



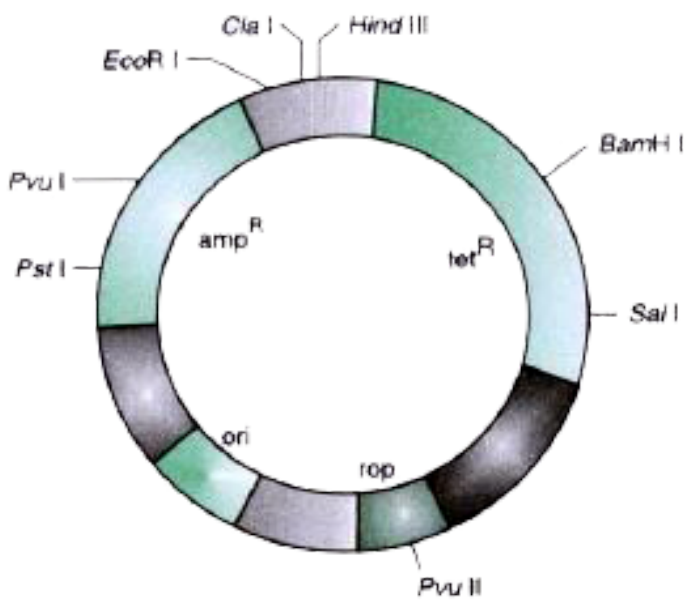
BIOLOGY

BOOKS - SRIJAN BIOLOGY (ENGLISH)

BIOTECHNOLOGY : PRINCIPLES AND PROCESSES

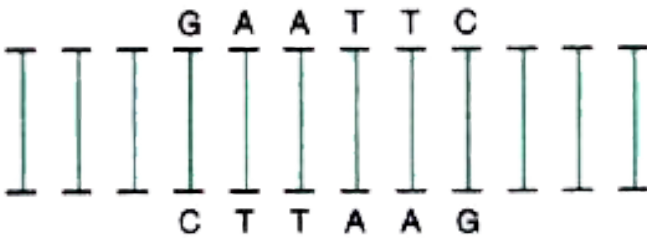
Illustrative Questions

1. Explain the importance of (a) ori and b) amp^R in the E. coli vector shown below :



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2. An interesting property of restriction enzymes is molecular cutting. Restriction enzymes typically recognise a symmetrical sequence of DNA.



Notice that the top strand is the same as the bottom strand, but reads backward. When the enzyme cuts the strand between G and A, it leaves overhanging chains :



- (a) What is this symmetrical sequence of DNA known as?
- (b) What is the significance of these overhanging chains?

(c) Name the restriction enzyme that cuts the strand between G and A.



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3. Explain with the help of a suitable example, the naming of a restriction endonuclease.



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4. Summarise the events in sequence when a mixture of plasmid vector and human DNA is

digested with restriction enzyme EcoRI is supplemented with enzyme DNA ligase.



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5. Given below are two restriction endonuclease enzymes Hind II and Sal I. Write the name of genus, species and strain of the bacteria from which these have been obtained.



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6. From what you have learnt, can you tell whether enzymes are bigger or DNA is bigger in molecular size? How did you know?



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7. What would be the molar concentration of human DNA in a human cell. Consult your teacher



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8. Besides better aeration and mixing property what other advantages do stirred tank bioreactors have over shake flasks?



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9. At which stage of meiosis, recombinant DNA is made ?



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10. Can you think and answer how can a reporter enzyme be used to monitor transformation of host cells by foreign DNA in addition to a selectable marker?



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11. How is copy number of the plasmid vector related to yield of recombinant protein?



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12. For producing a recombinant protein (for therapeutic purpose) in large scale, which vector would you choose - a low copy number or high copy number?



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13. Would you choose an exonuclease while producing a recombinant DNA molecule?



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14. What is the significance of adding proteases at the time of isolation of genetic material (DNA)?



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15. While doing a PCR, 'denaturation' step is missed. What will be its effect on the process?



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16. What is gene cloning?



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17. Both a wine maker and a molecular biologist who had developed a recombinant vaccine claim to be biotechnologists. Who in your opinion is correct?



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18. A recombinant DNA molecule was created by ligating a gene to a plasmid vector. By

mistake, an exonuclease was added to the tube containing the recombinant DNA. How does this affect the next step in the experiment, i.e., bacterial transformation?



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19. Restriction enzymes that are used in the construction of recombinant DNA are endonucleases which cut the DNA at 'specific-recognition sequence'. What would be the

disadvantage if they do not cut the DNA at specific-recognition sequence?



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20. A plasmid DNA and a linear DNA (both are of the same size) have one site for a restriction endonuclease. When cut and separated on agarose gel electrophoresis, plasmid shows one DNA band while linear DNA shows two fragments. Explain



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21. How does one visualise DNA on agarose gel?



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22. A plasmid without a selectable marker was chosen as vector for cloning a gene. How does this affect the experiment?



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23. A mixture of fragmented DNA was electrophoresed in an agarose gel. After staining the gel with ethidium bromide, no DNA bands were observed. What could be the reasons?



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24. Describe the role of $CaCl_2$ in the preparation of competent cells ?



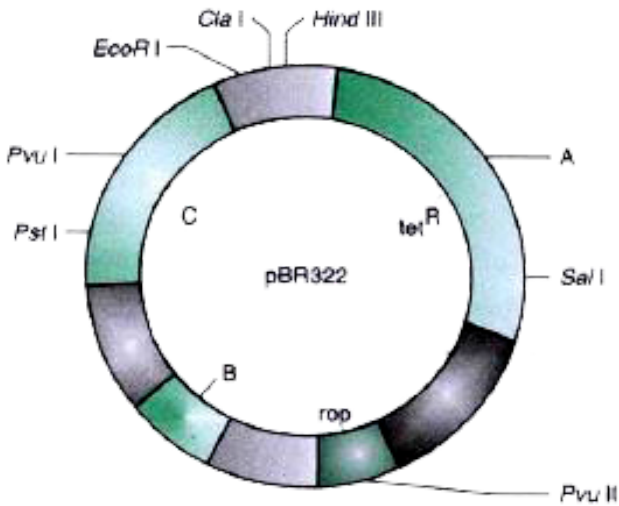
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25. What would happen when one grows a recombinant bacterium in a bioreactor but forget to add antibiotic to the medium in which the recombinant is growing?



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26. Name the regions marked A, B and C.



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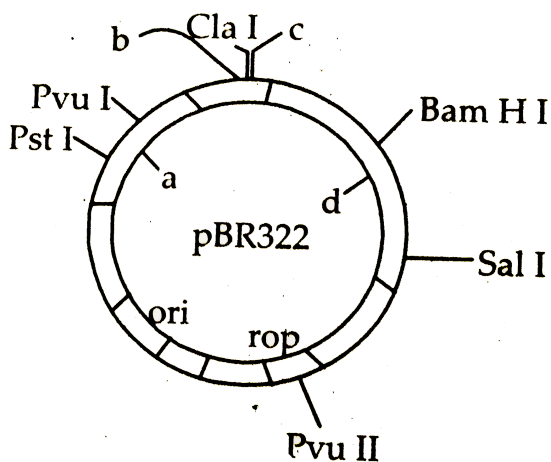
27. A policeman finds a very small piece of body tissue from the site of crime and takes it to the forensic department:

- (a) By which technique will they amplify the DNA collected from the tissue sample?
- (b) Mention in a sequence, the 3 steps involved in each cycle of this technique.
- (c) What is the role of thermostable DNA polymerase in this technique?



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28. Why are only type II restriction endonucleases used in recombinant DNA technology?



29.

(a) Identify the selectable markers in the diagram of E. Coli vector shown above .

(b) How is the coding squence of α -galactosidase consider a better markers than

the ones identified by you in the diagram ?

Explain.



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30. What will happen if a plasmid vector is digested with EcoR1 at a single site?



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31. Why is gene synthesis using reverse transcriptase or artificial synthetic method is

better than to obtain a gene or DNA segment by shotgun method?



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32. Why and how is bacterium *Thermus aquaticus* employed in recombinant DNA technology?



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33. In an experiment of recombinant DNA technology, in a bacterial culture some of the colonies produced blue colour in presence of a chromogenic substrate. Why?



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34. How does bacterial DNA is protected against restriction enzymes?



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35. What is the significance of 'sticky ends' formed by restriction endonuclease?



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36. Can you list 10 recombinant proteins which are used in medical practice? Find out where they are used as therapeutics



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Practice Questions Very Short Answer Type Questions

1. Name the enzyme commonly used to dissolve the bacterial cell wall.



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2. Expand PCR, Bt.



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3. Name the scientists who generated first recombinant DNA molecules



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4. Name a 'natural genetic engineer' of plants.



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5. In the context of genetic engineering, what do you mean by 'vehicle'?



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6. What is the function of DNA ligase?



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7. Name the enzyme responsible for cleavage in the following sequence:





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8. What are plasmids?



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9. Name the scientists who were awarded Nobel Prize for discovery of Restriction enzymes



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10. Bacteria that convert milk into curd play two other beneficial roles? What are they?



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11. A plasmid and a DNA sequence in a cell need to be cut for producing recombinant DNA. Name the enzyme which acts as a molecular scissors to cut the DNA segments.



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12. What is the use of Southern blotting technique?



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13. Name any two methods used to introduce recombinant DNA into host cell.



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14. How retroviruses are being used in genetic engineering.



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15. What is a plasmid?



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16. What is the use of PCR



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Practice Questions Short Answer Type I Questions

1. Expand the terms: rDNA, BACs, YACs, cD A.



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2. What is electrophoresis?



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3. Define the term vector with reference to genetic engineering.



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4. What is the use of alkaline phosphatase?



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5. What are exonucleases?



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6. How has *Agrobacterium tumefaciens* been suitably modified to act as a cloning vector?



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7. How is DNA made visible in gel electrophoresis?



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8. Refer to the diagram and answer the following questions:

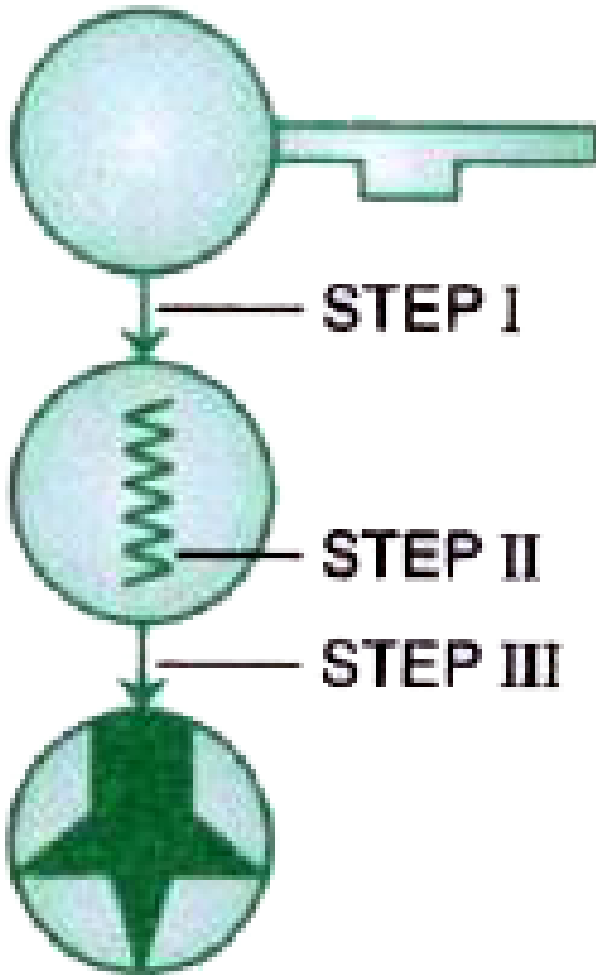
(a) From which is T1 plasmid obtained?

(b) Name the enzyme which is involved in step I.

(c) What happens in step III?

(d) The plant produced is called hybrid or

transgenic.



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9. State the principle of 'gel electrophoresis' and mention two applications of this technique of biotechnology



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10. How is DNA isolated in purified form from a bacterial cell.



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11. What are recombinant proteins? How do bioreactors help in their production?



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12. Explain the contribution of *thermus aquaticus* in the amplification of a gene of interest



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13. What are transgenic plants?



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Practice Questions Short Answer Type II
Questions

1. Write any three uses of PCR



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2. Write any three uses of gene cloning?



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3. Differentiate between YAC and BAC.



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4. Discuss differences between blunt ends and sticky ends of DNA.



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5. Define briefly about principles of biotechnology



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6. Discuss the role of plasmids as vectors.



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7. Write a short note on restriction enzymes.



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8. How are bacteriophage vectors advantageous over plasmid vectors?



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9. Define two dimensional gel electrophoresis.



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10. What does PCR stand for ? Describe the different steps of PCR.



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11. In a bacterial culture, some of the colonies produced blue colour in the presence of a chromogenic substrate and some did not due to the presence or absence of an insert (rDNA) in the coding sequence of β - galactosidase.

(a) Mention the mechanism and the steps

involved in this experiment.

(b) How is it advantageous over simultaneous plating on two plates having different antibiotics?



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Practice Questions Long Answer Type I Questions

1. What are essential features of a vector?



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2. What is the significance of restriction enzymes in rDNA technology?



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3. Define briefly about the principles of biotechnology.



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4. Write a note on bioreactors.



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5. How are foreign gene products obtained?



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6. Discuss 'conceptual development of genetic engineering principle'



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7. What is the scope of biotechnology?



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8. What are cDNA libraries? How are they made
?



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**Pervious Years Board Paper Questions Very Short
Answer Type Questions**

1. Write a short note on DNA fingerprinting



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2. Give one significant difference between Electroporation and Gene Gun



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3. Answer the following questions briefly and to the point:

Give the full form of EFB.



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4. Give one significant contribution of Sanger



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Pervious Years Board Paper Questions Short Answer Type I Questions

1. Write a short note on electrophoresis.



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Pervious Years Board Paper Questions Short Answer Type Ii Questions

1. What are stem cells? Write two applications of stem cells in medical treatment



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2. Write short notes on the following Biomedical engineering.



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3. Write short notes on the following

Stem cells



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4. Write short notes on the following

Cryopreservation.



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Pervious Years Board Paper Questions Long Answer Type I Questions

1. Give a brief account of genetic engineering.



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2. Briefly describe the technique employed in DNA fingerprinting



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3. Explain how insulin can be produced using recombinant DNA technology



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4. What does PCR stand for? Describe the different Steps of PCR



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5. Give an account of the Blue-White Method of selection of recombinants



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6. What are restriction endonucleases? Give the rules of their nomenclature



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7. Explain the mechanism of action of restriction endonucleases that makes them suitable for genetic engineering



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8. Explain what are the desirable characteristics of an ideal cloning vector used in rDNA technology



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9. Describe two vectorless methods of gene transfer used in rDNA technology



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Review Questions

1. Give one significant difference between each of the following:

Lysing enzymes and cleaving enzymes



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2. Give one significant difference between each of the following

Denaturation and Renaturation of DNA



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3. Each of the following questions/statements has four suggested answers. Rewrite the correct answer in each case:

The most common bacterium used in genetic engineering is

A. Escherichia

B. Clostridium

C. Salmonella

D. Bacillus

Answer:



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4. Each of the following questions/statements has four suggested answers. Rewrite the

correct answer in each case:

Genetic material of virus is

A. RNA only

B. DNA only

C. Either DNA or RNA

D. Both DNA and RNA

Answer:



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5. Each of the following questions/statements has four suggested answers. Rewrite the correct answer in each case:

Who discovered recombinant DNA (rDNA) technology?

A. Har Gobind Khorana

B. James D. Watson

C. S. Cohen and H. Boyer

D. Sulton and Avery

Answer:



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6. Each of the following questions/statements has four suggested answers. Rewrite the correct answer in each case:

Which one of the following is not obtained from genetic engineering?

A. Haemoglobin

B. Flavr savr tomato

C. Golden rice

D. None of these

Answer:



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7. Mention one significant function of the following:

Restriction endonuclease



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8. Mention one significant function of the following

Antisense RNA technology



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9. State the best known contribution of

Karl Ereky

William Hays and Joshua Lederberg

Har Gobind Khorana

Kornberg





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10. Expand the following

PCR

ELISA

GMO

OECD



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11. What are the advantages and probable risks of genetic engineering?



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12. Write any three uses of gene cloning?



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13. Define briefly about the principles of biotechnology.



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Competition Corner Objective Type Questions

1. Genetically engineered human insulin, humulin was launched by American drug company on

A. 5th July 1998

B. 5th July 1993

C. 5th July 1973

D. 5th July 1983

Answer: D



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2. Which of the following is used as genetic vector in plants?

A. *Bacillus thuringiensis*

B. *Agrobacterium tumefaciens*

C. *Pseudomonas putida*

D. None of the above

Answer: B



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3. Transfer of any gene into a completely different organism can be done through

A. Genetic engineering

B. Tissue culture

C. Transformation

D. None of these

Answer: A



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4. The basis of DNA fingerprinting is

- A. The double helix
- B. Errors in base sequence
- C. Polymorphism in sequence
- D. DNA replication

Answer: C



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5. Which one of the following can help in the diagnosis of a genetical disorder?

A. ELISA

B. ABO blood groups

C. PCR

D. NMR

Answer: C



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6. Polyethylene glycol method is used for

A. Gene transfer without a vector

B. Biocliiesel production

C. Seedless fruit production

D. Energy production from sewage

Answer: A



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7. Which one of the following is commonly used in transfer of foreign DNA into crop plants?

A. *Trichoderma harzianum*

B. *Meloidogyne incognita*

C. *Agrobacterium tumefaciens*

D. *Penicillium expansum*

Answer: C



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8. The genetic defect-Adenosine Deaminase deficiency may be cured permanently by

A. Periodic infusion of genetically engineered lymphocytes having functional ADA C-DNA

B. Administering adenosine deaminase activators

C. Introducing bone marrow cells producing ADA into cells at early

embryonic stages

D. Enzyme replacement therapy

Answer: A



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9. What is true about Bt toxin?

A. The inactive protoxin gets converted into active form in the insect gut

B. Bt protein exists as active toxin in the

Bacillus

C. The activated toxin enters the ovaries of

the pest to sterilise it and thus prevent

its multiplication

D. The concerned Bacilllls has antitoxins

Answer: A



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10. The bacterium *Bacillus thuringiensis* is widely used in contemporary biology as a/an

A. Indicator of water pollution

B. Insecticide

C. Agent for production of dairy products

D. Source of industrial enzyme

Answer: B



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11. Who discovered that restriction enzymes have the capability of cutting DNA strands in a particular fashion, which left what has become known as 'sticky ends' on the strands ?

A. Ramdeo Mishra

B. Stanley Cohen

C. Herbert Boyer

D. James D. Watson

Answer: C



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12. Genetically engineered bovine (rbST), sometimes called rbT (recombinant bovine somatotropin) or rbGH (recombinant brovine growth hormone) are used in the

A. Therapeutic drugs

B. Agriculture

C. Dairy industry

D. DNA fingerprinting

Answer: C



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13. This method of finding a gene is used when researchers know very little about the gene they are trying to find. This process results in a complete gene library: a collection of copies of DNA fragments that represent the entire genome of an organism.

A. Cloning

B. Shotgun cloning

C. Gene synthesis cloning

D. PCR

Answer: B



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14. The function of polymerase chain reaction is

A. Transduction

B. DNA amplification

C. Translation

D. None of these

Answer: C



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15. Which of the following bio-engineered bacteria is utilised for cleaning of marine oil slicks ?

A. *Escherichia coli*

B. *Pseudomonas syringae*

C. *Pseudomonas putida*

D. *Rhizoctonia solani*

Answer: C



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16. Product of biotechnology is

A. Transgenic crops (GM crops)

B. Humulin

C. Biofertiliser

D. All of the above

Answer: D



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17. Natural genetic engineer is: Bacillus subtilis

Pseudomonas sp. Escherichia coli

Agrobacterium tumefaciens

A. Bacillus subtilis

B. Pseudomonas sp.

C. Escherichia coli

D. Agrobacterium tumefaciens

Answer: D



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18. The characteristics of a molecular probe are

I. Very long molecule

II. Double-stranded

III. DNA or RNA

IV. Complementary to a part of desired gene

The correct pair is

A. I,II

B. II,III

C. III,IV

D. IV,I

Answer: C



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19. Blood stains are found at the site of a murder. If DNA profiling technique is to be used for identifying the criminal, which of the following is ideal for use?

- A. Serum
- B. Erythrocytes
- C. Leucocytes
- D. Platelets

Answer: C



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20. Palaeontologists unearthed a human skull during excavation. A small fragment of the scalp tissue was still attached to it. Only little DNA could be extracted from it. If the genes of the ancient man need to be analysed, the best way of getting sufficient amount of DNA from this extract is

A. Hybridising the DNA with a DNA probe

B. Subjecting the DNA to polymerase chain reaction

C. Subjecting the DNA to gel electrophoresis

D. Treating the DNA with restriction endonuclease

Answer: B



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21. T_i plasmids used in genetic engineering is obtained from

- A. *Bacillus thuringiensis*
- B. *Agrobacterium rhizogenes*
- C. *Agrobacterium tumefaciens*
- D. *Pseudomonas syringae*

Answer: C



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22. Which of these is used as vector in gene therapy for SCID?

A. Arbovirus

B. Retrovirus

C. Enterovirus

D. Parvovirus

Answer: D



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23. DNA element with ability to change positions is called

A. Cistron

B. Transposon

C. Intron

D. Recon

Answer: B



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24. Which of the following is used in recombinant DNA technique ?

A. Cell wall of virus

B. Gene which produces capsid of virus

C. Virus

D. Capsid of virus

Answer: C



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25. Which of the following is not a restriction endonuclease?

A. Eco RI

B. Hind III

C. Pst I

D. DNase I

Answer: D



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26. Restriction endonuclease

- A. Cuts the DNA molecule randomly
- B. Cuts the DNA molecule at specific sites
- C. Restricts the synthesis of DNA inside the nucleus
- D. Synthesises DNA

Answer: B



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27. Molecular scissors, which cut DNA at specific site is

A. Pectinase

B. Polymerase

C. Restriction endonuclease

D. Ligase

Answer: C



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28. Genetically engineered bacteria are being employed for production of

A. Thyroxin

B. Human insulin

C. Cortisol

D. Epinephrine

Answer: B



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29. Which one is regarded as a molecular scissors in biotechnology?

- A. Reverse transcriptase
- B. Restriction endonuclease
- C. Taq polymerase
- D. Topoisomerase

Answer: B



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30. An institution where valuable plant material is likely to become irretrievably lost in the wild or in cultivation is preserved viable condition is known as

A. Genome

B. Gene library

C. Gene bank

D. Herbarium

Answer: C



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31. Genetic engineering has been successfully used for producing

A. Transgenic mice for testing safety of polio vaccine before use in humans

B. Transgenic models for studying new treatments for certain cardiac diseases

C. Transgenic cow-Rosie, which produces high-fat milk for making ghee

D. Animals like bulls for farm work as they
have super power

Answer: A



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32. Restriction endonucleases are enzymes
which

A. Make cuts at specific positions within
the DNA molecule

B. Recognise 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

Answer: A



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33. DNA or RNA segment tagged with a radioactive molecule is called

A. Vector

B. Probe

C. Clone

D. Plasmid

Answer: B



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34. 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' ATCGTA.....5'

B. 5'..... GATATG.....3'

3' CTAATA.....5'

C. 5'.....GAATTC.....

3'CTAATC.....3'

D. none of the above

Answer: C



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35. The vector for T-DNA is

A. *Thermus aquaticus*

B. *Salmonella typhimurium*

C. *Agrobacterium tumefaciens*

D. *Bacillus thuringiensis*

Answer: C



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36. Which of the following is a plasmid?

A. pBR 322

B. Bam H I

C. Sal I

D. Eco RI

Answer: A



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37. The mobile genetic element is

- A. Transposon
- B. Mutation
- C. Endonuclease
- D. Variation

Answer: A



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38. In recombinant DNA technique, the term vector refers to

A. Donor DNA, is identified and picked up through electrophoresis

B. Plasmid, transfers DNA into living cell

C. Collection of entire genome in the form of plasmid

D. Enzyme, cuts the DNA at specific sites

Answer: B



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39. Enzyme that is used in PCR technology is

- A. Taq polymerase
- B. Polymerase
- C. Helicase
- D. Reverse transcriptase

Answer: A



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40. GAATTC is the recognition site for the restriction endonuclease

A. EcoR I

B. Hind II

C. Eco R II

D. Bam HI

Answer: A



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41. Satellite DNA is useful tool in ;

A. Organ transplanatation

B. Sex determination

C. Forensic science

D. Genetic engineering

Answer: C



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42. 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

Answer: D



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43. The technique of DNA fingerprinting was initially developed by

A. Ian Wilmut

B. Har Gobind Khurana

C. Jacque Monod

D. Alex Jeffreys

Answer: D



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44. There is a restriction endonuclease called Eco RI. What does 'co' part in it stand for ?

- A. Colon
- B. Coelom
- C. Coenzyme
- D. Coenzyme

Answer: D



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45. Which one of the following also acts as a catalyst in a bacterial cell?

A. 5 sr RNA

B. sn RNA

C. hn RNA

D. 23 sr RNA

Answer: D



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46. Which of the following is required as inducer(s) for the expression of Lac operon?

A. Lactose

B. Lactose and galactose

C. Glucose

D. Galactose

Answer: A



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47. Which of the following is not a feature of the plasmids?

- A. Transferable
- B. Single-stranded
- C. Independent replication
- D. Circular structure

Answer: B



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48. The taq polymerase enzyme is obtained from

- A. *Bacillus subtilis*
- B. *Pseudomonas putida*
- C. *Thermus aquaticus*
- D. *Thiobacillus ferrooxidans*

Answer: C



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49. Which of the following is a restriction endonucleases?

A. Dnse I

B. Rnase

C. Hind II

D. Protease

Answer: C



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50. Which of the following is not required for any of the techniques of DNA fingerprinting available at present?

- A. Restriction enzymes
- B. DNA-DNA hybridisation
- C. Polymerase chain reaction
- D. Zinc finger analysis

Answer: D



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Competition Corner Assertion And Reason Type Questions

1. Assertion: DNA segments can be excised by 'molecular scissors' or 'chemical scalpels' that biotechnologists call restriction enzymes

Reason: Restriction enzymes are synthesised by microbes as a defence mechanism and are specific endonucleases which can cleave double-stranded DNA.

A. If both Assertion and Reason are true and the Reason is the correct

explanation of the Assertion.

B. If both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

Answer: A



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2. Assertion: Three main types of restriction endonucleases, i.e., Type I, Type II and Type III are known with slightly different modes of action.

Reason: In palindromes with rotational symmetry, second half of complementary strand in a DNA double helix is the mirror image of base sequence in the first half of another strand.

A. If both Assertion and Reason are true and the Reason is the correct

explanation of the Assertion.

B. If both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

Answer: C



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3. Assertion: The cut pieces of DNA are linked with plasmid DNA

Reason: Plasmid DNA fails to act as vectors.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

Answer: C



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4. Assertion: Genetic engineering is essentially the alteration of the genetic make up of cells by deliberate and artificial means.

Reason: It involves transfer or replacement of genes to create recombinant DNA.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

Answer: A



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5. Assertion: Genetic engineering is also called recombinant DNA technology.

Reason: It brings about improvement of genetic make up of an organism.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

Answer: A



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6. Assertion: Insulin is a type of antibiotic.

Reason: It is synthesised by the process of fermentation

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both Assertion and Reason are true and the Reason is not the correct

explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

Answer: D



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7. Assertion: In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryote)

Reason : Both bacteria and yeast multiply very fast to form huge population, which express the desired gene

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

Answer: A



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