Biotechnology Principles and Processes

Que 1: Name the organism from which the enzyme Taq polymerase used in PCR isolated ***Marks :(1)***

Ans: Thermus aquaticus

Que 2: *Agrobacterium tumifaciens* is a pathogen of several dicot plants. Name the plasmid present in this bacterium. ***Marks :(1)***

Ans: Ti plasmid

Que 3: Stanley Cohen and Herbert Boyer constructed an artificial recombinant DNA by linking an antibiotic resistant gene into the plasmid of a bacteria. ***Marks :(3)***

a) Name this bacteria?

b) Write the three basic steps in genetic modification of an organism.

Ans: *a. Salmonella typhimurium*

i. Identification of DNA with desirable genes.

ii. Introduction of identified DNA into the host.

iii. Maintenance of introduced DNA in the host.

iv. Transfer of DNA into the progeny.

Que 4: Observe the sequence given below. ***Marks :(2)***

5'----GAATTC-------3'

3'----CTTAAG-------5'

1. **Suggest a name for this type of sequence. Define it.**
2. **What is the significance of this sequence?**

Ans:

1. Palindromic sequence. Sequence of base pairs that reads same on the two strands when orientation of reading is kept the same.
2. Recognition site of restriction endonucleases.

Que 5: pBR 322 is a commonly used cloning vector in genetic engineering.

a) What does *ori* in pBR 322 stand for?

b) Write the significance of *ori* and *rop* sequences. ***Marks :(2)***

Ans: *a. ori* stands for origin of replication.

b. Replication of DNA starts from *ori* sequence and this is also responsible for controlling the copy number of linked DNA. *rop* codes for the proteins involved in the replication of the plasmid.

Que 6: Expand Ti plasmid. ***Marks :(2)***

Name the bacterium from which this plasmid is isolated. Write its significance.

Ans:

- Tumour inducing plasmid.
- *Agrobacterium tumifaciens*.
- Ti plasmid is modified into a cloning vector which is not pathogenic and is able to deliver genes of interest into a plant cell.

Que 7: Expand PCR. ***Marks :(2)***

Write the name and peculiarity of DNA polymerase enzyme used in PCR.

Ans:

- Polymerase Chain Reaction.
- *Taq polymerase*. DNA polymerase isolated from the bacterium *Thermus aquaticus* can remain active during high temperature induced denaturation of double stranded DNA.

Que 8: In order to cut DNA with restriction enzymes, DNA has to be isolated from the host cell and to be purified. ***Marks :(3)***

a) Name two enzymes used to break open cells during isolation of DNA.

b) Explain how DNA is purified during this process?

c) Name the process of removal of DNA after purification.

Ans: a. Lysozyme, Cellulase, Chitinase (Any two).

b. DNA is purified by using enzymes like ribonucleases, proteases etc. to remove RNA, proteins and other macromolecules.

c. Spooling.

Que 9: What do you mean by recombinant protein? Give example. ***Marks :(2)***

Ans: If any protein encoding gene is expressed in a heterologous host, it is called a recombinant protein.

Eg ;- Genetically engineered insulin from E-coli .

Que 10: Disarmed pathogens can be effectively used to deliver genes of our interest into bacterial, plant and animal cells. ***Marks :(2)***

a. Give two examples for such pathogens used in biotechnology.

b. Give an account of micro-injection.

Ans: *a.Agrobacterium tumifaciens* and retroviruses.

b. Direct injection of recombinant DNA into the nucleus of an animal cell

Que 11: Ti plasmid is used for making transgenic plants. It is obtained from. ***Marks :(1)***

a) *E.coli* b)*Salmonella typhimurium* c) *Agrobacterium tumifaciens* d)*Bacillus thuringiensis*

Ans: c) *Agrobacterium tumifaciens*

Que 12: Write the significance of the bacterium *Thermus aquaticus* in r DNA technology? ***Marks :(2)***

Ans: Thermostable DNA polymerase, *Taq* polymerase used in PCR is extracted from *Thermus aquaticus.*

Que 13: Name the enzyme used in PCR. ***Marks :(1)***

a) DNA Polymerase b) Cellulase c) *Taq* polymerase d) Chitinase.

Ans: c) *Taq* polymerase

Que 14: Observe the sequence given below. ***Marks :(2)***

5'---- GAA TT C------3

3'---- CT T AAG------5'

a) Identify the above DNA sequence and give its significance.

b) Name the enzyme used to cut this DNA sequence.

Ans: a) Palindromic sequence.Recognition site of EcoR I

b) Restriction endonulcease /EcoR I

Que 15: Name the enzyme used to cut the DNA at specific point ***Marks :(1)***

a) DNA polymerase **b) Restriction endonuclease**

c) DNA ligase **d) Protease**

Ans: b) Restriction enzymes

Que 16: Name the two core techniques that enabled the birth of modern biotechnology. ***Marks :(2)***

Ans: 1. Genetic engineering.

2. Maintenance of sterile ambience /Chemical engineering

Que 17: Restriction endonuclease is used to cut DNA at specific sequences?

a) Write the name of first discovered restriction endonuclease?

b) Which are the basic rules of naming restriction enzymes? ***Marks :(3)***

Ans: a) Hind II

b) The first letter of the name comes from the genus name

The second two letters come from the species name of the prokaryotic cell from which they were isolated,

The 4 th letter represents name of strain

Roman number following the name indicates the order in which the enzyme was isolated from a strain of bacteria.

Que 18: Identify the techniques used for the following. ***Marks :(3)***

a) Separation of DNA fragments

b) Amplification of DNA

c) Large scale purification and preservation of products from bioreactor

Ans: a) Gel electrophoresis

b) PCR

c) Downstream Processing

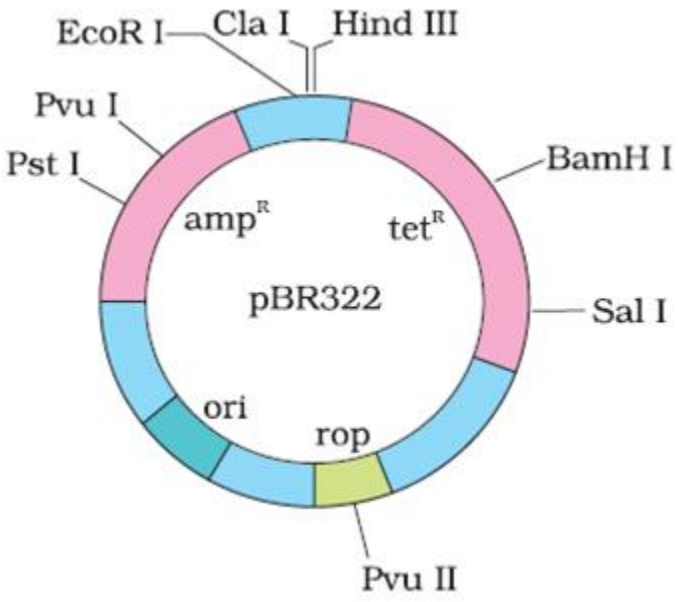
Que 19: Choose the odd one and give reason. ***Marks :(2)***

Hind III, EcoR I, BamH I,amp^R

Ans: amp^R - Selectable marker.

All others are restriction enzymes.

Que 20: Observe the figure given below. ***Marks :(2)***



a) Identify the selectable markers present in this vector.

b) What is the use of these selectable markers?

Ans: a) amp^R and tet^R

b) Help in identifying and eliminating non-transformants and selectively permitting the growth of the transformants.

Que 21: The technique used to separate DNA fragment is Gel electrophoresis.

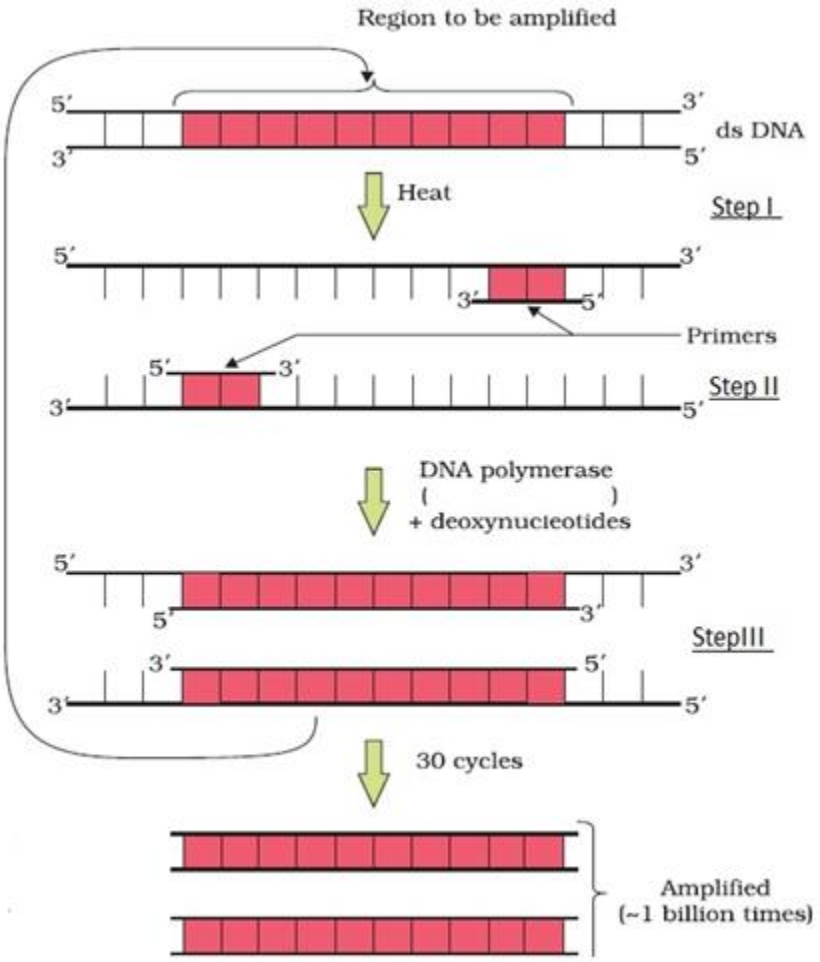
a) Name the gel commonly used in electrophoresis

b) Identify the source of this gel. ***Marks :(2)***

Ans: a) Agarose gel.

b) Natural polymer extracted from sea weeds.

Que 22: A gene of interest can be amplified in vitro into millions of copies in a limited time period. The diagram given below shows its basic steps. ***Marks :(3)***



a) Name this technique.

b) Identify Step I, Step II, Step III

c) Name the DNA polymerase used in this technique.

Ans: a) PCR/ Polymerase Chain Reaction.

b) Step I - Denaturation.

Step II - Annealing,

Step III - Extension

c) Taq polymerase

Que 23: Match the items in column A and B. ***Marks :(2)***

A	**B**
a) *Ori*	**1.Restriction enzyme**
b) *rop*	**2.Selectable marker**
c) *tet*^{R}	**3. Code for protein involved in replication**
d) EcoR I	**4. Origin of replication**

Ans:

a) *Ori*	4. Origin of replication
b) rop	3. Code for protein involved in replication
c) tet^{R}	2.Selectable marker
d) EcoR I	1.Restriction enzyme

Que 24: The DNA fragments can be separated using gel electrophoresis. ***Marks :(3)***

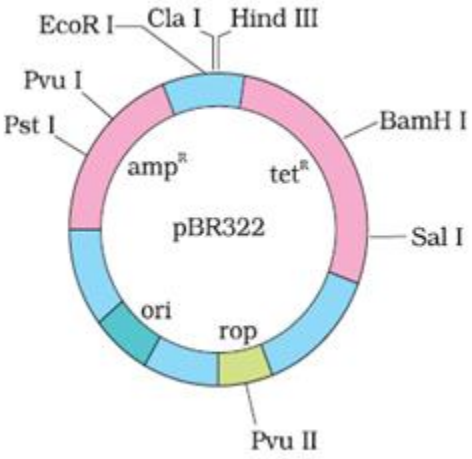
a) Name the gel and stain used in this process.

b) What is elution?

Ans: a) Agarose gel, Ethidium bromide

b) Separated bands of DNA are cut from agarose gel and extracted from the gel piece. This step is known as elution.

Que 25: Observe the figure of cloning vector pBR 322 given below and answer the following questions. ***Marks :(3)***



a) Identify any two cloning sites from the vector.

b) A single recognition site of a restriction enzyme is preferable for vectors. Why?

Ans: a*) EcoR I, Psu I, Cla I,BamH I,Pvu ll,Hind lll,Pst l ,Sal l* (any Two)

b) Presence of more than one recognition site of an enzyme within the vector will generate several fragments, which will complicate the gene cloning.

Que 26: Police collected a small amount of blood sample from a murder site. They want to amplify the DNA extracted from the blood sample. ***Marks :(2)***

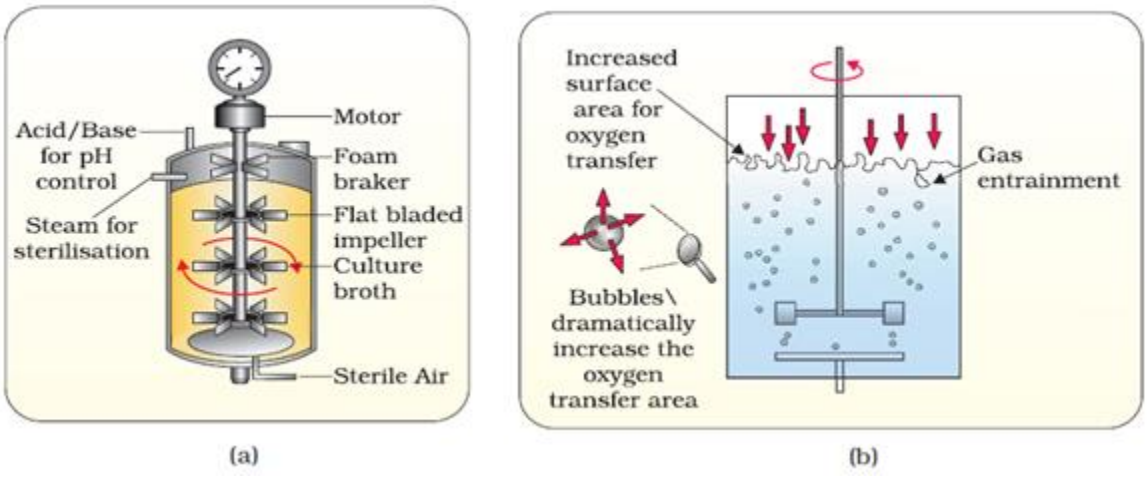
a) Suggest a process for amplifying the DNA sample.

b) Name the various steps in this process.

Ans: a) PCR.

b) Denaturation, Annealing, Extension

Que 27: Observe the following figures a and b. ***Marks :(3)***



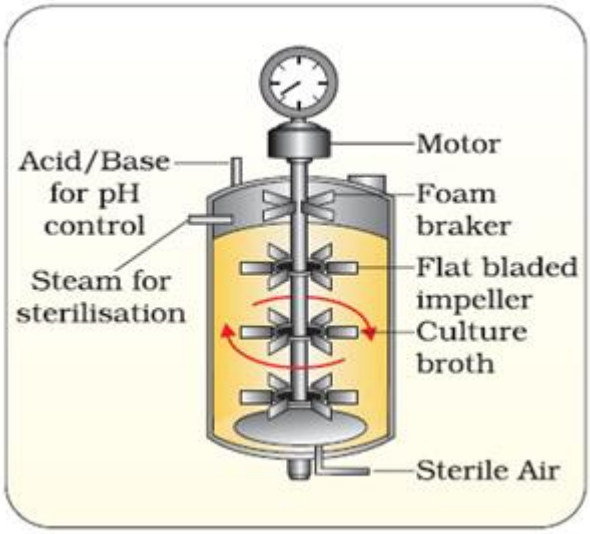
i. Identify the bioreactors a and b

ii. What is Downstream processing?

Ans: i) a. Simple Stirred-tank bioreactor b. Sparged stirred -tank bioreactor

ii)The process of separation and purification of the products formed in a bioreactor is collectively referred as downstream processing.

Que 28: Observe the diagram given below. Write the name and any two peculiarities of this device. ***Marks :(3)***



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Ans: Bioreactor / Simple Stirred Tank bioreactor

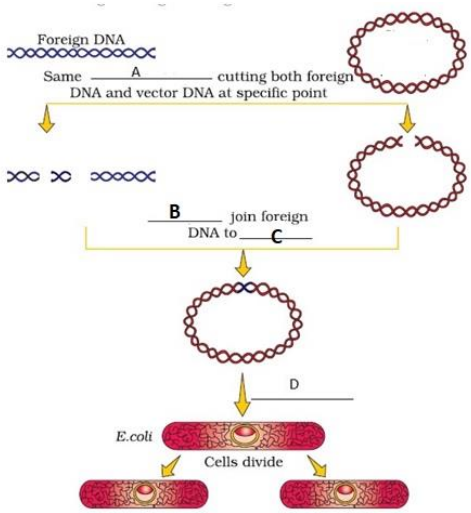
1)The stirrer in the reactor facilitates even mixing and oxygen availability throughout the bioreactor.

2) Alternatively, air can be bubbled through the reactor.

3)The bioreactor has

- an agitator system.
- an oxygen delivery system.
- a foam control system.
- a temperature control system.
- a pH control system.
- a sampling port. (Any two)

Que 29: Diagrammatic representation of recombinant DNA technology is given below. ***Marks :(2)***



1. Write the name of enzymes mentioned in A and B.

2. What do C and D stand for?

Ans: 1. Restriction endonucleases and ligase

2. C-Plasmid and D- Transformation.

Que 30: Genetic engineering helps to overcome the limitation of traditional hybridization procedure in plant and animal breeding. ***Marks :(2)***

a) What is the limitation of traditional hybridization procedure mentioned here?

b) Explain how genetic engineering helps us to overcome this limitation?

Ans:

1. Traditional hybridization procedure often leads to inclusion and multiplication of undesirable genes along with desirable genes.
2. Genetic engineering allows us to isolate and introduce only one or a set of desirable genes without introducing undesirable genes into the target organism.

Que 31: Distinguish exonucleases and endonucleases. Give an example of endonuclease. ***Marks :(2)***

Ans: Exonucleases remove nucleotides from the ends of the DNA strand whereas, endonucleases make cuts at specific positions within the DNA strand.

Eg: EcoRl, Hind ll(any one)