

Molecular Basis of Inheritance — NEET Biology PYQ (2005-2021)

Class 12 Biology · 87 real NEET & AIPMT questions, year-tagged · answers checked by RankUp

NEET 2021

1. Complete the flow chart on central dogma.

(a) $\rightarrow$ DNA $\rightarrow$ (b) $\rightarrow$ mRNA $\rightarrow$ (c) $\rightarrow$ (d)

- (A) (a)-Replication; (b)-Transcription; (c)-Transduction; (d)-Protein
- (B) (a)-Translation; (b)-Replication; (c)-Transcription; (d)-Transduction
- (C) (a)-Replication; (b)-Transcription; (c)-Translation; (d)-Protein
- (D) (a)-Transduction; (b)-Translation; (c)-Replication; (d)-Protein

NEET 2021

2. Identify the correct statement.

- (A) In capping, methyl guanosine triphosphate is added to the 3' end of hnRNA.
- (B) RNA polymerase binds with Rho factor to terminate the process of transcription in bacteria.
- (C) The coding strand in a transcription unit is copied to an mRNA.
- (D) Split gene arrangement is characteristic of prokaryotes.

NEET 2021

3. What is the role of RNA polymerase III in the process of transcription in eukaryotes ?

- (A) Transcribes rRNAs (28S, 18S and 5.8S)
- (B) Transcribes tRNA, 5s rRNA and snRNA
- (C) Transcribes precursor of mRNA
- (D) Transcribes only snRNAs

NEET 2021

4. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence, called as :

- (A) Satellite DNA
- (B) Repetitive DNA
- (C) Single nucleotides
- (D) Polymorphic DNA

NEET 2021

5. Which of the following RNAs is not required for the synthesis of protein ?

- (A) mRNA
- (B) tRNA
- (C) rRNA
- (D) siRNA

NEET 2021

6. Which is the "Only enzyme" that has "Capability" to catalyse Initiation, Elongation and Termination in the process of transcription in prokaryotes ?

- (A) DNA dependent DNA polymerase
- (B) DNA dependent RNA polymerase
- (C) DNA Ligase
- (D) DNase

NEET 2021

7. If Adenine makes 30% of the DNA molecule, what will be the percentage of Thymine, Guanine and Cytosine in it ?

- (A) T : 20 ; G : 30 ; C : 20
- (B) T : 20 ; G : 20 ; C : 30
- (C) T : 30 ; G : 20 ; C : 20
- (D) T : 20 ; G : 25 ; C : 25

NEET 2021

8. Which one of the following statements about Histones is wrong ?

- (A) Histones are organized to form a unit of 8 molecules.
- (B) The pH of histones is slightly acidic.
- (C) Histones are rich in amino acids - Lysine and Arginine.
- (D) Histones carry positive charge in the side chain.

NEET 2021

9. Statement I : The codon 'AUG' codes for methionine and phenylalanine.

Statement II : 'AAA' and 'AAG' both codons code for the amino acid lysine.

In the light of the above statements, choose the correct answer from the options given below.

- (A) Both Statement I and Statement II are true
- (B) Both Statement I and Statement II are false
- (C) Statement I is correct but Statement II is false
- (D) Statement I is incorrect but Statement II is true

NEET 2020 · Q67

10. Name the enzyme that facilitates opening of DNA helix during transcription.

- (A) DNA ligase
- (B) DNA helicase
- (C) DNA polymerase
- (D) RNA polymerase

NEET 2020 · Q74

11. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is 6.6×10^9 bp, then the length of the DNA is approximately:

- (A) 2.0 meters
- (B) 2.5 meters
- (C) 2.2 meters
- (D) 2.7 meters

NEET 2020 · Q77

12. Which of the following statements is correct?

- (A) Adenine pairs with thymine through two H-bonds.
- (B) Adenine pairs with thymine through one H-bond.
- (C) Adenine pairs with thymine through three H-bonds.
- (D) Adenine does not pair with thymine.

NEET 2019 · Q115

13. Purines found both in DNA and RNA are :

- (A) Adenine and thymine
- (B) Adenine and guanine
- (C) Guanine and cytosine
- (D) Cytosine and thymine

NEET 2019 · Q154

14. Which of the following features of genetic code does allow bacteria to produce human insulin by recombinant DNA technology ?

- (A) Genetic code is not ambiguous
- (B) Genetic code is redundant
- (C) Genetic code is nearly universal
- (D) Genetic code is specific

NEET 2019 · Q158

15. Expressed Sequence Tags (ESTs) refers to :

- (A) Genes expressed as RNA
- (B) Polypeptide expression
- (C) DNA polymorphism
- (D) Novel DNA sequences

NEET 2019 · Q166

16. Match the following genes of the Lac operon with their respective products :

(a) i gene — (i) β -galactosidase

(b) z gene — (ii) Permease

(c) a gene — (iii) Repressor

(d) y gene — (iv) Transacetylase

Select the correct option.

- (A) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)
- (B) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)
- (C) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
- (D) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

NEET 2019 · Q172

17. Under which of the following conditions will there be no change in the reading frame of following mRNA ?

5' AACAGCGGUGCUAUU 3'

- (A) Insertion of G at 5th position
- (B) Deletion of G from 5th position
- (C) Insertion of A and G at 4th and 5th positions respectively
- (D) Deletion of GGU from 7th, 8th and 9th positions

NEET 2018 · Q102

18. Select the correct match:

- (A) T.H. Morgan – Transduction
- (B) $F_2 \times$ Recessive parent – Dihybrid cross
- (C) Ribozyme – Nucleic acid
- (D) G. Mendel – Transformation

NEET 2018 · Q106

19. The experimental proof for semiconservative replication of DNA was first shown in a

- (A) Plant
- (B) Bacterium
- (C) Fungus
- (D) Virus

NEET 2018 · Q109

20. Select the correct match:

- (A) Matthew Meselson and F. Stahl – *Pisum sativum*
- (B) Alfred Hershey and Martha Chase – TMV
- (C) Alec Jeffreys – *Streptococcus pneumoniae*
- (D) Francois Jacob and Jacques Monod – Lac operon

NEET 2018 · Q158

21. All of the following are part of an operon except

- (A) an enhancer
- (B) structural genes
- (C) an operator
- (D) a promoter

NEET 2018 · Q161

22. AGGTATCGCAT is a sequence from the coding strand of a gene. What will be the corresponding sequence of the transcribed mRNA?

- (A) ACCUAUGCGAU
- (B) UGGTUTCGCAT
- (C) AGGUAUCGCAU
- (D) UCCAUAGCGUA

NEET 2017 · Q65

23. If there are 999 bases in an RNA that codes for a protein with 333 amino acids, and the base at position 901 is deleted such that the length of the RNA becomes 998 bases, how many codons will be altered?

- (A) 1
- (B) 11
- (C) 33
- (D) 333

NEET 2017 · Q103

24. Spliceosomes are not found in cells of:

- (A) Plants
- (B) Fungi
- (C) Animals
- (D) Bacteria

NEET 2017 · Q117

25. DNA replication in bacteria occurs:

- (A) During S phase
- (B) Within nucleolus
- (C) Prior to fission
- (D) Just before transcription

NEET 2017 · Q120

26. Which of the following RNAs should be abundant in animal cell?

- (A) r-RNA
- (B) t-RNA
- (C) m-RNA
- (D) mi-RNA

NEET 2017 · Q128

27. During DNA replication, Okazaki fragments are used to elongate:

- (A) The leading strand towards replication fork.
- (B) The lagging strand towards replication fork.
- (C) The leading strand away from replication fork.
- (D) The lagging strand away from the replication fork.

NEET 2017 (Gujarati paper) · Q68

28. Consider the following statements and choose the correct option:

- (a) Six codons do not code for any amino-acid.**
- (b) Codon is read in m-RNA in a contiguous fashion.**
- (c) Three codons function as stop codons.**
- (d) The initiator codon AUG codes for methionine.**

- (A) (a), (b) and (d) are wrong
- (B) (a), (b) and (c) are wrong
- (C) (b), (c) and (d) are wrong
- (D) (a) is wrong

NEET 2017 (Gujarati paper) · Q87

29. If the ratio of (T + C)/(A + G) in one strand of DNA is 1.43, same ratio in the complementary strand is:

- (A) 0.35
- (B) 0.70
- (C) 1.43
- (D) 2.10

NEET 2017 (Gujarati paper) · Q128

30. The technique of DNA fingerprinting is superior to conventional fingerprinting because it can:

- (A) Generate unique fingerprints for each finger.
- (B) Compare the whole DNA sequence of two individuals.
- (C) Differentiate between polymorphic DNA sequences among individuals.
- (D) Be generated more rapidly, and is inexpensive.

NEET 2017 (Gujarati paper) · Q132

31. A couple claimed in court that a child belonged to them. Their claim can be true if the DNA fingerprint pattern of the child shows:

- (A) 100% similarity to both the parents' DNA fingerprint as both contribute equally to zygote formation.
- (B) 100% similarity to mother's DNA print because of maternal inheritance.
- (C) 100% similarity to father's DNA print due to large number of mitochondria in sperm.
- (D) 50% bands similar to father and 50% similar to mother DNA fingerprint pattern.

NEET 2016 Phase 2 · Q120

32. Taylor conducted the experiments to prove semiconservative mode of chromosome replication on

- (A) *Vinca rosea*
- (B) *Vicia faba*
- (C) *Drosophila melanogaster*
- (D) *E. coli*

NEET 2016 Phase 2 · Q122

33. The equivalent of a structural gene is

- (A) muton
- (B) cistron
- (C) operon
- (D) recon

NEET 2016 Phase 2 · Q124

34. Which of the following rRNAs acts as structural RNA as well as ribozyme in bacteria?

- (A) 5 S rRNA
- (B) 18 S rRNA
- (C) 23 S rRNA
- (D) 5.8 S rRNA

NEET 2016 Phase 1 · Q107

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

- (A) glucose
- (B) galactose
- (C) lactose
- (D) lactose and galactose

NEET 2016 Phase 1 · Q110

36. A complex of ribosomes attached to a single strand of RNA is known as:

- (A) Polysome
- (B) Polymer
- (C) Polypeptide
- (D) Okazaki fragment

NEET 2016 Phase 1 · Q141

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

- (A) Polymerase chain reaction
- (B) Zinc finger analysis
- (C) Restriction enzymes
- (D) DNA - DNA hybridization

NEET 2016 Phase 1 · Q158

38. Which one of the following is the starter codon?

- (A) AUG
- (B) UGA
- (C) UAA
- (D) UAG

AIPMT 2015

39. Gene regulation governing lactose operon of E.coli that involves the lac I gene product is:

- (A) Feedback inhibition because excess of β -galactosidase can switch off transcription
- (B) Positive and inducible because it can be induced by lactose
- (C) Negative and inducible because repressor protein prevents transcription
- (D) Negative and repressible because repressor protein prevents transcription

AIPMT 2015

40. In sea urchin DNA, which is double stranded, 17% of the bases were shown to be cytosine. The percentages of the other three bases expected to be present in this DNA are:

- (A) G 8.5%, A 50%, T 24.5%
- (B) G 34%, A 24.5%, T 24.5%
- (C) G 17%, A 16.5%, T 32.5%
- (D) G 17%, A 33%, T 33%

AIPMT 2014

41. Select the correct option (Direction of RNA synthesis ; Direction of reading of the template DNA strand):

- (A) $3' \rightarrow 5'$; $5' \rightarrow 3'$
- (B) $5' \rightarrow 3'$; $5' \rightarrow 3'$
- (C) $3' \rightarrow 5'$; $3' \rightarrow 5'$
- (D) $5' \rightarrow 3'$; $3' \rightarrow 5'$

AIPMT 2014

42. Commonly used vectors for human genome sequencing are:

- (A) BAC and YAC
- (B) Expression Vectors
- (C) T/A Cloning Vectors
- (D) T-DNA

AIPMT 2014

43. An analysis of chromosomal DNA using the Southern hybridization technique does not use:

- (A) Blotting
- (B) Autoradiography
- (C) PCR
- (D) Electrophoresis

AIPMT 2014

44. Transformation was discovered by:

- (A) Hershey and Chase
- (B) Griffith
- (C) Watson and Crick
- (D) Meselson and Stahl

AIPMT 2014

45. Which one of the following is wrongly matched?

- (A) Translation – Using information in m-RNA to make protein
- (B) Repressor protein – Binds to operator to stop enzyme synthesis
- (C) Operon – Structural genes, operator and promoter
- (D) Transcription – Writing information from DNA to t-RNA

NEET 2013

46. Which enzyme/s will be produced in a cell in which there is a nonsense mutation in the lac Y gene?

- (A) β -galactosidase
- (B) Lactose permease
- (C) Transacetylase
- (D) Lactose permease and transacetylase

AIPMT 2012 Mains

47. What is it that forms the basis of DNA fingerprinting?

- (A) The relative proportions of purines and pyrimidines in DNA
- (B) The relative difference in the DNA occurrence in blood, skin and saliva
- (C) The relative amount of DNA in the ridges and grooves of the fingerprints
- (D) Satellite DNA occurring as highly repeated short DNA segments

AIPMT 2012 Prelims

48. Removal of introns and joining of exons in a defined order during transcription is called

- (A) Splicing
- (B) Looping
- (C) Inducing
- (D) Slicing

AIPMT 2012 Prelims

49. PCR and Restriction Fragment Length Polymorphism are the methods for

- (A) Genetic Fingerprinting
- (B) Study of enzymes
- (C) Genetic transformation
- (D) DNA sequencing

AIPMT 2012 Prelims

50. Which one of the following is not a part of a transcription unit in DNA ?

- (A) The structural gene
- (B) The inducer
- (C) A terminator
- (D) A promoter

AIPMT 2012 Prelims

51. Removal of RNA polymerase III from nucleoplasm will affect the synthesis of

- (A) rRNA
- (B) tRNA
- (C) hnRNA
- (D) mRNA

AIPMT 2011 Mains

52. The unequivocal proof of DNA as the genetic material came from the studies on a

- (A) Viroid
- (B) Bacterial virus
- (C) Bacterium
- (D) Fungus

AIPMT 2011 Mains

53. In the history of biology, the human genome project led to the development of

- (A) Bioinformatics
- (B) Biosystematics
- (C) Biotechnology
- (D) Biomonitoring

AIPMT 2011 Prelims

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

- (A) 23S rRNA
- (B) 5S rRNA
- (C) snRNA
- (D) hnRNA

AIPMT 2011 Prelims

55. What are those structures that appear as 'beads-on-string' in the chromosomes when viewed under electron microscope?

- (A) Base pairs
- (B) Genes
- (C) Nucleotides
- (D) Nucleosomes

AIPMT 2010 Mains · Q4

56. Which one of the following statements about the particular entity is true?

- (A) Centromere is found in animal cells, which produces aster during cell division
- (B) The gene for producing insulin is present in every body cell
- (C) Nucleosome is formed of nucleotides
- (D) DNA consists of a core of eight histones

AIPMT 2010 Mains · Q24

57. In eukaryotic cell transcription, RNA splicing and RNA capping take place inside the

- (A) Ribosomes
- (B) Nucleus
- (C) Dictyosomes
- (D) ER

AIPMT 2010 Mains · Q52

58. The lac operon consists of

- (A) Four regulatory genes only
- (B) One regulatory gene and three structural genes
- (C) Two regulatory genes and two structural genes
- (D) Three regulatory genes and three structural genes

AIPMT 2010 Mains · Q60

59. The 3'-5' phosphodiester linkages inside a polynucleotide chain serve to join

- (A) One DNA strand with the other DNA strand
- (B) One nucleoside with another nucleoside
- (C) One nucleotide with another nucleotide
- (D) One nitrogenous base with pentose sugar

AIPMT 2010 Prelims · Q121

60. The one aspect which is not a salient feature of genetic code, is its being

- (A) Specific
- (B) Degenerate
- (C) Ambiguous
- (D) Universal

AIPMT 2010 Prelims · Q122

61. Satellite DNA is useful tool in

- (A) Genetic engineering
- (B) Organ transplantation
- (C) Sex determination
- (D) Forensic science

AIPMT 2010 Prelims · Q123

62. Which one of the following does not follow the central dogma of molecular biology?

- (A) HIV
- (B) Pea
- (C) Mucor
- (D) Chlamydomonas

AIPMT 2010 Prelims · Q126

63. Select the two correct statements out of the four (a-d) given below about lac operon.

- (a) Glucose or galactose may bind with the repressor and inactivate it
- (b) In the absence of lactose the repressor binds with the operator region
- (c) The z-gene codes for permease
- (d) This was elucidated by Francois Jacob and Jacques Monod

The correct statements are

- (A) (a) and (b)
- (B) (b) and (c)
- (C) (a) and (c)
- (D) (b) and (d)

AIPMT 2009 Prelims · Q89

64. What is not true for genetic code?

- (A) It is nearly universal
- (B) It is degenerate
- (C) It is unambiguous
- (D) A codon in mRNA is read in a non-contiguous fashion

AIPMT 2009 Prelims · Q96

65. Removal of introns and joining the exons in a defined order in a transcription unit is called:

- (A) Tailing
- (B) Transformation
- (C) Capping
- (D) Splicing

66. Semiconservative replication of DNA was first demonstrated in:

- (A) Escherichia coli
- (B) Streptococcus pneumoniae
- (C) Salmonella typhimurium
- (D) Drosophila melanogaster

67. Whose experiments cracked the DNA and discovered unequivocally that a genetic code is a triplet?

- (A) Hershey and Chase
- (B) Morgan and Sturtevant
- (C) Beadle and Tatum
- (D) Nirenberg and Mathaei

68. Polysome is formed by

- (A) Ribosomes attached to each other in a linear arrangement
- (B) Several ribosomes attached to a single mRNA
- (C) Many ribosomes attached to a strand of endoplasmic reticulum
- (D) A ribosome with several subunits

69. Which one of the following pairs of nitrogenous bases of nucleic acids, is wrongly matched with the category mentioned against it?

- (A) Adenine, Thymine - Purines
- (B) Thymine, Uracil - Pyrimidines
- (C) Uracil, Cytosine - Pyrimidines
- (D) Guanine, Adenine - Purines

70. In the DNA molecules

- (A) There are two strands which run antiparallel-one in 5'→3' direction and other in 3'→5'
- (B) The total amount of purine nucleotides and pyrimidine nucleotides is not always equal
- (C) There are two strands which run parallel in the 5'→3' direction
- (D) The proportion of Adenine in relation to thymine varies with the organism

71. Which one of the following pairs of codons is correctly matched with their function or the signal for the particular amino acid?

- (A) UUA, UCA - Leucine
- (B) GUU, GCU - Alanine
- (C) UAG, UGA - Stop
- (D) AUG, ACG - Start / Methionine

72. The Okazaki fragments in DNA chain growth

- (A) polymerize in the 3'-to-5' direction and form replication fork
- (B) prove semi-conservative nature of DNA replication
- (C) polymerize in the 5'-to-3' direction and explain 3'-to-5' DNA replication
- (D) result in transcription

73. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?

- (A) super-coiling in nucleosomes
- (B) DNase digestion
- (C) through elimination of repetitive DNA
- (D) deletion of non-essential genes

AIPMT 2007 Prelims · Q122

74. During transcription, RNA polymerase holoenzyme binds to a gene promoter and assumes a saddle-like structure. What is its DNA-binding sequence?

- (A) AATT
- (B) CACC
- (C) TATA
- (D) TTAA

AIPMT 2007 Prelims · Q148

75. Differentiation of organs and tissues in a developing organism, is associated with

- (A) differential expression of genes
- (B) lethal mutations
- (C) deletion of genes
- (D) developmental mutations

AIPMT 2007 Prelims · Q156

76. One gene-one enzyme relationship was established for the first time in

- (A) Salmonella typhimurium
- (B) Escherichia coli
- (C) Diplococcus pneumoniae
- (D) Neurospora crassa

AIPMT 2007 Prelims · Q170

77. Telomere repetitive DNA sequences control the function of eukaryotic chromosomes because they

- (A) are RNA transcription initiator
- (B) help chromosome pairing
- (C) prevent chromosome loss
- (D) act as replicons

AIPMT 2007 Prelims · Q190

78. Molecular basis of organ differentiation depends on the modulation in transcription by

- (A) ribosome
- (B) transcription factor
- (C) anticodon
- (D) RNA polymerase

AIPMT 2007 Prelims · Q192

79. The two polynucleotide chains in DNA are

- (A) discontinuous
- (B) antiparallel
- (C) semiconservative
- (D) parallel

AIPMT 2006 Prelims · Q135

80. Amino acid sequence, in protein synthesis is decided by the sequence of :

- (A) t-RNA
- (B) m-RNA
- (C) c-DNA
- (D) r-RNA

AIPMT 2006 Prelims · Q169

81. One gene - one enzyme hypothesis was postulated by :

- (A) R. Franklin
- (B) Hershey and Chase
- (C) A. Garrod
- (D) Beadle and Tatum

AIPMT 2006 Prelims · Q170

82. One turn of the helix in a B-form DNA is approximately :

- (A) 20 nm
- (B) 0.34 nm
- (C) 3.4 nm
- (D) 2 nm

AIPMT 2006 Prelims · Q172

83. Antiparallel strands of a DNA molecule means that :

- (A) one strand turns anti-clockwise
- (B) the phosphate groups of two DNA strands, at their ends, share the same position
- (C) the phosphate groups at the start of two DNA strands are in opposite position (pole)
- (D) one strand turns clockwise

AIPMT 2005 Prelims · Q114

84. Telomerase is an enzyme which is a :

- (A) repetitive DNA
- (B) RNA
- (C) simple protein
- (D) ribonucleoprotein

AIPMT 2005 Prelims · Q115

85. During transcription holoenzyme RNA polymerase binds to a DNA sequence and the DNA assumes a saddle like structure at that point. What is that sequence called ?

- (A) CAAT box
- (B) GGTT box
- (C) AAAT box
- (D) TATA box

AIPMT 2005 Prelims · Q129

86. E. coli cells with a mutated Z gene of the lac operon cannot grow in medium containing only lactose as the source of energy because :

- (A) in the presence of glucose, E. coli cells do not utilize lactose
- (B) they cannot transport lactose from the medium into the cell
- (C) the lac operon is constitutively active in these cells
- (D) they cannot synthesize functional β -galactosidase

AIPMT 2005 Prelims · Q177

87. Which one of the following makes use of RNA as a template to synthesize DNA ?

- (A) Reverse transcriptase
- (B) DNA dependant RNA polymerase
- (C) DNA polymerase
- (D) RNA polymerase

Answer key and explanations

1. Answer: (C) (a)-Replication; (b)-Transcription; (c)-Translation; (d)-Protein

In the central dogma DNA copies itself by replication, is transcribed into mRNA, and mRNA is translated into protein. Transduction is transfer of DNA by viruses and is not a step of the central dogma.

2. Answer: (B) RNA polymerase binds with Rho factor to terminate the process of transcription in bacteria.

In bacteria, RNA polymerase associates transiently with the rho factor to terminate transcription.

Capping adds methyl guanosine triphosphate to the 5' end, the template strand (not the coding strand) is copied, and split genes are typical of eukaryotes.

3. Answer: (B) Transcribes tRNA, 5s rRNA and snRNA

In eukaryotes RNA polymerase III transcribes tRNA, 5S rRNA and snRNAs. RNA polymerase I makes the 28S, 18S and 5.8S rRNAs and RNA polymerase II makes hnRNA, the precursor of mRNA.

4. Answer: (B) Repetitive DNA

DNA fingerprinting looks for differences in regions of repetitive DNA, where short stretches are repeated many times and the number of repeats differs between people. Satellite DNA is one type of repetitive DNA, so repetitive DNA is the broader, textbook answer.

5. Answer: (D) siRNA

mRNA carries the code, tRNA brings amino acids and rRNA forms the ribosome, so all three are needed to make protein. siRNA works in RNA interference to silence genes, not in protein synthesis.

6. Answer: (B) DNA dependent RNA polymerase

In bacteria a single DNA-dependent RNA polymerase catalyses initiation (with the sigma factor), elongation and termination (with the rho factor) of transcription. DNA-dependent DNA polymerase acts in replication, not transcription.

7. Answer: (C) T : 30 ; G : 20 ; C : 20

By Chargaff's rule $A = T$ and $G = C$, so if A is 30% then T is also 30%. The remaining 40% is shared equally, giving $G = 20\%$ and $C = 20\%$.

8. Answer: (B) The pH of histones is slightly acidic.

Histones are rich in the basic amino acids lysine and arginine, so they carry positive side-chain charges and are basic, not slightly acidic. Eight histone molecules form the histone octamer of the nucleosome.

9. Answer: (D) Statement I is incorrect but Statement II is true

AUG codes only for methionine (it is also the start codon); phenylalanine is coded by UUU and UUC, so Statement I is false. AAA and AAG both code for lysine, showing degeneracy of the code, so Statement II is true.

10. Answer: (D) RNA polymerase

In transcription RNA polymerase itself opens the DNA helix and elongates the RNA, with no separate helicase needed. DNA helicase opens the helix in replication, and DNA ligase and DNA polymerase are replication enzymes.

11. Answer: (C) 2.2 meters

Length = number of base pairs $\times$ distance per base pair = $6.6 \times 10^9 \times 0.34 \times 10^{-9} \text{ m} = 2.244 \text{ m}$, which is about 2.2 m. The values 2.0, 2.5 and 2.7 m do not match the product.

12. Answer: (A) Adenine pairs with thymine through two H-bonds.

Adenine pairs with thymine through two hydrogen bonds, while guanine pairs with cytosine through three. A-T pairing is the basis of Chargaff's rule, so it never pairs through one or three bonds and does pair with thymine.

13. Answer: (B) Adenine and guanine

The purines adenine and guanine occur in both DNA and RNA. Cytosine, thymine and uracil are pyrimidines, and thymine is found only in DNA.

14. Answer: (C) Genetic code is nearly universal

Because the genetic code is nearly universal, a bacterium reads the codons of the human insulin gene the same way a human cell does and makes the same polypeptide. Redundancy (degeneracy) and specificity are real features but do not explain expression across species.

15. Answer: (A) Genes expressed as RNA

In the Human Genome Project, ESTs identified all the genes that are expressed as RNA. Sequence annotation, the other approach, sequenced the whole genome including non-coding parts.

16. Answer: (C) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

The i gene codes for the repressor, z for β -galactosidase, y for permease and a for transacetylase. Swapping the products of the y and a genes is the common error.

17. Answer: (D) Deletion of GGU from 7th, 8th and 9th positions

The mRNA reads AAC AGC GGU GCU AUU; positions 7–9 form the whole codon GGU, so deleting them removes one amino acid and the downstream codons GCU AUU stay in frame. Inserting or deleting one or two bases shifts every codon after that point (frameshift).

18. Answer: (C) Ribozyme - Nucleic acid

A ribozyme is a catalytic RNA, such as the peptidyl transferase activity of rRNA, so it is a nucleic acid. Morgan is linked with linkage, a cross of the F_2 (or F_1) with the recessive parent is a test cross, and transformation was discovered by Griffith, not Mendel.

19. Answer: (B) Bacterium

Meselson and Stahl (1958) grew *Escherichia coli* in ^{15}N medium and then ^{14}N medium and showed hybrid and light DNA by density gradient centrifugation, the first proof of semiconservative replication. Taylor later showed the same in *Vicia faba*, a plant, so the plant option is the later, not the first, proof.

20. Answer: (D) Francois Jacob and Jacques Monod - Lac operon

Jacob and Monod proposed the lac operon model of gene regulation in *E. coli*. Meselson and Stahl worked on *E. coli*, Hershey and Chase used bacteriophage T2, and Alec Jeffreys developed DNA fingerprinting; *Streptococcus pneumoniae* was Griffith's organism.

21. Answer: (A) an enhancer

An operon such as the lac operon consists of a promoter, an operator and structural genes (with a regulator gene nearby). Enhancers are regulatory DNA sequences of eukaryotic genes that can act from a distance and are not parts of prokaryotic operons.

22. Answer: (C) AGGUAUCGCAU

The mRNA has the same sequence and polarity as the coding strand, except that uracil replaces thymine, so AGGTATCGCAT becomes AGGUAUCGCAU. The complementary sequence UCCAUAGCGUA would be obtained by copying the coding strand itself, which is the trap.

23. Answer: (C) 33

Base 901 is the first base of codon 301 (bases 901–903). Deleting it shifts the reading frame from codon 301 to the end, so codons 301 to 333, that is $333 - 300 = 33$ codons, are altered while the first 300 stay the same. Choosing 333 wrongly assumes the whole message is misread.

24. Answer: (D) Bacteria

Spliceosomes remove introns from eukaryotic hnRNA. Bacterial genes are not split into exons and introns, so bacteria have no spliceosomes, while plants, fungi and animals, all eukaryotes, do.

25. Answer: (C) Prior to fission

Bacteria have no defined cell cycle phases or nucleolus; they replicate their circular DNA before the cell divides by binary fission. The S phase belongs to the eukaryotic cell cycle.

26. Answer: (A) r-RNA

rRNA is the most abundant RNA in any cell, about 80% of total RNA, because it is the structural and catalytic part of the very large number of ribosomes. mRNA forms only a few percent, as it is short-lived and varies from gene to gene.

27. Answer: (D) The lagging strand away from the replication fork.

DNA polymerase works only $5' \rightarrow 3'$, so on the lagging strand it makes short Okazaki fragments in the direction away from the moving replication fork, and ligase joins them. The leading strand is made continuously towards the fork and needs no fragments.

28. Answer: (D) (a) is wrong

Only three codons (UAA, UAG, UGA) do not code for any amino acid, so the claim of six is the only false statement. The code is read contiguously without punctuation, the three stop codons terminate translation, and AUG both initiates and codes for methionine.

29. Answer: (B) 0.70

Because A pairs with T and G with C, $(T + C)$ of the complementary strand equals $(A + G)$ of the given strand, so the ratio inverts: $1/1.43 \approx 0.70$. Keeping the ratio at 1.43 would apply only to $(A + T)/(G + C)$, which stays the same in both strands.

30. Answer: (C) Differentiate between polymorphic DNA sequences among individuals.

DNA fingerprinting compares repetitive, highly polymorphic DNA sequences (VNTRs), which differ between individuals and are inherited from parents. It does not compare whole genomes, and it is slower and more expensive than taking conventional fingerprints.

31. Answer: (D) 50% bands similar to father and 50% similar to mother DNA fingerprint pattern.

A child gets one set of chromosomes from each parent, so about half of the bands in its DNA fingerprint match the father and half match the mother. A complete match with either parent, or with both, is impossible for a biological child.

32. Answer: (B) Vicia faba

Taylor and colleagues in 1958 used radioactive thymidine on root tips of *Vicia faba* (faba bean) to show that chromosomes replicate semiconservatively. The *E. coli* experiment with heavy nitrogen was done by Meselson and Stahl and dealt with DNA, not whole chromosomes.

33. Answer: (B) cistron

A cistron is the segment of DNA coding for one polypeptide, which is what a structural gene is. A muton and a recon are the smallest units of mutation and recombination, and an operon is a group of structural genes with their regulatory elements.

34. Answer: (C) 23 S rRNA

The 23S rRNA of the bacterial 50S subunit forms part of the ribosome's structure and also catalyses peptide bond formation as peptidyl transferase. 18S and 5.8S rRNAs are found in eukaryotic ribosomes, and 5S rRNA is structural only.

35. Answer: (C) lactose

Lactose (strictly its isomer allolactose) binds the lac repressor and inactivates it, so the structural genes are transcribed. Glucose actually represses the operon and galactose is not the inducer.

36. Answer: (A) Polysome

Several ribosomes translating the same mRNA at the same time form a polysome (polyribosome). A polypeptide is the product of translation, and Okazaki fragments are short DNA pieces of the lagging strand.

37. Answer: (B) Zinc finger analysis

DNA fingerprinting uses restriction digestion, PCR amplification and hybridisation with labelled VNTR probes (Southern blotting). Zinc finger analysis is not a part of any fingerprinting technique; zinc fingers are DNA-binding protein motifs.

38. Answer: (A) AUG

AUG, coding for methionine, is the initiation (start) codon. UGA, UAA and UAG are stop codons that terminate translation.

39. Answer: (C) Negative and inducible because repressor protein prevents transcription

The lac I gene codes for a repressor that binds the operator and blocks transcription, so control is negative. Lactose (allolactose) inactivates the repressor and switches the operon on, so it is inducible, not repressible.

40. Answer: (D) G 17%, A 33%, T 33%

By Chargaff's rule $G = C = 17\%$, so $G + C = 34\%$ and $A + T = 100 - 34 = 66\%$. Since $A = T$, each is 33%. Options with unequal A and T break the base-pairing rule.

41. Answer: (D) 5' → 3' ; 3' → 5'

RNA polymerase can add nucleotides only to the 3' end, so RNA grows 5' → 3'; because the template is antiparallel, it is read 3' → 5'. Any combination that has RNA growing 3' → 5' or the template read in the same direction as synthesis is wrong.

42. Answer: (A) BAC and YAC

In the Human Genome Project the DNA was broken into large fragments and cloned in BAC (bacterial artificial chromosome) and YAC (yeast artificial chromosome) vectors, which accept very large inserts. Expression vectors, T/A cloning vectors and T-DNA are not the hosts used for genome sequencing.

43. Answer: (C) PCR

Southern hybridisation involves restriction digestion of DNA, gel electrophoresis, blotting onto a membrane, hybridisation with a labelled probe and detection by autoradiography. PCR is not a step of this technique.

44. Answer: (B) Griffith

Frederick Griffith (1928), working with *Streptococcus pneumoniae* and mice, found that heat-killed virulent bacteria could transform live non-virulent ones: transformation. Hershey and Chase proved DNA is the genetic material, Watson and Crick gave the double helix, and Meselson and Stahl proved semiconservative replication.

45. Answer: (D) Transcription - Writing information from DNA to t-RNA

Transcription copies genetic information from DNA into RNA, chiefly mRNA, so 'writing information from DNA to t-RNA' is the wrong match. Translation, the repressor binding the operator, and an operon made of structural genes, operator and promoter are all correctly described.

46. Answer: (A) β-galactosidase

The lac operon genes are transcribed in the order z, y, a. A nonsense mutation in lacY stops translation of permease, but β-galactosidase from lacZ, which lies upstream, is still made. Permease cannot be produced, and transacetylase downstream is lost or greatly reduced.

47. Answer: (D) Satellite DNA occurring as highly repeated short DNA segments

DNA fingerprinting compares repetitive DNA, satellite DNA such as VNTRs whose copy number differs between people. The purine to pyrimidine ratio is the same in everyone, and the technique has nothing to do with skin ridges.

48. Answer: (A) Splicing

Splicing is the removal of introns from the primary transcript (hnRNA) and joining of exons in a defined order. Slicing is a distractor that sounds similar but is not the term for this process.

49. Answer: (A) Genetic Fingerprinting

DNA (genetic) fingerprinting uses PCR to amplify DNA and RFLP (restriction digestion and hybridisation with probes) to compare banding patterns between individuals. These methods are not used to study enzymes or to transform cells.

50. Answer: (B) The inducer

A transcription unit consists of a promoter, a structural gene and a terminator. An inducer (such as lactose in the lac operon) is a small molecule that regulates expression; it is not a stretch of DNA.

51. Answer: (B) tRNA

In eukaryotes, RNA polymerase III transcribes tRNA, 5S rRNA and snRNAs, so removing it stops tRNA synthesis. RNA polymerase I makes most rRNA, and RNA polymerase II makes hnRNA (the precursor of mRNA).

52. Answer: (B) Bacterial virus

Hershey and Chase grew bacteriophages (bacterial viruses) with radioactive phosphorus or sulphur and found that only the labelled DNA entered the bacteria, giving unequivocal proof that DNA is the genetic material. Griffith's and Avery's work on the bacterium *Streptococcus* was suggestive but not unequivocal.

53. Answer: (A) Bioinformatics

The Human Genome Project produced enormous amounts of sequence data, and storing, retrieving and analysing it led to the rapid growth of bioinformatics. Biotechnology existed long before the project and is not its product.

54. Answer: (A) 23S rRNA

In bacteria, the 23S rRNA of the large ribosomal subunit acts as a ribozyme, catalysing peptide bond formation (peptidyl transferase activity). snRNA and hnRNA are eukaryotic nuclear RNAs, and 5S rRNA is structural.

55. Answer: (D) Nucleosomes

DNA wrapped around histone octamers forms nucleosomes, which repeat along the chromatin fibre and look like beads on a string under the electron microscope. Base pairs, nucleotides and genes are far too small or not visible as separate beads.

56. Answer: (B) The gene for producing insulin is present in every body cell

Every somatic cell carries the full genome, so the insulin gene is present in all body cells even though it is expressed only in pancreatic beta cells. Asters are formed by centrioles (centrosome), not by the centromere. A nucleosome is DNA wrapped around a histone octamer, so it is the nucleosome (not DNA) that has a core of eight histones.

57. Answer: (B) Nucleus

In eukaryotes the DNA is in the nucleus, so the primary transcript (hnRNA) is made there and is also capped, tailed and spliced there before the mature mRNA leaves for the cytoplasm. Ribosomes are where translation happens, after these steps.

58. Answer: (B) One regulatory gene and three structural genes

The lac operon has one regulatory gene (i, coding the repressor) and three structural genes: z (β -galactosidase), y (permease) and a (transacetylase), along with promoter and operator sites. The promoter and operator are DNA sites, not genes, so it does not have two or three regulatory genes.

59. Answer: (C) One nucleotide with another nucleotide

In a polynucleotide, the phosphate of one nucleotide links the 3'-carbon of one sugar to the 5'-carbon of the next, so a 3'-5' phosphodiester bond joins successive nucleotides. The two DNA strands are held together by hydrogen bonds, and a base is joined to its sugar by an N-glycosidic bond.

60. Answer: (C) Ambiguous

The genetic code is unambiguous and specific: each codon codes for only one amino acid. It is degenerate (several codons per amino acid) and nearly universal, so 'ambiguous' is the one property it lacks.

61. Answer: (D) Forensic science

Satellite DNA repeats such as VNTRs are highly polymorphic between individuals, so they form the basis of DNA fingerprinting used in forensic identification and paternity testing.

62. Answer: (A) HIV

HIV is a retrovirus: it copies its RNA genome into DNA with reverse transcriptase, which reverses the usual DNA → RNA direction of the central dogma. Pea, Mucor and Chlamydomonas are cellular organisms with DNA genomes that follow DNA → RNA → protein.

63. Answer: (D) (b) and (d)

Without lactose, the repressor binds the operator and blocks transcription, and the lac operon was described by Jacob and Monod. The inducer that inactivates the repressor is lactose (allolactose), not glucose or galactose. The z gene codes for β-galactosidase, while permease comes from the y gene.

64. Answer: (D) A codon in mRNA is read in a non-contiguous fashion

The genetic code is read in a contiguous way, codon after codon without punctuation, so a 'non-contiguous' reading is false. It is indeed nearly universal, degenerate (several codons per amino acid) and unambiguous (one codon codes for one amino acid).

65. Answer: (D) Splicing

In eukaryotes the primary transcript (hnRNA) has introns, which are removed and the exons joined in order by splicing. Capping adds methyl guanosine at the 5' end and tailing adds a poly-A tail at the 3' end; neither removes introns.

66. Answer: (A) Escherichia coli

Meselson and Stahl (1958) grew E. coli in ¹⁵N and then ¹⁴N medium and showed by CsCl density gradient centrifugation that DNA replicates semiconservatively. Streptococcus pneumoniae was used by Griffith for transformation, not replication.

67. Answer: (D) Nirenberg and Mathaei

Nirenberg and Matthaei used cell-free protein synthesis with synthetic RNA (poly-U giving polyphenylalanine), which helped decode the codons and confirm the triplet code. Hershey and Chase proved DNA is the genetic material, not the nature of the code.

68. Answer: (B) Several ribosomes attached to a single mRNA

A polysome (polyribosome) is a chain of several ribosomes translating the same mRNA at the same time. The ribosomes are linked through the mRNA, not directly to one another, and ribosomes bound to ER form rough ER rather than a polysome.

69. Answer: (A) Adenine, Thymine - Purines

Adenine is a purine but thymine is a pyrimidine, so grouping them together as purines is wrong. Adenine and guanine are purines, and cytosine, thymine and uracil are pyrimidines, so the other pairs are correct.

70. Answer: (A) There are two strands which run antiparallel-one in 5'→3' direction and other in 3'→5'

The two polynucleotide chains of the double helix run antiparallel, one 5'→3' and the other 3'→5'. By Chargaff's rule, purines always equal pyrimidines and A always equals T in double-stranded DNA, so those options are false.

71. Answer: (C) UAG, UGA - Stop

UAA, UAG and UGA are the three stop codons. In the other options only one codon of each pair fits: UCA codes serine, GUU codes valine and ACG codes threonine.

72. Answer: (C) polymerize in the 5'-to-3' direction and explain 3'-to-5' DNA replication

DNA polymerase can add nucleotides only in the 5'→3' direction, so on the lagging strand short Okazaki fragments are made 5'→3' and later joined by DNA ligase. This explains how that strand is built overall in the 3'→5' direction. No polymerase works 3'→5', and semi-conservative replication was proved by Meselson and Stahl, not by Okazaki fragments.

73. Answer: (A) super-coiling in nucleosomes

Negatively charged DNA wraps around positively charged histone octamers to form nucleosomes, which coil further into chromatin fibres, packing about 2.2 m of DNA into a tiny nucleus. Cells do not digest DNA or delete genes or repetitive sequences to save space.

74. Answer: (C) TATA

RNA polymerase is positioned at the promoter by the TATA box (Pribnow box in prokaryotes), an AT-rich consensus sequence TATAAT/TATAAAA about 10-30 bases upstream of the start site. AATT and TTAA are not the recognised promoter consensus.

75. Answer: (A) differential expression of genes

All cells of an organism carry the same genes; they differentiate into different tissues because different sets of genes are switched on or off in each. Mutations and gene deletions are abnormal events, not the basis of normal development.

76. Answer: (D) Neurospora crassa

Beadle and Tatum studied nutritional mutants of the mould *Neurospora crassa* and showed each gene controls one enzyme. *Diplococcus pneumoniae* was used by Griffith for transformation, and *E. coli* for lac operon and replication studies.

77. Answer: (C) prevent chromosome loss

Telomeres are repetitive caps at chromosome ends that stop the ends from being degraded, fused or shortened at each replication, so they keep chromosomes stable and prevent their loss. Replication origins (replicons) and promoters are different sequences.

78. Answer: (B) transcription factor

Which genes a cell transcribes, and therefore what it becomes, is controlled by regulatory proteins (transcription factors) that bind promoters and enhancers to switch genes on or off. RNA polymerase carries out transcription in every cell but by itself does not decide which genes are expressed; ribosomes and anticodons act in translation.

79. Answer: (B) antiparallel

In the double helix one strand runs 5'→3' and its partner 3'→5', so the chains are antiparallel. 'Semiconservative' describes how DNA replicates, not how its strands are arranged.

80. Answer: (B) m-RNA

The order of codons in mRNA decides the order of amino acids in the polypeptide. tRNA only brings amino acids by reading those codons; it does not decide the order.

81. Answer: (D) Beadle and Tatum

Beadle and Tatum, working with *Neurospora* mutants, proposed that one gene controls one enzyme. Garrod earlier described inborn errors of metabolism but did not state this hypothesis.

82. Answer: (C) 3.4 nm

B-DNA has about 10 base pairs per turn with 0.34 nm between pairs, so one turn (pitch) is about 3.4 nm. 0.34 nm is the distance between adjacent base pairs, and 2 nm is the helix diameter.

83. Answer: (C) the phosphate groups at the start of two DNA strands are in opposite position (pole)

The two strands of DNA run in opposite directions, one 5'→3' and the other 3'→5', so the phosphate end (5') of each strand lies at opposite ends of the molecule. Both strands turn the same way in a right-handed helix.

84. Answer: (D) ribonucleoprotein

Telomerase has a protein reverse-transcriptase part plus its own RNA, which serves as the template for adding telomere repeats. That makes it a ribonucleoprotein, not a simple protein and not RNA alone.

85. Answer: (D) TATA box

The promoter's TATA box (Pribnow box in prokaryotes) is the AT-rich site where RNA polymerase binds. The DNA bends and opens easily there to start transcription. The CAAT box lies further upstream and mainly regulates how often transcription starts.

86. Answer: (D) they cannot synthesize functional β -galactosidase

The z gene codes for β -galactosidase, which splits lactose into glucose and galactose. Without a working enzyme, lactose cannot be used for energy. Lactose transport depends on permease, the y gene product, so the transport option describes a y mutation instead.

87. Answer: (A) Reverse transcriptase

Reverse transcriptase, found in retroviruses such as HIV, is an RNA-dependent DNA polymerase that copies RNA into DNA. DNA polymerase copies DNA into DNA, and RNA polymerase copies DNA into RNA.

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