

Sample Paper

4

Time : 90 Minutes

Max. Marks : 50

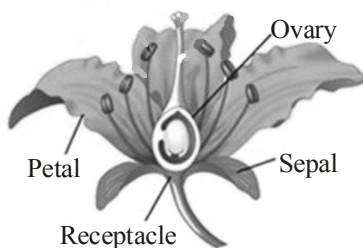
General Instructions

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

SECTION-A

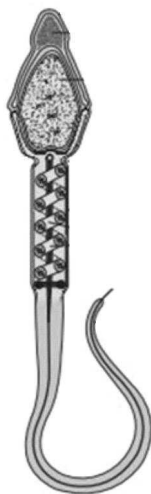
DIRECTION: This section consists of 24 questions. Attempt any 20 questions from this section. The first attempted 20 questions would be evaluated.

1. The outermost and innermost wall layers of microsporangium in an anther are respectively.
(a) Endothecium and tapetum (b) Epidermis and endodermis
(c) Epidermis and middle layer (d) Epidermis and tapetum
2. The structure ruptures when "water breaks" in pregnancy
(a) placenta (b) amniotic fluid
(c) chorionic sac (d) amniochorionic membrane
3. From among the sets of terms given below, identify those that are associated with the gynoecium.
(a) Stigma, ovule, embryo sac, placenta
(b) Thalamus, pistil, style, ovule
(c) Ovule, ovary, embryo sac, tapetum
(d) Ovule, stamen, ovary, embryo sac
4. The phenomenon wherein, the ovary develops into a fruit without fertilisation is called
(a) parthenocarpy (b) apomixis
(c) asexual reproduction (d) sexual reproduction
5. Flower with all the four type of floral organs is

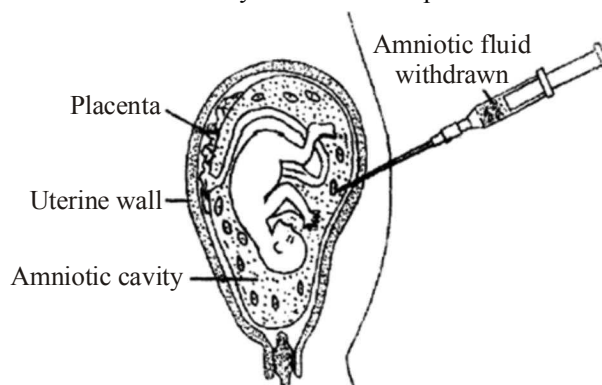


- (a) Regular (b) Irregular (c) Complete (d) Perfect
6. Egg is liberated from ovary in
(a) Secondary oocyte stage (b) Primary oocyte stage
(c) Oogonial stage (d) Mature ovum stage

7. _____ provides energy to the sperm for its movement.

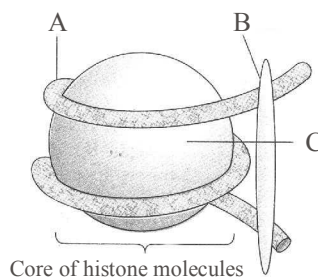


- (a) Tail (b) Middle piece (c) Head (d) Acrosome
8. Which one is a primary sex organ?
 (a) Testis (b) Scrotum (c) Prostate (d) Penis
9. Seminal plasma in human males is rich in :
 (a) fructose and calcium (b) glucose and calcium
 (c) DNA and testosterone (d) ribose and potassium
10. Which of the following tests cannot be examined by Amniocentesis procedure?



- (a) Chromosome analysis (b) Detecting genetic defects
 (c) Maturity of fetal lungs (d) None of these
11. Tapetum is
 (a) parietal in origin usually the inner most layer of anther wall.
 (b) modified endothecium of anther wall.
 (c) modified outer most layer of sporogenous tissue.
 (d) parietal in origin and is the inner most layer of ovule wall.
12. All genes located on the same chromosome
 (a) Form different groups depending upon their relative distance
 (b) Form one linkage group
 (c) Will not form any linkage group
 (d) Form interactive group that affect the phenotype
13. Mendel's law of independent assortment holds good for genes situated on the
 (a) non - homologous chromosomes
 (b) homologous chromosomes
 (c) extra nuclear genetic element
 (d) Same chromosome

14. The incorrect statement with regard to Haemophilia is :
(a) It is a recessive disease
(b) It is a dominant disease
(c) A single protein involved in the clotting of blood is affected
(d) It is a sex-linked disease
15. Genetic variation in a population arises due to
(a) Mutations only
(b) Recombination only
(c) Mutations as well as recombination
(d) Reproductive isolation and selection
16. Mutations can be induced with :
(a) infra red radiations
(b) IAA
(c) ethylene
(d) gamma radiations
17. Across between parents with A and AB blood groups results in the offspring with which of the following blood groups?
(a) only A
(b) only B
(c) A, B and AB
(d) only O
18. Which one from those given below is the period for Mendel's hybridization experiments?
(a) 1840 - 1850
(b) 1857 - 1869
(c) 1870 - 1877
(d) 1856 - 1863
19. Transcription in prokaryotic cell is :
(a) initiated at a promoter using one of three RNA polymerases (RNA polymerase II).
(b) initiated at a start codon with the help of initiation factors and the small subunit of the ribosome.
(c) initiated at a promoter and uses only one strand of DNA, the template strand, to synthesize a complementary RNA strand.
(d) is terminated at stop codons.
20. Chargaff's rules of base pairing states that
(a) the ratio of purines to pyrimidines is roughly equal in all tested organisms.
(b) the ratio of A to T is roughly equal in all tested organisms.
(c) the ratio of A + T and G + C is roughly equal in all tested organisms.
(d) Both (a) and (c)
21. One of the most frequently used techniques in DNA fingerprinting is
(a) AFLP
(b) VNTR
(c) SSCP
(d) SCAR
22. Which of the following is not a property of the genetic code?
(a) Universal
(b) Non-overlapping
(c) Ambiguous
(d) Degeneracy
23. Given diagram is labelled as A, B and C. Label B indicates



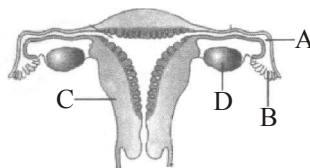
- (a) DNA
(b) Histone octamer
(c) H1 histone
(d) None of them
24. Uridine, present only in RNA is a
(a) Pyrimidine
(b) Nucleoside
(c) Nucleotide
(d) Purine

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.

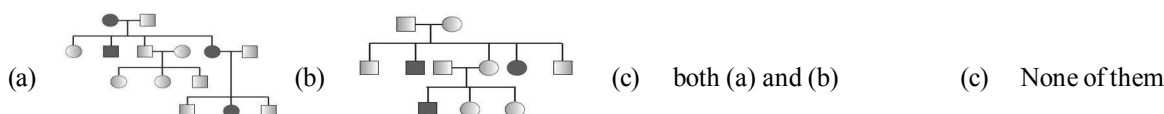
Question No. 25 to 28: Consist of two statements Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (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:** In very rare cases, a surrogate mother may have to be used to bring up in vitro fertilised ovum to maturity.
Reason: Success rate of test tube baby is more than 90%.
26. **Assertion:** Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone (GnRH).
Reason: The increased levels of GnRH then acts at the anterior pituitary gland and stimulate secretion of two gonadotropins –LH and FSH.
27. **Assertion:** Spermatogenesis requires 72-74 days to get completed.
Reason: Sperms reach the epididymis and stay there for 2-3 days for maturation i.e., to become motile.
28. **Assertion:** The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome.
Reason: The acrosome is formed by the Golgi complex of the spermatid.
29. Refer to the given diagram and select the option that correctly identifies the labelled part along with its characteristic.

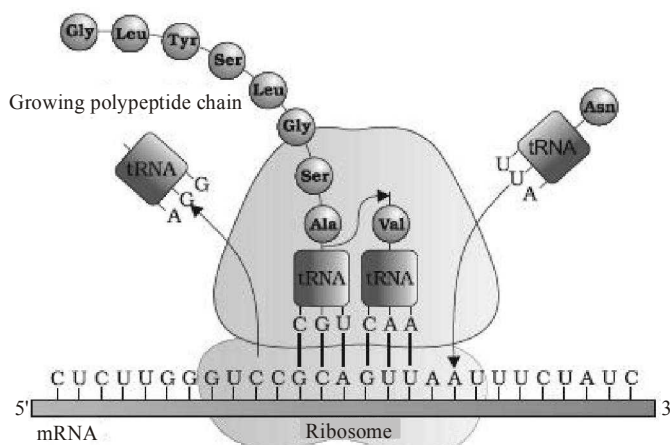


- (a) A-Ampulla – Site of blastocyst implantation
 (b) B-Fimbriae – Collect ova
 (c) C-Myometrium – Shed during menstrual bleeding
 (d) D-Ovary – Secrete hCG
30. Which of the following options is correct?
- | Haploid | Diploid |
|----------------------------|------------------------|
| (a) Secondary oocyte | Primary spermatocyte |
| (b) Secondary spermatocyte | Secondary oocyte |
| (c) Primary oocyte | Secondary spermatocyte |
| (d) Ovum | Spermatid |
31. Which of the following pair has haploid structures?
- (a) Nucellus and antipodal cells
 (b) Antipodal cells and egg cell
 (c) Antipodal cells and megaspore mother cell
 (d) Nucellus and primary endosperm nucleus
32. Choose the correct sequence of events that occur in human reproduction.
- (a) Gametogenesis → insemination → fertilisation → implantation → gestation → parturition
 (b) Gametogenesis → gestation → insemination → fertilisation → implantation → parturition
 (c) GestatIO n → gametogenesis → insemination → implantation → fertilisation → parturition
 (d) Gametogenesis → insemination → gestation → implantation → fertilisation → parturition
33. MTP is practised mainly to –
- (a) get rid of unwanted female child legally .
 (b) get rid of unwanted pregnancies due to failure of contraception of rapes.
 (c) both (a) and (b).
 (d) decrease population size.

34. Action of vaginal diaphragm is –
 (a) prevent the ova to come in the uterus
 (b) prevent the sperm to come in contact with ova
 (c) spermicidal
 (d) anti-implantational
35. The study of formation, growth and development of new individual from an egg is called
 (a) embryology (b) embryogenesis (c) morphogenesis (d) embryolysis
36. A mutation at a single locus causes a change in many different characters. This is an example of a
 (a) polygene effect (b) epigenetic effect (c) cytoplasmic effect (d) pleiotropic effect
37. The genotypes of a husband and Wife are $I^A I^B$ and $I^A i$.
 Among the blood types of their children, how many different genotypes and phenotypes are possible?
 (a) 3 genotypes ; 4 phenotypes (b) 4 genotypes ; 3 phenotypes
 (c) 4 genotypes ; 4 phenotypes (d) 3 genotypes ; 3 phenotypes
38. Pick out the correct statements :
 1. Haemophilia is a sex-linked recessive disease
 2. Down's syndrome is due to aneuploidy
 3. Phenylketonuria is an autosomal recessive gene disorder.
 4. Sick cell anaemia is a X-linked recessive gene disorder
 (a) (1) and (4) are correct (b) (2) and (4) are correct
 (c) (1), (3) and (4) are correct (d) (1), (2) and (3) are correct
39. Which of the above diagram shows autosomal dominant trait?

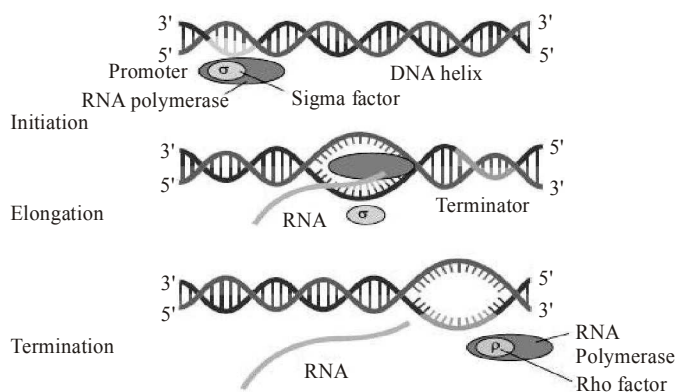


40. Occasionally, a single gene may express more than one effect. The phenomenon is called
 (a) multiple allelism (b) mosaicism (c) pleiotropy (d) polygeny
41. A colour blind man marries a woman with normal sight who has no history of colour blindness in her family.
 What is the probability of their grandson being colour blind?
 (a) 1 (b) Nil (c) 0.25 (d) 0.5
42. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?
 (a) super-coiling in nucleosomes
 (b) DNase digestion
 (c) through elimination of repetitive DNA
 (d) deletion of non-essential genes
43. The net electric charge on DNA and histones is
 (a) both positive (b) both negative (c) both (a) and (b) (d) zero
44. The given diagram represents the process of



- (a) Replication (b) Transcription (c) Translation (d) All of them

45. A disease caused by an autosomal primary non-disjunction is
 (a) Klinefelter's Syndrome (b) Turner's Syndrome
 (c) Sickle Cell Anemia (d) Down's Syndrome
46. Which one of the following cannot be explained on the basis of Mendel's Law of Dominance?
 (a) The discrete unit controlling a particular character is called a factor
 (b) Out of one pair of factors one is dominant, and the other recessive
 (c) Alleles do not show any blending and both the characters recover as such in F_2 generation.
 (d) Factors occur in pairs
47. Thirty percent of the bases in a sample of DNA extracted from eukaryotic cells is adenine. What percentage of cytosine is present in this DNA?
 (a) 10% (b) 20% (c) 30% (d) 40%
48. The given diagram represents the process of transcription in eukaryotes or prokaryotes.

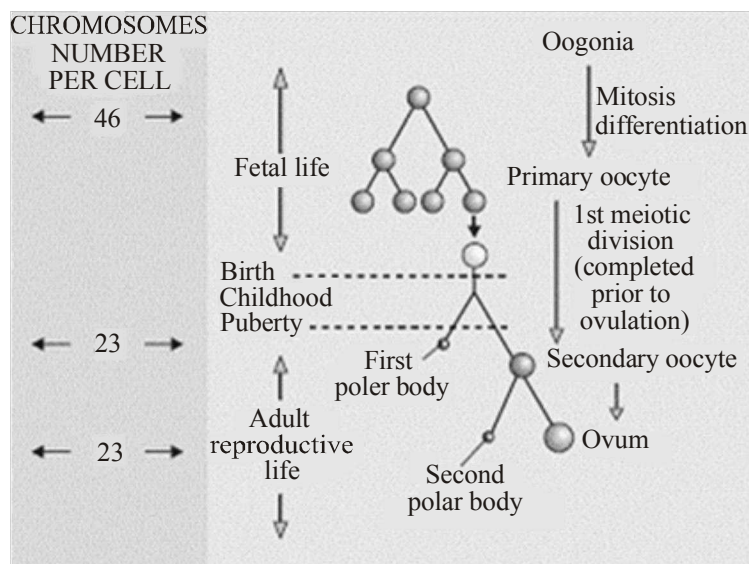


- (a) Eukaryotes (b) Prokaryotes (c) Both of them (d) None of them

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.

Case: Refer to the below mention diagram and answer the questions that follows-

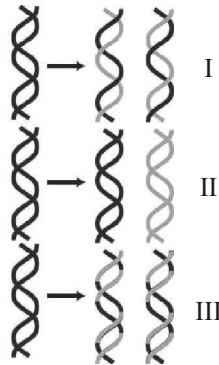


49. What is the process of the formation of a mature female gamete called?
 (a) Menstruation (b) Spermatogenesis (c) Oogenesis (d) Ovulation
50. The onset of oogenesis occurs during _____
 (a) puberty (b) birth (c) adulthood (d) embryonic development

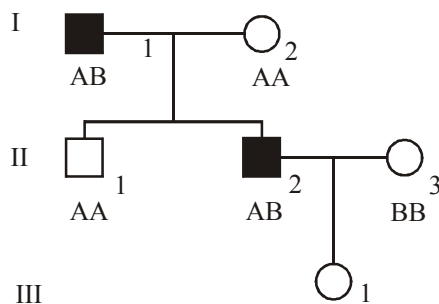
51. What is the stage of the cell cycle at which primary oocytes are arrested?
 (a) Prophase I (b) Metaphase I (c) Prophase II (d) Metaphase II
52. A person with tetraploidy will have _____ set of chromosomes in their first polar body.
 (a) haploid (b) triploid (c) diploid (d) polyploid
53. The division of primary oocyte into the secondary oocyte and first polar body is an example of _____.
 (a) symmetric division (b) asymmetric division
 (c) Cell death (d) asexual reproduction
54. Which of the following is the correct set of ploidy and cell type?
 (a) Primary oocyte: Diploid; Secondary oocyte: Haploid; Ovum: Haploid
 (b) Primary oocyte: Haploid; Secondary oocyte: Haploid; Ovum: Haploid
 (c) Oogonium: Diploid; Primary oocyte: Diploid; Secondary oocyte: Diploid
 (d) Oogonium: Diploid; Primary oocyte: Haploid; Secondary oocyte: Haploid
55. What does the structure of DNA resemble?



- (a) A triple chain (b) A twisted ladder (c) Blueprints (d) A twisted ball
56. Which of the following figure represents the conservative replication of DNA?

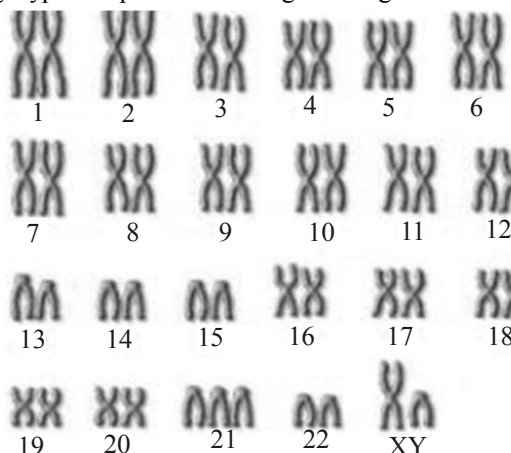


- (a) Figure I (b) Figure III (c) Figure II (d) None of them
57. In this pedigree A and B represent alleles at a marker locus closely linked to the disease locus. Affected individuals are shown as shaded. The disease status in III 1 is unknown. Which of the following is correct?

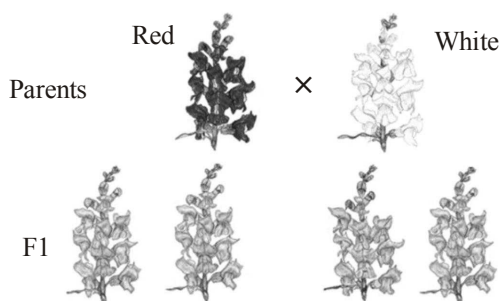


- (a) The probable pattern of inheritance shown by the disease in this family is autosomal recessive.
 (b) If recombination does not occur the probability that III 1 will be affected if she has an AB marker genotype is 1.
 (c) If recombination does not occur, the probability that III 1 will be affected if she has a BB marker genotype is 1.
 (d) If the recombination fraction between the disease and marker loci equals 0.04, the probability that III 1 will be affected if she inherits an AB marker genotype equals 0.9

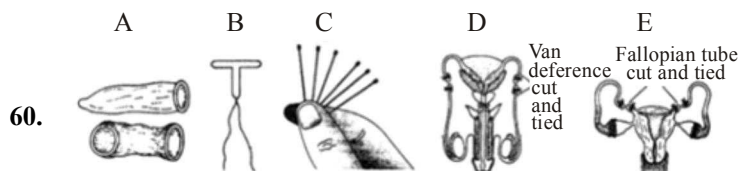
58. The figure below displays the karyotype of a person suffering from a genetic disorder. Identify the disorder:



- (a) Down's syndrome
(b) Klinefelter's syndrome
(c) Turner's syndrome
(d) Cri du chat syndrome
59. If snapdragons demonstrate incomplete dominance in flower color, what would be the result of a cross between a red-flowered snapdragon with a white-flowered snapdragon?



- (a) All the offspring will have white flowers
(b) All the offspring will have pink flowers.
(c) All the offspring will have red flowers.
(d) Three-fourths of the offspring will have red flowers and one-fourth will have white flowers.



- | | | | |
|--------------|------------------|---------------|-------------|
| I. Tubectomy | II. Vasectomy | III. Implants | IV. Condoms |
| V. Copper T | V. Cervical caps | | |
- (a) A – VI; B – V; C – III; D – II; E – I
(b) A – III; B – V; C – IV; D – I; E – II
(c) A – IV; B – V; C – III; D – II; E – I
(d) A – VI; B – V; C – IV; D – I; E – II

Sample Paper

4

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



- (d) A typical microsporangium is generally surrounded by four-wall layers, *i.e.*, the epidermis (outermost protective layer) endothecium, (middle fibrous layers) and the tapetum (innermost nutritive layer).
- (d) 3. (a)
- (a) The formation of seedless fruits without fertilisation is parthenocarpy. The fruits developed from unfertilised ovary are called parthenocarpic fruits.
- (c) 6. (a) 7. (b) 8. (a)
- (a) Seminal plasma in human males are rich in fructose, calcium and certain enzymes. They provide a medium for transport of sperms, nourishes and activates sperms.
- (c) 11. (a)
- (b) All the genes, present on a particular chromosome form a linkage group. The number of linkage group of a species correspond to the total number of different chromosome of that species. It is not simply the number of chromosome in haploid set.
- (a) **Non-homologous Chromosome:** The law of independent assortment holds true as long as two different genes are on separate chromosomes. When the genes are on separate chromosome, the two alleles of one gene (A and a) will segregate into gametes independently of the two alleles of the other gene (B and b).
- (b) Haemophilia is sex linked recessive disease in which a simple protein that is a part of protein cascade involved in clotting of blood is affected. Due to this, in an affected individual a simple cut will result in non stop bleeding.
- (c) Crossing over leads to recombination of genetic material on the two chromosomes. Mutation results in alternation of DNA sequences and consequently results in change in the genotype and the phenotype of an organism. In addition to recombination, mutation is another phenomenon that leads to variation in DNA.
- (d) Mutation can be induced by gamma radiation.
- (c)
- (d) Mendel conducted hybridization experiments for 7 years on Pea plant between 1856 to 1863 and his data was published in 1865.
- (c) Option (a) describes transcription in eukaryotic cells; Option (b) describes translation.
- (d) Chargaff found that the relative ratios of purine to pyrimidines were equal. Adenine and guanine are purines and cytosine and thymine are pyrimidines; therefore, ratios of adenine and thymine should be equal. Chargaff also found that there is no conserved ratio between specific pairs (e.g., A + T and G + C).
- (b) 22. (c) 23. (c)
- (b) The combination of pentose sugar with nitrogenous bases (purines or pyrimidines) is called nucleoside. Examples are adenosine, guanosine, cytidine, thymidine and uridine.
- (c) Assertion is true but Reason is false. Success rate of test tube baby is less than 20%.
- (b) Assertion and Reason are true, but Reason is not the correct explanation of Assertion. Gonadotropin releasing hormone (GnRH) is a hypothalamic hormone.
- (c) Assertion is true but Reason is false. Sperms reach the epididymis and stay there for 8-17 days for maturation.
- (b) Assertion and Reason are true, but Reason is not the correct explanation of Assertion. The acrosome is filled with enzymes that help in fertilisation of the ovum.

29. (b) The vas deferens is a continuation of the cauda epididymis. It is about 40 cm long and enters the abdominal cavity through the inguinal canal. Then, it passes over the urinary bladder, curves round the ureter and joins a duct from seminal vesicle and opens into urethra as the ejaculatory duct. These ducts store and transport the sperms from the testis to the outside through urethra.

30. (a) Spermiogenesis is the process of release of spermatozoa from Sertoli cells into the cavity of the seminiferous tubules. From here, sperms pass through vasa efferentia into the epididymis for temporary storage.

31. (b) 32. (a) 33. (b) 34. (b) 35. (a) 36. (d)

37. (b) Husband $\times$ Wife
 $I^A I^B$ $I^A i$

$\begin{smallmatrix} O \\ + \end{smallmatrix}$ $\begin{smallmatrix} \sigma \\ \nearrow \end{smallmatrix}$	I^A	I^B
I^A	$I^A I^A$	$I^A I^B$
i	$I^A i$	$I^B i$

Number of genotypes = 4

Number of phenotypes = 3

$I^A I^A$ and $I^A i$ = A

$I^A I^B$ = AB

$I^B i$ = B

38. (d) Sickle cell disease is inherited in an autosomal recessive pattern.

39. (a)

40. (c) Pleiotropy is a phenomenon in which a single gene may express more than one trait. Sometimes, one trait will be very evident and other will be less evident, e.g., a gene for white eye in *Drosophila* also affect the shape of organs is male responsible for sperm storage as well as other structures.

Multiple allelism is a series of three or more alternative or allelic forms of a gene, that can occupy the same locus.

Mosaicism is the occurrence of cells that differ in their genetic component from other cells of the body.

Polygeny refers to a single characteristics that is controlled by more than two genes. (It is also known as multifactorial inheritance).

41. (c)

42. (a) The nucleosome model explains the packaging of histone proteins and DNA in the chromatin material which forms the chromosome.

43. (c) 44. (c)

45. (d) Down's syndrome is caused by non-disjunction of 21st chromosome i.e. Trisomy.

46. (c) According to Mendel's law of Dominance, out of two contrasting allelomorphous factors only one expresses itself in an individual. The factor that expresses itself is called

dominant while the other which has not shown its effect in the heterozygous individual is termed as recessive. The option (c) in the given question cannot be explained on the basis of law of dominance. It can only be explained on the basis of Mendel's Law of independent assortment, according to which in a dihybrid cross, the two alleles of each character assort independently of the alleles of other character and separate at the time of gamete formation.

47. (b) If 30% of DNA is adenine, then by Chargaff's rule 30% will be thymine. The remaining 40% of the DNA is cytosine and guanine. Since the ratio of cytosine to guanine must be equal, then each accounts for 20% of the bases.

48. (b)

49. (c) Spermatogenesis is the process of the production of mature sperms from spermatogonia, while oogenesis is the process of the formation of mature female gametes from oogonia.

50. (d) Oogenesis starts right from the embryonic development stage. Oogonia divide to form primary oocytes that are arrested at Prophase I.

51. (a) Oogonia are formed during fetal development. Soon they start undergoing meiosis but are arrested at Prophase I awaiting further cues of division. Oogonia at this stage are called primary oocytes.

52. (c) Oogenesis is the production of a haploid secondary oocyte from a diploid oogonium and in the process resulting in the production of two polar bodies, each of which is haploid. Naturally, a tetraploid person having tetraploid oogonia will produce diploid polar bodies and a diploid oocyte

53. (b) Asymmetric division refers to the unequal distribution of cytoplasm between the daughter cells. Primary oocyte undergoes the first round of meiosis, producing a large haploid secondary oocyte and a tiny first polar body. Thus this is an instance of asymmetric division.

54. (a) The diploid oogonium goes through the first round of meiosis to form primary oocyte, which is arrested at Prophase I. Thus, the primary oocyte is also diploid. The division is completed after the formation of the secondary oocyte, which is haploid. The secondary oocyte undergoes another round of meiosis to form haploid ovum.

55. (b) 56. (c)

57. (c) The pedigree points to autosomal dominant inheritance with two generation involvement and male to male transmission II 2 has inherited both the disease and allele B from his father. Therefore if III 1 inherits allele A from her father the probability that she will be affected equals 0 if there is no recombinant or 0.04 if the recombination fraction = 0.04.

58. (a) 59. (b) 60. (c)