DPP - Daily Practice Problems

Chapter-wise Sheets

Date : _____ **Start Time :** _____ **End Time :** _____

BIOLOGY CB33

SYLLABUS : Biotechnology: Principles and Processes

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. The linking of antibiotic resistance gene with the plasmid vector became possible with
(a) DNA ligase
(b) Endonucleases
(c) DNA polymerase
(d) Exonucleases

2. DNA or RNA segment tagged with a radioactive molecule is called
(a) Vector (b) Probe
(c) Clone (d) Plasmid

3. Restriction endonucleases are enzymes which
(a) make cuts at specific positions within the DNA molecule
(b) recognize a specific nucleotide sequence for binding of DNA ligase
(c) restrict the action of the enzyme DNA polymerase
(d) remove nucleotides from the ends of the DNA molecule

4. Agarose extracted from sea weeds finds use in :
(a) Spectrophotometry
(b) Tissue culture
(c) PCR
(d) Gel electrophoresis

5. PCR and Restriction Fragment Length Polymorphism are the methods for :
(a) Study of enzymes
(b) Genetic transformation
(c) DNA sequencing
(d) Genetic Fingerprinting

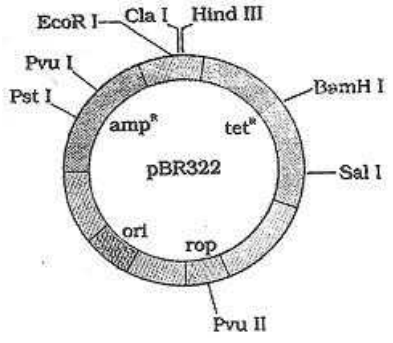
6. 'Cloning' is meant for/to
(a) production of HGH gene in *E. coli*
(b) preserve the genotype of organism
(c) replace the original gene
(d) All of the above

7. Which one of the following is used as vector for cloning genes into higher organisms?
(a) Baculovirus
(b) *Salmonella typhimurium*
(c) *Rhizopus nigricans*
(d) Retrovirus

RESPONSE GRID					
1. ⓐⓑⓒⓓ	**2.** ⓐⓑⓒⓓ	**3.** ⓐⓑⓒⓓ	**4.** ⓐⓑⓒⓓ	**5.** ⓐⓑⓒⓓ
6. ⓐⓑⓒⓓ	**7.** ⓐⓑⓒⓓ			

Space for Rough Work

8. The figure below is the diagrammatic representation of the *E.Coli* vector pBR 322. Which one of the given options correctly identifies its certain component (s) ?



(a) ori - original restriction enzyme
(b) rop-reduced osmotic pressure
(c) Hind III, EcoRI - selectable markers
(d) amp^R, tet^R - antibiotic resistance genes

9. Electroporation procedure involves
(a) fast passage of food through sieve pores in phloem elements with the help of electric stimulation.
(b) opening of stomatal pores during night by artificial light.
(c) making transient pores in the cell membrane to introduce gene constructs.
(d) purification of saline water with the help of a membrane system.

10. What is the first step in the Southern blot technique?
(a) Denaturation of DNA on the gel for hybridization with specific probe.
(b) Production of a group of genetically identical cells.
(c) Digestion of DNA by restriction enzyme.
(d) Denaturation of DNA from a nucleated cell such as the one from the scene of crime.

11. The polymerase chain reaction (PCR) technology was discovered by
(a) Karry Mullis (b) Saiki *et al*
(c) Craig Venter (d) Maxam and Gilbert

12. For transformation, micro-particles coated with DNA to be bombarded with gene gun are made up of :
(a) Silver or Platinum
(b) Platinum or Zinc
(c) Silicon or Platinum
(d) Gold or Tungsten

13. Plasmid used to construct the first recombinant DNA was isolated from which bacterium species?
(a) *Escherichia coli*
(b) *Salmonella typhimurium*
(c) *Agrobacterium tumefaciens*
(d) *Thermus aquaticus*

14. Genetic engineering is possible because
(a) we can cut DNA at specific sites by restriction endonucleases
(b) restriction endonucleases purified from virus can be used in bacteria
(c) the phenomenon of transduction in bacteria is well understood
(d) we can seen DNA by electron microscope

15. Gel electrophoresis is a
(a) technique of separation of charged molecules under the influence of magnetic field
(b) technique of incorporation of DNA molecules into the cell through transient pores made due to electrical impulses
(c) technique of separation of DNA fragments through the pores of agarose gel under the influence of electric field
(d) technique of separation and purification of gene products.

16. In recombinant DNA technology, the term vector refers to
(a) the enzyme that cuts DNA into restriction fragments
(b) the sticky end of a DNA fragment
(c) a plasmid used to transfer DNA into a living cell
(d) a DNA fragment which carries only ori gene

17. In agarose gel electrophoresis
(a) DNA migrates towards the negative electrode
(b) supercoiled plamids migrate slower than their nicked counterparts
(c) larger molecules migrate faster than smaller molecules
(d) ethidium bromide can be used to visualize the DNA

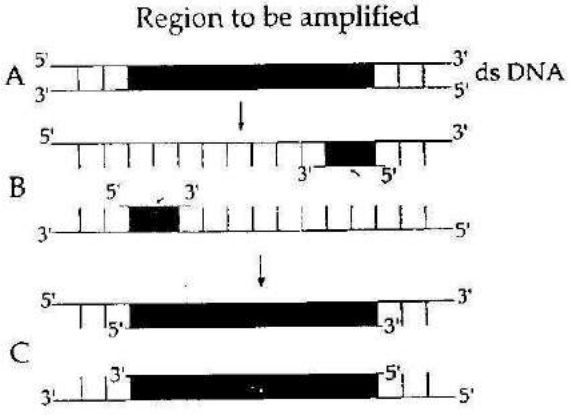
18. Which of the following is based upon the principle of antigen-antibody interaction?
(a) PCR (b) ELISA
(c) R DNA technology (d) RNA

19. Two microbes found to be very useful in genetic engineering are
(a) *Vibrio cholerae* and a tailed bacteriophage
(b) *Diplococcus* sp. and *Pseudomonas* sp.
(c) Crown gall bacterium and *Caenorhabditis elegans*
(d) *Escherichia coli* and *Agrobacterium tumefaciens*

RESPONSE GRID					
	8. (a)(b)(c)(d)	**9.** (a)(b)(c)(d)	**10.** (a)(b)(c)(d)	**11.** (a)(b)(c)(d)	**12.** (a)(b)(c)(d)
	13. (a)(b)(c)(d)	**14.** (a)(b)(c)(d)	**15.** (a)(b)(c)(d)	**16.** (a)(b)(c)(d)	**17.** (a)(b)(c)(d)
	18. (a)(b)(c)(d)	**19.** (a)(b)(c)(d)			

Space for Rough Work

20. The figure below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents?



(a) B - Denaturation at a temperature of about 98°C separating the two DNA strands.
(b) A - Denaturation at a temperature of about 50°C.
(c) C - Extension in the presence of heat stable DNA polymerase.
(d) A - Annealing with two sets of primers.

21. Biolistics (gene-gun) is suitable for
(a) DNA finger printing
(b) Disarming pathogen vectors
(c) Transformation of plant cells
(d) Constructing recombinant DNA by joining with vectors

22. Baculoviruses are excellent candidates for
(a) species-specific narrow spectrum pesticidal applications.
(b) species-specific broad spectrum pesticidal applications.
(c) species-specific narrow spectrum insecticidal applications.
(d) species-specific broad spectrum insecticidal applications.

23. Which of the following technique is used for the separation of DNA fragments ?
(a) Gel electrophoresis (b) Chromatography
(c) Transformation (d) Transduction

24. Plasmids are suitable vectors for gene cloning because
(a) these are small circular DNA molecules which can integrate with host chromosomal DNA.
(b) these are small circular DNA molecules with their own replication origin site.
(c) these can shuttle between prokaryotic and eukaryotic cells.
(d) these often carry antibiotic resistance genes.

25. The term "competent" refers to
(a) increasing the competition between cells
(b) making cells impermeable for DNA
(c) increasing the efficiency with which DNA enters the bacterium through pores in its cell wall
(d) making cells permeable for divalent cations

26. The correct sequence of different steps of polymerase chain reaction is
(a) Annealing → Denaturation → Extension
(b) Denaturation → Extension → Annealing
(c) Denaturation → Annealing → Extension
(d) Extension → Denaturation → Annealing

27. Eukaryotic genes do not function properly when cloned into a bacterial cell, because
(a) of high pH present in bacterial cells
(b) of inability to excise introns and destruction by bacterial restriction enzymes
(c) of inappropriate insertion of genes
(d) both (a) and (b).

28. Which structure involved in genetic engineering?
(a) Plastid (b) Plasmid
(c) Codon (d) None of these

29. *Ti*-plasmid used in genetic engineering has been modified by
(a) adding tumour forming genes.
(b) deleting tumour forming genes.
(c) adding genes for endonucleases.
(d) deleting genes for endonucleases.

30. Which of the following technique is used for the detection of RNA fragments ?
(a) Northern blotting (b) Chromatography
(c) Transformation (d) Transduction

31. Which of these is not correctly matched ?
(a) Gene gun—biolistic gun
(b) Plasmids—extrachromosomal DNA
(c) DNA ligase—Biological scissors
(d) Bacteriophages—viruses.

32. Polyethylene glycol method is used for
(a) biodiesel production
(b) seedless fruit production
(c) energy production from sewage
(d) gene transfer without a vector

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ	**28.** ⓐⓑⓒⓓ	**29.** ⓐⓑⓒⓓ
	30. ⓐⓑⓒⓓ	**31.** ⓐⓑⓒⓓ	**32.** ⓐⓑⓒⓓ		

Space for Rough Work

33. Which of the following is a molecular scissors?
(a) *EcoR*I (b) *Hind* III
(c) *Bam* H II (d) All of these

34. Rennin used in cheese industry is
(a) antibiotic (b) alkaloid
(c) enzyme (d) inhibitor

35. The primary reason why the same basic techniques can be used to analyze the DNA from species as diverse as bacteria and humans is that
(a) all cells are identical.
(b) every organism has the same amount of DNA.
(c) the DNA sequences of all organisms are the same.
(d) DNA has a consistent structure in all organisms.

36. Which of the following is a plasmid?
(a) pBR 322 (b) *Bam H* I
(c) *Sal* I (d) *Eco R* I

37. There is a restriction endonuclease called *EcoR*I. What does *.co* part in it stand for ?
(a) Colon (b) Coelom
(c) Coenzyme (d) *coli*

38. Restriction endonuclease - *Hind* II always cuts DNA molecules at a particular point by recognizing a specific sequence of
(a) six base pairs. (b) five base pairs.
(c) four base pairs. (d) seven base pairs.

39. Which of the following enzyme is used in case of fungus to cause release of DNA along with other macromolecules ?
(a) Lysozyme (b) Cellulase
(c) Chitinase (d) Amylase

40. Match Column I with Column II and identify the correct option.

	Column - I		**Column - II**
A.	Primers	I.	PCR
B.	Separation and purification of products	II.	C_2H_5OH
C.	Precipitation of DNA	III.	Uptake of foreign DNA by bacterium
D.	Transformation	IV.	Down stream processing

(a) A-IV; B-I; C-II; D-III
(b) A-II; B-I; C-IV; D-III
(c) A-IV; B-I; C-III; D-II
(d) A-I; B-IV; C-II; D-III

41. Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme?
(a) 5'.....CGTTCG.....3'
3'.....ATGGTA.....5'
(b) 5'.....GATATG.....3'
3'.....CTACTA.....5'
(c) 5'.....GAATTC.....3'
3'.....CTTAAG.....5'
(d) 5'.....CACGTA.....3'
3'.....CTCAGT.....5'

42. During heat shock to the bacterium, the temperature used for giving thermal shock is
(a) 52°C (b) 100°C
(c) liquid nitrogen (d) 42°C

43. Stirred-tank bioreactors have been designed for
(a) addition of preservatives to the product.
(b) purification of the product.
(c) ensuring anaerobic conditions in the culture vessel.
(d) availability of oxygen throughout the process.

44. After completion of biosynthetic stage, the product has to be subjected through a series of processes before it is ready to marketing as a finished product. This series of processes is called
(a) upstream processing (b) downstream processing
(c) elution (d) insertional inactivation

45. Which of the following is not necessary to execute a polymerase chain reaction successfully?
(a) All four DNA bases
(b) Short DNA base primers
(c) DNA polymerase
(d) DNA library

RESPONSE GRID					
	33. ⓐⓑⓒⓓ	**34.** ⓐⓑⓒⓓ	**35.** ⓐⓑⓒⓓ	**36.** ⓐⓑⓒⓓ	**37.** ⓐⓑⓒⓓ
	38. ⓐⓑⓒⓓ	**39.** ⓐⓑⓒⓓ	**40.** ⓐⓑⓒⓓ	**41.** ⓐⓑⓒⓓ	**42.** ⓐⓑⓒⓓ
	43. ⓐⓑⓒⓓ	**44.** ⓐⓑⓒⓓ	**45.** ⓐⓑⓒⓓ		

Space for Rough Work

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 33 - BIOLOGY			
Total Questions	45	Total Marks	180
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	48	Qualifying Score	60
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

HINTS & SOLUTIONS

DPP /CB33

1. (a) The linking of antibiotic resistance gene with the plasmid vector became possible with DNA ligase. DNA ligase is an enzyme that is able to join together two portions of DNA and therefore plays an important role in DNA repair. DNA ligase is also used in recombinant DNA technology as it ensures that the foreign DNA is bound to the plasmid into which it is incorporated.

2. (b) DNA or RNA segment tagged with a radioactive molecule is called probe. They are used to detect the presence of complementary sequences in nucleic acid samples. Probes are used for identification and isolation of DNA and RNA.

3. (a) Restriction endonucleases are enzymes that makes cuts at specific positions within the DNA molecule. They acts as molecular scissors. They recognise specific base sequence at palindromic sites in DNA duplex and cut its strands.

4. (d) In gel electrophoresis, agarose extracted from sea weed used as gel agarose, made of 0.7% gel show good resolution of large DNA and 2% gel will show good resolution of small fragments.

5. (d)

6. (b) Cloning is the production of an organism with exactly similar genetic make up as in the mother individual. Cloning is done to preserve genotype of an individual. This is achieved by cell culture, tissue culture or genetic engineering.

7. (d) Retrovirus has the ability to transform normal cells into cancerous cells. Hence, it can used as a vector for cloning desirable genes into animal cells.

8. (d) In pBR 322;
-ori-represents site of origin of replication
-rop-represents those proteins that take part in replication of plasmid.
-*Hind* III, *Eco*RI- Recoginition sites of Restriction endonucleases
-amp^R and tet^R - They are antibiotic resistant gene part.

9. (c) Electroporation is the method of making cell membrane permeable for the entry of recombinant DNA into the bacteria.

10. (c) The Southern blot is used to detect and identify certain DNA sequences in a sample of bodily fluid. It uses single-stranded DNA to search out their complementary strands. When a Southern blot is performed on DNA, the first step is digestion of DNA with restriction enzymes. Restriction enzymes cut DNA at known sequences, and produces DNA fragments of a certain length. Once the DNA is cut into pieces, scientists conduct electrophoresis to separate them by size.

11. (a) PCR is now a common and often indispensable technique, developed in 1984 by Kary Mullis, used in medical and biological research labs for a variety of applications. These include DNA cloning for sequencing, DNA-based phylogeny, or functional analysis of genes; the diagnosis of hereditary diseases; the identification of genetic fingerprints (used in forensic sciences and paternity testing); and the detection and diagnosis of infectious diseases. In 1993, Mullis won the Nobel Prize in Chemistry for his work on PCR.

12. (d) For gene transfer into the host cell without using vector microparticles made of tungsten and gold coated with foreign DNA are bombarded into target cells at a very high velocity.

13. (b) The first fecombinant DNA was constructed by Stanley Cohen and Herbert Boyer in 1972. They cut the piece of DNA from a plasmid carryign antibotic-resistance gene in the bacterium *Salmonella typhimurium* and linked it to the plasmid of *Escherichia coli*. The vector transfers the piece of DNA attached to it.

14. (a) Genetic engineering is the artificial synthesis, isolation, modification, combination, addition and repair of the genetic material (DNA) to alter the phenotype of the host organims to suit human needs. It is the manipulation of genes by man in vitro. Restriction endonucleases play major role in genetic engineering as they can cut DNA at specific sites.

15. (c) Electrophoresis is a technique of separation of molecules such as DNA, RNA or protein, under the influence of an electrical field, so that they migrate in the direction of electrode bearing the opposite charge, viz, positively charged molecule move towards cathode (–ve electrode) and negatively charged molecues travel towards anode (+ve electrode) under an electric filed through a matrix of agarose gel. The DNA fragments separate according to their size through the agarose gel, with smaller fragments moving farther away as compared to larger ones. The DNA fragments can be visualized by staining them with ethidium bromide followed by exposure to UV radiations. Bright orange coloured bands of DNA can be observed. The separated DNA bands are then cut out from the agarose gel and extracted from the gel piece. This step is known as elution. The DNA fragments purified in this manner are used in constructing recombinant DNA by joining them with cloning vectors.

16. (c) The DNA used as a carrier for transferring a fragment of foreign DNA into a suitable hosts is called vehicle DNA of cloning vector or gene carrier. When desired gene is introduced into a vector, recombinant DNA is formed. Vectors may be plasmids, bacteriophages, cosmids, phagemids, Yeast Artificial Chromosomes (YACs) Bacterial Artificial Chromosomes (BACs), transposons, viruses, etc.

17. (d) **18. (b)**

19. (d) *Escherichia coli* is a bacterium found in human colon. On this bacterium scientists have made extensive genetic experiments to make some vital chemicals like insulin. Another bacterium is *Agrobacterium tumefaciens* which causes crown gall in plants is extensively used for genetic experiments.

20. (c) PCR is a technique for enzymatically replicating DNA without using a living organism such as *E. coli* or yeast. It is commonly used in medical and biological research labs for a variety of tasks like detection of hereditary diseases, identification of genetic fingerprints etc.
The correct steps shown in the given figure are:
A – Denaturation at a temperature of about 94° to 98°C. During the denaturation, the double strand melts open to single stranded DNA, and all enzymatic reactions stop.
B – Annealing (binding of DNA primer to the separated strands. Occurs at 50° to 65°Celsius, which is lower than the optimal temperature of the DNA polymerases)
C – Extension or elongation of the strands using the DNA primer with heat-stable DNA polymerases, most frequently Taq (*Thermus aquaticus*) at 72ºC.

21. (d) **22. (c)** **23. (a)** **24. (b)**

25. (c) Transformation is a process by which a cell takes up naked DNA fragment from the environment, incorporates it into its own chromosomal DNA and finally expresses the trait controlled by the incoming DNA. Since DNA is a hydrophilic molecule, it can not pass through membranes, so that bacterial cells must be made competent to take up DNA. This is done by treating them with a specific concentration of a divalent cation, such as calcium (Ca^{2+}) which increases the efficiency with which DNA enters the bacterium through pores in its cell wall. Recombination DNA (rDNA) can then be forced into such cells by incubating them briefly at 42° C (heat shock), and then putting them back on ice. This enables the bacteria to take up the recombination DNA.

26. **(c)** Polymerase chain reaction is a technique used to replicate a fragment of DNA so as to produce many copies of a particular DNA sequence. A single PCR amplification cycle involves three basic steps: denaturation, annealing and extension (polymerisation).

27. **(a)** Eukaryotic genes do not function properly when transferred into bacterial cell because introns are present in eukaryotic cells but are absent in prokaryotic cells. Hence, when bacterial cell is transformed with recombinant DNA generated using human gene, it could not process it. As a result desired protein will not be produced.

28. **(b)** **29.** **(b)** **30.** **(a)** **31.** **(c)**

32. **(d)** Direct gene transfer is the transfer of naked. DNA into plant cells but the presence of rigid plant cell wall acts as a barrier to uptake. Therefore, protoplasts are the favoured target for direct gene transfer. Polyethylene glycol mediated DNA uptake is a direct gene transfer method that utilizes the interaction between polyethylene glycol, naked DNA, salts and the protoplast membrane to effect transport of the DNA into the cytoplasm.

33. **(d)** **34.** **(c)**

35. **(d)** The fact that DNA is structured the same way in all known organisms means that similar methods can be used to study the hereditary material.

36. **(a)** pBR 322 is an artificially constructed vector plasmid. It is widely used in gene cloning experiments.

37. **(d)** *EcoR*I is an endonuclease enzyme isolated from strains of *E.coli* and a part of restriction modified system. So, .co part stands for *coli*.

38. **(a)** Restriction endonuclease-*Hind* II, always cuts DNA molecules at a particular point by recognizing a specific sequence of six base pairs. This specific base sequence is known as the recognition sequence for *Hind* II.

39. **(c)** Chitinase is an enzyme that cleaves the glycosidic bonds in chitin, thereby breaking down the structural polysaccharide component of the hard outer covering of many animals and of the cell wall of fungi.

40. **(d)**

41. **(c)** Palindromic sequences in DNA molecule are group of bases that forms the same sequence when read in both forward and backward direction. In the given question, only option (c) represents a palindromic sequence.

42. **(d)** During heat shock to the bacterium, the temperature used for giving thermal shock is 42º C. This enables the bacteria to take up the recombinant DNA.

43. **(d)** A stirred-tank bioreactors is usually cylindrical or with a curved base to facilitate the mixing of the reaction contents. The stirrer facilitates even mixing and oxygen availability throughout the bioreactor. Alternatively air can be bubbled through the reactor.

44. **(b)** Downstream processing refers to the recovery and purification of biosynthetic products, particularly pharmaceuticals. It is an essential step in the manufacture of pharmaceuticals such as antibiotics, hormones (e.g. insulin and human growth hormone), antibodies and vaccines; antibodies and enzymes used in diagnostics; industrial enzymes; and natural fragrance and flavour compounds.

45. **(d)** Polymerase chain reaction (PCR) is a technique of synthesizing multiple copies of the desired gene (or DNA) *in vitro*.
At the start of PCR, the DNA from which a segment is to be amplified, an excess of the two primer molecules, the four deoxynucleoside triphosphates and the DNA polymerase are mixed together in reaction mixture that has appropriate quantities of Mg^{2+}. The PCR operation is followed in a sequence where denaturation, primer extention occurs.