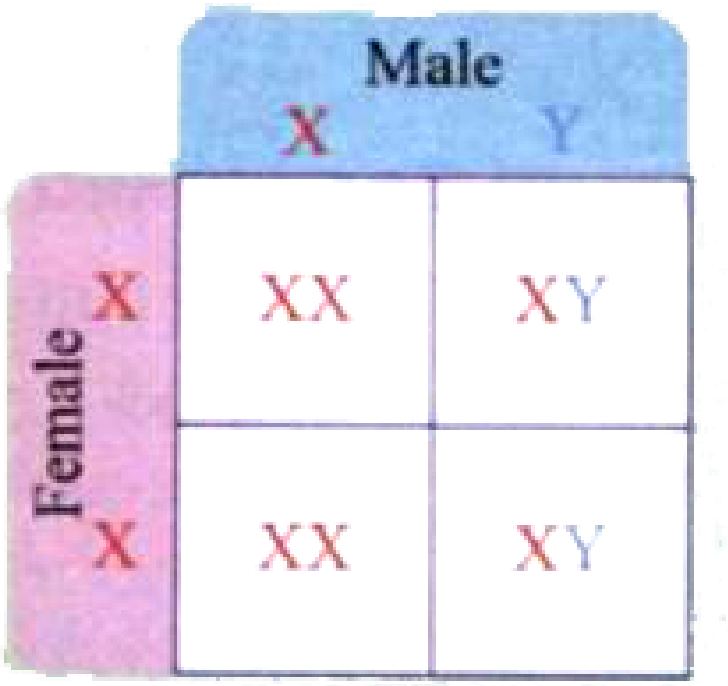
BIOLOGY

BOOKS - CENGAGE BIOLOGY

CHROMOSOMAL THEORY OF INHERITANCE AND GENETIC DISORDERS

Question

1. The figure below shows a punnett square that crosses a male and a female. What are the chances of having a boy or a girl?



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2. Red -green color blindness is caused by a sex-linked recessive allele. A colourblind man marries a woman with normal vison whose father was colour-blind. What is the probability that they will have a colour-blind daughter?

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3. Why are dominant x-linked traits seen is women more commonly than in men ?

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Mandatory Exercise

1. Mention the salient features of chromosomal theory of inheritance.

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2. Sex of the offspring is determined by

(A) only the mother, because she has two X chromosomes

(B) only the father, because he has one X and one Y chromosome

(C) an X chromosome from the mother and either an X or Y chromosome from the father

(D) mutations

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3. Down's syndrome is an example of

(A) incomplete dominance

(B) genetic engineering

(C) a chromosome disorder

(D) a sex-linked disorder

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4. What are the main conventional symbols and signs used in genetic family trees? What is a genetic family tree?

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5. The genetic disorders can be grouped under two broad categories - sex-linked disorders and chromosomal disorders. Which one of two can be traced in a family by pedigree chart? Name two such disorders.

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6. The egg of an animal contains 10 chromosomes, of which one is X chromosome.

How many autosomes would there be in the karyotype of this animal?

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7. How is the child affected if it has grown from the zygote formed by an XX-egg fertilized by a Y-carrying sperm? What do you call this abnormality? List out the symptoms.

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8. A woman of 47 years delivered an abnormal child with flattened nasal bridge and mouth usually open with a large protruding tongue. Name this genetic abnormality. What causes this condition?

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9. In humans the sex of the child is determined by the father and not by the mother. How?

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10. Pattern baldness is sex-linked, but cannot be expressed normally in females.

(a) If a carrier marries a pattern-bald man, what are the possible genotypes of their children?

(b) If female is homozygous for pattern baldness (but does not express the trait due to hormones) and she marries a normal man, what percentage of her sons will be pattern bald?

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11. Action of ultraviolet rays on DNA is

(A) induction of thymidine dimers

(B) deletion of base pair

(C) addition of base pair

(D) methylation of base pair

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12. A women with normal vision, but whose father was colour blind, marries a colour blind

man. Suppose that the fourth child of this couple was a boy. This boy

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13. Haemophilia is a condition, where there is

(A) no production of haemoglobin in the blood

(B) no production of melanin in the skin

(C) a failure of clotting mechanism of blood

(D) a delay in clotting of blood

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14. A woman who has haemophilia marries a normal man. How many of their children will have haemophilia and what is their sex?

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15. Identify each of the alterations of chromosome structure.

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16. How does sickle cell anemia affect the red blood cells?

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17. If mother and father are both sickle cell carriers, what are the chances that the child will not have the trait?

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Mandatory Consolidated Exercise

1. Shilpa's father is colourblind, as is her maternal grandfather (her mother's father). Shilpa herself has normal sight but carrier for colourblind. Shilpa and her husband, Sanjay who is also colourblind, have just had their first child, a son they have named Arjun. Answer the following questions about this small family:

(a) What is the probability that this child will be colour-blind?

(b) Three sources of the colour-blindness allele are mentioned in this family. If Arjun is

colourblind from which of these three men (Shilpa's grandfather, Shilpa's father or Sanjay) did he inherit the allele?

(c) Using proper pedigree format, diagram the available information about the four generation of this family described, assuming that Arjun is colourblind.

(d) If Sanjay was not colourblind, how would this affect the prediction about Arjun?

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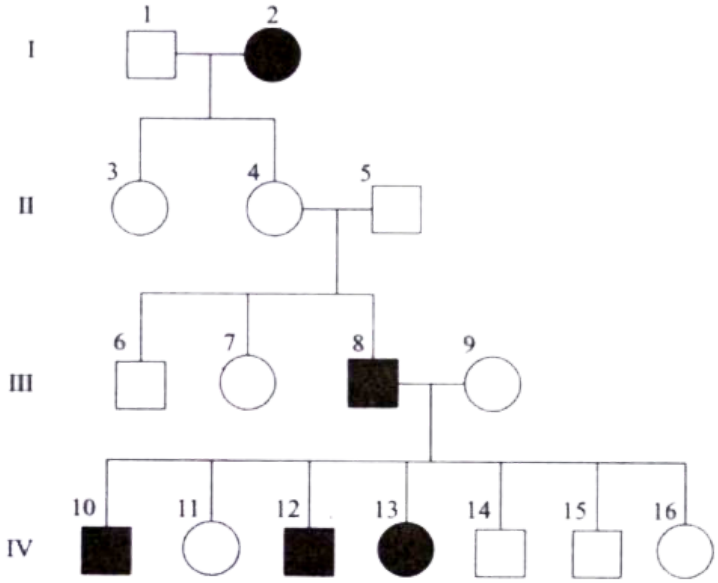
2. Use the pedigree to answer the questions below:



In a pedigree, a square represents a male. If it is darkened he has haemophilia, if clear, he had normal blood clotting.

(i) How many males are there?

(ii) How many males have haemophilia?

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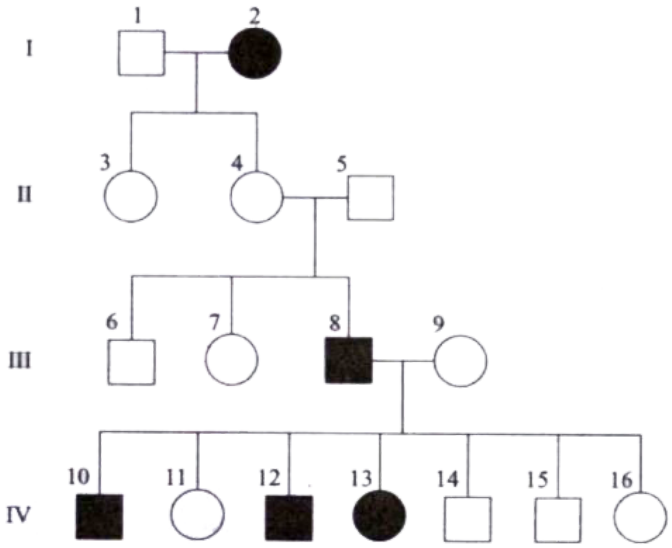
3. Use the pedigree to answer the questions below:



A circle represents a female. If it is darkened, she has haemophilia, if clear she is normal.

(i) How many females are there?

(ii) How many females have haemophilia?

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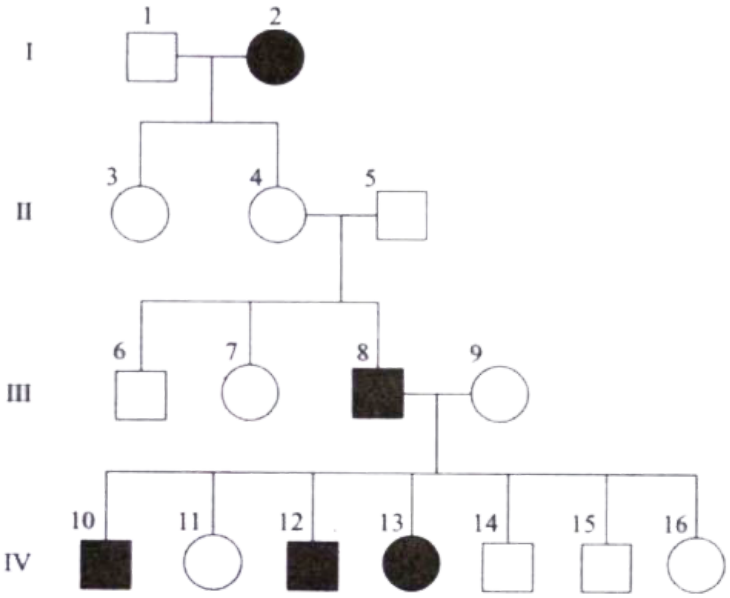
4. Use the pedigree to answer the questions below:



A marriage is indicated by a horizontal line connecting a circle to a square. How many marriages are there?

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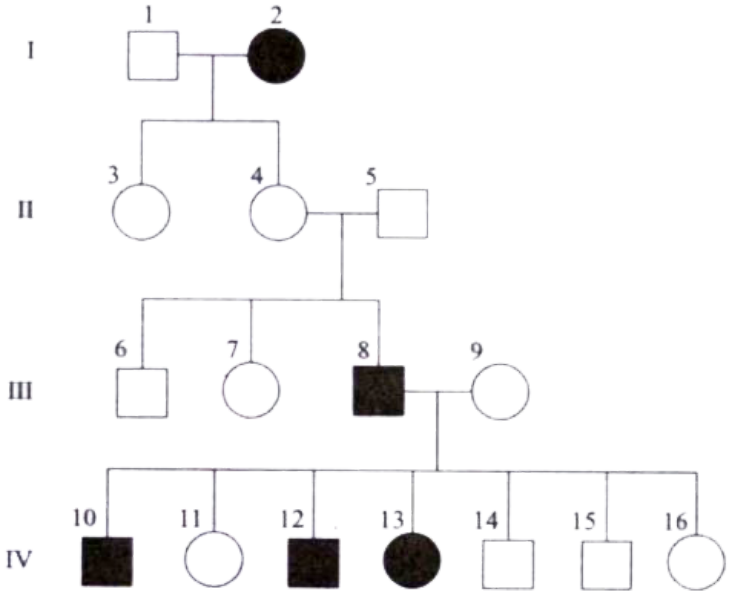
5. Use the pedigree to answer the questions below:



Females with haemophilia have an easy genotype to indentify. They are all X^nX^n. Both recessive alleles must be present for a femalc to have haemophilia. If one dominant

allele is present (X^N), the individual would be normal for clotting. How many females have the genotype X^nX^n?

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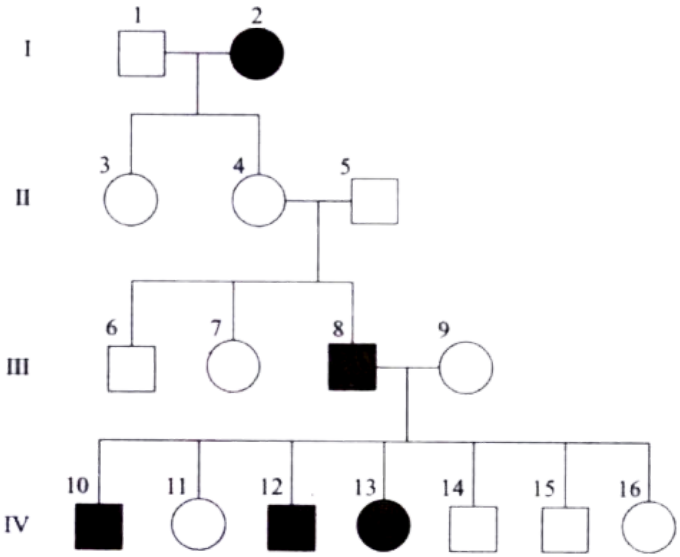
6. Use the pedigree to answer the questions below:



Females who do not show the trait for haemophilia may be homozygous dominant $\left(X^N X^N\right)$ or heterozygous $\left(X^N X^n\right)$. The heterozygous female is called a carrier. If any child has haemophilia, then the female (mother) must be heterozygous.

(i) What would be the genotype for the female who marries into the family in generation III?

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Mandatory Multiple Choice Questions With One Or More Than One Correct Answer

1. In sickle cell anaemia, the glutamic acid is replaced by

A. proline

B. valine

C. nine

D. alanine

Answer: B

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2. In human males all the chromosomes are paired perfectly except one. This/these unpaired chromosome is/are

A. large

B. Y chromosome

C. small chromosome

D. X-chromosome

Answer: B::C

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3. Which of the following describes the allele that causes colour blindness?

A. Recessive

B. Carried on the Y chromosome

C. Carried on the X chromosome

D. Present only in males

Answer: A::C

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4. The genetic event that results in Klinefelter syndrome (XXY) is probably

A. nondisjunction

B. deletion

C. parental imprinting

D. allosomal aneuploidy

Answer: A::D

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5. A normal female whose father was colourblind marries a normal male whose father was also colour-blind. What is the probability that their son will be colour-blind?

A. $0\ \%$

B. $25\ \%$

C. $50\ \%$

D. $75\ \%$

Answer: C

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6. Mutations used in agriculture are commonly

A. lethal

B. induced

C. spontaneous

D. recessive and lethal.

Answer: B

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7. Haemophila is

A. Christmas disease

B. X-linked recessive disease

C. Y-linked recessive disease

D. bleeder's disease

Answer: A::B::D

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8. Which one is related to chromosomal abnormality?

A. Aneuploidy

B. Cyanosis

C. Klinefelter's syndrome

D. AIDS

Answer: A::C::D

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9. Number of chromosomes present in human is

A. 23

B. 46

C. 92

D. 96

Answer: B

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10. The representation of sex-chromosome 2A + x x in human is

A. Female

B. Male

C. Intersex

D. Meta male

Answer: A

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11. Genic balance theory was given by

A. Bridges

B. Morgan

C. Boveri

D. Muller

Answer: A

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12. Which one of the following defects in man is due to sex-linked inheritance?

A. Albinism

B. Colour blindness

C. Beri-beri

D. Rickets

Answer: B

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13. Any abrupt change in genetic material which is inheritable is called

A. Allele

B. Gene

C. Mutation

D. Mutagene

Answer: C

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14. Genome represents

A. Haploid chromosome set

B. Complete chromosome set

C. Diploid chromosome set

D. All the genes present in the population

Answer: A

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15. Mutation is discovered by

A. Mendel

B. Bateson

C. Hugo-de Vries

D. Punnet

Answer: C

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16. Autosomes in humans are

A. 22 pairs

B. 11 pairs

C. 10 pairs

D. 6 pairs

Answer: A

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17. Mutation causing agents are called

A. Mutagene

B. Cytogene

C. Crossing over

D. Linkage

Answer: A

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18. When an animal has both the characters of male and female,it is called:

A. Intersex

B. Gynandromorphy

C. Super female

D. Super male

Answer: B

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19. In Down 's syndrome of a male child , the sex complement is

A. XO

B. XY

C. XX

D. XXY

Answer: B

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20. Trisomic conditions are

A. n-1

B. 2n+1

C. 2n+2

D. 2n-2

Answer: B

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21. Ishiara charts are used by ophthalamologist for detecting

A. Eye infection

B. Night blindness

C. Color blindness

D. Finger prints

Answer: C

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22. A mutation at a gene locus changes a character due to the change in

A. DNA structure

B. Protein structure

C. RNA structure

D. All of the above

Answer: B

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23. A segment of chromosome breaks and rejoins after rotation, it is

A. Duplication

B. Translocation

C. Inversion

D. Deletion

Answer: C

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24. Phenylketonuria is an autosomal recessive disorder of chromosome

A. 11

B. 12

C. 16

D. 17

Answer: B

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25. Red colour blindness is due to the lack of pigment

A. Cyanolabe

B. Chlorolabe

C. Erythrolabe

D. None

Answer: C

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26. Sex chromosomes of birds are

A. ZZ-ZW

B. ZZ-WW

C. XX-XY

D. XO-XX

Answer: A

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27. The tips of chromosomes are known as

A. Centromere

B. Chromomere

C. Telomere

D. Satellite

Answer: C

28. Mutations that devoelop suddnely in nature are

A. Spontaneous

B. Induced

C. Gene mutation

D. Point Mutation

Answer: A

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29. Christmas disease is another name of

A. Haemophilia

B. Colour blindness

C. Thalassaemia

D. Cystic fibrosis

Answer: A

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30. Which one of the following conditions though harmful in itself ,is also a potential saviour from a mosqutio borne infectious disease?

A. Thalassemia

B. Sickle cell anaemia

C. Leukemia

D. Pernicious anaemia

Answer: B

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31. In Melandrium sex determination is of

A. XX-XO

B. ZZ-ZW

C. XX-XY

D. XY-XO

Answer: C

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32. If a diploid cell is treated with colchicine, then it becomes

A. 2n

B. 3n

C. 4n

D. n

Answer: C

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33. Colchicine is obtained from

A. Colchium autumnale

B. Solanum

C. Allium

D. Oenothera

Answer: A

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34. Ear with hairy pinnae is called

A. Colour blindness

B. Hypophosphatemia

C. Hypertrichosis

D. Haemophilia

Answer: C

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35. Chromosomes are made up of

A. DNA + pectin

B. RNA + DNA

C. DNA only

D. DNA + histones protein

Answer: D

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36. Cytoplasmic inheritance is due to

A. Chloroplast

B. Mitochondria

C. Both B and A

D. Golgi body

Answer: C

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37. Change in number of chromosome is called

A. Chromosomal aberration

B. Aneuploidy

C. Both A and B

D. None

Answer: B

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38. A chromosome with sub terminal centromere is

A. Acentric

B. Acrocentric

C. Metacentric

D. Telocentric

Answer: B

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39. Cris-cross inheritance is characteristics of

A. Y-linked

B. X-linked

C. X-linked and Y-linked

D. None of these

Answer: B

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40. Role of chromosomes in sex determination was proposed by

A. Boveri

B. Henking

C. McClung

D. Morgan

Answer: C

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41. Turner's syndrome of female is due to the chromosome

A. 2A + XXY

B. 2A + XXX

C. 2A + XO

D. 2A + XY

Answer: C

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42. Arrangement of chromosome of the basis of shape and size is called

A. Idiogram

B. Karyotype

C. Chromatid

D. Mutation

Answer: B

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43. _____ is the failure of chromosome to separate.

A. Non-disjunction

B. Disjunction

C. Conjugation

D. None

Answer: A

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44. Fractional change in number of chromosome is called

A. Euploidy

B. Aneuploidy

C. Parthenogenesis

D. All of these

Answer: B

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45. X-chromosome is

A. Telocentric

B. Metacentric

C. Acrocentric

D. Acentric

Answer: B

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Mandatory Olympiad And Ntse Level Exercises

1. Women have sex chromosomes of XX and men have sex chromosomes of XY. Which of a man's grandparents could not be the source of any of the genes on his Y-chromosome?

A. Father's mother

B. Father's father

C. Mother's mother

D. Mother's mother, mother's father and father's mother

Answer: D

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2. Blood types are controlled by a single gene with multiple alleles. The alleles for A and B are codominant. The allele for O is recessive to both A and B. The chart shows the genotypes for the blood types for the human population.

Blood Type	Genotypes
A	I^AI^A, I^Ai
B	I^BI^B, I^Bi
AB	I^AI^B
O	I^AI^O / ii

Which blood type would not be possible for

children of a type AB mother and a type A father?

A. O

B. A

C. B

D. AB

Answer: A

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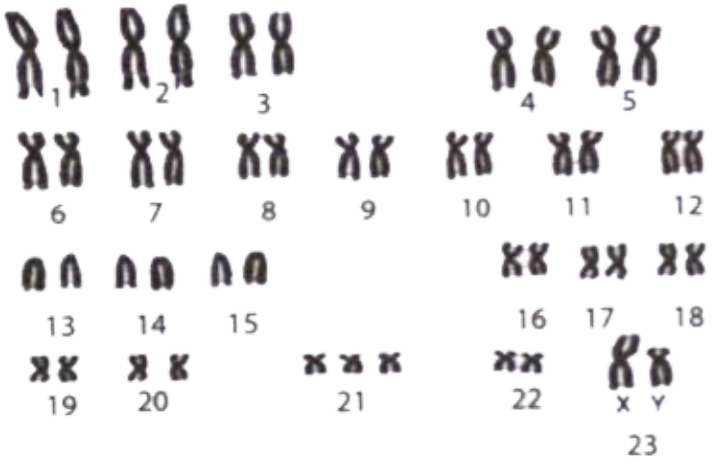
3. The diagram represents the chromosomes of a person with a genetic disorder caused by nondisjunction in which the chromosomes fail to separate properly. Which chromosome set display non-disjunction? What is the syndrome?



A. Chromosome set 21, Down's syndrome

B. Chromosome set 21, Klinefelter's syndrome

C. Chromosome set 23, Klinefelter's syndrome

D. Chromosome set 23, Turner's syndrome

Answer: A

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4. In the progeny of a colour blind woman and a normal man

A. all the daughters are normal

B. all the sons are colour blind

C. all the sons and all the daughters are colour blind

D. all the daughters are colour blind

Answer: B

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5. Which of the following genetic diseases show criss-cross pattern of inheritance?

A. haemophilia and colour blindness

B. haemophilia, colour blindness and hypertrichosis of ear

C. albinism and sickle cell anaemia

D. Klinefelter's syndrome and Turner's syndrome

Answer: A

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6. Albinism, lack of pigmentation in humans, results from an autosomal recessive gene designated a Parents with normal pigmentation have an albino child. What is the probability that their next child be albino? What is the probability that the next child will be an albino girl?

A. $1/2, 1/4$

B. $1/4, 1/2$

C. $1/4, 1/8$

D. $1/8, 1/4$

Answer: B

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7. The problem of erythroblastosis foetalis occurs when

A. both father and mother are Rh positive

B. both father and mother are Rh negative

C. mother is Rh positive and father is Rh negative

D. father is Rh positive and mother is Rh negative

Answer: D

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8. An individual of blood group A has

A. antigen A in the RBCs and anti-B antibodies in plasma

B. antigen B in the RBCs and anti-A antibodies in plasma

C. antigen A in the plasma and anti-B antibodies in RBCs

D. antigen A and anti-B antibodies in RBCs

Answer: A

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9. A child of O blood group was born to a mother of blood group A and father of blood group B. What are the genotypes of parents?

A. mother-I_(A),I_(A). , $father$ – I_(B)I_(B)`

B. mother-I_AI_O, father-I_BI_O

C. mother-I_BI_B, father-I_AI_A

D. mother - I_BI_O, father- I_AI_O

Answer: B

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10. Which of the following statement is true with reference to X-linked recessive traits in human beings?

A. They express equally in both the sexes.

B. They express more in males than in females.

C. They express more in females than in males.

D. They express only in males.

Answer: B

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Mandatory Challenging Exercise

1. A woman has a daughter. There are three men whom she claims might have been the father of the child. The judge in the paternity court orders that all three men, the child and the mother to have blood tests. The results are mother, Type A, daughter, type O, Man #1,

Type A, Man #2, Type B, Man #3, type O. The mother claims that this proves that Man #3 must be the little girl's father.

(a) Is the mother correct? Why or why not?

(b) The judge is not satisfied, so he asks the medical records of the people involved. He discovers that the little girl is colorblind. Men # 1 and 2 are also colour-blind, Man #3 has normal vision, as does the mother (Note: colour-blind is X-linked and recessive). Assuming that one of these three men must be the father, can you now determine which of the three it is?

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2. An unaffected woman whose father had haemophilia marries a man who has haemophilia. What is the chance their sons will be haemophiliacs? What is the chance that their daughters will be haemophiliacs?

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3. Genetic counseling helps individuals determine the genetic risk or probability a disorder will be passed to offspring. Why would a pedigree be a very important tool for the counselors? Which pattern of inheritance (dominant, recessive, X-linked) would be the easiest to detect?

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