries in which the insert size is 80-100 kb, library is then screened by finding common restriction fragments. | 1 |
| | BAC clones are then mapped to find overlapping arrays of contiguous clones called contigs. The mapped contigs are sequenced by breaking large DNA fragments into small pieces. | 1 |
| | **Random shotgun sequencing**<br>In random shotgun sequencing, big genomic DNA molecules are cloned in small (2.0 kb) and medium (10 kb) plasmid vectors and a library is constructed | ½<br>1 |
| | Picking many clones, sequencing them and feeding all these data into a computer program, these sequences are joined by finding overlapping parts. The result is, we get long pieces of DNA sequences. | 1 |
| | **OR** | |
| | Cystic Fibrosis (Cystic Fibrosis Trans membrane Conductance Regulator CFTR gene) | ½ |
| | 1. Inheritance: autosomal recessive disease<br>2. Genomic location: Chromosome 7 (7q31.2)<br>3. Mutation: The most common mutation is a deletion of 3 bps resulting in the loss of codon no. 508, which codes for phenylalanine | ½*3 |
| | Huntington disease (Hunting tin gene HTT) | ½ |
| | 1. Inheritance: autosomal dominant<br>2. Location: Chrosome 4 (4p16.3)<br>3. Mutation: increased number of CAG repeats more than 35 times | ½*3 |
| | Two diseases showing gene polymorphism with complex inheritance<br>Common late-onset Alzheimer's disease<br>Migraine | ½<br>½ |
| 30 | Cultivation of adult stem cells from bone marrow and their differentiation into specialized cells | 3 |



Cultivation of adult stem cells from bone marrow and their differentiation into specialized cells.

1

Ernest McCulloch and James Till

½*2

Leukemia (Cancerous blood cells), Heart disease, heart attack (cardiac tissue damage). Paralysis (spinal cord injury). Alzheimer's, Parkinson's, Huntington's (dead brain cells).and Burns (damaged skin cells) *(Any two)*