

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

Test Booklet Series

Serial No.

284

D

SCREENING TEST – 2010

SUBJECT : BIOTECHNOLOGY

Time Allowed : Two Hours

Maximum Marks : 120

INSTRUCTIONS

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SEAL

(For Rough Work)

284

Screening Test – 2010

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1. Which of the following enzymes is absent in anaerobes ?
 - (a) Catalase
 - (b) Cytochrome peroxidase
 - (c) Pyruvate carboxylase
 - (d) All of the above
2. Lysogenic conversion refers to :
 - (a) Lysis of bacteria
 - (b) Inclusion of prophage of DNA in bacteria
 - (c) Conversion of one bacterial strain to other
 - (d) Any of the above
3. IL-2 is secreted by :
 - (a) CD4 and lymphocytes
 - (b) CD8 cells
 - (c) Macrophages
 - (d) Neutrophils
4. Adenosine deaminase (enzyme) deficiency is associated with :
 - (a) Severe Combined Immunodeficiency Disease (SCID)
 - (b) X-linked agammaglobulinemia
 - (c) Transient hypogammaglobulinemia of infancy
 - (d) Chronic granulomatous disease
5. Which molecule serves to destabilize the DNA helix in order to open it up, creating a replicating fork ?
 - (a) SSBPs
 - (b) DNA Ligase
 - (c) DNA helicase
 - (d) DNA gyrase
6. The most unsaturated fatty acid among the following is :
 - (a) Arachidonic acid
 - (b) Oleic acid
 - (c) Linoleic acid
 - (d) Linolenic acid
7. In vivo synthesis of DNA is :
 - (a) 5' to 3'
 - (b) 3' to 5'
 - (c) Either way, depending upon the direction of Polymerase
 - (d) In Leading strand 5' to 3' whereas, in Lagging Strand 3' to 5'
8. Mad Cow Disease which afflicted British cows is caused by :
 - (a) Prions
 - (b) a virus
 - (c) DDT
 - (d) Mycoplasma

9. Archaeobacteria are :

- (a) all bacteria which grow in extreme environmental conditions
- (b) prokaryotes, but not bacteria, which are usually found growing under extreme environmental conditions
- (c) prokaryotes which are precursors of eukaryotic organelles
- (d) fossilized bacteria which may or may not be revived

10. Which one of the following is *not* an organelle ?

- (a) Microsome
- (b) Nucleus
- (c) Lysosome
- (d) Peroxisome

11. Which of the following is a property of eukaryotic DNA ?

- (a) All DNA encodes protein
- (b) Different region of DNA are transcribed in different cell types
- (c) DNA is kept from wrapping up into compact structure by histones
- (d) The amount of DNA is proportional to the complexity of the organism

12. Why is RNA primer considered essential during DNA synthesis by DNA polymerase I ?

- (a) The enzyme requires a free 3'-OH group
- (b) The enzyme requires a free 5'-OH group
- (c) The enzymes requires a free 3'-PO₄ group
- (d) The enzyme requires a free 5'-PO₄ group

13. All of the following are used for isoelectric focusing, *except* :

- (a) a polyacrylamide gel
- (b) a pH gradient
- (c) an electric charge
- (d) SDS

14. Mode of action of Puromycin is :

- (a) It acts as a protein-protein binding inhibitor
- (b) It binds to tubulin and prevents formation of microtubules
- (c) It acts as chain terminator in protein synthesis
- (d) All of the above

15. Single stranded DNA is *not* found in :

- (a) M-13
- (b) Gemini virus
- (c) Rous sarcoma virus
- (d) ØX174

16. Bt transgenic cotton with pest resistance was developed with a gene from :
- Pests
 - Fungi
 - Horn worm Larva
 - Bacteria
17. Which of the following is *not* a feature of eukaryotic gene expression ?
- polycistronic mRNAs are very rare
 - many genes are interrupted by non-coding DNA sequences
 - RNA synthesis and protein synthesis are coupled as in prokaryotes
 - mRNA is often extensively modified before translation
18. In the Meselson-Stahl DNA replication experiment, what percent of the DNA was composed of one light strand and one heavy strand after one generation of growth in ^{14}N containing growth media ?
- 0
 - 25
 - 50
 - 100
19. For the DNA strand 5'-TACGATCATAT-3' the *correct* complementary DNA strand is :
- 3'-TACGATCATAT-5'
 - 3'-ATGCTAGTATA-5'
 - 3'-AUGCUAGUAUA-5'
 - 3'-GCATATACGCG-5'
20. The Electron Microscope was invented by :
- Knoll and Ruska
 - Zernike and Zacharius
 - Koch and Lister
 - Roentgen and Curie
21. The Golgi apparatus is involved in the synthesis of :
- Ribosomes
 - Lysosomes
 - Mesosomes
 - Nucleosomes
22. Blood group with antigen 'A' and antibody 'B' is :
- A
 - AB
 - B
 - O
23. Which of the following is *not* required when recombination is considered at molecular level in *E. coli* ?
- A nicking of sugar phosphate backbone
 - Strand displacement
 - Ligation of sugar phosphate backbone
 - RNA synthesis

24. Pectin is a polymer of :

- (a) Pectic acid
- (b) Galacturonic acid
- (c) Guluronic acid
- (d) Glucuronic acid

25. Which one is *not true* of Chargaff's law ?

- (a) $A = T$ and $G = C$
- (b) $A + T = G + C$
- (c) $A + G = T + C$
- (d) $A + C = T + G$

26. The termination codon of polypeptide synthesis is :

- (a) UAA (b) UAG
- (c) UGA (d) All of the above

27. The bacterial cell wall component susceptible to Lysozyme is :

- (a) Lipopolysaccharide
- (b) Teichoic acid
- (c) Peptidoglycan
- (d) Lipoprotein

28. Which of the following processes occur in mitochondria ?

- (a) ATP synthesis
- (b) DNA synthesis
- (c) Protein synthesis
- (d) All of the above

29. The characteristic clover leaf model of tRNA is attributed to its :

- (a) Primary structure
- (b) Secondary structure
- (c) Tertiary structure
- (d) Quaternary structure

30. Bacterial metabolism in which the cell oxidises inorganic compounds to produce organic molecules from CO_2 in the absence of light is called :

- (a) Chemo autotrophy
- (b) Chemo heterotrophy
- (c) Photo autotrophy
- (d) Photo heterotrophy

31. The protein moiety of an enzyme is known as :

- (a) Holoenzyme
- (b) Apoenzyme
- (c) Coenzyme
- (d) Isoenzyme

32. Nucleotides are composed of :

- (a) Nitrogenous base and pentose sugar
- (b) Nitrogenous base, pentose sugar and phosphate group
- (c) Nitrogenous base and two phosphate groups
- (d) Nitrogenous base and three phosphate groups

33. One complete Kreb's cycle starting from oxaloacetate produces how many moles of ATP ?

- (a) 3 (b) 6
- (c) 12 (d) 24

34. The main source of cholesterol from the following is :

- (a) Animal fats
- (b) Vegetable fats
- (c) Egg yolk
- (d) All the three

35. Amino acids in solution at neutral pH are predominantly :

- (a) Cations
- (b) Anions
- (c) Zwitterions
- (d) None of the three

36. Which of the following is *not* an essential amino acid ?

- (a) Leucine (b) Valine
- (c) Threonine (d) Alanine

37. The net gain of ATP per molecule of glucose metabolized aerobically in prokaryotes is :

- (a) 2 (b) 32
- (c) 38 (d) 85

38. Which one of the following statements is *incorrect* ?

- (a) Lactate dehydrogenase produces D-lactic acid.
- (b) Ethanol production by yeast involves pyruvate decarboxylase enzyme.
- (c) Acetyl CoA is not an intermediate in the formation of ethanol by yeast.
- (d) None of the above

39. Which of the following statements is *correct* ?

- (a) Polycistronic mRNA produces a large protein which gets broken into individual proteins.
- (b) Polycistronic mRNA contains multiple sites for the assembly of ribosomes.
- (c) Polycistronic mRNA gets broken into fragments which upon translation results in the formation of individual proteins.
- (d) Ribosomes assembled at the 5' region of the polycistronic mRNA continue to move along to produce individual proteins.

40. Structurally asymmetric lipids with polar and non-polar ends are said to be :

- (a) Amphipathic
- (b) Amphibolic
- (c) Bilateral
- (d) None of these

41. Which of the following is *not* characteristic of prokaryotic promoters ?
- They bind RNA polymerase
 - They are close to the transcription start site
 - They have an A-T rich Pribnow-box
 - They have a pyrimidine-rich Shine-Dalgarno box
42. Proteosomes are :
- Cellular organelles involved in protein trafficking
 - Macromolecules that autodigest mitochondria
 - Ribonucleoprotein complex repaired for protein synthesis
 - Macromolecules that degrade ubiquitinated proteins
43. A radioisotope with the longest half-life is :
- ^{14}C Carbon
 - ^3T ritium
 - ^{32}P hosphorus
 - ^{125}I odine
44. In signal transduction, scaffold proteins :
- pass the message to the next signaling component
 - convert the signal to a different form
 - bind multiple signaling proteins in a functional complex
 - greatly increase the signal they receive

45. The length of the 'leader peptide' associated with attenuation of tryptophan operon is :
- 1410 amino acids
 - 141 amino acids
 - 41 amino acids
 - 14 amino acids
46. DNA fragments larger than 100 Kb can be more effectively resolved by :
- Agarose gel electrophoresis
 - SDS-PAGE
 - Sequencing Gel
 - Pulse Field Gel electrophoresis
47. Void volume in gel filtration is :
- Total volume in the beads
 - Volume of buffer between the beads
 - Both (a) + (b)
 - One fourth of (a) + (b)
48. In differential centrifugation, mitochondria sediment between :
- $200 \times g$ to $1,000 \times g$
 - $500 \times g$ to $10,000 \times g$
 - $10,000 \times g$ to $20,000 \times g$
 - $20,000 \times g$ to $1,00,000 \times g$
49. Regulation of gene expression by attenuation was discovered in :
- lac operon
 - Arabinose operon
 - Shikimate pathway
 - trp operon

50. In cloning experiments, self-ligation of vector can be avoided by :

- (a) End filling by Klenow
- (b) Phosphatasing the ends
- (c) Polishing the ends with S1 nuclease
- (d) any of the above

51. Enhancer elements are found in :

- (a) coding region
- (b) upstream of coding region
- (c) down stream of coding region
- (d) Any of the above region

52. A reagent which will increase the T_m of a DNA solution is :

- (a) $NaCl$
- (b) Urea
- (c) Methanol
- (d) All of the above

53. Central Dogma of Molecular Biology does *not* includes :

- (a) DNA to DNA
- (b) RNA to Protein
- (c) DNA to RNA
- (d) Protein to RNA

54. Shuttle vectors differ from typical plasmid cloning vectors in having :

- (a) a multiple cloning site
- (b) more than one antibiotic resistance gene
- (c) more than one centromere sequence
- (d) two different origins of replication

55. Among the following, the weakest bond is :

- (a) Hydrogen bond
- (b) Ionic bond
- (c) Covalent bond
- (d) Vander Waal's bond

56. The number of sense codons in the "standard" genetic code is :

- (a) 20
- (b) 44
- (c) 61
- (d) 64

57. Griffith's experiments with *S. pneumoniae* indicated that :

- (a) bacteria could exchange genetic information by conjugation
- (b) hereditary information could be stably transferred from one bacterial strain to another
- (c) the hereditary material was unlikely to be made up of protein
- (d) the hereditary material must be DNA

58. An organism which lacks spliceosomes is :

- (a) *Neurospora crassa*
- (b) *Saccharomyces cerevisiae*
- (c) *Bacillus subtilis*
- (d) all of the above

59. Bird flu is caused by :

- (a) H5N1
- (b) HIV
- (c) RHINO Virus
- (d) REO Virus

60. The relationship between proto-oncogenes and tumor suppressor genes is the following :

- (a) Each can lead to malignant transformation when mutated
- (b) Both are normal viral genes
- (c) Proto-oncogenes are growth promoting whereas tumor suppressor genes are growth retarding
- (d) Mutations in tumor suppressor genes are almost always dominant, while those in proto-oncogenes are generally recessive

61. The excision repair process may begin by recognition of damaged nucleotide or by recognition of damaged base. The damaged base often a consequence of chemical mutagen are recognised by variety of cell enzyme called :

- (a) Photolyase (b) Glycosylases
- (c) Ligases (d) Polymerase

62. "Propeller twist" refers to the angle :

- (a) of rotation about the helical axis between neighbouring bases on one strand of double-helical DNA
- (b) between the plane of a base and that of the sugar to which it is linked
- (c) by which a base is tilted away from the plane normal to the helical axis
- (d) between the planes of two bases in a base pair

63. Study involving fusion of cells from individuals with Xeroderma pigmentosum have identified 7 different genes that can cause disease. A patient comes to you with apparent case of Xeroderma pigmentosum. You decide to fuse cells of this patient with the existing cell lines derived from other patients. You discover that when you fuse the cell from patient with cells of patient X, the hybrid fusion product does not repair the UV lesion. If patient X is deficient in the protein that binds Thymine dimer, XPA, what do you conclude ?

- (a) Your patient is also deficient in this gene product
- (b) Your patient is deficient in different aspect of repair mechanism
- (c) Your patient has new gene
- (d) None of the above

64. In the beginning of each cycle the temperature of PCR reaction is raised to :

- (a) denature the DNA
- (b) anneal the primers
- (c) elongate the product
- (d) ligate the primer

65. The restriction enzyme DdeI recognizes a DNA sequence, CTGAG, and cut the sequence at this point. A domain of normal haemoglobin gene contain CCTGAGGAG sequence. A allele responsible for sickle cell anemia is CCTGTGGAG. Which allele will DdeI recognizes and cut ?

- (a) Normal β -chain allele
- (b) Sick cell β -chain allele
- (c) Both normal & sickle chain allele
- (d) Normal α -chain allele

66. DNA fingerprinting using variable number of tandem repeat (VNTRs) is based on the observation that :

- (a) VNTRs sequence show little variability
- (b) Every individual has unique alleles at each VNTRs locus
- (c) VNTR loci are highly polymorphic
- (d) DNA of VNTR loci are more stable than that of loci which code for proteins

67. Meat tendering enzyme is :

- (a) Papain
- (b) Pepsin
- (c) Trypsin
- (d) Chymotrypsin

68. An organism which does *not* have intracellular membrane-bound organelles is :

- (a) *Saccharomyces cerevisiae*
- (b) *Escherichia coli*
- (c) *Plasmodium vivax*
- (d) *Euglena gracilis*

69. Which of the following is shared by both prokaryotes and eukaryotes ?

- (a) 3' poly A tail
- (b) Promoter
- (c) Introns
- (d) Splicing

70. Which is *not* a DNA binding domain ?

- (a) zinc finger
- (b) leucine zipper
- (c) intron-exon-intron
- (d) helix turn helix

71. Which activity of DNA Polymerase remove the RNA primer ?

- (a) 3' to 5' exonuclease activity
- (b) 5' to 3' endonuclease activity
- (c) 5' to 3' exonuclease activity
- (d) Primase activity

72. Which of the following does *not* explain that how human cell can apparently replicate DNA much faster than bacterium ?

- (a) There are more origin of replication in Eukaryotes
- (b) The eukaryotic DNA polymerase moves faster than Bacterium
- (c) There are more DNA polymerase in Eukaryotes
- (d) DNA synthesis occurs at multiple points along the chromosomes in Eukaryotes

73. 5' untranslated regions are present :

- (a) only in mRNAs of prokaryotic genes
- (b) only in mRNAs of eukaryotic genes
- (c) in mRNAs of both prokaryotic and eukaryotic genes
- (d) only in mRNAs that undergo splicing

74. DNA was shown by Hershey and Chase to be the genetic material of bacteriophages by labelling it with :

- (a) ^{32}P
- (b) ^3H
- (c) ^{35}S
- (d) ^{15}N

75. A mutation is :

- (a) a change in nucleotide sequence resulting in a gene product with altered sequence
- (b) a change in nucleotide sequence resulting in a gene product with altered function
- (c) a change in nucleotide sequence resulting in a phenotypic change only in the homozygous state
- (d) any change in nucleotide sequence

76. 'Genetic polymorphism' refers to :

- (a) the generation of different forms of a protein encoded by the single gene, by mechanisms such as alternatic splicing
- (b) the existence in a population of multiple alleles of a gene
- (c) the multiple mutant phenotypes resulting from a mutation in a single gene
- (d) the variety of mutant phenotypes of different severity caused by a mutant allele when placed in different genetic backgrounds

77. An example of a *cis*-regulatory element would be an :

- (a) inducer
- (b) enhancer
- (c) transcription factor
- (d) all of the above

78. A recessive mutant allele of a gene :
- (a) is repressed in the presence of the wild type allele
 - (b) has a more deleterious phenotype than a dominant mutant allele
 - (c) shows a mutant phenotype only in the homozygous state
 - (d) All of the above
79. The process by which amino acid is covalently bonded to RNA molecule is called :
- (a) Charging
 - (b) Translation
 - (c) Initiation
 - (d) Wobbling
80. Isoaccepting tRNA molecule are :
- (a) a subset of tRNA molecule that are recognized by particulate aminoacyl tRNA synthetase
 - (b) an enzyme that causes bonding of amino acid to tRNA molecule
 - (c) ribosomal initiation factor
 - (d) enzyme that catalyse the formation of peptide bonds
81. Sugars differing in configuration at a single asymmetric centre are :
- (a) Stereoisomers
 - (b) Epimers
 - (c) Enantiomers
 - (d) Anomers

82. Lectins contain binding sites for :
- (a) carbohydrates
 - (b) lipids
 - (c) DNA
 - (d) RNA
83. Average bond enthalpy of H-O bond (kJ mol^{-1}) is :
- (a) 393
 - (b) 460
 - (c) 347
 - (d) 619
84. In bacteria, just before the cell divides, the two daughter genomes are attached to the :
- (a) Cell membrane
 - (b) Replication origin
 - (c) Kinetochore
 - (d) Centromeres
85. cdK is an important protein for the regulation of cell cycle. It is a protein that :
- (a) is degraded after it is used
 - (b) is phosphorylated to become active
 - (c) binds to different cyclins
 - (d) manufactures growth factors
86. Which of the following is *not* a tumour suppressor gene ?
- (a) APC
 - (b) NF1
 - (c) RB1
 - (d) RET

87. Breast cancer is associated with :

- (a) HNPCC
- (b) BRCA 2
- (c) NF1
- (d) RET

88. Which one of the following is *not* a second messenger ?

- (a) cyclic AMP
- (b) Inositol triphosphate
- (c) Calmodulin
- (d) Diacyl glycerol

89. "Pruteen" term was given to the single cell protein manufactured by continuous batch culture of :

- (a) *Fusarium graminearum*
- (b) *Methylophilus methylotrophus*
- (c) *Saccharomyces cerevisiae*
- (d) *Spirulina Flexuosa*

90. Monoclonal antibodies are associated with the name of :

- (a) Jenner and Jastin
- (b) Emil von Behring
- (c) Georges Kohler and Cesar Milstein
- (d) Pasteur and Koch

91. Thylakoids are found in :

- (a) ribosomes
- (b) mitochondria
- (c) chloroplasts
- (d) lysosomes

92. In Pinocytosis :

- (a) large, insoluble complexes penetrate across the plasma membrane
- (b) all soluble molecules penetrate across the plasma membrane
- (c) molecules penetrate with the assistance of facilitated transport
- (d) soluble molecules enter cells in vesicles that were pinched off from the plasma membrane

93. The Na-K pump moves Na^+ and K^+ across the plasma membrane by :

- (a) facilitated transport
- (b) active transport
- (c) co-transport
- (d) endocytosis

94. The pKa of lactic acid shall have the following value, given that when the concentration of lactic acid is 0.010M and the concentration of lactate is 0.087 M., the pH is 4.80 :

- (a) 5.06
- (b) 3.86
- (c) 4.8
- (d) 0.54

95. A frameshift mutation could be caused by a :

- (a) transition
- (b) transversion
- (c) insertion
- (d) any of the above

96. Which of the foods listed would be most likely to spoil as a result of bacterial growth ?

- (a) a meat product with near neutral pH
- (b) fruit in a high sugar syrup
- (c) a vegetable in a high salt, acid brine (liquid)
- (d) all of the above

97. Which of the following is *best* to sterilized heat labile solution ?

- (a) dry heat
- (b) autoclave
- (c) membrane filtration
- (d) pasteurization

98. The constant $k = 1.381 \times 10^{-23}$ J/K refers to :

- (a) Gas Constant
- (b) Faraday's Constant
- (c) Boltzmann Constant
- (d) Planck's Constant

99. The pore size of a gel is determined by :

- (a) Amounts of acrylamide and cross linker present
- (b) Amount of acrylamide present
- (c) Amount of mercaptoethanol present
- (d) Amount of TEMED present

100. The cross linking agent in SDS-PAGE is :

- (a) TEMED
- (b) APS
- (c) SDS
- (d) Bis acrylamide

101. The diploid human genome comprises 6.4×10^9 base pairs. The length of DNA in a human cell shall be :

- (a) 2.18 m
- (b) 34 cm
- (c) 64 m
- (d) 28 cm

102. If a particular reaction has a negative ΔG , is it likely to occur ?

- (a) Not unless energy is added to the system
- (b) Yes, if it is coupled to another reaction
- (c) Yes, it can occur spontaneously
- (d) No, it will not occur

103. The Bam HI recognition site which is 6 nucleotide pairs will occur in the human DNA on an average, once in :

- (a) 20,000 nucleotides
- (b) 256 nucleotides
- (c) 4096 nucleotides
- (d) 5896 nucleotides

104. HIV enter in its host cell via receptor mediated endocytosis, which of the following is receptor protein ?

- (a) P-32
- (b) GP-120
- (c) CD-4
- (d) P-18

105. National Gene Bank for Medicinal and Aromatic Plants has been established at :

- (a) NBPGRI, New Delhi
- (b) CIMAP, Lucknow
- (c) TBGRI, Trivendrum
- (d) All of the above

106. Yeast Ty1 element is an example of :

- (a) a LINE element
- (b) a SINE element
- (c) a Retrotransposon
- (d) None of the above

107. Non-sense codons in mitochondrial genetic code are :

- (a) UGA and UGG
- (b) UAG and UAA
- (c) AGU and UGU
- (d) AGA and AGG

108. Confirmatory test for AIDS is :

- (a) Western Blotting
- (b) Eastern Blotting
- (c) Southern Blotting
- (d) Northern Blotting

109. The enzyme fumarase catalyzes the reversible hydration of fumaric acid to 1-malate but it will not catalyze the hydration of maleic acid, the *cis*-isomer of fumaric acid. This is an example of :

- (a) racemization
- (b) chiral activity
- (c) isomerisation
- (d) stereospecificity

110. On a Ramachandran plot, the degree of rotation between nitrogen and α carbon atoms of the main chain is called :

- (a) psi
- (b) phi
- (c) sigma
- (d) delta

111. Which of the following rRNAs is absent in *E.coli* ?

- (a) 23S
- (b) 18S
- (c) 16S
- (d) 5S

112. A temperate bacteriophage is :

- (a) A phage that infects at cold temperatures
- (b) A single-stranded bacteriophage
- (c) Remains in integrated and free forms
- (d) A virus that infects bacteria of temperate animals

113. 'F' factor of *E.coli* is transferred during conjugation as a :

- (a) Single-stranded DNA
- (b) Linear double-stranded DNA
- (c) Circular double-stranded DNA
- (d) Concatamer

114. In the crown gall disease caused by *Agrobacterium tumefaciens*, opines are :

- (a) Responsible for tumour formation
- (b) Made by *Agrobacterium* and used for pathogenesis
- (c) Made by tumours and used for tumour growth
- (d) Made by tumours and secreted

115. Which division of bacteria has a gram-positive cell wall ?

- (a) Gracilicutes
- (b) Archaea
- (c) Firmicutes
- (d) Tenericutes

116. The protozoan trophozoite is the :

- (a) Active feeding stage
- (b) Inactive dormant stage
- (c) Infective stage
- (d) Spore forming stage

117. The temperature-pressure combination for an autoclave is :

- (a) 100°C and 4 psi
- (b) 131°C and 9 psi
- (c) 121°C and 15 psi
- (d) 115°C and 3 psi

118. Drugs that prevent the formation of the bacterial cell wall are :

- (a) Quinolones
- (b) Beta-lactams
- (c) Tetracyclines
- (d) Aminoglycosides

119. Xeroderma pigmentosum is caused by :

- (a) UV radiations
- (b) IR radiations
- (c) X-rays
- (d) β -rays

120. Biotechnological work and its progress in India is looked after by which department under the Ministry of Science and Technology ?

- (a) DST
- (b) DBT
- (c) MAB
- (d) IBWL

(For Rough Work)

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