

# BIOTECHNOLOGY AND ITS APPLICATIONS

## SUBJECT: BIOLOGY | QUESTION BANK (QUESTIONS 1–110)

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

*Instructions: Choose the most appropriate option for MCQs. Answer short-answer questions in the space provided by your teacher.*

### SECTION A — MULTIPLE-CHOICE AND STRUCTURED QUESTIONS

1. Cry protein is obtained from:
  - a) *Bacillus subtilis*
  - b) *Bacillus thuringiensis*
  - c) *Clostridium welchii*
  - d) *E. coli*
2. *Escherichia coli* having plasmids for production of human insulin is cultured in medium containing:
  - a) Glucose
  - b) Maltose
  - c) Lactose
  - d) Sucrose
3. Which transgenic animal has been given human genes for organ transplantation into humans without risk of rejection?
  - a) Cow
  - b) Sheep
  - c) Goat
  - d) Pig
4. A protoxin is:
  - a) Toxin produced by protozoa
  - b) Inactive toxin
  - c) A denatured toxin
  - d) A primitive toxin
5. The first clinical gene therapy was given in 1990 to a 4-year-old girl with enzyme deficiency of:
  - a) Adenosine deaminase (ADA)
  - b) Tyrosine oxidase
  - c) Monoamine oxidase
  - d) Glutamate dehydrogenase
6. Agrochemicals are:
  - a) Chemical products of agriculture
  - b) Synthetic chemicals employed in agriculture
  - c) Chemicals used as pesticides
  - d) Chemicals used as fertilizers

7. \_\_\_\_\_ is used as a vector for cloning into higher organisms.
- a) Salmonella typhimurium
  - b) Baculovirus
  - c) Retrovirus
  - d) All of these
8. The genetic defect—adenosine deaminase (ADA) deficiency—may be cured permanently by:
- a) Introducing bone marrow cells producing ADA into cells at early embryonic stages
  - b) Enzyme replacement therapy
  - c) Periodic infusion of genetically engineered lymphocytes having functional ADA cDNA
  - d) Administering adenosine deaminase activators
9. Transgenic plants are those:
- a) Grown on artificial medium after hybridisation in the field
  - b) Produced after protoplast fusion in artificial medium
  - c) Produced by somatic embryo on artificial medium
  - d) Generated by introducing foreign DNA into a cell and regenerating a plant from that cell
10. The Ti plasmid used for producing transgenic plants is found in:
- a) Azotobacter
  - b) Rhizobium
  - c) Azospirillum
  - d) Agrobacterium
11. Animal suffering during testing can be minimised by which principles of animal-biotechnology ethics?
- a) Reduction
  - b) Refinement
  - c) Replacement
  - d) All of the above
12. ADA is an enzyme deficient in the genetic disorder SCID. What is the full form of ADA?
- a) Aspartate deaminase
  - b) Adenosine deaminase
  - c) Arginine deaminase
  - d) Adenosine deoxy aminase
13. Pathophysiology is the:
- a) Study of physiology of path
  - b) Study of normal physiology of host
  - c) Study of altered physiology of host
  - d) None of the above
14. What is the function of polymerase chain reaction (PCR) in genetic engineering?
- a) Cut DNA into many fragments
  - b) Carry DNA into a new cell
  - c) Link together newly joined fragments of DNA
  - d) Make millions of copies of a specific DNA segment

15. Which statement is true regarding DNA polymerase used in PCR?
- a) It is isolated from a virus
  - b) It remains active at high temperature
  - c) It ligates introduced DNA in recipient cells
  - d) It serves as a selectable marker
16. Humulin is:
- a) A form of chitin
  - b) Human insulin
  - c) A powerful antibiotic
  - d) An enzyme
17. The first transgenic plant released for commercial use was:
- a) Bt cotton
  - b) Tobacco
  - c) Golden rice
  - d) Flavr Savr tomato
18. RNA interference has been used to develop plants resistant to:
- a) Nematodes
  - b) Fungi
  - c) Viruses
  - d) Insects
19. Assertion: In gene therapy, a new gene is introduced only into somatic cells. Reason: Genetic modification is done to replace faulty genes with normal, functional genes. Choose the correct option.
- a) Both are true, and the reason correctly explains the assertion
  - b) Both are true, but the reason does not correctly explain the assertion
  - c) Assertion is true, but reason is false
  - d) Both are false
20. RNA interference helps in:
- a) Cell defence
  - b) Cell differentiation
  - c) Micropropagation
  - d) Cell proliferation
21. \_\_\_\_\_ was formerly obtained by slaughtering pigs, but this practice stopped after the development of genetic-engineering methods.
- a) Meat
  - b) Insulin
  - c) Both A and B
  - d) Fats
22. Before animal testing, animals should be given:
- a) Anaesthesia
  - b) Analgesics
  - c) Antibiotics
  - d) Antiseptics

23. Gene therapy is treatment done on:

- a) Adults only
- b) Children or embryos only
- c) Pregnant mothers only
- d) Persons of any age and condition

24. Transgenic models exist for many human diseases, including (i) cancer, (ii) cystic fibrosis, (iii) rheumatoid arthritis and (iv) Alzheimer's disease.

- a) (i) and (iii) only
- b) (ii) and (iii) only
- c) (i), (ii) and (iii) only
- d) All of these

25. RNA interference has been used to develop plants resistant to:

- a) Insects
- b) Nematodes
- c) Fungi
- d) Viruses

26. A measure taken by India to overcome biopiracy is:

- a) Creating bio-depositories within the country
- b) National biodiversity legislation
- c) Seeking changes to US patent laws through the WTO
- d) All of the above

27. In Bt cotton, the Bt toxin present in plant tissue as protoxin is converted into active toxin due to:

- a) Acidic pH of the insect gut
- b) Action of gut micro-organisms
- c) Conversion factors in the insect gut
- d) Alkaline pH of the insect gut

28. Which biomolecules can be analysed by ELISA?

- a) Peptides
- b) Hormones
- c) Antibodies
- d) All of the above

29. A globular protein of about 6 kDa, consisting of 51 amino acids arranged in two polypeptide chains held by disulphide bridges, is:

- a) Insulin
- b) Fibrinogen
- c) Glucagon
- d) Keratin

30. When multinational companies patent biological samples or knowledge from another country without proper authorisation, it is called:

- a) Bioweapon
- b) Bioethics
- c) Biopiracy
- d) Biopatent

31. Bt toxin is harmful to insects such as:

- a) Lepidopterans (tobacco budworm, armyworms)
- b) Coleopterans (beetles)
- c) Dipterans (flies and mosquitoes)
- d) All of the above

32. Silencing of a gene can be achieved through:

- a) Short interfering RNA (siRNA/RNAi)
- b) Antisense RNA
- c) Both A and B
- d) Neither A nor B

33. Transgenic plants are developed by:

- a) Introducing foreign genes
- b) Introducing gene mutations
- c) Deleting certain chromosome parts
- d) Stopping spindle formation

34. Biopiracy may involve the unauthorised exploitation of biological resources and traditional knowledge for purposes such as:

- a) Introduction of new plant varieties
- b) Introduction of new living organisms
- c) Production of pharmaceuticals
- d) All of the above

35. Transgenic animals are extensively used for all the following procedures except:

- a) Bioremediation
- b) Chemical safety testing
- c) Vaccine safety testing
- d) Toxicity testing

36. Human insulin is commercially produced using transgenic:

- a) E. coli
- b) Brassica napus
- c) Bacillus thuringiensis
- d) Agrobacterium

37. Gene therapy has successfully treated genetic diseases in laboratory animals through:

- a) Exposure to X-rays to rectify the defective gene
- b) Replacing the defective gene with a functional gene
- c) Oral delivery of genes
- d) Therapeutic medicines applied to genes

38. A DNA or RNA segment used to carry genetic material into a host is generally called a:
- a) Vector
  - b) MASIR
  - c) Clone
  - d) Plasmid
39. Bt cotton is NOT:
- a) A GM plant
  - b) Insect-resistant
  - c) A bacterial-gene expression system
  - d) Resistant to all pesticides
40. Crystals of Bt toxin produced by some bacteria do not kill the bacteria themselves because the toxin is:
- a) Something to which bacteria are resistant
  - b) Immature
  - c) Inactive
  - d) Enclosed in a special sac
41. The site of production of ADA in the body is:
- a) Bone marrow
  - b) Lymphocytes
  - c) Blood plasma
  - d) Monocytes
42. Which statement about Bt toxin is true?
- a) The activated toxin sterilises the pest by entering its ovaries
  - b) The bacterium has antitoxins
  - c) The inactive protoxin is converted into active toxin in the insect gut
  - d) Bt protein exists as an active toxin in *Bacillus*
43. GEAC refers to:
- a) Genetic Engineering Authorised Company
  - b) Genetic Engineering Approval Committee
  - c) Genetic Engineering American Company
  - d) Genetic Elements and Corrections
44. Restriction endonucleases are employed for cutting:
- a) Double-stranded DNA
  - b) RNA fragments
  - c) mRNA
  - d) Single-stranded DNA only
45. Transgenic plants are:
- a) Produced by a somatic embryo in artificial medium
  - b) Generated by introducing foreign DNA into a cell and regenerating a plant from it
  - c) Produced after protoplast fusion in artificial medium
  - d) Grown in artificial medium after field hybridisation

46. The role of GEAC is to:
- a) Study only the positive effects of GMOs
  - b) Commercialise new technology
  - c) Bring new technology
  - d) Make decisions regarding GM research and the safety of introducing GM organisms/genes
47. The nematode that infests and damages tobacco roots is:
- a) *Ascaris megalocephala*
  - b) *Ancylostoma*
  - c) *Meloidogyne incognita*
  - d) *Trichinella*
48. Assertion: Biopatents may be awarded for biological entities and products derived from them. Reason: A patent on the use of turmeric in wound healing was cancelled in 2008. Choose the correct option.
- a) Both are true, and the reason correctly explains the assertion
  - b) Both are true, but the reason does not correctly explain the assertion
  - c) Assertion is true, but reason is false
  - d) Both are false
49. An abnormal gene is replaced by a normal gene through:
- a) Gene therapy
  - b) Medicines
  - c) Cloning
  - d) Radiation
50. In genetic engineering, what is used to transfer genes from one cell to another?
- a) Virus
  - b) Probe
  - c) Plasmid
  - d) Vector
51. Genetically modified (GM) brinjal developed in India was designed for:
- a) Insect resistance
  - b) Enhanced shelf life
  - c) Enhanced mineral content
  - d) Drought resistance
52. Biopiracy is related to:
- a) Traditional knowledge and biological resources
  - b) Biomolecules
  - c) Isolated genes from biological resources
  - d) All of the above
53. CryIAb is introduced into a plant to control corn-borer infestation.
- a) Name the resultant plant after successful insertion of the desired gene.
  - b) Summarise the action of the introduced gene.

54. Which phenomenon is related to ELISA?
- a) Agglutination
  - b) Clotting
  - c) Neutralisation
  - d) None of the above
55. The PCR technique was invented by:
- a) Boyer
  - b) Sanger
  - c) Kary Mullis
  - d) None of these
56. Starting with a single template molecule, how many DNA molecules are generated after 10 ideal PCR cycles?
- a) 1,024 molecules
  - b) 1,128 molecules
  - c) 1,224 molecules
  - d) 927 molecules
57. Genetic engineering has been successfully used for producing:
- a) Transgenic mice for testing polio-vaccine safety before use in humans
  - b) Transgenic models for studying treatments for certain cardiac diseases
  - c) Transgenic cow Rosie, which produced milk enriched with human protein
  - d) Animals such as bulls with super-strength for farm work
58. In competitive indirect ELISA, the competitive step involves:
- a) Unlabelled antibody incubated in the presence of its antigen
  - b) Labelled antibody incubated in the presence of its antigen
  - c) Labelled antigen incubated in the presence of its antibody
  - d) None of the above
59. Assertion: Pig organs such as the heart and pancreas may potentially be used for humans through transgenic animals. Reason: Transgenic pigs may show improved growth and meat production. Choose the correct option.
- a) Both are true, and the reason correctly explains the assertion
  - b) Both are true, but the reason does not correctly explain the assertion
  - c) Assertion is true, but reason is false
  - d) Both are false
60. Which are ethical practices in animal research?
- a) Surgical procedures under appropriate anaesthesia
  - b) Research conducted to professional standards
  - c) Any animal may be used without safeguards
  - d) Both A and B
61. Which kind of therapy was given in 1990 to a four-year-old girl with ADA deficiency?
- a) Radiation therapy
  - b) Gene therapy
  - c) Chemotherapy
  - d) Immunotherapy

62. Choose the correct option regarding a retrovirus:
- a) A DNA virus that synthesises RNA during infection
  - b) An RNA virus that can synthesise DNA during infection
  - c) A single-stranded DNA virus
  - d) A double-stranded RNA virus
63. Golden rice is:
- a) Transgenic rice containing genes for beta-carotene production
  - b) A wild rice variety with yellow grains
  - c) Long-stored rice with a yellow tint
  - d) Rice grown along the Yellow River in China
64. Which are key principles or areas of bioethics?
- a) Animal rights
  - b) Environmental ethics
  - c) Autonomy
  - d) All of the above
65. Assertion: GM foods face resistance from some people. Reason: GM foods necessarily contain mutated genes that cause infections and allergies. Choose the correct option.
- a) Both are true, and the reason correctly explains the assertion
  - b) Both are true, but the reason does not correctly explain the assertion
  - c) Assertion is true, but reason is false
  - d) Both are false
66. Which of the following can be applications of ELISA?
- a) Detection of antibodies associated with tuberculosis
  - b) Detection of rotavirus in faeces
  - c) Detection of hepatitis B markers in serum
  - d) All of the above
67. Assertion: PCR can detect very small amounts of DNA and is used in testing for HIV in suspected AIDS patients. Reason: PCR is also a powerful technique for identifying many genetic disorders. Choose the correct option.
- a) Both are correct, and the reason correctly explains the assertion
  - b) Both are correct, but the reason does not correctly explain the assertion
  - c) Assertion is correct, but reason is incorrect
  - d) Both are incorrect
68. Which antibodies may be used in sandwich ELISA?
- a) Detection antibodies
  - b) Capture antibodies
  - c) Monoclonal antibodies
  - d) All of the above
69. Write the functions of:
- i) cry1Ac gene
  - ii) RNA interference (RNAi)

70. a) What is gene therapy?

b) Describe a procedure that could provide a permanent cure for a disease using gene therapy. Name the disease.

71. Gel electrophoresis separates DNA fragments from a mixture. Arrange these events in the correct order:

1. Cut out DNA bands
2. Expose the gel to UV light
3. Force DNA to move through the gel
4. Stain DNA with ethidium bromide

a) 4-3-1-2

b) 4-3-2-1

c) 1-2-3-4

d) 1-3-4-2

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## SECTION B — SUBJECTIVE QUESTIONS (1 MARK EACH)

72. How are the two short polypeptide chains of insulin linked together?
73. Name the first transgenic cow that produced milk enriched with a human protein.
74. Find out from the internet what Golden Rice is.
75. Is ADA deficiency curable only by gene therapy?
76. What are transgenic animals? Give an example.
77. Name the types of cry genes that provide resistance to corn plants and cotton plants, respectively, against lepidopterans.
78. The site of production of ADA in the body is \_\_\_\_\_.
79. State the role of transposons in silencing mRNA in eukaryotic cells.
80. What are Cry genes? In which organism are they present?
81. Write a possible source of the RNA interference (RNAi) gene.
82. Mention an example of stem-cell therapy.
83. Why are certain cotton plants called Bt-cotton plants?
84. What is the significance of RNA interference (RNAi) in eukaryotic organisms?
85. Why are transgenic mice used to test the safety of polio vaccines?
86. A multinational company outside India tried to patent the use of turmeric without proper prior rights. What is such an act, when involving unauthorised use of biological resources or traditional knowledge, called?
87. ELISA is based on antigen–antibody interactions. Can it be used in the molecular diagnosis of a genetic disorder such as phenylketonuria?
88. GM crops help reduce \_\_\_\_\_ losses.
89. How does silencing specific mRNA through RNA interference prevent parasitic infestation?
90. Name any genetically modified crop.
91. Name the recombinant human growth hormone used to treat hypopituitary dwarfism.
92. Name two diseases that can be treated with medicines containing biological products made by transgenic animals.
93. What is Golden Rice?
94. How do tobacco plants benefit when nematode-specific genes are introduced using vectors? Name the vector used.
95. Nematode-specific genes are introduced into host plants using vectors. State the purpose of this procedure.
96. What is the 'Chakravarty bug'? Give its scientific name and application.
97. What chemical change does proinsulin undergo to become mature, functional insulin?
98. What is chimeric DNA?
99. Why is cellulase used to isolate genetic material from plant cells but not from animal cells?

- 100.** State the role of the C-peptide in human insulin.
- 101.** Name a cellular defence method that operates in eukaryotic organisms.
- 102.** Name the first transgenic cow.
- 103.** The \_\_\_\_\_ of human insulin is removed during maturation.
- 104.** Expand GEAC and ELISA.
- 105.** Name the protein produced in transgenic animals that is used to treat emphysema.
- 106.** How does mature, functional insulin differ from its prohormone form?
- 107.** How many polypeptide chains are present in a molecule of insulin?
- 108.** How can transgenic animals that produce useful products be created?
- 109.** In which form does Bt toxin protein exist inside the bacterium?
- 110.** Name the Indian variety of rice that was patented by an American company.

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# MCQ ANSWER SHEET

BIOTECHNOLOGY AND ITS APPLICATIONS | M.P. SIR

|    |   |    |       |    |   |    |   |
|----|---|----|-------|----|---|----|---|
| 1  | B | 2  | C     | 3  | D | 4  | B |
| 5  | A | 6  | B     | 7  | D | 8  | A |
| 9  | D | 10 | D     | 11 | D | 12 | B |
| 13 | C | 14 | D     | 15 | B | 16 | B |
| 17 | D | 18 | A     | 19 | B | 20 | A |
| 21 | B | 22 | A     | 23 | D | 24 | D |
| 25 | B | 26 | B     | 27 | D | 28 | D |
| 29 | A | 30 | C     | 31 | D | 32 | C |
| 33 | A | 34 | D     | 35 | A | 36 | A |
| 37 | B | 38 | CHECK | 39 | D | 40 | C |
| 41 | B | 42 | C     | 43 | B | 44 | A |
| 45 | B | 46 | D     | 47 | C | 48 | C |
| 49 | A | 50 | D     | 51 | A | 52 | D |
| 54 | C | 55 | C     | 56 | A | 57 | A |
| 58 | A | 59 | B     | 60 | D | 61 | B |
| 62 | B | 63 | A     | 64 | D | 65 | C |
| 66 | D | 67 | B     | 68 | D | 71 | B |

Note: Questions 53, 69 and 70 are written-response questions and are not included in this MCQ key. Question 38 appears malformed/ambiguous in the supplied options, so it is marked CHECK rather than assigning an unreliable answer. For exam use, verify the key against the prescribed NCERT/RBSE text.