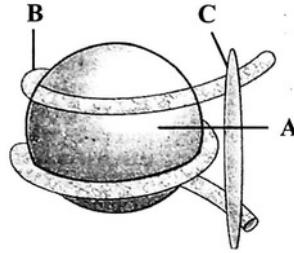


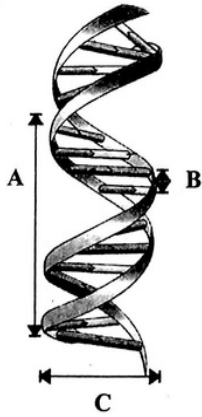
MOLECULAR BASIS OF INHERITANCE

1. Refer the given figure of nucleosome and select the option that correctly identifies the parts A, B and C.



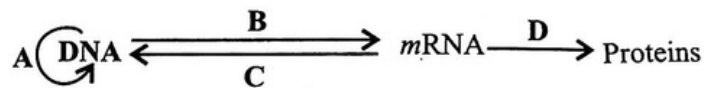
A	B	C
(A) DNA	Histone octamer	H1 histone
(B) Histone octamer	H1 histone	DNA
(C) Histone octamer	DNA	H1 histone
(D) DNA	H1 histone	Histone octamer

2. Which of the following pairs is incorrectly matched?
- (A) Purines - Adenine and Guanine
 - (B) Pyrimidines - Cytosine and Uracil
 - (C) Nucleosides - Adenosine and Thymidine
 - (D) DNA - Basic biomolecule
3. Given figure represents the DNA double helix model as proposed by Watson and Crick (1953). Select the option that shows correct measurements of A, B and C.



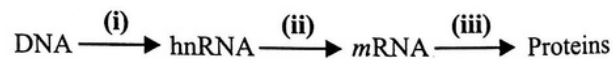
- (A) A – 3.4 nm, B – 0.34 nm, C – 2 nm
- (B) A – 34 nm, B – 3.4 nm, C – 20 nm
- (C) A – 3.4 nm, B – 0.34 nm, C – 20 nm
- (D) A – 34 nm, B – 3.4 nm, C – 2 nm

4. The given flowchart represents the flow of genetic information between biomolecules. Identify the processes A, B, C and D and select the correct option.



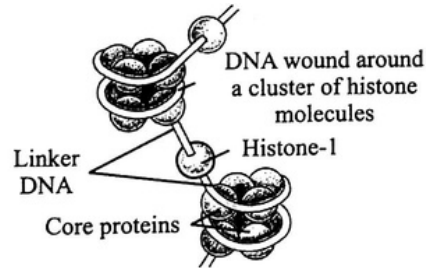
A	B	C	D
(A) Translation	Transcription	Replication	Reverse Transcription
(B) Replication	Transcription	Translation	Reverse Transcription
(C) Replication	Transcription	Reverse Transcription	Translation
(D) Replication	Reverse Transcription	Transcription	Translation

5. Histone proteins are (A) basic, negatively charged (B) basic, positively charged. (C) acidic, positively charged (D) acidic, negatively charged.
6. Refer the given sequence of steps and select the correct option.



- | (i) | (ii) | (iii) |
|-------------------|---------------|-------------|
| (A) Replication | Transcription | Translation |
| (B) Replication | Processing | Translation |
| (C) Transcription | Splicing | Translation |
| (D) Transcription | Replication | Translation |
7. Chemically, RNA is (i) reactive and (ii) stable as compared to DNA.
- (A) (i) equally, (ii) equally
 (B) (i) less, (ii) more
 (C) (i) more, (ii) less
 (D) (i) more, (ii) equally

8. What does the given diagram represent?



- (A) Nucleosome (B) Spliceosome
 (C) Histone complex (D) Both A and B

9. Which of the following shows the correct positions of the phosphate (P), sugar (S) and base (B) molecules in the line diagrams representing structure of DNA?

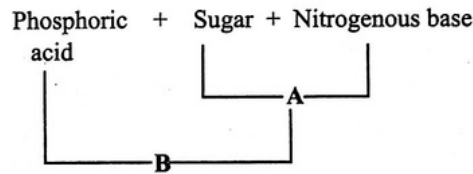
- (A)
$$\begin{array}{c} P \\ | \\ B - S \\ | \\ P \\ | \\ B - S \\ | \\ P \\ | \\ B - S \\ | \\ P \end{array}$$
- (B)
$$\begin{array}{c} B \\ | \\ P - S \\ | \\ B \\ | \\ P - S \\ | \\ B \\ | \\ P - S \\ | \\ B \end{array}$$
- (C)
$$\begin{array}{c} P \\ | \\ S - B \\ | \\ P \\ | \\ S - B \\ | \\ P \\ | \\ S - B \\ | \\ P \end{array}$$
- (D)
$$\begin{array}{c} S \\ | \\ B - P \\ | \\ S \\ | \\ B - P \\ | \\ S \\ | \\ B - P \\ | \\ S \end{array}$$

10. In a DNA molecule, the phosphate group is attached to carbon _____ of the sugar residue of its own nucleotide

and carbon _____ of the sugar residue of the next nucleotide by _____ bonds.

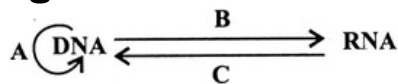
- (A) 5', 3', phosphodiester (B) 3', 5', phosphodiester
 (C) 5', 3', glycosidic (D) 3', 5', glycosidic

11. What does A and B represent in the given representation?



- (A) A – Ribonucleoside, B – Deoxyribonucleoside
 (B) A – Ribonucleotide, B – Deoxyribonucleotide
 (C) A – Nucleoside, B – Nucleotide
 (D) A – Nucleotide, B – Nucleoside

12. The given flowchart shows centra dogma reverse.



Enzymes used in processes A, B and C are respectively

- | A | B | C |
|------------|------------|------------|
| (A) DNA | RNA | DNA |
| dependent | dependent | dependent |
| DNA | DNA | RNA |
| polymerase | polymerase | polymerase |
| (B) DNA | DNA | RNA |
| dependent | dependent | dependent |

	DNA	RNA	DNA
	polymerase	polymerase	polymerase
(C)	DNA	DNA	RNA
	dependent	dependent	dependent
	RNA	DNA	DNA
	polymerase	polymerase	polymerase
(D)	RNA	DNA	RNA
	dependent	dependent	dependent
	DNA	RNA	RNA
	polymerase	polymerase	polymerase

13. Match Column-I with Column-II and select the correct option from the codes given below.

Column I		Column II	
A.	F.Meischer	(i)	DNA double helix
B.	Griffith	(ii)	Nuclein
C.	Hershey and Chase	(iii)	<i>S.pneumoniae</i>
D.	Watson and Crick	(iv)	Bacteriophages
E.	Wilkins and Franklin	(v)	X-ray diffraction studies

(A) A-(ii), B-(iii), C-(iv), D-(i), E-(v)

(B) A-(v), B-(iv), C-(iii), D-(i), E-(ii)

(C) A-(i), B-(iii), C-(iv), D-(ii), E-(v) (D)
A-(i), B-(iv), C-(iii), D-(ii), E-(v)

14. Watson and Crick (1953) proposed DNA double helix model and won the Nobel Prize; their model of DNA was based on

(i) X-ray diffraction studies of DNA done by Wilkins and Franklin.

(ii) Chargaff's base equivalence rule.

(iii) Griffith's transformation experiment.

(iv) Messelson and Stahl's experiment.

(A) (i), (ii) and (iv)

(B) (i) and (ii)

(C) (i), (ii), (iii) and (iv)

(D) (iii) and (iv)

15. The process of transformation is not affected by which of the following enzymes?

A. DNase

B. RNase

C. Peptidase

D. Lipase

(A) A, B

(B) A, B, C, D

(C) B, C, D

(D) A, B, C

16. Select the incorrect statement regarding DNA replication.

(A) Leading strand is formed in $5' \rightarrow 3'$ direction.

(B) Okazaki fragments are formed in $5' \rightarrow 3'$ direction.

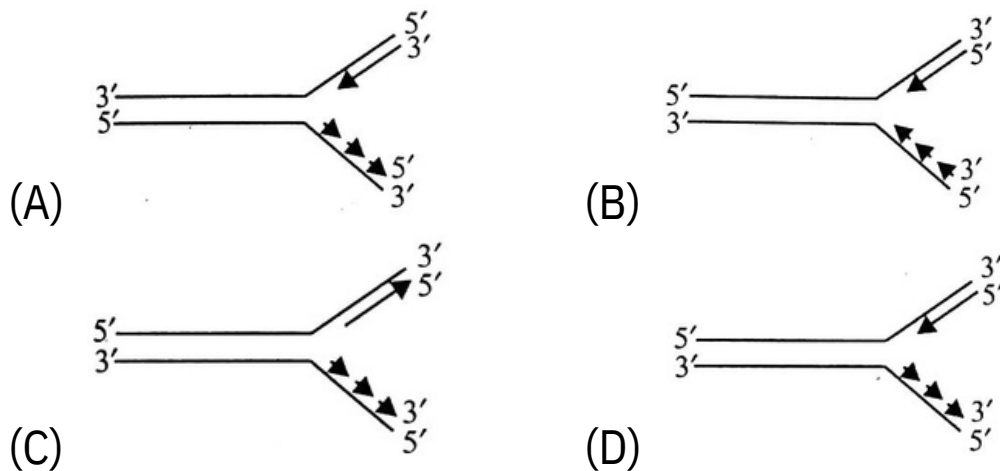
(C) DNA polymerase catalyses polymerization in $5' \rightarrow 3'$ direction.

(D) DNA polymerase catalyses polymerization in 3' → 5' direction.

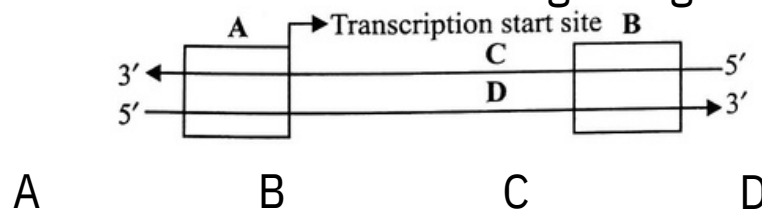
17. Select the correct match of enzyme with its related function.

- (A) DNA polymerase - Synthesis of DNA strands
- (B) Helicase - Unwinding of DNA helix
- (C) Ligase - Joins together short DNA segments
- (D) All are correct

18. Which of the following figures correctly represents the replication fork formed during DNA replication?

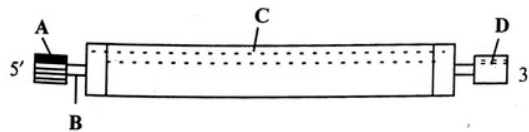


19. When diagram represents the components of a transcription unit. Select the correct answer regarding it.



- | | | | |
|----------------|------------|-----------------|-----------------|
| (A) Terminator | Promoter | Template strand | Coding strand |
| (B) Promoter | Terminator | Coding strand | Template strand |
| (C) Promoter | Terminator | Template strand | Coding strand |
| (D) Terminator | Promoter | Coding strand | Template strand |

20. Identify A, B, C and D in the given diagram of mRNA.



- | A | B | C | D |
|--------------------|-------------------|-------------------|----------------|
| (A) Methylated cap | Initiation codon | Coding region | Poly A tail |
| (B) Poly A tail | Termination codon | Initiation codon | Methylated cap |
| (C) Methylated cap | Non-coding region | Coding region | Poly A tail |
| (D) Methylated cap | Coding region | Non-coding region | Poly A tail |

21. The structural genes, in eukaryotes possess coding and non-coding sequences called as (i) and (ii) respectively.

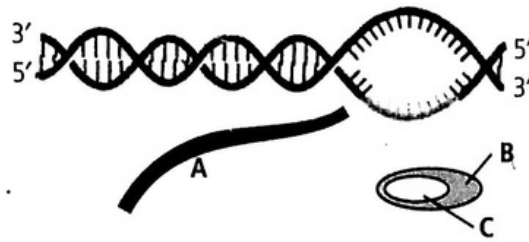
- (A) (i) promoter, (ii) operator
 (B) (i) introns, (ii) exons (C) (i) exons, (ii) introns (D) (i) enhancer, (ii) silencer

22. Match Column-I with Column-II and select the correct option from the codes given below.

Column I	Column II
A. Sigma factor (i)	5' - 3'
B. Capping	(ii) Initiation
C. Tailing	(iii) Termination
D. Coding strand	(iv) 5' end
	(v) 3' end

- (A) A-(iii), B-(v), C-(iv), D-(ii)
 (B) A-(ii), B-(iv), C-(v), D-(i)
 (C) A-(ii), B-(iv), C-(v), D-(iii)
 (D) A-(iii), B-(v), C-(iv), D-(i)

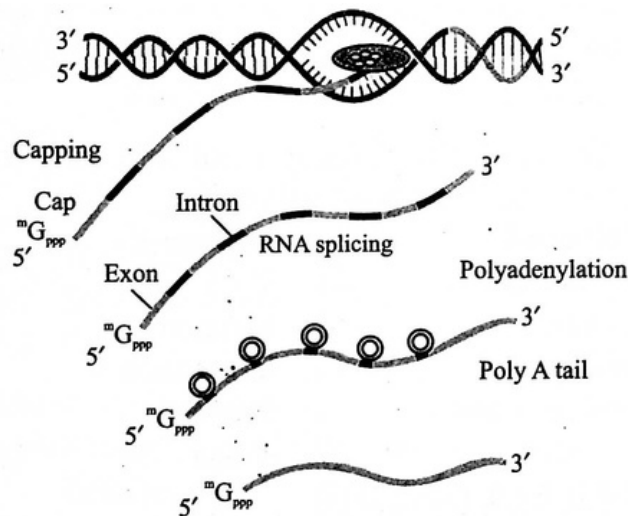
23. The given figure represents the process of transcription in bacteria.



Select the option which correctly labels A, B and C.

- (A) A – DNA, B – RNA, C – Promoter
- (B) A – RNA, B – RNA polymerase, C – Rho factor
- (C) A – RNA, B – RNA polymerase, C – Sigma factor
- (D) A – DNA, B – DNA polymerase, C - RNA

24. Refer the given diagram. What does it represent?



- (A) Transcription in prokaryotes
- (B) Transcription in eukaryotes
- (C) Translation in prokaryotes
- (D) Translation in eukaryotes

25. What would be the base sequence of RNA transcript obtained from the given DNA segment? 5' - G C A T T C G G C T A G T A A C - 3' Coding strand of DNA

3' - C G T A A G C C G A T C A T T G - 5' Non-coding strand of DNA

- (A) 5' - G C A U U C G G C U A G U A A C - 3'
- (B) 5' - C G U A A G C C G A U C A U U G - 3'
- (C) 5' - G C A T T C G G C T A G T A A C - 3'
- (D) 5' - C G T A A G C C G A T C A T T G - 3'

26. Select the correct statements regarding the process of transcription in eukaryotes.

(i) The strand of dsDNA which takes part in transcription process is called as coding strand.

(ii) The enzyme RNA polymerase can catalyse polymerization only in one direction i.e., 5' → 3'.

(iii) An unusual nucleotide methyl guanosine triphosphate is added to the 5' end of hnRNA during capping.

(iv) During tailing process, adenylate residues (200 – 300) are added at 3' end in a template independent manner.

- (A) (i) and (ii)
- (B) (iii) and (iv)
- (C) (ii), (iii) and (iv)
- (D) All are correct.

27. The fully processed hnRNA is called as (i) and is transported out of the (ii) into the (iii) for translation.

- | | (i) | (ii) | (iii) |
|-----|------|-----------|-----------|
| (A) | mRNA | Nucleus | Cytoplasm |
| (B) | mRNA | Cytoplasm | Nucleus |
| (C) | tRNA | Cytoplasm | Nucleus |
| (D) | tRNA | Nucleus | Cytoplasm |

28. Select the incorrectly matched pair.

- | | | |
|-----|-------------------|-----------------|
| (A) | Initiation codons | - AUG, GUG |
| (B) | Stop codons | - UAA, UAG, UGA |
| (C) | Methionine | - AUG |
| (D) | Anticodons | - mRNA |

29. The three codons which result in the termination of polypeptide chain synthesis are

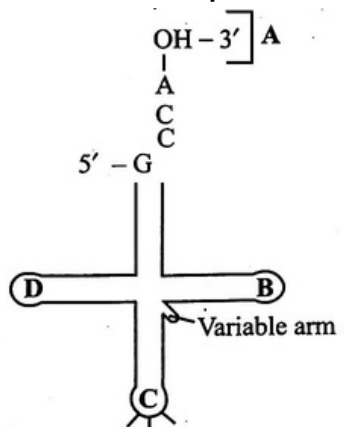
- (A) UAA, UAG, GUA
- (B) UAA, UAG, UGA
- (C) UAA, UGA, UUA
- (D) UGU, UAG, UGA.

30. Match Column-I with Column-II and select the correct option from the codes given below.

Column I (Codons)	Column II (Translated amino acid)
A. UUU	(i) Serine
B. GGG	(ii) Methionine
C. UCU	(iii) Phenylalanine
D. CCC	(iv) Glycine
E. AUG	(v) Proline

- (A) A-(iii), B-(iv), C-(i), D-(v), E-(ii) (B) A-(iii), B-(i), C-(iv), D-(v), E-(ii) (C) A-(iii), B-(iv), C-(v), D-(i), E-(ii) (D) A-(ii), B-(iv), C-(i), D-(v), E-(iii)

31. Identify the labels A, B, C and D in the given structure of tRNA and select the correct option.



- A B C D

(A) Anticodon T ψ C loop	AA loop	DHU loop binding site
(B) AA binding site	(C) AA loop	Anticodon DHU loop loop
(C) AA binding site	(D) AA loop	Anticodon T ψ C loop loop
(D) AA binding site	DHU loop	T ψ C loop Anticodon loop

32. Read the following statements.

- (i) One codon codes for only one amino acid.
- (ii) Some amino acids are coded by more than one codon.
- (iii) The sequence of triplet nitrogenous bases in DNA or mRNA corresponds to the amino acid sequence in the polypeptide chain.

Give suitable terms for the characteristics of 'genetic code' as per the above statements.

Degeneracy Colinearity Unambiguous

(A) (i)	(iii)	(iii)
(B) (iii)	(ii)	(i)
(C) (ii)	(iii)	(i)
(D) (i)	(ii)	(iii)

33. Match Column-I with Column-II and select the correct option from the codes given below.

Column I (Codons)	Column II (Translated amino acid)
A. Translation	(i) Aminoacyl tRNA synthetase
B. Transcription	(ii) Okazaki fragments
C. DNA replication	(iii) RNA polymerase

- (A) A-(ii), B-(i), C-(iii) (B) A-(i), B-(iii), C-(ii) (C) A-(iii), B-(i), C-(ii) (D) A-(ii), B-(iii), C-(i)

34. Refer the given mRNA segment.

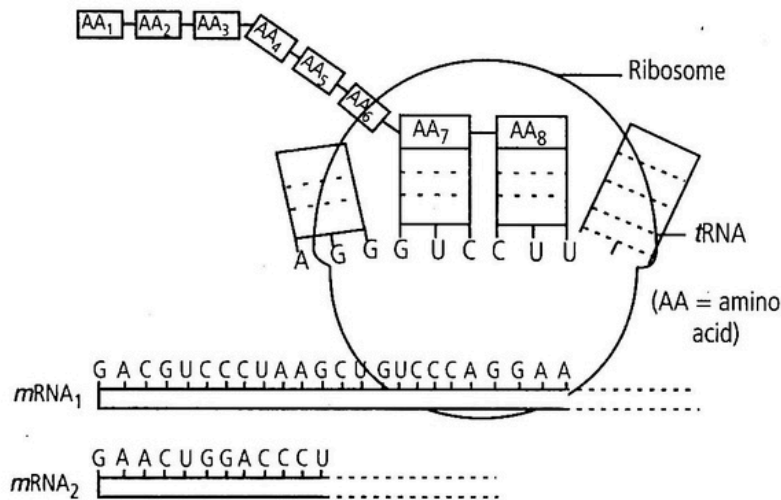


It can be translated completely into a polypeptide.

Which of the following codons may correspond with A and B?

- (A) A – AUG, GUG; B – UAA, UAG or UGA
 (B) A – UAA, UGA; B – AUG, GUG or UAG
 (C) A – AUG, UGA; B – GUG, UAA or UGA
 (D) A – AUG, GAG; B – UAA, UUU or UGA

35. Refer to the diagram which shows the synthesis of part of a protein molecule.



Which of the following is the first part of the protein molecule that would be translated from mRNA₂?

- (A) AA₄ – AA₂ – AA₇ – AA₆
- (B) AA₆ – AA₇ – AA₂ – AA₄
- (C) AA₃ – AA₁ – AA₆ – AA₈
- (D) AA₈ – AA₅ – AA₁ – AA₃

36. Given below are the steps of protein synthesis. Arrange them in correct sequence and select the correct option.

- (i) Codon – anticodon reaction between mRNA and aminoacyl tRNA complex.
- (ii) Attachment of mRNA and smaller sub-unit of ribosome.
- (iii) Charging or Aminoacylation of tRNA.
- (iv) Attachment of larger sub-unit of ribosome to the mRNA-tRNA^{Met} complex.

(v) Linking of adjacent amino acids. (vi) Formation of polypeptide chain. (A) (ii) → (i) → (iii) → (v) → (iv) → (vi) (B) (v) → (ii) → (i) → (iii) → (iv) → (vi) (C) (iii) → (ii) → (iv) → (i) → (v) → (vi) (D) (iii) → (ii) → (i) → (iv) → (v) → (vi)

37. Which of the following enzyme is known as ‘chemical knife of DNA’?

(A) Ligase (B) Polymease (C) Endonuclease (D) Transcriptase

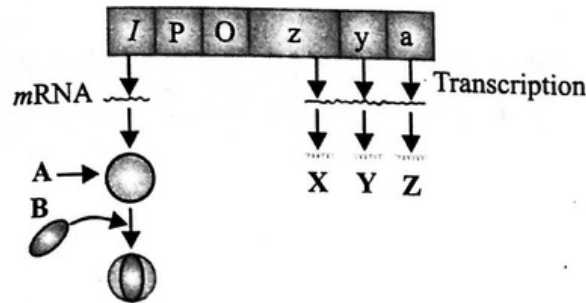
38. Match Column-I with Column-II and select the correct option from the codes given below.

Column I (Codons)	Column II (Translated amino acid)
A. Griffith	(i) <i>Lac</i> operon
B. Hershey and Chase	(ii) Semi-conservative DNA replication
C. Messelson and Stahl	(iii) Transduction
D. Jacob and Monod	(iv) Transformation

(A) A-(iv), B-(iii), C-(ii), D-(i)

(B) A-(iii), B-(iv), C-(ii), D-(i) (C)
 A-(iv), B-(ii), C-(iii), D-(i) (D) A-
 (ii), B-(i), C-(iii), D-(iv)

39. The given figure shows *lac* operon and its functioning. Select the option which correctly labels A, B, X, Y and Z.



- | | A | B | X | Y | Z |
|---|--------|--------|-----------|------------|------------|
| (| Repres | Induce | β - | Permease | Transacety |
| A | sor | r | Galactosi | | lase |
|) | | | dase | | |
| (| Repres | Induce | Permease | β - | Transacety |
| B | sor | r | | Galactosid | lase |
|) | | | ase | | |
| (| Induce | Repres | β - | Permease | Transacety |
| C | r | sor | Galactosi | | lase |
|) | | | dase | | |
| (| Induce | Repres | β - | Transacety | Permease |
| D | r | sor | Galactosi | lase | |
|) | | | dase | | |

40. Repressible operon system is usually found in (i) _____ pathways. The pathway's end product serves as a (ii) _____ to

activate the repressor, turn off enzyme synthesis and prevent overproduction of the end product of the pathway. Genes for this operon are usually switched (iii) and the repressor is synthesized in an (iv) form.

(i) (ii) (iii) (iv)

- (A) Anabolic Corepressor On Inactive
- (B) Anabolic Inducer (C) Off Active
- Catabolic Inducer Off Active
- (D) Catabolic Corepressor On inactive

41. Inducible operon system usually occurs in (i) pathways. Nutrient molecules serve as (ii) to stimulate production of the enzymes necessary for their breakdown. Genes for inducible operon are usually switched (iii) and the repressor is synthesized in an (iv) form.

(i) (ii) (iii) (iv)

- (A) Anabolic Corepressor On Inactive
- (B) Anabolic Inducer (C) Off Active
- Catabolic Inducer Off Active
- (D) Catabolic Corepressor On inactive

42. The sequence of structural genes is *lac* operon is

- (A) *Lac A, Lac Y, Lac Z* (B) *Lac A, Lac Z, Lac Y* (C) *Lac Y, Lac Z, Lac A* (D) *Lac Z, Lac Y, Lac A*

43. Human genome consists of approximately
 (A) 3×10^9 bp (B) 6×10^9 bp
 (C) 20,000 – 25,000 bp (D) 2.2×10^4 bp

44. Match Column-I with Column-II and select the correct option from the codes given below.

Column I	Column II
A. Alec Jeffreys	(i) <i>Lac</i> operon
B. F.Sanger	(ii) Automated DNA sequencers
C. Jacob and Monod	(iii) DNA finger printing
D. Avery, MacLeod and McCarty	(iv) Transforming principle

- (A) A-(ii), B-(iii), C-(iv), D-(i)
 (B) A-(iii), B-(ii), C-(i), D-(iv)
 (C) A-(iii), B-(ii), C-(iv), D-(i)
 (D) A-(i), B-(ii), C-(iii), D-(iv)
45. Arrange the various steps of DNA fingerprinting technique in the correct order.
- (i) Separation of DNA fragments by electrophoresis.
 - (ii) Digestion of DNA by restriction endonucleases.
 - (iii) Hybridization using labeled VNTR probe.
 - (iv) Isolation of DNA.

(v) Detection of hybridized DNA fragments by auto radiography. (vi) Transferring the separated DNA fragments to nitrocellulose membrane. (A) (iv) → (ii) → (i) → (vi) → (iii) → (v) (B) (iv) → (i) → (ii) → (iii) → (vi) → (v) (C) (ii) → (i) → (iv) → (vi) → (iii) → (v) (D) (iii) → (v) → (iv) → (ii) → (i) → (vi)

ANSWERS

1. C 2. D 3. A 4. C 11. C 5. B 6. C 7. C 8. A 9. A 10. A
 12. B 13. A 14. B 21. C 15. C 16. D 17. D 18. D 19. C 20. C
 22. B 23. B 24. B 31. B 25. A 26. C 27. A 28. D 29. B 30. A
 32. C 33. B 34. A 41. C 35. D 36. D 37. C 38. A 39. A 40. A
 42. D 43. A 44. B 45. A

SOLUTIONS

2. DNA (deoxyribonucleic acid) is an acidic biomolecule.
3. The DNA helix makes one complete spiral turn every 3.4 nm and has a diameter of 2 nm. The distance between adjacent stacks is 0.34 nm.

9. DNA helix is made up of two polynucleotide chains, where the backbone is constituted by sugar-phosphate chains and the bases project inside.
11. Sugar + Nitrogenous base → Nucleoside.
Sugar + Nitrogenous base + Phosphate → Nucleotide.
21. In eukaryotes, the coding sequences or expressed sequences are defined as exons. Exons appear in mature or processed RNA. The exons are interrupted by introns, they do not appear in mature or processed RNA.
24. The given diagram represents post-transcriptional processing resulting in the formation of mRNA. Since, introns and exons are present, it is transcription in eukaryotes.
37. Endonuclease enzymes are also called 'chemical knife of DNA' as they cleave DNA at or near specific recognition sequences known as restriction sites.
43. Human genome has 3.1647 billion nucleotide base pairs (3×10^9 bp). The average gene size is 3000 base pairs. The human genome consists of about 20, 500 genes.