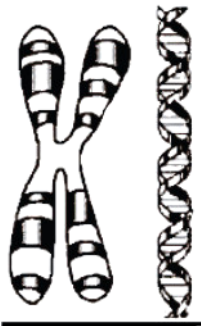


Chapter 20

Chromosomes and DNA

TOPIC WISE MULTIPLE CHOICE QUESTIONS

INTRODUCTION

KIPS MCQs

(1) Name the biologist who discovered the chromosomes:
(a) Alexander Fleming **(b) Walther Fleming**
(c) Griffith **(d)** Martha Chase

(2) Which one of the following has 16 pairs of chromosomes?
(a) Honeybee **(b)** Fruit fly
(c) Mosquito **(d)** Mouse

(3) Which statement is not true for chromosomes?
(a) All Eukaryotes have chromosomes. **(b)** All chromosomes are essential for survival
(c) Each chromosome has a centromere **(d) Each chromosome has four arms**

(4) The particular array of chromosomes that an individual possesses is called its:
(a) Genotype **(b) Karyotype**
(c) Phenotype **(d)** None of these

(5) J shaped chromosomes are:
(a) Metacentric **(b) Sub-metacentric**
(c) Acrocentric **(d)** Telocentric

(6) In which stage of Mitosis the chromosomes can acquire different shapes?
(a) Prophase **(b)** Metaphase
(c) Anaphase **(d)** Telophase

(7) *Penicillium*, a fungus has _____ pair of chromosomes.
(a) 8 **(b) 1**
(c) 6 **(d)** 20

(8) Karyotypes show marked differences among:
(a) Different species **(b)** Individual of same species
(c) Both a and b **(d)** None of these

PAST PAPER MCQs

(9) The particular array of chromosomes that an individual possesses is called its: (LHR 2019)
(a) Genome **(b) Karyotype**
(c) Gene pool **(d)** DNA duplex

(10) The number of chromosomes in mosquito is: (LHR 2017, GRW 2017)
(a) 32 **(b)** 20
(c) 06 **(d)** 26

(11) Walther Fleming discovered chromosome in larvae of: (SGD 2017)
(a) Frog **(b)** Seaurchin
(c) Salamander **(d)** Starfish

(12) A chromosome with equal length of its arms: (LHR 2018)
(a) Acrocentric **(b)** Telecontric
(c) Metacentric **(d)** Sub meta centric

(13) Highly condensed portions of the chromatin are called: (LHR 2018)
(a) Euchromatin **(b) Hetero chromatin**
(c) Supercoils **(d)** Centromeres

(14) A chromosome with equal length of its arms: (LHR 2018)
(a) Acrocentric **(b)** Telocentric
(c) Metacentric **(d)** Sub metacentric

(15) Highly condensed portions of the chromatin are called: (GRW 2018)
(a) Euchromatic **(b) Heterochromatin**
(c) Supercoils **(d)** Centromeres

(16) The number of chromosomes in mouse is: (FSD 2014, 2018)
(a) 06 **(b)** 32
(c) 26 **(d) 40**

(17) Walther Fleming first observed chromosomes in the dividing cells in the Larvae of: (LHR 2019, GRW 2019)
(a) Frog **(b)** Insect
(c) Sea Urchin **(d) Salamander**

(18) The particular array of chromosomes that an individual possess is called its: (MTN 2021, LHR 2019)
(a) Genotype **(b)** Phenotype
(c) Karyotype **(d)** Epistasis

(19) Chromosomes appear inside the nucleus at the time of: (LHR 2021)
(a) Cell elongation **(b)** Cell maturation
(c) Cell differentiation **(d) Cell division**

(20) Morphological characteristics of chromosomes are collectively called: (LHR 2021)
(a) Holotype **(b)** Karyokinesis
(c) Karyotype **(d)** Neotype

(21) If the centrometere is located in the middle of the chromosome it is called: (LHR 2021)
(a) Metacentric **(b)** Sub metacentric
(c) telocentric **(d)** Acrocentric

(22) Highly condensed portions of chromatin are called: (MTN 2021)
(a) Euchromatin **(b)** Chromatids
(c) Centromere **(d) Heterochromatin**

COMPOSITION OF CHROMOSOMES

KIPS MCQs

(23) The histones are positively charged proteins due to an abundance of basic amino acids, like:
(a) Arginine **(b)** Lysine
(c) Both a & b **(d)** None of these

(24) Which portion of chromatin is condensed only during cell division:
(a) Euchromatin **(b)** Heterochromatin
(c) Both of these **(d)** None of these

(25) % of DNA in a chromosome is:
(a) 40 **(b)** 60
(c) 20 **(d)** 80

(26) A portion of chromatin with an open configuration is called:
(a) Heterochromatin **(b) Euchromatin**
(c) Nucleosome **(d)** Centrosome

(27) Chromosomes are composed of DNA & protein in the ratio of:
(a) 1:3 **(b) 2:3**
(c) 1:5 **(d)** 3:2

(28) The histones are positively charged proteins due to an abundance of basic amino acids, like:
(a) Arginine **(b)** Lysine
(c) Both a & b **(d)** None of these

(29) Which portion of chromatin is condensed only during cell division:
(a) Euchromatin **(b)** Heterochromatin
(c) Both of these **(d)** None of these

(30) Which portion of the chromosomes never expresses in the terms of phenotype?
(a) Euchromatin **(b) Heterochromatin**
(c) Both of these **(d)** None of these

(31) When a DNA duplex coiled around a core of eight histone proteins the structure formed is:
(a) Nucleoside **(b)** Chromatid
(c) Nucleosome **(d)** Chromosome

(32) A typical human chromosome contain about _____ nucleotides in its DNA.
(a) 140 billion **(b) 140 million**
(c) one million (d) 34 million

PAST PAPER MCQs

(33) Number of histone protein molecules in a single nucleosome are: (RWP 2017)
(a) 06 **(b)** 09
(c) 08 **(d)** 10

(34) Chromosomal part which uncoils during interphase is called: (RWP 2017)
(a) Euchromatin **(b)** Heterochromatin
(c) Chromatin **(d)** Both A and B

(35) Highly condensed portions of the chromatin are called: (GRW 2018)
(a) Euchromatin **(b)** Hetero chromatin
(c) Supercoils **(d)** Centromeres

THE CHROMOSOMAL THEORY OF INHERITANCE

KIPS MCQs

(36) Chromosomal theory of hereditary was first formulated by:
(a) Karl Correns **(b)** Walther Fleming
(c) T H Morgan **(d) Walter Sutton**

(37) Central role for chromosomes in heredity was first suggested in 1900 by:
(a) Karl Correns **(b)** Walther Fleming
(c) T H Morgan **(d)** Walter Sutton

(38) The gene for the color of eye of *Drosophila* resides on:
(a) Autosomal chromosomal **(b) X-chromosomes**
(c) Y-chromosomes **(d)** Both X&Y

DNA AS HEREDITARY MATERIAL & REPLICATION

KIPS MCQs

(39) What is the name of Bacteria causing pneumonia?
(a) Clostridium pneumoniae **(b)** Staphylococcus pneumoniae
(c) Streptococcus pneumoniae **(d)** Streptobacillus pneumoniae

(40) Which one of the following digesting enzyme can stop the process of transformation?
(a) Protein digesting **(b)** RNA – Digesting
(c) DNA–digesting **(d)** None of these

(41) Which of the following form of Pneumococcus is non virulent?
(a) R form **(b)** S form
(c) Heat killed S form **(d) both a and c**

(42) The first evidence of hereditary nature of DNA was proved by:
(a) Alexander Fleming **(b)** Walther Fleming
(c) F. Griffith **(d)** Martha Chase

(43) In Hershey and Chase experiment DNA is labeled with:
(a) P^{35} **(b)** S^{32}
(c) S^{35} **(d)** P^{32}

PAST PAPER MCQs

(44) Transfer of genetic material from one cell to other that can alter the genetic makeup of recipient cell is called: (GRW 2019)
(a) Transformation **(b)** Translation
(c) Transcription **(d)** Replication

CHEMICAL NATURE OF DNA

KIPS MCQs

(45) Point out the Purine from the following list:
(a) Cytosine **(b)** Uracil
(c) Thymine **(d) Guanine**

(46) The distance between two base pairs in a DNA molecule is:
(a) 2nm **(b)** 3.4 nm
(c) 0.34nm **(d)** 5 nm

(47) To which carbon of Pentose sugar, the base is attached?
(a) C_1 **(b)** C_2
(c) C_3 **(d)** C_5

(48) Miescher extracted a white substance from the nuclei of human cells and fish sperm and called this substance:
(a) Nucleic acid **(b)** DNA
(c) Nuclein **(d)** RNA

(49) Phosphodiester linkage is represented by:
(a) O-C-O **(b) P-O-C**
(c) –N-H- **(d)** Pair of P-O-C

(50) Due to purine-pyrimidine base pairing, DNA has a constant diameter that is:
(a) 3.4 nm **(b)** 0.34 nm
(c) 2 nm **(d) 20 nm**

(51) One complete turn of DNA molecule has _____ base pairs.
(a) 10 **(b)** 20
(c) 34 **(d)** 3.4

PAST PAPER MCQs

(52) Nucleosomes occurs at every: (SWL 2017)
(a) 2000 nucleotides **(b)** 1200 nucleotides
(c) 200 nucleotides **(d)** 150 nucleotides

(53) Erwin Chargaff showed that the amount of guanine in DNA is always equal to: (MTN 2017)
(a) Cytosine **(b)** Thymine
(c) Adenine **(d)** Uracil

(54) Miescher extracted a white substance from the nuclei of human cells and fish sperm called: **(MTN 2021)**
(a) Nuclein **(b)** Penicillin
(c) Mucin **(d)** Adenine

DNA REPLICATION

KIPS MCQs

(55) Sequence of original duplex is conserved, duplex itself is not. This is about:
(a) Conservative model of DNA replication
(b) Dispersive model of DNA replication
(c) Semiconservative model of DNA replication
(d) None of these

(56) The correct sequence of enzymes used during replication of DNA is:
(a) Helicase- ligase- DNA polymerase **(b)** DNA polymerase - ligase- helicase
(c) Helicase- DNA polymerase - ligase **(d)** DNA polymerase - helicase- ligase

(57) DNA polymerase III can add nucleotide to _____ prime end of growing strand:
(a) 5' end **(b) 3'end**
(c) Both of these **(d)** None of these

(58) According to Watson and Crick DNA replication is:
(a) Dispersive **(b)** Conservative
(c) Semi conservative **(d)** All of the above

(59) Each strand of DNA acts as model or mold in _____ hypothesis of DNA replication.
(a) Conservative **(b) Semi-conservative**
(b) Both a & b **(d)** None of these

(60) Which one of the following enzyme is found in *E.coli* bacterium in nature?
(a) DNA-Polymerase-I **(b)** DNA-Polymerase-II
(c) DNA-Polymerase-III **(d) All of the above**

(61) Okazaki fragments are formed with the strand of DNA called:
(a) Leading strand **(b) Lagging strand**
(c) Both of these **(d)** None of these

(62) The length of Okazaki segment in prokaryotes is:
(a) 100-200 Nucleotides **(b)** 500 to 900 nucleotides
(c) 1000 to 2000 nucleotides **(d)** More than 2000 Nucleotides

PAST PAPER MCQs

(63) DNA polymerase only adds nucleotides to the end: **(LHR 2017)**
(a) 5' – end **(b) 3' – end**
(c) 2' – end **(d)** 4' – end

(64) CEach Okazaki fragment is synthesized by:
(FSD 2017, LHR 2017, DGK 2018, SGD 2019, 2021)
(a) DNA polymerase-I **(b) DNA polymerase-III**
(c) DNA polymerase-II **(d)** DNA polymerase-IV

(65) DNA Polymerase Enzyme was isolated from: **(MLT 2019)**
(a) Viruses **(b) Bacteria**
(c) Fungi **(d)** Protozoa

WHAT IS A GENE

KIPS MCQs

(66) If following substance is found in urine, then on oxidation with air it produces black urine
(a) Urea **(b)** Phenylalanine
(c) Homogentisic acid **(d)** Sugar

PAST PAPER MCQs

(67) Beadle and Tatum exposed Neurospora spores to: (DGK 2017)
(a) α-rays **(b)** Gamma rays
(c) X-rays **(d)** β-rays

(68) Position of gene on chromosome is called: (MTN 2021)
(a) Allele **(b)** Genotype
(c) Locus **(d)** Phenotype

CELL USE RNA TO MAKE PROTEINS

KIPS MCQs

(69) How many kinds of tRNA are present in Human cells?
(a) 35 **(b) 45**
(c) 55 **(d)** 3

PAST PAPER MCQs

(70) Which of the following polymerase synthesize tRNA: (LHR 2017)
(a) RNA polymerase-I **(b) RNA polymerase-II**
(c) RNA polymerase-III **(d)** RNA polymerase

TRANSCRIPTION

KIPS MCQs

(71) In prokaryotes, TATAAT binding site is:
(a) –10 sequence **(b) –25 sequence**
(c) –35 sequence **(d) –70 sequence**

(72) RNA polymerase II synthesizes _____ in eukaryotes.
(a) t-RNA **(b)** r-RNA
(c) m-RNA **(d) All of the above**

PAST PAPER MCQs

(73) In bacteria the newly synthesized mRNA is released in: (DGK 2017)
(a) Nucleus **(b) Cytoplasm**
(c) Mitochondria **(d)** Nucleolus

(74) Which of the following polymerase synthesis tRNA? (LHR 2018)
(a) RNA polymerase-I **(b)** RNA polymerase-II
(c) RNA polymerase-III **(d)** RNA polymerase

(75) Which strand of DNA is transcribed? (MTN 2019)
(a) Coding **(b)** Sense
(c) Template **(d)** Both strands

(76) Synthesis of mRNA copy from DNA template is called: (GSD 2021)
(a) Transcription **(b)** Translation
(c) Transduction **(d)** Transformation

(77) TTGACA binding site in prokaryotes is called: (MTN2021)
(a) –25 sequence **(b) –35 sequence**
(c) –10 sequence **(d)** –75 sequence

GENETIC CODE

KIPS MCQs

(78) Every gene starts with codon AUG which normally encodes the amino acid:
(a) Arginine **(b)** Lysine
(c) Methionine **(d)** Tryptophan

(79) The genetic code AGA from nucleus specifies:
(a) Methionine **(b)** Arginine
(c) Lysine **(d) Threonine**

(80) Find out the sequence of nucleotides in Anticodon, if code is TCG:
(a) CAT **(b)** TCG
(c) UCG **(d)** AGC

PAST PAPER MCQs

(81) All of the following are non-sense codons except that of: (BWP 2017)
(a) AUG **(b)** UAA
(c) UGA **(d)** UAG

(82) Every gene starts with initiation code AUG which normally encodes the amino acid: (SWL 2018)
(a) Arginine **(b)** Citruline
(c) Lysine **(d) Methionine**

(83) In sickle cell anemia code for glutamic acid is replaced by: (MTN 2018)
(a) Leucine **(b)** Histidine
(c) Valine **(d)** Proline

(84) A sequence of three nucleotides in mRNA is called: (MTN 2018)
(a) Cistron **(b) Codon**
(c) Anticodon **(d)** Template

(85) Which one of the given is non-sense codon? (BWP 2018)
(a) UCC **(b) UAA**
(c) UCG **(d)** UCU

(86) A combination of three nucleotides of DNA that specifies an amino acid s called: (DGK 2018)
(a) Cistron **(b)** Anticodon
(c) Entron **(d) Genetic code**

(87) The genetic code for glycine is: (RWP 2019)
(a) UAG **(b)** GAU
(c) GUA **(d) GGU**

(88) Genetic code for the amino acid methionine is: (MLT 2019)
(a) AUC **(b)** UGC
(c) CGC **(d) AUG**

(89) A Gene with initiation codon, which encodes the Amino Acid methionine is: (MLT 2019)
(a) UAA **(b)** UAG
(c) AUG **(d)** UGG

(90) All are Stop Codons except: (BWP 2021)
(a) UAA **(b) AUG**
(c) UAG **(d)** UGA

TRANSLATION

KIPS MCQs

(91) Name the site of attachment of Amino-acid on tRNA molecule:
(a) Anticodon **(b) 3'end**
(c) 5' end **(d)** All of the above

(92) The information contained in the mRNA is used to direct the synthesis of polypeptides by ribosomes. This process is called as:
(a) Transcription **(b)** Translocation
(c) Translation **(d)** Replication

(93) Particular tRNA is attached to a specific amino acid by an enzyme known as:
(a) RNA polymerase **(b) Aminoacyl tRNA synthetase**
(c) Sigma factor **(d)** Initiation factor

PAST PAPER MCQs

(94) DNA polymerase only adds nucleotides to the end: (LHR 2017)
(a) 5' – end **(b) 3' – end**
(c) 2' – end **(d)** 4' – end

MUTATION

KIPS MCQs

(95) Which is real cause of Alkaptonuria?
(a) Homogentisic Acid in Urine
(b) Absence of enzyme used for breakdown of Homogentisic acid
(c) Mutation in specific gene
(d) Oxidation of Urine.

(96) In sickle cell anemia one amino acid, Glutamic acid is replaced by:
(a) Leucine **(b)** Proline
(c) Histidine **(d) Valine**

(97) Molecular basis of sickle cell anemia was found by:
(a) Beadle & Tatum **(b) F. Sanger**
(c) Friedrich Miescher **(d)** Vernon Ingram

(98) Which type of mutational changes can affect only the sequence of nucleotides in DNA but not the amount?
(a) Deletion **(b)** Insertion
(c) Base substitution **(d)** All of the above

(99) In Sickle cell anemia, the Hemoglobin molecule changes its _____ structures.
(a) Primary **(b)** Secondary
(c) Tertiary **(d)** All of the above

(100) A sudden change in structure of gene is:
(a) Epistasis **(b)** Metastasis
(c) Mutation **(d)** All of the above

PAST PAPER MCQs

(101) The ultimate source of all changes is: (LHR 2017)
(a) Mutation **(b)** Evolution
(c) Migration **(d)** Genetic drift

(102) The affected individuals have one missing X-chromosome with only 45 chromosomes in: (LHR 2017)
(a) Down's syndrome **(b)** Sach's syndrome
(c) Turner's syndrome **(d)** Klinefelter's syndrome

(103) If the alterations involve only one or a few base pairs in the coding sequence they are called: (RWP 2017)
(a) Mutation **(b) Point mutation**
(c) Deletion **(d)** Inversion

ANSWER KEY

(Topic Wise Multiple Choice Questions)

1	b	26	b	51	a	76	a	101	A
2	a	27	b	52	c	77	b	102	C
3	d	28	c	53	a	78	c	103	B
4	b	29	a	54	a	79	a		
5	b	30	d	55		80	c		
6	c	31	c	56	c	81	a		
7	b	32	b	57	b	82	a		
8	c	33	c	58	c	83	d		
9	b	34	a	59	b	84	b		
10	c	35		60	d	85	b		
11	c	36	d	61	b	86	d		
12	c	37	a	62	c	87	d		
13	b	38	b	63	b	88	d		
14	c	39	c	64	b	89	a		
15	b	40	c	65	b	90	b		
16	d	41	d	66	c	91	b		
17	d	42	c	67	c	92	c		
18	c	43	d	68	c	93	b		
19	d	44	a	69	b	94	b		
20	c	45	d	70	b	95	c		
21	a	46	c	71	c	96	d		
22	d	47	a	72	d	97			
23	c	48	c	73	b	98	c		
24	a	49	a	74	c	99	a		
25	a	50	d	75		100	c		

INTRODUCTION

KIPS SHORT QUESTIONS

Q:1 How can you distinguish between Sub-metacentric & Metacentric chromosomes?

Ans: **Submetacentric** chromosomes have arms of unequal lengths on both the sides of the centromere while **metacentric** chromosomes have arms of equal or almost equal length.

Q:2 What do you mean by Karyotype? Give its significance

Ans. Karyotype:

The particular array of chromosomes that an individual possesses is called its karyotype.

Significance:

It shows marked differences among species and sometimes even among individuals of the same species.

PAST PAPER SHORT QUESTIONS

Q:3 Draw shapes of chromosomes depends upon the location of centromere. **(RWP 2017)**

Q:4 How many chromosomes are found in sugarcane and mouse? **(RWP 2018)**

Q:5 Write the name of chromosomes on the basis of centromere. **(DGK 2018**

Q:6 What is meant by karyotype? **(FSD 2021)**

Q:7 Enlist types of chromosomes. **(SWL 2021)**

Q:8 Give various type of chromosomes depending upon location of centromere. **(RWP 2021)**

Q:9 Compare Euchromatin with Heterochromatin. **(BWP 2021)**

Q:10 Differentiate between heterochromatin and euchromatin.
(BWP 2017, MTN 2018, LHR 2018, FSD 2019, GRW 2021, RWP 2021, LHR 2022)

Q:11 What is Karyotype? Give its application in species recognition. **(LHR 2022)**

COMPOSITION OF CHROMOSOMES

KIPS SHORT QUESTIONS

Q:12 Why histones are positively charged?

Ans: Histones are positively charged due to an abundance of the basic amino acids, arginine and lysine.

Q:13 Differentiate between coiling & super coiling in DNA molecule.

Ans:

Coiling	Super Coiling
Every 200 nucleotides, the DNA duplex are **coiled** around a core of eight histone proteins forming a complex known as a nucleosome.	Further coiling occurs when the string of nucleosomes, the chromatin fiber, wraps up into higher order coils called **super coils**.
The result of coiling is nucleosome.	The result of super coiling is complete chromosome.

Q:14 Give the structure of a Nucleosome. How many nucleotides are present in the DNA duplex, around a core of eight Histones proteins?

Ans: It is repeating subunit of chromatin formed by coiling of DNA duplex around a core of eight histone proteins. It contains 200 nucleotides.

Q:15 Differentiate between Heterochromatin and Euchromatin.

Ans:

Heterochromatin	Euchromatin
It is the highly condensed portion of the chromatin.	It is condensed only during cell division.
Some part remain permanently condensed so the DNA is never expressed.	Its genes can be expressed.
It is a closed configuration.	It is an open configuration.

PAST PAPER SHORT QUESTIONS

Q:16 How do histone and DNA interact with each other in nucleosome? **(RWP 2013, SGD 2021)**
Q:17 Differentiate between chromosomes and nucleosomes. **(SWL 2021)**
Q:18 What is nucleosome? **(BWP 2017, SWL 2018, MTN 2018, MTN 2021)**
Q:19 Differentiate between chromosome and nucleosome. **(SGD 2021)**
Q:20 Give the composition of chromosomes. **(LHR 2022)**

THE CHROMOSOMAL THEORY OF INHERITANCE

KIPS SHORT QUESTIONS

Q:21 Define chromosomal theory of inheritance.
Ans: Chromosomal theory was first formulated by Walter Sutton in 1902. This theory states that gene and chromosome show parallel behaviour so genes are located on the chromosomes.

PAST PAPER SHORT QUESTIONS

Q:22 What is contribution of Karl Correns in genetics? **(SWL 2017)**

DNA AS HEREDITARY MATERIAL & REPLICATION

KIPS SHORT QUESTIONS

Q:23 Define transformation.
Ans. Transformation is the transfer of genetic material from one cell to another and can alter the genetic makeup of the recipient cell.

Q:24 Point out the main cause which creates hindrance in the formation of Polysaccharide coat on R-type Pneumococcus bacteria.
Ans: R-type bacteria lacks an enzyme needed to manufacture the protein coat and thus forms rough colonies.

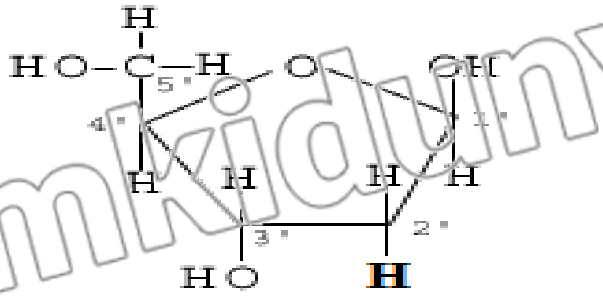
PAST PAPER SHORT QUESTIONS

Q:25 What is transfromation? **(RWP 2022)**
Q:26 Define Transformation. **(SWL 2021, FSD 2021)**
Q:27 Define transformation. Why discovered this phenomena? **(SWL 2022)**

CHEMICAL NATURE OF DNA

KIPS SHORT QUESTIONS

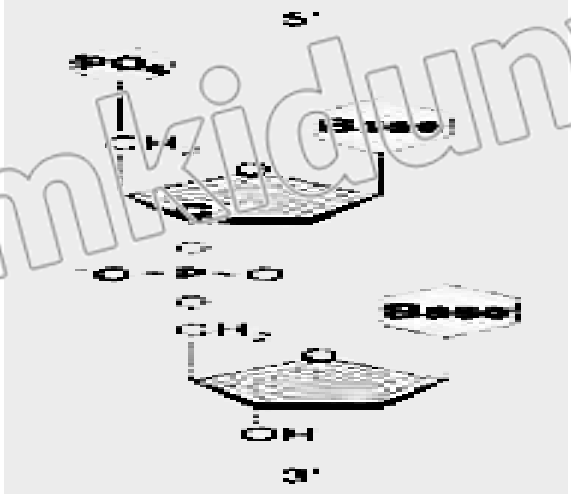
Q:28 Draw a structural formula of Deoxyribose sugar and numbering the "C" atoms.
Ans.



Deoxyribose (DNA) only

Q:29 Define phosphodiester bond.
Ans. The reaction between the phosphate group of one nucleotide and the hydroxyl group of another is a dehydration synthesis, eliminating a water molecule and forming a covalent bond that links

the two groups. The linkage is called a phosphodiester linkage because the phosphate group is now linked to the two sugars by means of a pair of ester (P-O-C) bonds.



Q:30 Give the significance of phosphodiester bond in the molecule of DNA.

Ans: In DNA and RNA, the phosphodiester bond is the linkage between the 3' carbon atom and the 5' Carbon of the pentose sugars of two nucleotides. It determines the primary structure of DNA and RNA to form polynucleotide chain.

Q:31 Point out the difference b/w minor groove and major groove of DNA molecule.

Ans: As the DNA strands wind around each other, they leave gaps between each set of phosphate backbones. There are two of these grooves around the surface of the double helix: one groove, the major groove, is 22 Å wide and the other, the minor groove, is 12 Å wide.

Q:32 What are the contributions of the following biologists?

(a) Erwin Chargaff **(b)** P. A. Levene

Ans:

Erwin Chargaff showed that the amount of adenine in DNA always equals the amount thymine, and the amount of guanine always equals the amount of cytosine. It also implies that there is always equal proportion of Purine (A+G) and pyrimidine (C+T)

P.A. Levene in 1920's determined the basic structure of nucleic acids. He concluded that DNA and RNA molecules are made of repeating units called nucleotides. Each nuleotide composed of three main components.

(i) Phosphate groups (PO_4) **(ii)** Five carbon sugars

(iii) Nitrogen containing bases called Purines (adenine A and guanine G) and pyrimidines (thymine T, and cytosine C, RNA contains Uracil U instead of T)

PAST PAPER SHORT QUESTIONS

Q:33 Differentiate between Pyrimidines and purines. **(MTN 2017 SWL 2017)**

Q:34 Write the structure of adanine and goanine. **(DGK 2018)**

Q:35 Write down the structural formulae of cytosine and thyamine. **(DGK 2019)**

Q:36 What is nucleotide and nucleoside? **(MTN 2019)**

Q:37 Draw structural formula of nucleotide. **(LHR 2021)**

Q:38 What are three main components of a DNA? **(LHR 2021)**

Q:39 Differentiate between nucleotides and nucleosides. **(GRW 2021)**

Q:40 Give the structure of typical nucleotide. **(FSD 2021)**

Q:41 Write down structural formulae of thymine and cytosine. **(MTN 2021)**

Q:42 Sketch a Phosphodiester bond. **(MTN 2017, SGD 2018, GRW 2018, MTN 2021)**
Q:43 Write contribution of Rosalind Franklin. **(RWP 2021)**
Q:44 Give the conclusions of Erwin Chargaff. **(MTN 2022)**

DNA REPLICATION

KIPS SHORT QUESTIONS

Q:45 What is RNA primer? What role does it play in DNA replication?

Ans: RNA primer is a sequence of about 10 RNA nucleotides complementary to the parent DNA template.

Role in DNA replication:

In DNA replication DNA polymerase III recognizes the primer and adds DNA nucleotides to it to construct the DNA strands. The RNA nucleotides in the primers are then replaced by DNA nucleotides.

Q:46 List the characteristic features of DNA polymerase III enzyme.

Ans.

- This enzyme is a dimmer and catalyzes replication of one DNA strand.
- It progressively threads the DNA through the enzyme complex, moving at a rapid rate, some 1000 nucleotides/ second.
- It can add nucleotides only to a chain of nucleotides that is already paired with the parent strand.
- It cannot initiate synthesis on its own.

Q:47 Give the functions of Helicase and Primase enzymes.

Ans: Helicase:

An enzyme involved in DNA replication, responsible for unwinding the double helix.

Primase:

A specialized RNA polymerase that synthesizes short stretches of RNA used as primers during replication.

Q:48 Differentiate between Leading Strand and Lagging Strand.

Ans:

Leading Strand	Lagging Strand
The strand of DNA that is assembled toward the replication fork.	The strand of DNA that is assembled away from the replication fork.
Its synthesis is continuous, fragments are not formed.	Its synthesis is discontinuous and Okazaki's fragments are formed.
Ligase enzyme do not take part in its synthesis.	Ligase enzyme take part to join Okazaki's fragments.

Q:49 Why the Okazaki fragments are formed instead of continuous new strand of DNA?

Ans: They are produced because of the need for DNA polymerase to always synthesize in a 5′ to 3′ direction. As both the DNA strands are antiparallel to each other so one must be assembled away from the replication fork. These Okazaki fragments are formed on lagging strand.

Q:50 Differentiate between conservative and semi conservative replication of DNA.

Ans:

Conservative	Semi conservative
During replication, complete duplex is conserved and a new duplex is formed.	Only one strand is conserved which act as template to construct other complementary strand.

Both primary and secondary structures of DNA are conserved.	Only primary structure is conserved while secondary diminishes.

Q:51 What are Okazaki fragments?

Ans. Okazaki fragments are about 100-200 nucleotides long in eukaryotes and 1000-2000 nucleotides long in prokaryotes. Each Okazaki fragment is synthesized by DNA polymerase III in 5'-3' direction, beginning at the replication fork and moving away from it i.e. on lagging strand.

PAST PAPER SHORT QUESTIONS

Q:52 How many DNA polymerases are found, write down their names. **(LHR 2017)**
Q:53 What is an Okazaki fragment? How is it synthesized? **(GRW 2017)**
Q:54 Describe semi-conservative model of DNA replication. **(RWP 2017)**
Q:55 How many DNA polymerases are found in prokaryotes? Write their names. **(SGD 2018)**
Q:56 Write the functions of DNA polymerase III. **(MTN 2018)**
Q:57 Define semi conservative replication. **(BWP 2018)**
Q:58 Write two characteristics of DNA polymerase III. **(LHR 2019)**
Q:59 Define Dispersive Replication of DNA. **(BWP 2019)**
Q:60 Give two limitations of DNA polymerase III in DNA replication. **(RWP 2019)**
Q:61 Which is true DNA replicating enzyme in *E.coli*? Also write its structural features. **(GRW 2021)**
Q:62 Differentiate between leading strand and lagging strand. **(LHR 2021)**
Q:63 Which is true DNA replicating enzyme in *E.coli*? Also write its structural features. **(GRW 2021)**
Q:64 Write the function of DNA polymerase III. **(FSD 2021)**
Q:65 Give two limitations of DNA polymerase III in DNA replication. **(SGD 2021)**
Q:66 What are Okazaki fragments? **(FSD 2017, MTN 2019, BWP 2021)**
Q:67 Meselson and Stahl experiment? **(DGK 2022)**
Q:68 Compare Okazaki fragments of prokaryotes and eukaryotes. **(SWL 2022)**
Q:69 What happens after second round of replication in Meselson and Stahl experiment? **(DGK 2022)**

WHAT IS A GENE

KIPS SHORT QUESTIONS

Q:70 What is fundamental cause of Alkaptonuria?

Ans: The fundamental cause of Alkaptonuria is mutation in a gene, which leads to the absence of an enzyme that is involved in the breakdown of homogentisic acid. This homogentisic acid starts excreting in urine, which oxidizes in air and urine turns black.

Q:71 What do you mean by encoding the structure of enzymes?

OR

What do you mean by one gene – one enzyme hypothesis?

Ans: According to Beadle and Tatum each gene encodes the structure of one enzyme. They called this relationship as one gene one enzyme hypothesis. Because many enzymes contain multiple proteins or polypeptide subunits, each encoded by a separate gene, the relationship is today more commonly referred as one gene/one-polypeptide.

Q:72 What was the contribution of Frederick Sanger?

Ans: He described the complete sequence of amino acids of insulin. By his work it was demonstrated for the first time the primary structure of protein, which consisted of definable units called as amino acids.

PAST PAPER SHORT QUESTIONS

Q:73 Briefly describe alkaptonuria disease. **(GRW 2017)**

Q:74 What is Alkaptonuria? **(RWP 2017, SWL 2018)**

Q:75 Describe Alkaptonuria disease. **(GRW 2019)**

Q:76 What is alkaptonuria? Give its cause. **(DGK 2019)**

Q:77 What is one-gene/one-polypeptide hypothesis? **(LHR 2017, MTN 2021, DGK 2019,)**

Q:78 Why is one gene\one enzyme hypothesis changed to one gene one polypeptide hypothesis? **(DGK 2022)**

CELL USE RNA TO MAKE PROTEINS

KIPS SHORT QUESTIONS

Q:79 Define central dogma of gene expression.

Ans. All organisms use the same basic mechanism of reading and expressing genes, which is often referred to as central dogma. It travels down from DNA to mRNA to synthesize specific proteins by the process of transcription and translation.

PAST PAPER SHORT QUESTIONS

Q:80 Discuss three types of RNA. **(MTN 2017)**

Q:81 Define central dogma. **(LHR 2018, MTN 2019)**

Q:82 Name three major classes of RNA. **(MTN 2021)**

Q:83 Briefly discuss how DNA encodes protein structure. **(MTN 2022)**

Q:84 Define central dogma. Name its two steps. **(FSD 2016, BWP 2022)**

TRANSCRIPTION

KIPS SHORT QUESTIONS

Q:85 Compare replication with transcription.

Ans:

Replication	Transcription
The process in which one parent DNA molecule produces two daughter DNA molecule is known as replication	The synthesis of mRNA from the DNA is called transcription.

Q:86 What is difference between the promoter on the DNA in Eukaryotes and Prokaryotes?

Ans: In prokaryotes within promoter there are two binding sites TTGACA also called -35 sequence and TATAAT sequence also called -10 sequences, which have affinity for the RNA polymerase. In eukaryotes these sites are at -75 and -25 respectively.

Q:87 What is transcription bubble?

Ans. The DNA strands open up at the place where RNA polymerase is attached to the template strand forming transcription bubble.

Q:88 What are template and coding strands?

Ans: Template Strand:

DNA strand that is transcribed is called template strand.

Coding Strand:

DNA strand that is not transcribed is called coding strand.

Q:89 What is sigma factor?

Ans. It is a subunit of RNA polymerase that is separated from it and is responsible for the correct initiation of transcription process.

PAST PAPER SHORT QUESTIONS

Q:90 Discuss the process of transcription. **(GRW 2017)**
Q:91 What is promoter? **(MTN 2017)**
Q:92 What is the difference between template strand and sense strand? **(LHR 2019)**
Q:93 What is the role of RNA polymerase in Transcription? **(GRW 2019)**
Q:94 What is Transcription? **(MTN 2019)**
Q:95 How eukaryotic mRNA is protected from cytoplasmic nucleases? **(DGK 2019)**
Q:96 What do you know about the term Transcription? **(BWP 2019)**
Q:97 How its eukaryotic mRNA is modified? What is the significance of this modification? **(GRW 2021)**
Q:98 Define transcription. **(LHR 2021)**
Q:99 Define promoter region. Which binding sites are present in this region? **(GRW 2021)**
Q:100 Compare template strand with coding strand. **(DGK 2017, BWP 2018, DGK 2019, SGD 2021)**
Q:101 Differentiate between template and strand of DNA. **(FSD 2021)**
Q:102 What is the function of RNA polymerase in Transcription? **(MTN 2021)**
Q:103 Describe promoter area in transcription. **(LHR 2022)**
Q:104 Why a cap and tail is added to mRNA? **(RWP 2022)**

GENETIC CODE

KIPS SHORT QUESTIONS

Q:105 Name the start and stop codons.

Ans. **Start Codons:** AUG
Stop Codons: UAA, UAG, UGA

Q:106 Why genetic code is not quite universal?

Ans: Some genetic codes express differently in mitochondria and in nucleus. Following variations are observed.

Genetic Code	Mitochondria	Other organisms
UGA	Tryptophan	Stop codon
AUA	Methionine	Isoleucine
AGA and AGG	Termination	Arginine

Q:107 What is the role of non-sense codon in translation?

Ans: The non-sense codon does not specify any amino acid. They are recognized by release factors, which are proteins that release the newly made polypeptide from the ribosome.

Q:108 Give the contribution of Khorana in understanding of structure of code.

Ans: Marshal Nirenberg, Philip Leader and Har Gobind Khorana tested all the 64 codons by making artificial mRNAs and triplet codons and using them to synthesize a protein or amino acyl-tRNA complexes in cell free systems.

Q:109 What do you mean by nonsense codon?

Ans. Such codons which do not specify any amino acid are called non-sense codons e.g. UAA, UAG, UGA. These also terminate the process of translation that's why are also called as stop codons.

Q:110 Define Genetic code, codon and anticodon.

Ans. **Genetic Code:**
It is the combination of three nucleotides, which specify a particular amino acid.

Codon:
Triplet code present on mRNA is called codon.
Anticodon:
Triplet code present on tRNA is called anti-codon.

PAST PAPER SHORT QUESTIONS

Q:111 Enlist initiation codon and non-sense codons. **(RWP 2022, GRW 2022)**
Q:112 Define genetic code. Write its properties. **(DGK 2017)**
Q:113 Differentiate between codon and anticodon. **(GRW 2017, FSD 2017)**
Q:114 Where codon and anticodon are situated? **(LHR 2018)**
Q:115 Enlist nonsense codon. Give their function. **(GRW 2018)**
Q:116 Why every genetic code does consists of three nucleotides? **(LHR 2022)**
Q:117 Which codons are called stop codons and why? **(SGD 2022)**
Q:118 Interpret how many types of tRNA are required for a living cell, if the genetic code is triplet code. **(FSD 2022)**

TRANSLANTION

KIPS SHORT QUESTIONS

Q:119 Differentiate between translation and transcription.
Ans:

Translation	Transcription
The synthesis of protein from mRNA is called translation.	The synthesis of mRNA from the DNA is called transcription.

Q:120 What is difference between the promoter on the DNA in Eukaryotes and Prokaryotes?
Ans: In prokaryotes within promoter there are two binding sites TTGACA also called -35 sequence and TATAAT sequence also called -10 sequences, which have affinity for the RNA polymerase. In eukaryotes these sites are at -75 and -25 respectively.
Q:121 Differentiate between peptidyl-site and aminoacyl site on initiation complex at the time of translation.
Ans:

Peptidyl Site	Aminoacyl Site
P or Peptidyl site is used to form peptide bond between the adjacent amino acids.	A or aminoacyl site is the one where successive amino acids bearing tRNAs will bind.
It is present in between A site and E site.	It is present next to P site.

Q:122 What is the role of aminoacyl-t RNA synthetase?
Ans: It is an enzyme that catalyzes the linkage of a tRNA molecule to its corresponding amino acid to form aminoacyl-tRNA complex during protein synthesis, one of which exists for each of the 20 amino acids.

PAST PAPER SHORT QUESTIONS

Q:123 Define the term translation. **(SWL 2017, DGK 2022, RWP 2018)**

MUTATION

KIPS SHORT QUESTIONS

Q:124 What are mutagens? Give an example.
Ans: The substance which causes the mutation is called as mutagens.
Result:

Mutagens causes mutations e.g. point mutation results in sickle cell anemia and phenyl ketonuria.

Example: Radiations and chemicals.

Q:125 What type of change in the kind of Nucleotides takes place in the case of sickle cell anemia?

Ans: In sickle cell anemia, thymine is replaced with adenine at the position that codes for glutamic acid converting the position to valine. At the nucleotide level it replaces single thiamine with adenine

Q:126 What are the causes of point mutations?

Ans. These occur due to spontaneous pairing errors that occur during DNA replication or result from damage to the DNA caused by the mutagens usually radiation or chemical.

Q:127 Briefly describe phenylketonuria.

Ans. In phenylketonuria, phenylalanine is not degraded because of defective enzyme phenylalanine hydroxylase. It consequently accumulates in the cells leading to mental retardation, as the brain fails to develop in infancy. The disorder is the result of point mutation.

Q:128 Differentiate between chromosomal aberrations and point mutation.

Ans:

Chromosomal aberrations	Point mutation
The changes in chromosomal number or chromosomal structure are called chromosomal aberration.	The mutational changes producing alterations in the sequence of DNA nucleotide which affect the message itself are called point mutation.
Chromosomal aberrations are megachanges.	Some point mutations occur due to spontaneous pairing errors. Some are result of damage to the DNA.
Example: Down's syndrome and Klinefelter's syndrome	**Example:** Sickle cell anemia and phenylketonuria

Q:129 Which types of cells are responsible for the transfer of mutation in offspring? Give one reason in support to your answer.

Ans: The mutations in the germ line cells are passed to subsequent generations, because these cells give rise to gametes. While somatic cell mutation cannot pass through next generation.

Q:130 What are the causes of point mutations?

Ans. These occur due to spontaneous pairing errors that occur during DNA replication or result from damage to the DNA caused by the mutagens usually radiation or chemical.

Q:131 Briefly describe phenylketonuria.

Ans. In phenylketonuria, phenylalanine is not degraded because of defective enzyme phenylalanine hydroxylase. It consequently accumulates in the cells leading to mental retardation, as the brain fails to develop in infancy. The disorder is the result of point mutation.

Q:132 Describe briefly about sickle cell anemia

Ans: Sickle cell anemia is a protein defect. In sickle cell anemia a point mutation leads to the change of amino acid glutamic acid into valine at position 6 from N terminal end in

haemoglobin chain. This alters the primary structure of the haemoglobin molecule which consequently alters tertiary structure. This mutation reduces the ability of haemoglobin to carry oxygen.

Q:133 What is mutation?

Ans: The spontaneous change in gene is called mutation caused by mutagens usually radiations or chemicals. They can be pass on generations (germ line changes) or cannot. They can be classified as:

i) Chromosomal aberrations

ii) Point mutations

e.g. Down's, Klinefelter's syndrome and sickle cell anemia, phenylketonuria are relative examples.

PAST PAPER SHORT QUESTIONS

Q:134 What are point mutations? **(LHR 2018)**

Q:135 What do you mean by mutations? **(LHR 2017)**

Q:136 Define point mutation. Give example. **(DGK 2017)**

Q:137 What are chromosomal aberrations? Write down its reasons. **(DGK 2017)**

Q:138 What is mutation? Give an example. **(FSD 2018, LHR 2019)**

Q:139 Define point mutations. Give one example. **(LHR 2018)**

Q:140 Define phenylketonuria. **(MTN 2018, GRW 2018)**

Q:141 What are mutagens? Give an example. **(DGK 2018)**

Q:142 Differentiate between point mutation and chromosomal aberrations. **(GRW 2019)**

Q:143 What is mutation? Give an example. **(FSD 2019)**

Q:144 What is phenylketonuria? **(FSD 2018, FSD 2019, SWL 2019)**

Q:145 What are chromosomal aberrations? Quote examples as well. **(DGK 2019)**

Q:146 What is a point mutation? **(BWP 2021, 2022)**

Q:147 Differentiate between point mutation and chromosomal mutations. **(FSD 2022)**