

**SUPER
10**

CBSE Class 12 BIOLOGY

2021-22 Term I Sample Papers
with **OMR Sheets**

Highlights

- 10 Fully Solved Sample Papers with Marking Scheme
- CBSE Sample Paper 2021-22 with Solutions
- Objective Qns. & Solns. of Sample Paper 2021-22
- Objective Qns. & Solns. 2019-20 Solved Paper
- Latest Revised CBSE Syllabus for 2021-22 (issued on 28-07-2021)
- Covers all new variety of Qns - A/R, Case base & MCQs etc.
- Separate OMR Answer Sheet for each Sample Paper

based on the
Pattern of
Sample Paper
issued by CBSE on
2nd Sep, 2021

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SP-21-30

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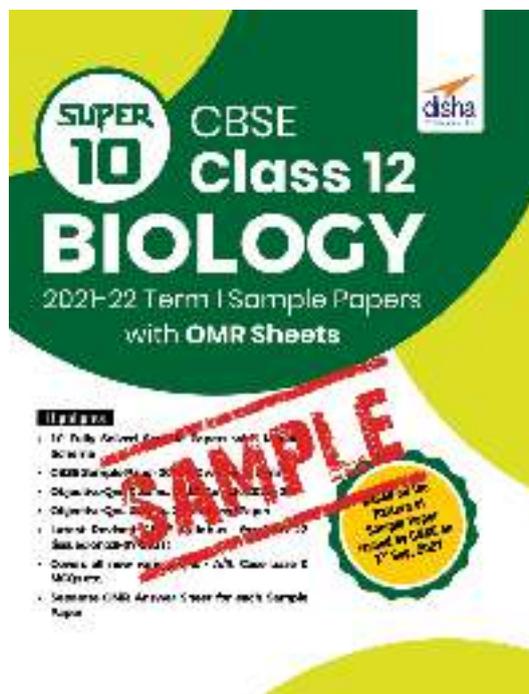
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All India CBSE Board 2020 Solved Paper
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Sample Paper

3

Time : 90 Minutes

Max. Marks : 50

General Instructions

- The Question Paper contains three sections.
- Section A** has 24 questions. Attempt any 20 questions.
- Section B** has 24 questions. Attempt any 20 questions.
- Section C** has 12 questions. Attempt any 10 questions.
- All questions carry equal marks.
- There is no negative marking

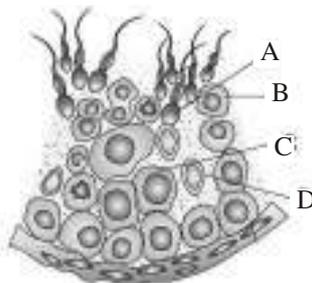
SECTION - A

DIRECTION: This section consists of 24 questions. Attempt any 20 questions from this section. The first attempted 20 questions would be evaluated.

- In human embryology, the chorion is derived from
(a) Ectoderm (b) Mesoderm & Ectoderm (c) Endoderm (d) Trophoblast
- After the transformation of spermatids into sperm, their heads become embedded in a cell called "X" and are finally released from the "Y" by the process called "Z". Identify X, Y and Z.

	X	Y	Z
(a)	Spermatogonium	Epididymis	Insemination
(b)	Leydig	Vas deferens	Parturition
(c)	Sertoli	Seminiferous tubule	Spermiation
(d)	Spermatocyte	Seminiferous tubule	Spermiogenesis

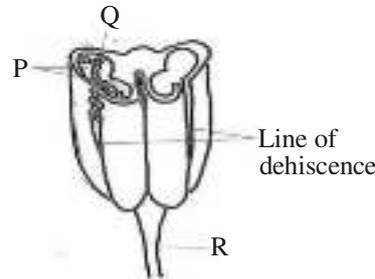
- What will happen to pregnancy if placenta fails to function during the gestation?
(a) The pregnancy would not continue.
(b) The foetus would be born prematurely.
(c) There would be no effect on the pregnancy.
(d) The corpus luteum would continue produce hormone as an alternative source until birth.
- Primitive streak in human embryo
(a) is formed before gastrulation (b) is formed during gastrulation
(c) is formed after gastrulation is complete (d) is not formed in mammals, but in birds and reptiles
- The figure given below shows the sectional view of seminiferous tubule.



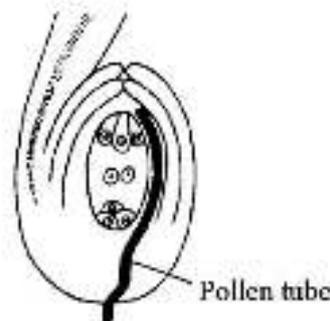
Which marked structure (A to D) undergoes second meiotic division to produce four equal haploid cells (called spermatids)?

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

6. Which of the following statement(s) is/are **incorrect** ?
- Endosperm formation starts prior to first division of zygote.
 - Angiospermic endosperm is mostly $3N$ while gymnospermic one is N .
 - The most common type of endosperm is nuclear.
 - Coconut has both liquid nuclear (multinucleate) and cellular endosperm.
 - Milky water of green tender coconut is liquid female gametophyte.
- (a) (i) and (ii) (b) Only (iii) (c) Only (v) (d) Only (ii)
7. Refer to the given figure. Identify the labelled parts and select the incorrect statement regarding them.

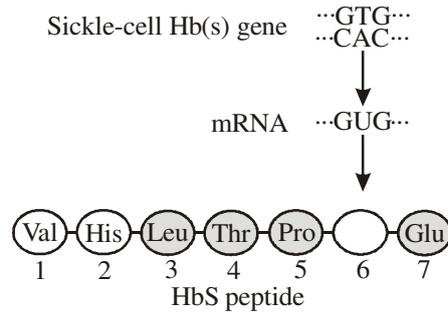


- P extend longitudinally throughout the length of an anther and are packed with Q.
 - R is long and slender stalk, attached proximally to thalamus or petal.
 - The study of Q is called palynology.
 - None of these
8. Which of the following processes is necessary for the complete development of male gametophyte?
- One meiotic cell division and two mitotic cell divisions.
 - One meiotic cell division and one mitotic cell division.
 - Two meiotic cell divisions and one mitotic cell division.
 - Two mitotic cell divisions.
9. In a seed of maize, scutellum is considered as cotyledon because it
- protects the embryo.
 - contains food for the embryo.
 - absorbs food materials and supplies them to the embryo.
 - converts itself into a monocot leaf.
10. The given diagram represent

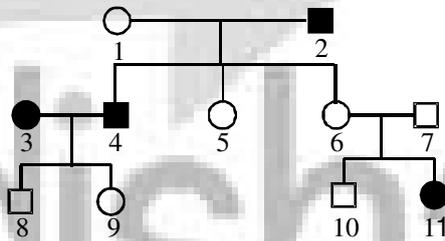


- Mesogamy (b) Porogamy (c) Chalazogamy (d) None of them
11. Filiform apparatus is found in
- synergids (b) anther wall (c) secondary nucleus (d) egg cell
12. Turner syndrome is due to
- Loss of X chromosome – $44 + XO$ (b) Loss of any chromosome
 - It is due to trisomy in 21st pair (d) None
13. Which of the following statement confirm the law of dominance
- $3:1$ ratio in F_2 generation
 - It is the conclusion of a dihybrid cross
 - Alleles do not show any blending and both characters recovered as such in F_2 generation
 - Alleles of a pair segregate from each other such that gamete receives only one of the two factors

14. Which of the following is true for given diagram.

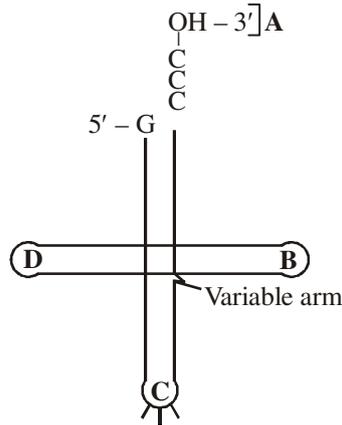


- (a) A → Autosomal dominant
 (b) B → Glutamic acid
 (c) B → Valine
 (d) It is caused due to bacteria
15. Mother and father of a person with 'O' blood group have 'A' and 'B' blood group respectively. What would be the genotype of both mother and father.
 (a) Mother is homozygous for 'A' blood group and father is heterozygous for 'B'
 (b) Mother is heterozygous for 'A' blood group and father is heterozygous for 'B'
 (c) Both mother and father are heterozygous for 'A' and 'B' blood group respectively
 (d) Both mother and father are homozygous for 'A' and 'B' blood group respectively.
16. Originally, genetic inheritance was thought to be a function of the blending of traits from the two parents. Which exception to Mendel's rules is an example of blending?
 (a) Polygenic inheritance
 (b) Incomplete dominance
 (c) Codominance
 (d) Pleiotropism
17. In Huntington's disease, the unaffected persons are homozygous for normal allele, h. The following is erroneous because:



- (a) it shows both male and female affected by Huntington's disease.
 (b) either person 6 or 7 should have the disease, if individual 11 shows the disease.
 (c) at least one of the 2 children (8, 9) should have the disease.
 (d) All of the above
18. Haemophilia is mentioned as a trait carried by the mother and passed to her sons. What is the pattern of inheritance for this trait?
 (a) Haemophilia is an allele carried on one of the mother's autosomal chromosomes.
 (b) Haemophilia is an allele carried on the Y-chromosome because more males have this genetic disorder than females.
 (c) Haemophilia is an allele carried on the X-chromosome and can be directly inherited by the son from the father or the mother.
 (d) Haemophilia is carried on the X-chromosome and can only be inherited by the son if the mother is a carrier.
19. The okazaki fragments in DNA chain
 (a) result in transcription.
 (b) polymerize in the 3' to 5' direction and forms replication form.
 (c) prove semi-conservative nature of DNA replication.
 (d) polymerize in the 5' to 3' direction and explain 3' to 5' DNA replication.
20. Methyl guanosine triphosphate is added at 5' end of hn-RNA in a process of
 (a) tailing (b) splicing (c) capping (d) None of these
21. What role does messenger RNA play in the synthesis of proteins?
 (a) It catalysis the process.
 (b) It translates the genetic code to a specific amino acid.
 (c) It provides the genetic blue print for the protein.
 (d) It modifies messenger RNA molecules prior to protein synthesis.

22. 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 C loop	AA binding site	DHU loop
(b)	AA binding site	T C loop	Anticodon loop	DHU loop
(c)	AA binding site	DHU loop	Anticodon loop	T C loop
(d)	AA binding site	DHU loop	T C loop	Anticodon loop

23. Select the two correct statements out of the four (i–iv) given below about *lac* operon.
- (i) Glucose or galactose may bind with the repressor and inactivate it.
 - (ii) In the absence of lactose, the repressor binds with the operator region.
 - (iii) The z-gene codes for permease.
 - (iv) This was elucidated by Francois Jacob and Jacque Monod.
- (a) (ii) and (iii) (b) (i) and (iii) (c) (ii) and (iv) (d) (i) and (ii)
24. During elongation of polypeptide chain, sigma factor is
- (a) functionless.
 - (b) retained for specific function.
 - (c) released for re-use.
 - (d) required during closing of chain.

SECTION - B

DIRECTION: This section consists of 24 questions (Sl. No.25 to 48). Attempt any 20 questions from this section. The first attempted 20 questions would be evaluated.

Question No. 25 to 28: Consist of two statements Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (a) If both Assertion and Reason are True and the Reason is a correct explanation of the Assertion.
- (b) If both Assertion and Reason are True but Reason is not a correct explanation of the Assertion.
- (c) If the Assertion is True but Reason is False.
- (d) If both Assertion and Reason are False.

25. **Assertion :** The technique of DNA fingerprinting was initially developed by Alec Jeffreys.

Reason : The DNA fingerprinting technique involved southern blot hybridisation using radiolabelled VNTR as probe.

26. **Assertion :** The Human Genome Project was a 13-year project coordinated by the U.S. Department of Energy and the National Institute of Health.

Reason : During the early years of the HGP, the Wellcome Trust (U.K.) became a major partner; additional contribution came from Japan, France, Germany, China and others.

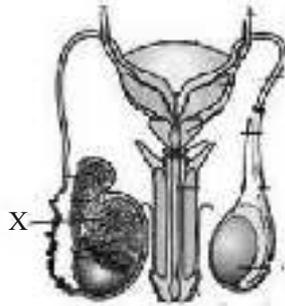
27. **Assertion:** HIV can also be transmitted by sharing of injection needles, surgical instruments etc. with infected persons, transfusion of blood or from an infected mother to the foetus too.

Reason: Hepatitis B, genital herpes and HIV infections are caused by bacterial infection.

28. **Assertion:** Condom should be used regularly and put on before starting coital activity, otherwise sperm containing lubricating fluid may be left in the vagina.

Reason: Condom should be reused again after two hours.

29. Identify the structure marked as “X” and its function in the given figure of male reproductive system.



- (a) Rete testis: It helps seminiferous tubule to open into vas efferentia.
 (b) Bulbourethral gland: It secretes alkaline mucus for lubricating the reproductive tract.
 (c) Vas efferentia: They have contractile mechanism that aids in the emission of seminal fluid.
 (d) Seminal vesicle: It synthesizes and secrete testicular hormone.
30. Read the following statement and answer the question.
 “The urethra originates from a structure (called ‘X’) and extends through the male external genitalia (called ‘Y’ which helps in introducing semen into the vagina) to its external opening called urethral meatus.”
 Identify X and Y.
- (a) X - Urinary bladder ; Y - Penis
 (b) X - Vas efferentia ; Y - Penis
 (c) X - Ejaculatory duct ; Y - Ureter
 (d) X - Bulbourethral gland ; Y - Ureter
31. The angiospermic endosperm, except in special cases, is a triploid (3n) tissue as it is product of triple fusion involving double fertilisation. It is, thus distinct from the endosperm of gymnosperms and heterosporous pteridophytes, where the endosperm is a
- (a) diploid before fertilisation
 (b) simple haploid (n) tissue of the gametophyte not involving any complication like polar fusion or fertilisation
 (c) polyploid formed after simple fertilisation
 (d) haploid formed after fertilisation
32. Select the correct statements regarding oogenesis.
- (i) It is initiated during the embryonic development stage when millions of oogonia are formed within each ovary.
 (ii) Graafian follicle releases primary oocyte from the ovary by ovulation.
 (iii) At puberty only 60,000 – 80,000 primary follicles are left in each ovary.
 (iv) Secondary oocyte within tertiary follicles grows in size and completes its second meiotic division.
- (a) (i), (ii) and (iii) (b) (i) and (iii) (c) (ii) and (iv) (d) all the four statements.
33. Which of the following STDs are not completely curable?
- (a) Chlamydia, gonorrhoea, trichomoniasis (b) Chancroid, syphilis, genital warts
 (c) AIDS, syphilis, hepatitis B (d) AIDS, genital herpes, hepatitis B
34. The first case of IVF-ET technique success, was reported by:
- (a) Bayliss and Starling Taylor (b) Robert Steptoe and Gilbert Brown
 (c) Louis Joy Brown and Banting Best (d) Patrick Steptoe and Robert Edwards
35. Which of the following method can be used for women who cannot produce ovum but can provide suitable environment?
- (a) IUD (b) GIFT (c) IUI (d) ICSI
36. The crossing of F_1 to homozygous recessive parent is called
- (a) back cross (b) test cross (c) F_1 cross (d) all of these
37. In fruit fly the maleness is determined by
- (a) Chromosomal ploidy (b) Ratio of X chromosome to Y chromosome
 (c) Presence of Y chromosome (d) None of these
38. Human blood grouping is ABO instead of ABC because O in it refers to
- (a) no antigen A or B on RBCs. (b) other antigens besides A and B.
 (c) overdominance of its gene over A and B. (d) one antibody only either anti-A or anti-B.
39. Which of the following diagram shows the sickle-cell anaemia condition?



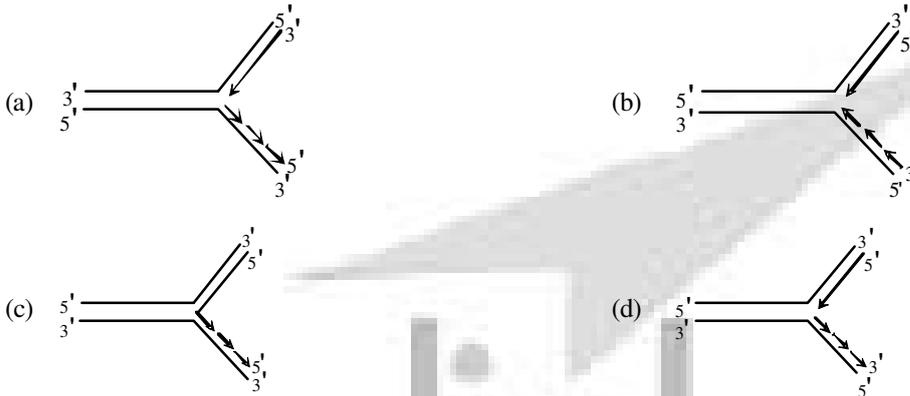
Fig A



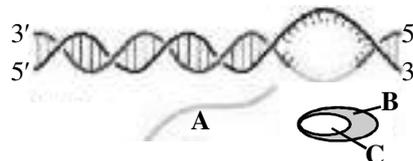
Fig B

- (a) Fig (A) (b) Fig (B) (c) Both Fig (A) & (B) (d) None of them

40. Round seed trait (R) is dominant over wrinkled (r) seed trait in Pea. Heterozygous round seeded plant (Rr) is crossed with wrinkled seeded plant (rr). What is the possibly progeny?
 (a) 302 round : 102 wrinkled (b) 210 round : 95 wrinkled
 (c) 105 round : 99 wrinkled (d) 103 round : 315 wrinkled
41. What will be the first three children. If the parents are heterozygous albino, the first three children will be
 (a) some normal, heterozygous and albino (b) normal
 (c) heterozygous albino (d) None of these
42. Identify the **incorrect** statement about RNA.
 (a) RNA was the first genetic material to evolve in the living systems.
 (b) Apart from being a genetic material, it is also a catalyst.
 (c) DNA evolved from RNA with chemical modifications.
 (d) RNA being a catalyst is non-reactive and stable.
43. In some viruses, RNA is present instead of DNA indicating that
 (a) their nucleic acid must combine with host DNA before replication.
 (b) they cannot replicate.
 (c) there is no hereditary information.
 (d) RNA can act to transfer heredity.
44. Which one of the following correctly represents the manner of replication of DNA?



45. Which of the following would you expect to find in an inducible system ?
 (a) A repressor protein, which is bound to DNA in absence of any other factor.
 (b) A repressor protein, which is bound to DNA in the presence of a co-repressor.
 (c) An activator protein, which is bound to DNA in the absence of any other factor.
 (d) An activator protein, which is bound to DNA only in the absence of air inhibitor.
46. Which of the following is **Not** a goal of the human genome project?
 (a) To sequence the genomes of selected model organisms.
 (b) To eliminate all diseases.
 (c) To consider social, ethical and legal aspects of genetic information.
 (d) To develop computational tools for analyzing sequence information.
47. Polymorphism in DNA sequence
 (a) is the basis of genetic mapping of human genome.
 (b) arises due to mutation.
 (c) is the basis of DNA finger printing.
 (d) All of the above
48. The given figure represent one of the step in the process of transcription in bacteria. Identify the step and label A, B & C marked in the figure.

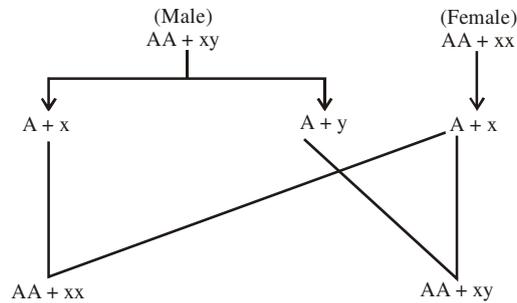


- (a) Initiation; A – DNA, B – RNA, C – Promoter
 (b) Termination; A – RNA, B – RNA polymerase, C – Rho factor
 (c) Elongation; A – RNA, B – RNA polymerase, C – Sigma factor
 (d) Elongation; A – DNA, B – DNA polymerase, C – RNA

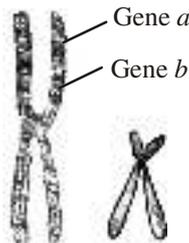
SECTION - C

DIRECTION: This section consists of one case followed by 6 questions linked to this case (Q.No.49 to 54). Besides this, 6 more questions are given. Attempt any 10 questions in this section. The first attempted 10 questions would be evaluated.

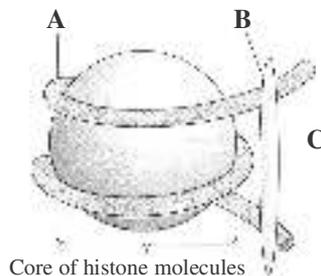
Observe the following schematic representation of determination of sex (xx-xy type mechanism) and answer the question that follows-



49. In an entity with genetic composition $AA + xxy$ such as *Drosophila* will be a normal female. In the case of mammals, it will be?
 - (a) Turner
 - (b) Klinefilter
 - (c) Normal female
 - (d) Normal male
50. _____ discovered by xy sex chromosome.
 - (a) MJD White
 - (b) R Brown
 - (c) Nettil Stevans
 - (d) Mendel
51. The number of Barr bodies are found in a female with $xxxy$ chromosomes
 - (a) four
 - (b) three
 - (c) two
 - (d) one
52. If a boy has sexual characters of that of a girl, its genotype would be
 - (a) xxy
 - (b) xyy
 - (c) xo
 - (d) xxy
53. The chromosomes accounted for sex determination are referred to as
 - (a) Heterosis
 - (b) Multiple alleles
 - (c) Allosomes
 - (d) Autosome
54. Which one of the following conditions correctly describes the manner of determining the sex in the given example?
 - (a) Homozygous sex chromosomes (ZZ) determine female sex in birds.
 - (b) XO type of sex chromosomes determine male sex in grasshopper.
 - (c) XO condition in human as found in Turner's syndrome, determines female sex.
 - (d) Homozygous sex chromosomes (XX) produce male in *Drosophila*.
55. The given figure is a highly simplified representation of the human sex chromosomes from a karyotype. The gene a and b could be of



- (a) colour blindness and body height.
 - (b) attached ear lobe and Rhesus blood group.
 - (c) haemophilia and red-green colour blindness.
 - (d) phenylketonuria and haemophilia.
56. The given figure shows the structure of nucleosome with their parts labelled as A, B & C. Identify A, B and C.



- (a) A – DNA; B – H_1 histone; C – Histone octamer
 - (b) A – H_1 histone; B – DNA; C – Histone octamer
 - (c) A – Histone octamer; B – RNA; C – H_1 histone
 - (d) A – RNA; B – H_1 histone; C – Histone octamer

- ★ Use Blue / Black Ball pen only.
- ★ Please do not make any stray marks on the answer sheet.
- ★ Rough work must not be done on the answer sheet.
- ★ Darken one circle deeply for each question in the OMR Answer sheet, as faintly darkened / half darkened circle might be rejected.

Start time : _____	End time _____	Time taken _____
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1. Name (in Block Letters)

□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
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2. Date of Exam

□	□	□	□	□	□
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3. Candidate's Signature

SECTION-A

1. (a) (b) (c) (d)	9. (a) (b) (c) (d)	17. (a) (b) (c) (d)
2. (a) (b) (c) (d)	10. (a) (b) (c) (d)	18. (a) (b) (c) (d)
3. (a) (b) (c) (d)	11. (a) (b) (c) (d)	19. (a) (b) (c) (d)
4. (a) (b) (c) (d)	12. (a) (b) (c) (d)	20. (a) (b) (c) (d)
5. (a) (b) (c) (d)	13. (a) (b) (c) (d)	21. (a) (b) (c) (d)
6. (a) (b) (c) (d)	14. (a) (b) (c) (d)	22. (a) (b) (c) (d)
7. (a) (b) (c) (d)	15. (a) (b) (c) (d)	23. (a) (b) (c) (d)
8. (a) (b) (c) (d)	16. (a) (b) (c) (d)	24. (a) (b) (c) (d)

SECTION-B

25. (a) (b) (c) (d)	33. (a) (b) (c) (d)	41. (a) (b) (c) (d)
26. (a) (b) (c) (d)	34. (a) (b) (c) (d)	42. (a) (b) (c) (d)
27. (a) (b) (c) (d)	35. (a) (b) (c) (d)	43. (a) (b) (c) (d)
28. (a) (b) (c) (d)	36. (a) (b) (c) (d)	44. (a) (b) (c) (d)
29. (a) (b) (c) (d)	37. (a) (b) (c) (d)	45. (a) (b) (c) (d)
30. (a) (b) (c) (d)	38. (a) (b) (c) (d)	46. (a) (b) (c) (d)
31. (a) (b) (c) (d)	39. (a) (b) (c) (d)	47. (a) (b) (c) (d)
32. (a) (b) (c) (d)	40. (a) (b) (c) (d)	48. (a) (b) (c) (d)

SECTION-C

49. (a) (b) (c) (d)	53. (a) (b) (c) (d)	57. (a) (b) (c) (d)
50. (a) (b) (c) (d)	54. (a) (b) (c) (d)	58. (a) (b) (c) (d)
51. (a) (b) (c) (d)	55. (a) (b) (c) (d)	59. (a) (b) (c) (d)
52. (a) (b) (c) (d)	56. (a) (b) (c) (d)	60. (a) (b) (c) (d)

No. of Qns. Attempted		Correct		Incorrect		Marks	
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Page for Rough Work

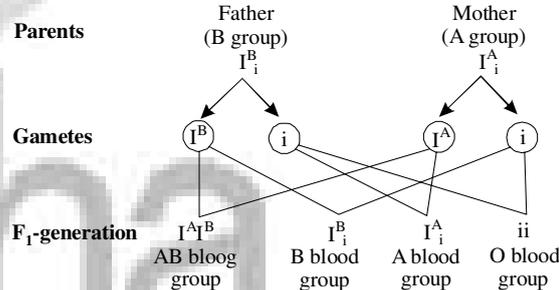
Sample Paper

3

ANSWER KEYS																			
1	(b)	7	(d)	13	(a)	19	(d)	25	(a)	31	(b)	37	(d)	43	(d)	49	(b)	55	(c)
2	(c)	8	(a)	14	(c)	20	(c)	26	(b)	32	(b)	38	(a)	44	(d)	50	(c)	56	(a)
3	(b)	9	(c)	15	(c)	21	(c)	27	(c)	33	(d)	39	(b)	45	(a)	51	(b)	57	(c)
4	(b)	10	(c)	16	(b)	22	(b)	28	(c)	34	(d)	40	(c)	46	(b)	52	(a)	58	(b)
5	(b)	11	(a)	17	(b)	23	(c)	29	(a)	35	(b)	41	(a)	47	(d)	53	(c)	59	(b)
6	(c)	12	(a)	18	(d)	24	(a)	30	(a)	36	(b)	42	(d)	48	(b)	54	(b)	60	(b)

SOLUTIONS

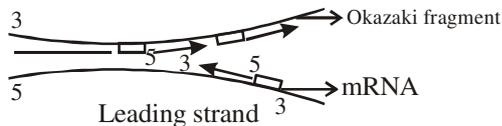
- (b)
- (c) After the transformation of spermatids into sperm, their heads become embedded in a cell called sertoli cells (X) and are finally released from the seminiferous tubule (Y) by the process called spermiation (Z).
- (b) When placenta fails to supply nutrients and oxygen to the body during the gestation period, this causes premature birth.
- (b)
- (b) 'B' are the secondary spermatocytes which further undergoes meiosis II to produce two haploid spermatids.
- (c) The coconut water from tender coconut is nothing but free nuclear endosperm (made up of thousands of nuclei) and the surrounding white kernel is the cellular endosperm. Female gametophyte is embryo sac.
- (d) The given figure is three dimensional cut section of anther. A typical angiosperm anther is bilobed with each lobe having two theca i.e., they are dithecous. Here P, Q and R are pollen sacs, pollen grains and filament respectively.
- (a) Development of male gametophyte is called micro-gametogenesis. One meiotic division and two mitotic divisions are necessary for the complete development of male gametophyte. Male gametophyte when fully developed is a 3 nucleate structure.
- (c) In a seed of maize, the scutellum is considered as cotyledon because it absorbs food materials and supplies them to the embryo.
- (c) Chalazogamy
Such type of fertilization in which pollen tube enter into the embryo sac through the chalaza is called chalazogamy.
- (a) Synergids bear prominent structure called 'filiform' apparatus which are finger like projections. This apparatus is present in upper part of each synergid. This apparatus is useful for the absorption and transportation of materials from the nucellus to the embryo sac.
- (a)
- (a)
- (c)
- (c) When a cross is carried out between heterozygous father (for blood group B) and heterozygous mother (of blood group A) to get four children with different blood groups.



All the four blood group are controlled by three allelic gene I^A , I^B , i and thus it shows phenomenon of multiple allelism, Both I^A and I^B is dominant over i . However, when both the alleles are dominant and show the phenomenon of codominance, forming the blood group AB, six genotypes are possible with combination of these three alleles. Thus, other options are incorrect.

- (b) Incomplete dominance results in the progeny's expressing an intermediate form of the two parental alleles. (In a cross between red-flowered plants and white-flowered plants, the expression of pink-flowered plants would be a "blend" of the parental traits). Codominance is not an example of blending because both alleles are fully expressed in the individual.
- (b) Since the offspring number 11 is affected (diseased), either of the two parents (6 or 7) have to be affected.
- (d) Haemophilia is an X-linked trait, and can only be inherited by the son from his mother's X-chromosome. The father contributes the Y-chromosome to his son (not his X-chromosome) and thus cannot pass any of his X-linked alleles to his son.

19. (d) On template strand which has 5' → 3' orientation, DNA polymerase synthesizes short pairs on new DNA (about 1000 nucleotide long) in 5' → 3' direction and then joins these piece together. These small fragments are called **okazaki fragments** and new DNA strand made in this discontinuous manner is called **lagging strand**. Okazaki fragments are joined by means of DNA ligase.



20. (c) In capping, unusual nucleotide (methyl guanosine triphosphate) is added to 5' end of hn-RNA and forms cap. CCA segment is also added to t-RNA as terminal addition for specific function.
21. (c) The process of protein synthesis is catalyzed by ribosomal RNA. Messenger RNA provides the genetic blueprint for the protein. Transfer RNA is responsible for translating the triplet code into a specific amino acid. Messenger RNA molecules are modified prior to protein synthesis by small nuclear RNA.
22. (b) tRNA or transfer RNA is a single stranded molecule and takes the shape of a clover leaf. In the process of transcription tRNA brings amino acid and reads the genetic code and acts as an adapter molecule. In the given structure of tRNA, the labels A, B, C and D are respectively AA binding site (amino acid binding site), T ψ C loop, anticodon loop (codon recognition site) and DHU loop (amino acid recognition site).
23. (c) Jacob and Monod proposed the *lac* operon of *E. coli*. The *lac* operon contains a promoter, an operator, and three structural genes called Z, Y, and A, coding for the enzyme, β galactosidase, permease and transacetylase respectively. The *lac* regulator gene, designated as *i* gene, codes for repressor. In the absence of the inducer, the repressor binds to the *lac* operator, preventing RNA polymerase from binding to the promoter and thus transcribing the structural gene.
24. (a) The function of sigma factor is to confer the specificity of RNA synthesis at the promoter site. But during elongation of polypeptide chain, sigma factor is functionless.
25. (a) Assertion and Reason are correct and the Reason is a correct explanation of Assertion. In the DNA fingerprinting technique, satellite DNA acts as probe that shows very high degree of polymorphism. It was called as Variable Number of Tandem Repeats (VNTR).
26. (b) Assertion and Reason are correct but Reason is not a correction explanation of Assertion. The human Genome project was started in 1990 and was completed in 2003.
27. (c) Assertion is true but Reason is false. Hepatitis B, genital herpes and HIV infections caused by Hepatitis B virus, Herpes simplex type 2 virus and Human Immuno deficiency virus (HIV) respectively. These diseases are difficult to cure.
28. (c) Assertion is true but Reason is false. Condom should be discarded after a single use. It is also a safeguard against infection of AIDS and sexual diseases.
29. (a) The structure marked as X is rete testis. The rete testis is an seminiferous network of delicate tubules located in the hilum of the testicle (mediastinum testis) that carries sperm from the seminiferous tubules to the efferent ducts.
30. (a) The urethra originates from a structure [called urinary bladder (X)] and extends through the male external genitalia [called penis (Y) which helps in introducing semen into the vagina] to its external opening called urethral meatus.
31. (b)
32. (b) Graafian follicle releases secondary oocyte from the ovary by the process of ovulation. Primary oocyte within the tertiary follicle grows in size and completes its first meiotic division.
33. (d) AIDS, genital herpes and hepatitis B are sexually transmitted diseases which are not completely curable.
34. (d)
35. (b) Gamete Intrafallopian Transfer technique is used for such females who cannot produce ovum. This method involves the transfer of ovum collected from a donor into the fallopian tube of another who cannot produce egg but provide a suitable environment for fertilisation.
36. (b) The crossing of F₁ to homozygous recessive parent is called test cross. Test cross is a cross between two individuals in which one individual shows the dominant phenotype of a characteristic and the other individual who is homozygous recessive for that trait in order to determine the genotype of the dominant individual.
37. (d) It is determined by the ratio of number of X-chromosomes to the number of autosomal sets.
38. (a)
39. (b) Fig (b) In sickle-cell anaemia, the cell of the RBC changes its shape from concave disc to elongated sickle like structure.
40. (c) 41. (a)
42. (d) RNA used to act as a genetic material as well as a catalyst (in some important biochemical reactions). But, RNA being a catalyst is reactive and unstable.
43. (d) RNA and DNA both are genetic material and carry genetic information from one generation to other. A virus is a small parasite that cannot reproduce by itself. Most viruses have either RNA or DNA as their genetic material. Once a virus infects a susceptible cell, it can direct the cell machinery to produce more viruses.
44. (d) The given figure represents the figure of replication fork of DNA. The new strands of DNA are formed in the 5' → 3' direction from the 3' → 5' template DNA by the addition of deoxyribonucleotides to the 3' end of primer RNA.
45. (a) Inducible system includes a repressor protein which is bound to DNA in the absence of any other factor.

46. (b) Human genome project was launched in the year 1990. It is an international scientific research project having the goal to determine the sequence of base pairs which make up human DNA, and to identify and map all of the genes of the human genome.
47. (d) Polymorphism in DNA sequence is a variation at genetic level. It arises due to mutation and is the basis of genetic mapping of human genome as well as of DNA fingerprinting.
48. (b) In the given figure, the step shown is termination of transcription in bacteria. The label A, B and C are respectively RNA, RNA polymerase and rho factor. RNA polymerase is an enzyme that synthesizes the formation of RNA from a DNA template during transcription. Rho factor is a termination factor which releases RNA from the DNA template.
49. (b) 50. (c) 51. (b) 52. (a) 53. (c)
54. (b) XO type of sex chromosomes determine male sex in grasshoppers. This type of sex-determination comes under XX-XO type. Its common examples are cockroaches, grasshoppers and bugs. The female has two homomorphic sex chromosomes XX and is homogametic. It produces similar eggs, each with one X-chromosome. The male has one chromosome only and is heterogametic. It produces 2 types of sperms : gynospers with X and androspers without X. In grasshopper, the males lack Y-sex chromosome and have only an X-chromosome besides autosomes whereas females have a pair of X-chromosomes. Male produce sperm cells that contain either an X-chromosome or no sex chromosome, which is designated as O.
55. (c) In the given figure of sex chromosomes, gene a and b present on X chromosomes represent disorders-haemophilia and red green colour blindness. Both these disorders occur due to recessive sex linked genes present on sex chromosomes. Red green colour blindness is more common in males than females due to presence of only one X chromosomes. The sufferers are not able to distinguish red and green colour.
56. (a) Nucleosome is a structural unit of a eukaryotic chromosome which consists of a length of DNA coiled around a core of histones and are thought to be present only during interphase of cell cycle. In the given figure of nucleosome structure, the parts marked as A, B and C are respectively DNA, H1 histones and histone octamer.
57. (c) In R, the fallopian tubes have been blocked, and in S, they are cut out. Both the procedures completely make it impossible for fertilization to occur.
58. (b) Fig (b) is a wind pollinated plant showing compact inflorescence and well exposed stamens. Pollination by wind is more common amongst abiotic pollinations. Wind pollination also requires that the pollen grains are light, small, dry and non-sticky so that they can be transported in wind currents. Both the stigmas and anthers are exserted. Anthers are versatile, stigma is hairy, feathery or branched to catch the wind borne pollen grains.
59. (b) Spermatogonia are undifferentiated germ cells which originate in seminiferous tubules and divide into two primary spermatocytes (a kind of germ cell) in the production of spermatozoa.
60. (b) 
- The given figure shows the concept of central dogma of molecular biology. In this question A is transcription, B - translation.