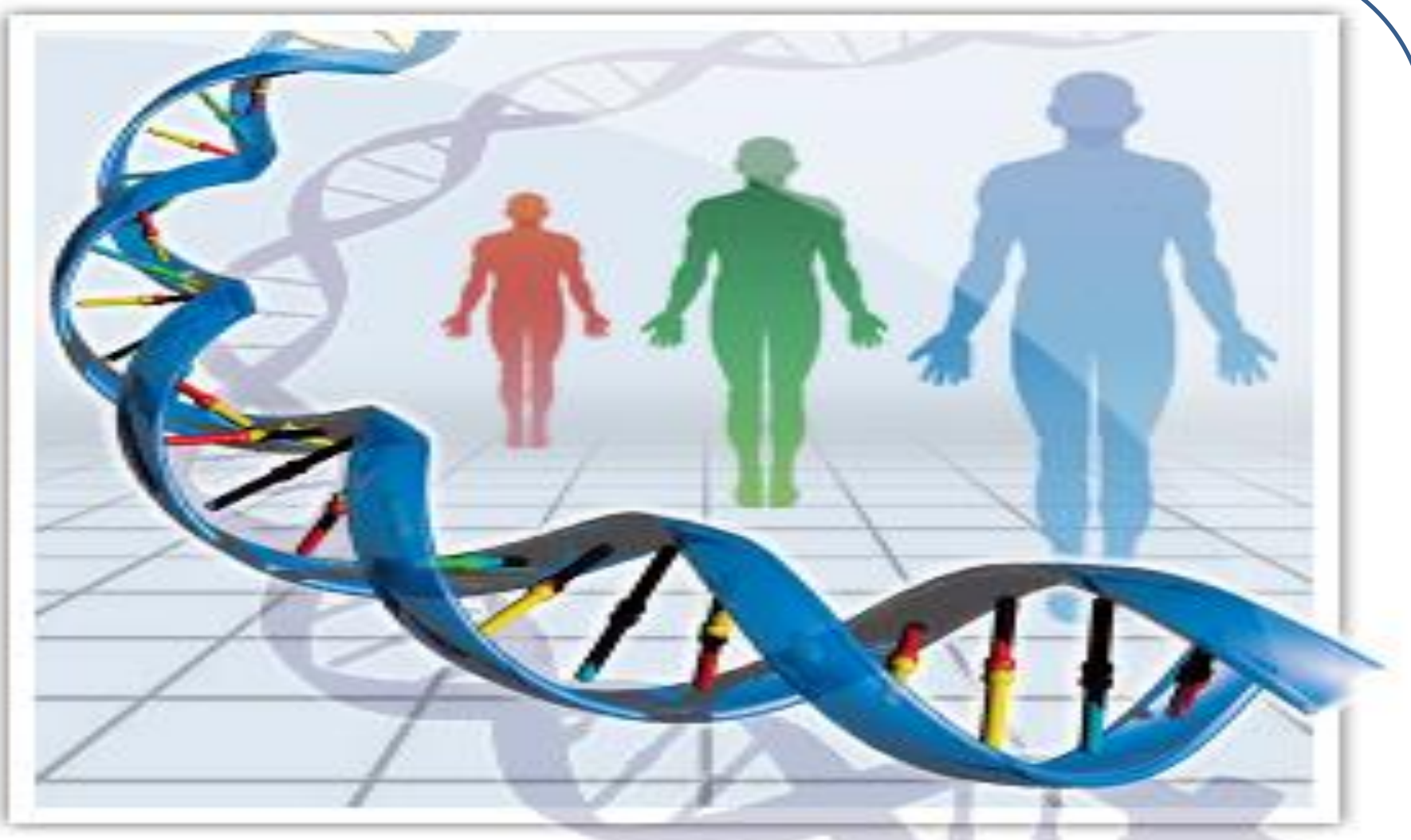
CHAPTER 22

Variations and Genetics



- Exercise Short Answers
- Important Short Answers
- Exercise MCQ's
- Important Additional MCQ's
- Past MDCAT MCQ's

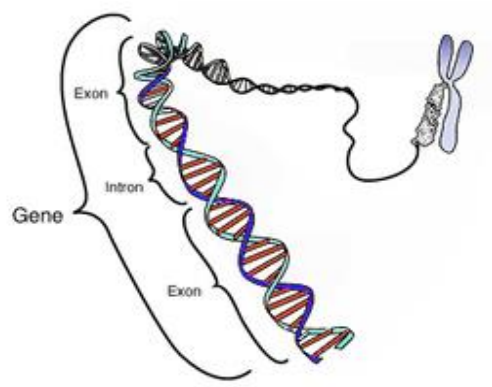
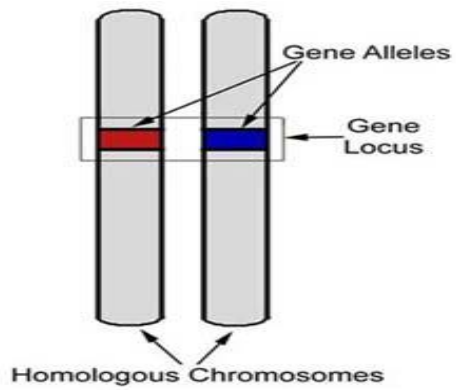
Exercise Short Answer

Q:1 Differentiate between.

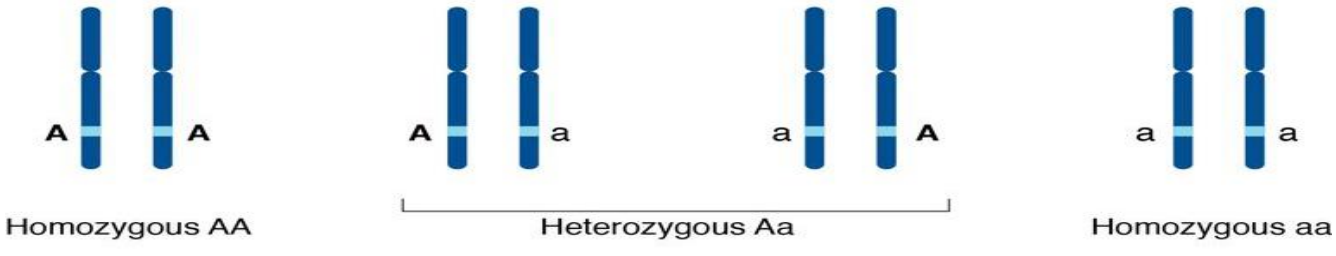
a) Phenotype and Genotype:

Phenotype	Genotype
• Phenotype is a form of appearance of a trait.	• Genotype is the genetic complement i.e., the genes in an individual for a particular trait.
• The physical and physiological appearance in an individual for a trait is phenotype.	• In it genes and alleles are counted for a particular trait.
• Phenotypic ratio for Mendelian trait will be 3:1.	• While genotypic ratio for Mendelian trait will be 1:2:1.
• **Examples:** 1. Flower color is a trait; red and white are its two phenotypes respectively. 2. Tallness, seed color of pea plants, ABO blood group in human.	• **Examples:** 1. Red and white trait is further determined by different genetic combination alleles. Allele 'R' for red and 'r' for white. 2. TT or Tt for pea plant height.

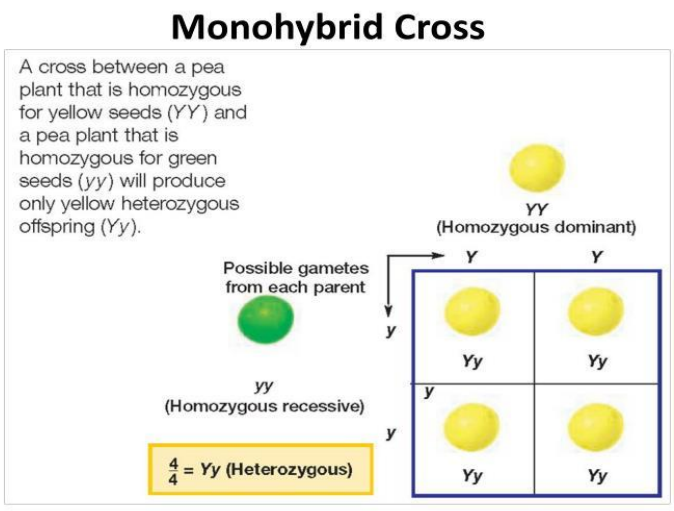
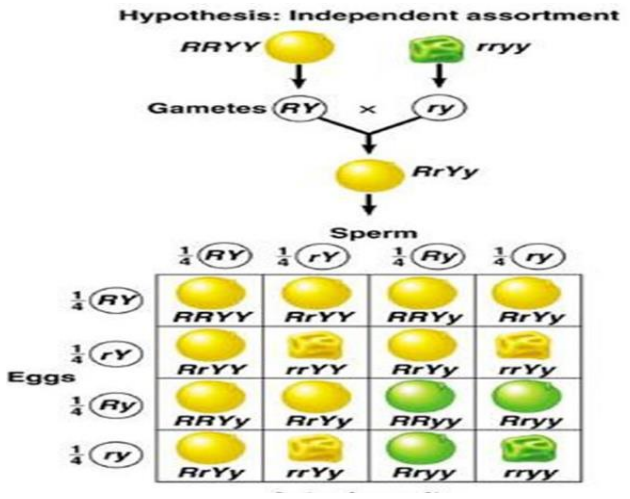
b) Gene and Allele:

Gene	Allele
• Gene is the basic unit of biological information. **OR** • A gene is a segment of DNA which controls a specific trait.	• Alternative form of a gene is called allele.
• Genes are actually parts of DNA comprising its base sequences.	• Alleles are partners of gene pair.
• Genes are the different parts of the DNA that decide the genetic traits a person is going to have.	• Alleles are the different sequences on the DNA-they determine a single characteristic in an individual.
• Genes cannot show varieties like allele.	• Allele may be in homozygous or heterozygous state.
• Gene is used as broad sense.	• While alleles are various shade or variations among a single gene.
• **Example:** Seed shape is a gene.	• **Example:** while round and wrinkled are 2 alleles/variations.
	

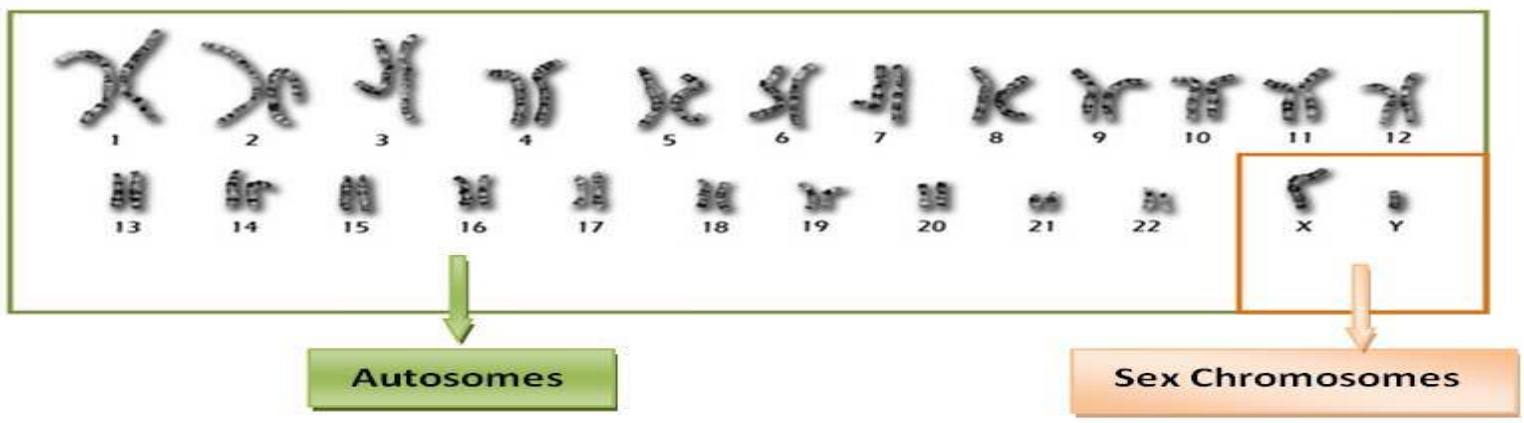
c) Homozygous or Heterozygous:

Homozygous	Heterozygous
• When both the alleles of a gene pair in an organism are same, the organism is homozygous for that pair. **OR** • Individual having same sets of alleles for a trait.	• When both the alleles of a gene pair in an organism are different, the organism is heterozygous for that pair. **OR** • Individual having different sets of alleles for a trait.
• Such individuals are said to be pure or true breed.	• Such individuals are said to be hybrid or recombinant.
• **Example:** ''RR'' is for homozygous round and "rr" for homozygous wrinkled.	• **Example:** "Rr" is heterozygous round.
	

d) Monohybrid and Dihybrid:

Monohybrid	Dihybrid
• Offspring of the parents who differ in one contrasting pair of trait but has homozygous condition in all other traits is called monohybrid.	• Offspring of the parents who differ in two contrasting pair of traits is called dihybrid.
• The cross between two monohybrid organisms is called monohybrid cross.	• The cross between two dihybrid organisms is called dihybrid cross.
• **Examples:** 1. Tt, in this example pea plant is homozygous in all traits except one i.e. plant height. 2. Offspring of cross of true breeding of round and wrinkled seeds.	• **Examples:** 1. TtRr, in this example pea plant is homozygous in all traits except plant height and seed shape. 2. Offspring of a cross of round yellow and wrinkled green seeds.
	

e) Autosomes and Sex-chromosomes:

Autosomes	Sex-chromosomes
• All the chromosomes other than sex-chromosomes are called autosomes.	• The chromosomes which are responsible for determination of sex (male or female) are called sex chromosomes.
• Number of autosomes is higher in a cell than the number.	• Number of sex-chromosomes is usually just a pair in a diploid individual.
• **Example:** One pair XX female and XY male determining chromosomes in human.	• **Example:** Twenty two pairs of chromosomes in human are autosomes.
	

f) Dominance and Epistasis:

Dominance	Epistasis
• Dominance is a physiological effect of an allele over its partner allele on the same gene locus.	• When an effect caused by a gene or gene pair at one locus interferes with or hides the effect caused by another gene or gene pair at another locus, such a phenomenon of gene interaction is called epistasis. **OR** • It is interaction between different genes occupying different loci.
• It involves the single pair of allele.	• It involves the two pair of alleles.
• A gene (dominant allele) suppresses the expression of its own allele (recessive allele).	• A gene suppresses the expression of allele of another gene.
• Only the recessive allele suppressed.	• It suppresses the effect of both dominant and recessive alleles of another gene.

• The effect is only due to dominant allele.	• Both dominant and recessive allele can become epistatic.
• **Example:** Seed shape i.e. round is dominant over wrinkled and expresses round in both homozygous and heterozygous conditions RR, Rr.	• **Example:** Bombay phenotype results from epistasis.

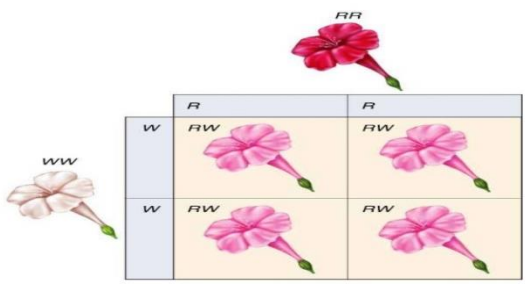
g) Allele and multiple Allele:

Allele	Multiple allele
• Alternative form of a gene is called allele.	• All the altered alternative form of a gene, whose number is more than two are called multiple alleles.
• Both of the contrasting alleles can occupy their respective loci on homologous in an individual.	• Only two of contrasting alleles can occupy their respective loci on homologous in a diploid individual.
• A gene may have only two mutant forms of alleles.	• A gene may have more than two mutant forms as alleles.
• Expression pattern will follow only one of the dominance relations.	• Expression pattern may follow more than one of the dominance relations.
• **Example:** Seed shape i.e., round or wrinkled are two allelic form of seed shape gene and can exist as Rr.	• **Example:** In ABO blood group, a single gene has 3 alleles as I^A,I^B,i.

h) X-linked trait and Y-linked trait:

X-linked trait	Y-linked trait
• A trait whose genes are present only on X chromosome is called X-linked trait or sex-linked traits.	• A trait whose genes are present only on Y chromosome is called Y-linked trait.
• These genes are called X-linked genes.	• These genes are called Y-linked genes.
• **Example:** Haemophilia and color blindness are X-linked recessive trait.	• **Example:** Maleness is a Y-linked trait.

i) Incomplete dominance and Co-dominance:

Incomplete dominance	Co-dominance
• When the phenotype of the heterozygote is intermediate between phenotypes of the two homozygotes, it is called incomplete or partial dominance.	• Different alleles of a gene that are both expressed in a heterozygous condition are called co-dominant and the phenomenon is called co-dominance.
• In heterozygous state both gene blend their phenotypic effect.	• In heterozygous state both genes independently express their phenotype effects.
• The heterozygote shows an intermediate phenotype between the two parental phenotypes.	• The heterozygote shows both parental phenotypes at a time.
• **Example:** Flower color of 4'O clock plant.	• **Example:** Human MN blood and ABO blood groups.
	<table><tr><th>Genotype</th><th>Phenotype</th></tr><tr><td>L^ML^M</td><td>M</td></tr><tr><td>L^ML^N</td><td>MN</td></tr><tr><td>L^NL^N</td><td>N</td></tr></table>

j) Sex limited and Sex influenced traits.

Sex limited traits	Sex influenced traits
• A sex limited trait is limited to only one sex due to autosomal differences either in males or in females.	• Sex-influenced trait occurs in both males and females but it is more common in one sex.
• Its genes are present in both sexes but express only in one sex.	• It is controlled by an allele which is dominant in one sex and recessive in other due to hormonal differences.

• **Examples:** 1. Genes for milk yield in dairy cattle affect only cows. 2. Beard growth in human is limited to man. A woman does not grow beard herself but can pass on genes of heavy beard growth to her sons.	• **Example**: 1. Pattern baldness is a sex-influenced trait. Men are more affected than women.

k) Continuous and Discontinuous variations:

Continuous variations (Quantitative variations)	Discontinuous variations (Qualitative variations)
• Such variations which do not show clear difference and are related closely are called continuous variations.	• Such variations which show clear or sharp differences are called discontinuous variations.
• Continuous variations are polygenic traits.	• Discontinuous variations are monogenic traits.
• They exist in more than two forms.	• They exist mostly in two or three forms.
• They do not have distinct phenotype.	• They have distinct phenotype.
• Quantitative variations are small and less striking.	• Qualitative variations are large and more obvious.
• It produces bell shaped graph.	• It results into a bar shaped graph.
• These are affected by environment.	• These are not affected by environment.
• **Examples:** Human height, human skin color and intelligence etc. are continuously varying traits.	• **Examples:** ABO blood group system and tongue rolling in human, ear lobes are discontinuously varying traits.

l) Dominant trait or Recessive trait:

Dominant trait	Recessive trait
• A form of trait that appears in F1 generation is called dominant trait. OR • A trait that appears in a hybrid between two true breeding varieties is called dominant trait.	• A form of trait that is masked by dominant in F1 generation and reappears in F2 generation is called recessive trait. OR • A trait that is suppressed or masked in a hybrid between two true breeding varieties, it is said to be recessive.
• This trait hides the effect of its relationship between the genes.	• This trait cannot express in the presence of its counterpart trait.
• **Example:** Seed shape i.e. round is dominant over wrinkled and expresses round in both homozygous and heterozygous conditions RR, Rr.	• **Example:** Seed shape i.e. wrinkled is recessive to round and express only in homozygous state rr.

m) Wild type and Mutant:

Wild type	Mutant
• An organism with normally existing traits (present in majority of the individuals of the population) is called wild type. **OR** • A normal gene or individual in a natural population is called wild type.	• An organism with a trait developed due to mutation is said to be mutant. **OR** • A mutant gene or individual carrying a gene that has undergone a mutation.
• In wild type, organisms are with normal phenotype and genotype.	• In mutant, organisms carrying mutant genes.
• **Example:** Red eye color in *Drosophila.*	• **Example:** White eye color in *Drosophila.*

Q:2 What is a gene pool?

Ans: Gene pool: All the genes / alleles found in a breeding population at a given time are collectively called the gene pool.

- It is the total genetic information encoded in the total genes in a breeding population existing at given time.

Q:3 Was pea a lucky choice for Mendel? What would have happened if he had studied an eighth character?

Ans: Yes, pea was a lucky choice for Mendel as he studied seven traits and pea plant has seven pairs of chromosomes. The genes of these traits were luckily located on separate chromosomes so he found independent assortment. If he had studied the eight characters, he might encounter with deviation from independent assortment.

Q:4 What is a test cross? Why did Mednel devise this cross?

Ans: Test cross: Test cross is a mating in which an individual showing a dominant phenotype is crossed with an individual showing its recessive phenotype.

- This cross finds out the homozygous or heterozygous nature of the genotype.
- Mendel devised a cross to test the genotype of an individual showing a dominant phenotype.
- It gives us an illustration of the principles of independent assortment.
- This cross finds out the homozygous or heterozygous nature of genotype. A typically round seed could be homozygous (RR) or heterozygous (Rr).
- It continuous to be an important tool for genetics.

Q:5 What would happen if alleles of a pair do not segregate at meiosis? How would it affect the purity of gamete?

Ans: If alleles of a pair do not segregate at meiosis, some gametes have an extra chromosome while others would lack one chromosome. This process is called non-disjunction.

- This phenomenon disturbs the purity of gametes according to which each gamete should receive only one of the two alleles.
- If alleles of a pair do not segregate at meiosis causes linkage which reduces variation and change Mendelian ratio.

Q:6 If the alleles do not assort independently, which type of combination is missing in the progency?

Ans: If the alleles do not assort independently then recombination would be missing in the progeny.

Q:7 Why each gamete had equal chance of getting one or the other allele of a pair?

Ans: Each gamete has equal chance of getting one or the other allele of a pair is due to joint probability.

Q:8 Does the dominant allele modify the determinative nature of its recessive partner? What sort of relationship do they have?

Ans: The dominant allele does not modify the determinative nature of its recessive partner. Dominance is a physiological effect of an allele over its partner allele on the same locus. When one allele is completely dominant over the other, presence of recessive allele is functionally hidden. So the heterozygote has the same phenotype as homozygote.

Q:9 Which type of traits can assort independently?

Ans: The traits which are present on different homologous chromosomes and are not linked to each other can assort independently.

Q:10 Why does the blood group phenotype of a person remain constant throughout life?

Ans: The blood group alleles start their expression at early embryonic stage and keep on expressing themselves till death. Therefore the blood group phenotype of a person never changes throughout life.

Q:11 What is a universal blood donor?

Ans: Universal blood donor: O blood group individuals are called universal donors. Phenotype O can also be sued as donor for small transfusions to A, B and AB recipients because donor's antibodies are quickly absorbed by other tissues or greatly diluted in the recipient's blood stream.

Q:12 How can ABO - incompatibility protect the baby against Rh - incompatibility?

Ans: Sometimes a mild ABO incompatibility protects the baby against more severe Rh incompatibility. If O' mother conceives A' or B' baby, any fetal A or B type RBC entering the mother's blood are quickly destroyed by her anti - A or anti - B antibodies, before she can form anti - Rh antibodies.

Q:13 Which types of genes do not obey law of independent assortment?

Ans: The genes located on the same chromosome do not obey law of independent.

Q:14 How can linked genes be separated from each other?

Ans: The linked genes can be separated from each other by crossing over.

Q:15 What is multifactorial inheritance?

Ans: Multifactorial inheritance: Polygenic inheritance with environmental influence is called multifactorial inheritance.

- The inheritance of trait which is controlled by several genes and is affected by environmental factors as well as is called multifactorial (polygenic with environmental influence) inheritance.

Q:16 What is MODY?

Ans: MODY: About 2% - 5% of type II diabetes gets the disease early in life, before 25 years of age. It is called maturity onset diabetes of the young (MODY).

- MODY can be inherited as an autosomal dominant trait.
- About 50% of cases of MODY are caused by mutations in gene for glucokinase enzyme, which converts glucose to lucose-6-phosphate, in pancreas.
- Mutation in other four genes which encode transcription factors involved in pancreatic development and insulin regulation.

Q:17 Can a child have more intelligence (IQ score) than his parents?

Ans: Intelligence is controlled by polygenes. Moreover, environment also affects it. Therefore, a child can have more intelligence than his parents.

Important Short Answers

Q:1 Why Mendel is famous for?

Ans: Gregor Johann Mendel laid the foundation of classical genetics by formulating two laws of heredity; law of segregation and law of independent assortment.

Q:2 Differentiate between Law of segregation and Law of independent assortment.

Law of segregation	Law of independent assortment
• According to this law, the two co-existing alleles of each trait in an individual segregate from each other at meiosis. So that each gamete receives only one of the two alleles.	• According to this law, when two contrasting pairs of traits are followed in the same cross, their alleles assort independently into gametes.
• Segregation is a separation process.	• Independent assortment is a binding process.
• Alleles unite again at random fertilization of gametes when zygote is formed.	• The distribution of alleles of one trait has no effect on the distribution of the other alleles.
• This law is applied in monohybrid traits/crosses.	• This law is applied in dihybrid or trihybrid crosses and so on.
• It gives phenotypic ratio: 3:1	• It gives phenotypic ratio: 9:3:3:1

Q:3 Name difference types of dominance relations among alleles?

Ans: There are four types of dominance relations among alleles, each indicating a different style of their functional effects upon each other.

1. Complete dominance
2. Incomplete dominance
3. Co-dominance
4. Over dominance

Q:4 Differentiate between Complete dominance and Over dominance.

Complete dominance	Over dominance
• When one allele (R) is completely dominant over other (r), presence of the recessive allele is functionally hidden, so the heterozygote (Rr) has the same round phenotype as (RR) homozygote.	• A condition in which heterozygote produce a phenotype that is more extreme or better from phenotype produced by homozygous.
• In this type the dominant heterozygote shows the same phenotypic effect as in homozygous dominant.	• In this type the dominant heterozygote exceeds in quantity the phenotypic expression of both homozygotes.
• Phenotypic and genotypic ratios of their F2 generation will be different. I,e. Phenotypic ratio: 3:1 Genotypic ratio: 1:2:1	• Phenotypic and genotypic ratio of their F2 generation will be same. i.e, 1:2:1
• Test cross is needed to check the homozygosity and heterozygosity of dominant trait individual.	• No needs of test cross as heterozygous dominant and homozygous dominant individuals are phenotypically different.
• **Example:** In pea seed shape, Round (R) is dominant over wrinkled (r). Both RR and Rr have same phenotypic effect.	• **Example**: In fruit fly *Drosophila* the heterozygote has genotype (W+/ W). It has more quantity of fluorescence pigments in eye than wild (W+/W+) or white eye (W/W) homozygote.

Q:5 What is Cross over or recombinant frequency?

Ans: Cross over or recombinant frequency: It is the proportion of recombinant types between two genes pairs as compared to the sum of all combinations.

Recombinant Frequency = Recombinant types / Sum of all combinations x 100

Q:6 What is the product rule?

Ans: Product rule: When two independent events are occurring simultaneously like in /dihybird cross, the ratio of each joint phenotype combination can be obtained by multiplying the probabilities of individual phenotypes. It is called product rule. **OR**

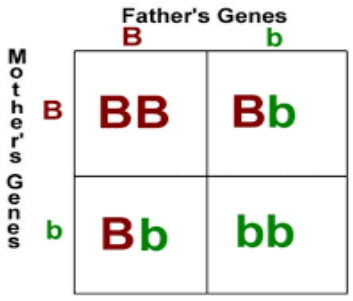
The rule according to which we can calculate the phenotypic ratio of dihybrid cross the multiplication of ratios of individual phenotypes of monohybrid crosses.

Example: Round Yellow = Round Yellow

¾ ¾ (¾ x ¾) = 9/16

Q:7 What is Punnett square?

Ans: Punnett square is a checker box in which male gametes are put on one side and female gametes on the other side and their combined results are placed in corresponding boxes to get the genotypic and phenotypic ratios of the next generations.



Q:8 What is antigen is produced by allele IA, IB and i?

Ans:

- Allele IA specifies production of antigen A
- Allele IB specifies production of antigen B
- Allele i does not specify any antigen

Q:9 Why AB blood group individuals are called universal recipients?

Ans: AB blood group individuals are called universal recipients because they can receive transfusions of blood from any of the four blood groups.

Q:10 What is probability?

Ans: Probability: Probability is the chance of an event to occur.

Example:

- In Mendal's monohybrid cross: the chance of Round seed in F2 was ¾ (75%) and that of wrinkled seed was ¼ (25%).
- Chance of birth of male or female baby in human is 50%, 50%.

Q:11 What is the difference between Homogametic and Heterogametic individuals?

Homogametic individuals	Heterogametic individuals
• Individual having both same types of sex chromosomes and produce all gametes of same type.	• Individual having different types of sex chromosomes and produce two types of gametes.
• Human female (XX), butterfly males (ZZ).	• Human males (XY), butterfly female (WZ).
• In human females all eggs (100%) will contain X-chromosome.	• In human males 50% sperms will have X-Chromosome.
• So human females cannot determine the sex of next generation.	• So human males determine the sex of next generation.

Q:12 What is bean-bang genetics.

Ans: Bean-bang genetics: If we consider all the alleles in a breeding population as beans in a beanbag, the entire beanbag full of beans is the gene pool of a population. This concept is called bean bag genetics.

Q:13 What is Bombay phenotype?

Ans: Bombay phenotype: Some persons may be genotypically of blood type A, B or AB but phenotypically of blood type O. Such a phenotype is called Bombay phenotype.

- These persons lack a glycoprotein which helps A and B antigen to attach on RBC's.

Q:14 Compare between Polygenes and Pleiotropy.

Polygene	Pleiotropy
• A continuously varying trait is encoded by alleles of two or more different gene pairs found at different loci, all influencing the same trait in an additive way. These quantitative traits are called polygenetic traits, and their genes or polygenes. **OR** • A trait which is controlled or encoded by alleles of two or more different gene pairs found at different loci is called polygenic trait and their genes are called polygenes.	• When a single gene affects two or more traits, the phenomenon is called pleiotropy. Such a gene with multiple phenotypic effects is called pleiotropic.
Examples: • Wheat grain color is controlled by three gene pairs i.e. AA, BB, CC and aa, bb, cc.	**Examples:** • Gene that effects growth rate in humans also influences both weight and height.

• Human skin color is controlled by three to six pairs of gene.	• White eye gene in *Drosophila* also affects the shape of sperm storing organs (spermathecae).

Q:15 What is meant by the Rh-Factor and how can you protect the baby against Rh-incompatibility?

Ans: Rh-factor: It is an antigen other than A and B present on RBCs. It was first discovered in Rhesus monkeys by Landsteiner, so is termed as Rh-factor.

- On the basis of presence or absence of Rh-factor, ABO blood type is further differentiated by a +ve or –ve sign. E.g. A^+, A^-. Rh-factor is controlled by a dominant allele D.

Protection of baby against Rh-incompatibility:

- The blood of such babies should be immediately replaced by Rh –ve blood free of Anti-Rh antibodies.
- To avoid Rh-incompatibility for the next foetus, mother is given an injection of Rh-antiserum immediately after birth and during early pregnancy.

Q:16 What is Erythroblastosis foetalis (Meternal - foetal Rh incompatibility)?

Ans: Erythroblastosis foetalis:

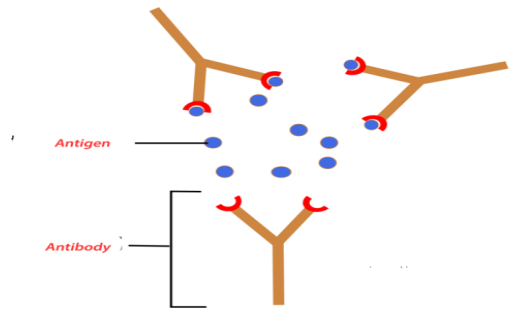
An Rh^{-ve} women may conceive a child who is Rh^{+ve}. If the RBCs of Rh^{+ve} foetus crosses the placental barrier and enters in Rh^{-ve} mothers' blood circulation, mother immune system reacts and produces a large number of anti-Rh antibodies. These anti-Rh antibodies seep through placenta into foetal circulation and cause hemolysis (bursting of RBCs) which results in anemia. The anaemic foetus starts to release many immature RBCs. So this hemolysis disease of the new born is called erythroblastosis foetalis.

Q:17 What is SRY?

Ans: SRY:

- SRY is the male determining gene.
- It is located at the tip of short arm of Y-chromosome.
- Its name SRY stands for "Sex determining regions of Y".

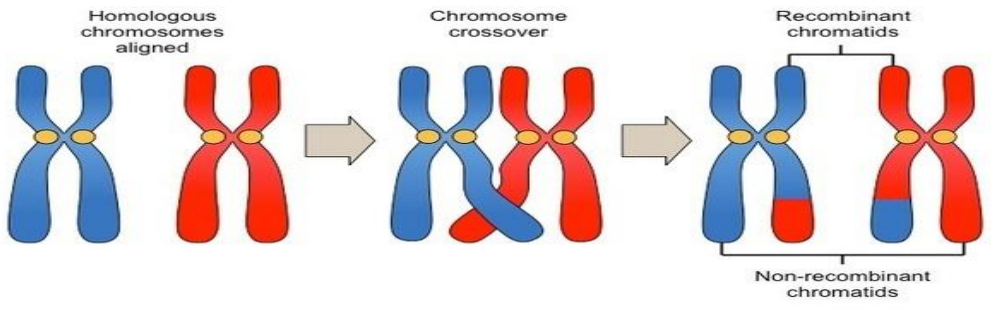
Q:18 Differentiate between Antigen and Antibody.

Antigens	Antibodies
• Antigens have combinations from polysaccharides as well as proteins.	• Antibodies are purely made up of protein.
• Antigens can be cell.	• Antibodies are never cells.
• Antigens may be foreign particles/agents or proteins that induce WBC's to produce antibodies.	• Antibodies are the defensive proteins released by WBC's in response to antigens.
• There are mainly two types of antigens, which are self and non self.	• Antibodies are made up f the five main sub categories according to proteins construct.
• **Examples:** Antigen A, B, Rh etc.	• **Examples:** IgA, IgB, IgM etc.
	

Q:19 What is crossing over?

Ans: Crossing over: Crossing over is an exchange of segments between non-sister chromatids of homologous chromosomes during meiosis.

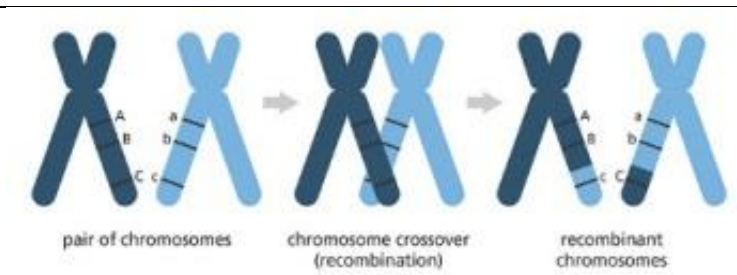
- Crossing over occurs when two genes are located far apart on the same chromosome.
- Crossing over can disrupt the gene groups made by linkage.
- Crossing over only occurs during the prophase of meiosis I.
- Crossing over produces recombinant alleles.



Q:20 Differentiate between Gene linkage and Linkage groups.

Gene linkage	Linkage groups
• When genes are located on the homologous chromosomes they are said to be linked and phenomenon is called as gene linkage.	• Group of genes located together or linked with one another on same chromosome.
• It shows a physical relationship between the genes.	• Linkage group acts as an enbloc system and is inherited in the form of group.
• **Examples:** Genes of gout, colorblindness and hemophilia are close enough and do not assort independently showing linkage.	• **Example:** Genes of gout, colorblindness and hemophilia on X-chromosome act as a linkage group.

Q:21 Differentiate between Recombination and Mutation.

Recombination	Mutation
• Recombination is the major process that changes the nucleotide sequence of a genome in a large scale and the changes are usually not repaired by DNA damage and repairing.	• Mutation is the process that changes the nucleotide sequence of a genome in a small scale and the changes are not corrected by repairing enzymes.
• Recombination is an enzyme controlled mechanism.	• Agents that cause mutation include the erroneous replication, chemicals and radiation.
• Recombination occurs during the cell division.	• Mutation can happen at any time.
• Most occur naturally.	• Induced by external mutagens.
• Major driving force of evolution.	• Contribution to evolution is less.
	

Q:22 What environmental factors affect the grain color in wheat?

Ans: Environmental factors like light, water and nutrients also influence the amount of grain color.

Q:23 What do you know about the tallness and shortness in humans?

Ans: Tallness in human is recessive to shortness. More the number of dominant alleles for shortness, the shorter the height will be. Similarly greater the number of recessive alleles for tallness, the taller the height will be.

Q:24 What do you know about chromosome number of Grasshopper?

Ans:

- The female has 24 chromosomes in the form of 11 pairs of autosomes and a pair of X-chromosomes.
- But the male grasshopper has 23 chromosomes having 11 pairs of autosomes and only one X chromosome.
- Thus male is XO and female is XX.

Q:25 What is nullo gamete?

Ans: Nullo gamete: A gamete without any sex chromosome is called nullo gamete.

- For example in male grasshopper half of the gametes are nullo gametes.

Q:26 What is meant by testicular feminization syndrome?

Ans: Testicular feminization syndrome (tfm syndrome): It is a rare x-linked recessive trait in which individuals have XY chromosomes but tfm gene on their X-chromosome develops them physically into females.

- They have breast, female genitalia, a blind vagina but no uterus.
- They are happily married as females but are sterile.
- Male sex hormone testosterone has no effect on these females.
- It is an androgen insensitivity syndrome.

Q:27 Which animals show XX - XY type or WZ - ZZ type of sex determination?

Ans: This type of sex - determination pattern is common in birds, butterflies and moths. It was discovered by J. Seiler in 1914 in moth.

Q:28 Compare XXY individuals in humans and Drosophila?

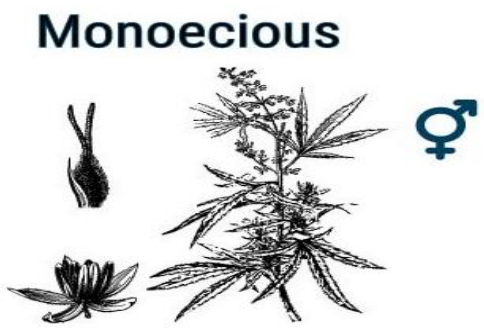
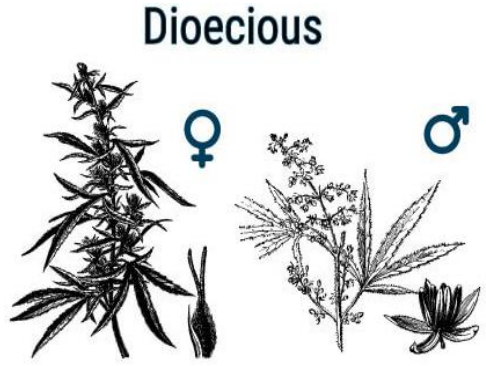
Ans:

- XXY individual produced through non disjunctional gametes in humans is a sterile male called Klinefelter's syndrome.
- But the same XXY set of chromosomes in *Drosphila* produces a fertile female.

Q:29 What is X:A ratio for females and males?

Ans: An X : A ratio of 1.00 or higher produces females whereas an X : A ratio of 0.5 or lower produces males.

Q:30 Differentiate between Monoecious and Dioecious plants?

Monoecious Plants	Dioecious plants
• (Mono=meaning one) These plants have male and female reproductive organs on the same plant.	• (Di=meaning two)These plants have either male or female organs in separate individual.
• Exhibit uni-parental reproduction.	• Exhibit bi-parental reproduction.
• Plants are capable of using both self and cross pollination.	• Plants only use cross pollination.
• That is, one plant or tree produces both the pollen and the fruit/seeds, on two types of structures.	• Male plants produce flowers with only stamens and female plants produce flowers with only carpels.
• **Example:** The banana is an example of a monoecious plant with male and female flowers.	• **Example:** The ginkgo tree is another example of a dioecious plant.
	

Q:31 Why T.H. Morgan is famous for?

Ans: Thomas Hunt Morgan (1910) provided experimental in support of chromosomal theory of heredity through discovery of sex linkage in fruit fly Drosophila.

- In 1933, T.H. Moran was awarded Nobel Prize for his contribution to genetics.

Q:32 What are pseudoautosmal genes?

Ans: Pseudoautosmal genes: The genes which are present in both X and Y chromosomes are called pseudoautosomal genes.

- There pattern of inheritance is like autosomal genes.
- These are also called X-linked and Y-linked genes.
- **Example:** Genes like bobbed gene in *Drosophila* are present on X and Y chromosomes.

Q:33 What is the Pattern of sex-linked inheritance?

Ans: An X - linked trait passes in a crisscross fashion from maternal grandfather (P1) through his daughter (F1) to the grandson (F2). It never passes direct from father to son because a son inherits only Y chromosome from father.

Q:34 What are opsins?

Ans: Opsin: Each type of cone cell has specific light absorbing proteins called opsins. The genes for red and green opsins are on X chromosome, while the gene for blue opsins is present on autosome 7.

Q:35 What is haemophilia? Compare its types.

Ans: Haemophilia:

- Haemophilia is a rare X - linked recessive trait.
- Hemophiliac's blood fails to clot after an injury, because it has either a reduction or malfunction or complete absence of blood clotting factors.

	Types	Cause	Percentage	Inheritance	Alleles
1	**Haemophlia A**	Abnormality of blood clotting factor VII	80%	Recessive X linked	Non allelic
2	**Haemophlia B**	Disturbance of blood clotting factor IX	20%	Recessive X linked	Non-allelic
3	**Haemophilia C**	Reduction in blood clotting factor XI	Less than 1%	Recessive autosomal	Allelic

Q:36 Which type of haemophilia affect men more than women?

Ans: Being X - linked recessives, haemophilia A and B affect men more than women, but haemophilia C affects both the sexes equally because it is autosomal.

Q:37 When a woman can suffer from haemophilia A or B?

Ans: A woman can suffer from haemophilia A or B only when she is homozygous for the recessive allele.

Q:38 What is the pattern of inheritance of haemophilia?

Ans: Haemophilia A and B zigzag from maternal grandfather through a carrier daughter to a grandson. It never passes direct from father to son.

Q:39 What is dichromat? What are different types of dichromatic blindness?

Ans: Dichromat: A dichromat can perceive two primary colors but is unable to perceive the one whose opsins are missing due to mutation.

Different types of dichromatic blindness:

1) **Protanopia** is red color blindness (Normal for green + blue color).
2) **Deuteranopia** is green color blindness (Normal for blue + red color).
3) **Tritanopia** is blue color blindness (Normal for red + green color).

Q:40 Differentiate between Protanopia and Tritanopia.

Protanopia	Tritanopia
• Protanopia is red color blindness (Normal for green + blue color).	• Tritanopia is blue color blindness (Normal for red + green color).
• It is a X-linked recessive trait.	• It is an autosomal recessive trait.
• In it male have more chances of colorblindness than female.	• In it male and female have equal chances/risks.
• It is inherited in zigzag fashion.	• It is not inherited in zigzag fashion.
• It does not pass direct from father to son.	• It can pass directly from father to son.
• The gene for red and green opsins are on X chromosome.	• The gene for the blue opsin is on autosome # 7.

Q:41 Why red-green color blindness is more common in men than women?

Ans: It is because chances for a male to be affected by it are double than a female as Y chromosome has no alternate gene.

Q:42 What is Deuteronopia?

Ans: Deuteronopia:

- Deuteranopia is green color blindness (Normal for blue + red color).
- It is a X-linked recessive trait.
- In it male have more chances of colorblindness than female.
- It is inherited in zigzag fashion.
- It does not pass direct from father to son.
- The gene for red and green opsins are on X chromosome.

Q:43 What are protanomalous and deuteranomalous?

Ans: Some people can detect red and green but with altered perception of the relative shades of these colors (i.e., they can see red instead of green and vice versa). They have abnormal but still partially functional opsins.

- **Protanomalous:** Weak for red color.
- **Deuteranomalous:** Weak for green color.

Q:44 What is Monochromacy? Also describe blue cone monochromacy.

Ans: Monchromacy: A monochromat can perceive only one colour.

- Monochromacy is true color blindness.

Blue cone monochromacy:

- Blue cone monochromacy is an X - linked recessive trait
- In this both red and green cone cells are absent. That is why it is also called red - green colors blindness.
- It is a common hereditary disease. It is inherited in zigzag fashion.
- Thus it is transferred from maternal grandfather to son.
- The chances for a male to be affected by it are double than a female. Thus this type of color blindness is more common in men than women.

Q:45 What is the pattern of X - linked dominant inheritance?

Ans: Pattern of X - linked dominant inheritance:

- It is more common in females than males.
- All daughters of an affected father are affected, but none of his sons are affected.
- Any heterozygous affected mother will pass the trait equally to half of her sons and half of her daughters.
- Example: Hypophosphatemic rickets is an X - linked dominant trait.

Q:46 A man is 45 years old and bald. His wife also has pattern baldness. What is the risk that their son will lose his hair?

Ans: A man is 45 years old and bald and his wife also has pattern baldness then the son has 100% chance to lose hair.

Q:47 Differentiate between IDDM and NIDDM.

IDDM	NIDDM
• IDDM stands for insulin dependent diabetes mellitus.	• NIDDM stands for non-insulin dependent diabetes mellitus.
• It is a multifactorial disease in which body's own immune system destroys β-cells of pancreas. So pancreas does not produce insulin.	• It produces endogenous insulin but their body cells do not respond to insulin, and do not take up glucose from blood.
• It is diabetes type I disease.	• It is diabetes type II disease.
• Type I diabetes is also called Juvenile diabetes because it usually occurs in early age before 40	• It occurs among people over age 40.
• It accounts for 10% of all diabetic patients.	• It accounts for 90% of all diabetic patients.
• Type I is an auto immune disorders.	• It is more common among the obese. Obesity increase insulin resistance.
• **Remedy:** Diabetics of type I must receive oxygenous (from outside source) insulin to survive.	• **Remedy:** Exercise reduces obesity as it indirectly increases insulin sensitivity and improves glucose tolerance.

Q:48 What is Diabetes mellitus and what are its effect on the body?

Ans: Diabetes mellitus:

- Diabetes mellitus is a hereditary disease
- Diabetes mellitus is actually a heterogeneous group of disorders characterized by increased blood sugar level.
- Diabetics are unable to metabolize blood sugar in their body and pass glucose in urine.

Effects in body:

- It is the leading cause of kidney failure.
- Adult blindness.
- Lower limb amputation.
- Also cause of heart attack.

Exercise MCQ's

❖ **Encircle the correct answer from the multiple choices.**

1) When a single gene has multiple phenotypic effects the phenomenon is called:
a) Co-dominance b) Epistasis c) Pielotropy d) Sex-linkage

2) What happens when both alleles of a gene pair independently express in a heterozygote?
a) Dominance b) Incomplete dominance c) Over dominance d) Codominance

3) A heterozygote offspring quantitatively exceeds the phenotypic expression of both the homozygote parents due to:
a) Dominance b) Incomplete dominance c) Over dominance d) Codominance

4) How many gene pairs contribute to the wheat rain colors?
a) One b) Two c) Three d) Four

5) Who for the first time found white eye mutant in Drosophila?
a) Morgan b) Bridges c) Correns d) De Varies

6) Which of the following traits is transmitted directly from an affected father to only his sons?
a) Autosomal b) X-linked c) Y-linked d) X and Y linked

7) Which phenomenon reduces the chances of genetic recombination and variation among offsprings?
a) Linkage b) Crossing over c) Independent assortment d) Dominance

8) Which of the following trait is not sex-linked recessive?
a) Haemophilia b) Color blindness c) Hypophophatemic rickets d) Tfm syndrome

9) Which of these traits zigzag from maternal gran father through a carrier daughter to a grandson?
a) Autosomal b) X-linked c) Y-linked d) X and Y linked

10) When a haemophilic carrier woman marries a normal man, who among her offspring may be affected.
a) All her children
b) All her daughters
c) Half of her daughters
d) Half of her sons

11) What is the risk of a color blind child in a family when mother is color-blind but father is normal:
a) 100% b) 75% c) 50% d) 25%

12) What is the risk of a color blind child in a family when father is color-blind but mother is normal:
a) Zero% b) 25% c) 50% d) 100%

Answer key:

1	c	**2**	d	3	c	**4**	c	**5**	b
6	c	**7**	a	8	c	**9**	b	**10**	d
11	c	**12**	a						

Important Additional MCQ's

❖ **Encircle the correct answer from the multiple choices.**

Law and Dominance relations

1) Mendelian factors were renamed as genes by:
a) Mendal b) Correns c) Johannsen d) Morgan

2) The position of a gene on the chromosome is called its:
a) Allele b) Phenotype c) Locus d) Genotype

3) Phenotype represents:
a) Morphology b) Physiology c) Genetics d) None of these

4) Position of gene on the chromosome is called its:
a) Phenotype b) Junction c) Locus d) Genotype

5) Locus is a……:
a) Complement of a gene b) Position of a gene c) Part of DNA d) Partner of a gene

6) Expression of a trait is termed as:
a) Genotype b) Karyotype c) Wild type d) Phenotype

7) …….. is a form of appearance of traits:
a) Genotype b) Phenotype c) Pleotropy d) Metastasis

8) All the genes found in breeding population:
a) Genotype b) Genome c) Gene frequency d) Gene pool

9) Genes keep on hopping on different loci:
a) Polygene b) Multiple allele c) Jumping gene d) SRY

10) In test cross, heterozygous produce:
a) All round b) All wrinkle c) 50:50 d) None of these

11) Cross which is used to find out the homozygous or heterozygous nature of the genotype is called:
a) Test cross b) Reciprocal cross c) Monohybrid cross d) Dihybrid cross

12) Incomplete dominance was discovered by:
a) De- Veris b) Johannsen c) Carl Correns d) Tschermach

13) When different alleles of a gene are both expressed in heterozygous condition. It is called:
a) Dominance b) Codominance c) Over dominance d) Epistasis

14) Two normal (Aa) parents have chance of albino child:
a) 25% b) 50% c) 75% d) 100 %

15) During test cross, if all offsprings are phenotypically dominant then parents are:
1) Homozygous
2) Heterozygous
3) One homozygous other heterozygous
4) None of these

16) In nature, Garden pea is:
a) Self-fertilized b) Cross fertilized c) Cross pollinated d) None of these

17) In which of the following cases, genotypic and phenotypic ratio will remain same in F2 generation:
a) Law of independent assortment
b) Law of Segregation
c) Test cross
d) Incomplete dominance

18) A pure breeding tall pea plant was crossed to dwarf plant what will be the frequency of dwarf plants in F1:
a) 0.25 b) 0.5 c) 0.75 d) 0

19) The genes which do not follow law of independent assortment:
a) Crossed genes b) Linked genes c) Recessive genes d) Dominant genes

20) How many pairs of homologous chromosomes are present in Pisum sativum:
a) Five pairs b) Six pairs c) Seven pairs d) Eight pairs.

21) Which of the following characters of pea plant is dominant?
a) Axial flowers b) Yellow pods c) White flowers d) Wrinkled seeds

22) A pea plant with yellow seed was crossed to a plant having green seeds. What will happen in F1; if plants are true breeding:
a) All seeds will be yellow
b) Half of seeds will be yellow
c) All the seeds will be green
d) Both will be present in ratio of 1:2:1

23) Filial is a Latin word. It means:
a) Spring b) Issue c) Progeny d) Descendent

24) Which of the following condition is hybrid:
a) TT b) Tt c) tt d) All of these

25) Which of the following is monohybrid cross:
a) TT x tt b) TTYy x Ttyy c) Both of these d) None of these

26) A pure breeding tall plant was crossed to dwarf plant. What would be probability of "Tt" genotype in F2:
a) 0.25 b) 0.5 c) 0.75 d) 0

27) A monohybrid cross yielded 3:1 in F2. What could be mode of inheritance?

a) Segregation b) Independent assortment c) Both of these d) None of these

Multiple Alleles till Crossing Over

28) MN blood group system is an example of:

a) Incomplete dominance b) Complete dominance c) Codominance d) Over dominance

29) In 1901 ABO group system was discovered by:

a) Punnett b) Karl Landsteiner c) Bernstein d) Wiener

30) ABO blood group system in man is encoded by a polymorphic gene I on chromosome:

a) 7 b) 9 c) 21 d) X

31) The gene for ABO blood group system in human is represented by symbol:

a) X b) Y c) I d) O

32) ABO blood group system is enclosed by a single polymorphic gene with:

a) Three multiple alleles b) Four multiple alleles c) Five multiple alleles d) Six multiple alleles

33) The blood serum contains antibodies is called:

a) Antigen b) Immunoglobulin c) Plasma d) Antiserum

34) Individuals called universal recipient have……. Blood group:

a) A b) B c) AB d) O

35) Secretor gene 'Se' is present on Chromosome Number:

a) 11 b) 19 c) 21 d) 23

36) Rh blood group system is named after its:

a) Discover b) Rhesus monkey c) A patient d) Rhinoceros

37) Bilirubin damages brain cells and turns the skin and white of eyes yellow, a condition is known as:

a) Hepatitis b) Leukemia c) Botulism d) Jaundice

38) How many genes control Rh blood group system?

a) One b) Two c) Three d) Four

39) A man with blood group "A" marries a woman of blood group "B". Both are heterozygous. What is the off-springs having phenotype "O":

a) Zero b) 25% c) 50% d) 75%

40) Presence of a gene at one locus suppresses effects of a gene at another locus, phenomenon is called:

a) Hypostasis b) Epistasis c) Pleiotropy d) Epitropy

41) Bombay phenotype is an example of:

a) Pleiotropy b) Dominance c) Probability d) Epistasis

42) When a single gene effects two or more traits, the phenomenon is called:

a) Epistasis b) Dominance c) Pleiotropy d) Over dominance

43) A gene which has multiple phenotypic effects is called:

a) Pleiotropic b) Multiple allele c) Epistasis d) Locus

44) In cats the dominant allele W not only makes the fur pure white but also causes:

a) Black spots b) Deshaped spermatheca c) Blindness d) Deafness

45) How many gene pairs contribute to the wheat grain color (Polygeneic inheretence):

a) One b) Two c) Three d) Four

46) The color phenotype of the grain is the sum of individual effects of …… alleles:

a) Six b) Four c) Five d) Five or three

47) Human skin color is controlled by gene pairs:

a) Two to four b) Three to six c) Four to six d) Seven to eight

48) Man has linkage groups:

a) 23 b) 46 c) 22 d) 92

49) All of the following are continuously varying traits except:

a) Kernel color in wheat
b) Skin color in humans
c) Height in humans
d) Tongue rolling in humans

50) Chances of genetic recombination are minimized due to:

a) Independent assortment of chromosomes
b) Crossing over
c) Mutation
d) Gene linkage

51) Feature correct to O-negative blood group:

a) A,B antigen present
b) Anti-A, Anti-B antibody present
c) Rh antigen present
d) Rh antibody present

52) The trait "Kernel color in corn" in controlled by how many pairs of genes:

a) One pair b) Two pairs c) Three pairs d) Many pairs.

53) True breeding variety is produced by:

a) Self-fertilization b) Cross fertilization c) Both of these d) None of these

54) Such inheritance in which traits vary quantitatively is:

a) Continuously varying trait b) Incomplete dominance c) Test cross d) Polygenic inheritance

Sex Chromosomes and Inheritance

55) **Sex chromosomes were discovered by**:
a) Sutton b) Morgan c) W. Fleming d) Corrrens

56) The gene that triggers development towards maleness is:
a) Tfm b) SRY c) MODY d) BOB

57) A gamete without any sex chromosome is called:
a) Autogamete b) Gamete c) Nullo gamete d) Sex-gamete

58) Drosophila males for eye color are:
a) Homozygous b) Heterozygous c) Hemezygous d) None

59) In men, sex determination depends upon the nature of:
a) Hetrogametic male b) Monogamatic female c) Hetrogametic female d) Monoametic male

60) In moths, male is:
a) Hetrogametic b) Homogametic c) Bigametic d) Both b & c

61) The genic system for the determination of sex is present in:
a) Protenor bug b) Yeast c) Drosophila d) Ginkgo

62) Haemphilia is a ……. trait:
a) X linked dominant b) X-linked recessive c) Sex-limited d) Sex influenced

63) Haemophilia C:
a) Affects both sexes equally
b) Affects men more than women
c) Affects women more than men
d) Is non-allelic recessive sex-linked

64) Green color blindness is called:
a) Deuteranopia b) Protanopia c) Tritanopia d) Color blind

65) Haemophilia B is due to abnormality of factor:
a) VIII b) IX c) X d) XI

66) Genes that affect growth rate in humans influencing both weight and height are:
a) Codominant b) Epistasis c) Pleiotropy d) Polygene

67) It was discovered by J.Seiler in 1914 in moth:
a) XO-XX b) XY-XX c) ZZ-ZW d) None of these

68) Each type of cone cell in retina has specific light absorbing protein on autosome:
a) Albumin b) Chlorine c) Hamelin d) Opsin

69) The gene for blue opsin is present on autosome:
a) 7 b) 11 c) 19 d) 21

70) True color blindness is:
a) Monochromacy b) Dichromacy c) Trichromacy d) Tetrachromacy

71) Blue cone monochromacy is X-linked trait in which:
a) Red cone cells are absent
b) Green cone cells are absent
c) Both red and green cone cells are absent
d) Blue cone cells are absent

72) Inheritance in man is traced by:
a) Mathematical method b) Genetic method c) Statistical method d) Pedigree method

73) Most common type of Diabetes mellitus is:
a) Type I b) Type II c) MODY d) None of these

74) Diabetics are unable to metabolize blood:
a) Urea b) Protein c) Fat d) Sugar

75) About 50% cases of MODY are caused by mutations in:
a) Kinase gene b) Galactokinase gene c) Glucokinase gene d) Proteinase

Answer key:

1	c	**2**	c	**3**	a	**4**	c	**5**	b	**6**	d	**7**	b	**8**	d	**9**	c	**10**	c
11	a	**12**	c	**13**	b	**14**	a	**15**	a	**16**	a	**17**	d	**18**	d	**19**	b	**20**	c
21	a	**22**	a	**23**	c	**24**	b	**25**	a	**26**	b	**27**	a	**28**	c	**29**	b	**30**	b
31	c	**32**	a	**33**	d	**34**	c	**35**	b	**36**	b	**37**	d	**38**	c	**39**	b	**40**	b
41	d	**42**	c	**43**	a	**44**	d	**45**	c	**46**	a	**47**	b	**48**	a	**49**	d	**50**	d
51	b	**52**	c	**53**	a	**54**	d	**55**	b	**56**	b	**57**	c	**58**	c	**59**	a	**60**	b
61	b	**62**	b	**63**	a	**64**	a	**65**	b	**66**	c	**67**	c	**68**	d	**69**	a	**70**	a
71	c	**72**	d	**73**	b	**74**	d	**75**	c										

Prof. Ijaz Ahmed Khan Abbasi (Lecturer Biology PGC)

Past MDCAT MCQ's

2008

1) In moths' male is :
a) Heterogametic b) Homogametic c) Dieogametic d) Both B and C

2) The genes of blue opsin are present on:
a) Autosome 9 b) Autosome 1 c) Autosome 7 d) Autosome 3

3) Position of a gene on the chromosome is called its:
a) Phenotype b) Junction c) Locus d) Genotype

4) The color phenotype of the grain is the sum of individual effects of …… alleles:
a) Six b) Four c) Five d) Five or three

2009

5) When phenotype of a heterozygote is in between the phenotypes of both the homozygote parents, it is called:
a) Incomplete dominance b) Pleiotropy c) Epistasis d) Codominance

6) Which one of correct about 'Rh+' blood?
a) Will produce anti-Rh antibodies if given Rh+ blood
b) Rh+ antigens are present on RBCs
c) Cannot produce anti-Rh antibodies in any case
d) Rh+ antibodies are present in blood

7) If all the members of a population are homozygous for the same allele, that allele is said to be:
a) Random in population's pool
b) Random in a species
c) Fixed in population's pool
d) Fixed in the gene pool

8) What is true about pattern baldness?
a) It is autosomal recessive disease in males
b) It is X-linked disease
c) It is autosomal dominant disease in males
d) It is Y-linked disease

2010

9) When a disease is transmitted directly from an affected father to his son, it is called:
a) X-linked b) Y-linked c) Autosomal d) X and Y-linked

10) Epistasis is a relationship between:
a) Alleles of a gene
b) Two contrasting traits
c) Two different genes at the same locus
d) Two different genes at different loci

11) Gene for albinism in man is present on chromosome number:
a) 11 b) 21 c) 22 d) 12

2011

12) The sex of individuals of next generation always depends on one of the parents who is:
a) Heterogametic b) Isogametic c) Homogametic d) Isomorphic

13) Which of the following will be hemophilic?
a) X^HX^h b) X^hY c) X^HX^H d) X^HY

14) Which of the following is an example of X-linked recessive trait in humans?
a) Hypophospatemic Rickets b) Baldness c) Color Blindness d) Beard Growth

15) Which trait in human in an example of multiple alleles?
a) Eye Color b) ABO-Blood Group c) Skin Color d) Rh-Blood Group

16) When a gene pair at one locus interacts with another gene at another locus, the interaction is called:
a) Dominance b) Pleiotropy c) Multiple Alleles d) Epistasis

2012

17) When the presence of a gene at one locus suppresses the effect of a gene at another locus, the phenomenon is called:
a) Hypostasis b) Epistasis c) Pleiotropy d) Epitropy

18) The gene for ABO-blood group systems in humans is represented by symbol:
a) X b) Y c) I d) O

19) When a single gene affects two or more traits, the phenomenon is called:
a) Epistasis b) Dominance c) Pleiotropy d) Over dominance

20) In men, sex-determination depends upon the nature of:

a) Heterogametic male b) Heterogametic female c) Homogametic female d) Homogametic male

2013

21) When a gene suppresses the effect of another gene at another locus the phenomenon is termed as:

a) Over dominance b) Epistasis c) Pleiotropy d) Co-dominance

22) A situation in which one gene affects two or more unrelated characters is called:

a) Epistasis b) Dominance relation c) Pleiotropy d) Polygenes

2014

23) When a gene expresses the effects of a gene at another focus, this is known as:

a) Epistasis b) Complete dominance c) Co-dominance d) Mutation

24) In male the sex determining gene is:

a) XY b) SYX c) SRY d) SXX

25) A gene which affects two or more unrelated characteristics is called:

a) Pleiotropic b) Dominant c) Epistatic d) Mutant

26) Position of a gene within a DNA molecule is:

a) Locus b) Amplicon c) Origin d) Filial

2015

27) X-linked recessive trait is:

a) Hypophosphatemia b) Haemophilia c) Vitamin-D resistant rickets d) Diabetes Mellitus

28) Human skin color is a good example of?

a) Sex-linked inheritance b) X-linked inheritance c) Polygenic inheritance d) Y-linked inheritance

29) Number of pairs of autosomes in humans in:

a) 23 b) 21 c) 24 d) 22

30) ABO blood system is an example of:

a) Polygenes b) Multiple Alleles c) Multiple genes d) Multiple Mutation

2016

31) Which one of the following is X-linked trait?

a) Male pattern baldness b) Haemophilia c) Diabetes mellitus d) Erythroblastosis fietalis

32) A character determined by three alleles is:

a) Human skin color b) Human eye color c) Human blood group d) Human Rh factor

33) The total number of genes in a population is called:

a) Gene pool b) Genome c) Allele pool d) Genomic library

2017

34) Large population size, random mating, no mutation and no emigration or immigration are the postulates of:

a) Hardy-Weinberg theorem
b) Mendel's law of segregation
c) Mendel's law of independent assortment
d) Theory presented by Schleien and Schwann

35) Pure breeding lines of pea were taken regarding seed shape — Round and wrinkled and were crossed with no intermediate between parents. All offsprings were found to be round. These results show:

a) Co dominance
b) Incomplete dominance
c) Dominance-recessive relationship
d) Over dominance relationship

36) The condition in which the heterozygote has a phenotype intermediate between contrasting homozygous parents is called as:

a) Dominance b) Co-dominance c) Incomplete dominance d) Over- dominance

37) The interaction between different genes occupying different loci is:

a) Dominance b) Pleiotropy c) Co-dominance d) Epistasis

38) Locus stands for:

a) Position of gene on homologous chromosome
b) Regions of chromosomes
c) Position of an allele within a DNA molecule
d) Close regions of same chromosome

39) Self-fertilization of F-1 dihybrids, following independent assortment of alleles result in:

a) 3/16 Tall-round ; 3/16 dwarf-wrinkled
b) 9/16 Tall-round ; 3/16 Dwarf-round
c) 9/16 Tall-wrinkled ; 3/16 dwarf-round
d) 3/16 Tall-wrinkled ; 3/16 Dwarf-round

40) As a result of cross-fertilization of a true breeding pea plant having purple colored flowers; with that of white colored flowers, the offsprings will have flowers with:

a) 1/4 purple ; 3/4 white
b) All white
c) 1/4 white ; 3/4 purple
d) All purple

41) The gene for red-green color blindness is present on:

a) Y-chromosome c b) Autosome 7 c) X-chromosome d) Autosome 9

Answer key:

1	b	**2**	c	**3**	c	**4**	a	**5**	a
6	a	**7**	d	**8**	c	**9**	b	**10**	d
11	a	**12**	a	**13**	b	**14**	c	**15**	b
16	d	**17**	b	**18**	c	**19**	c	**20**	a
21	b	**22**	c	**23**	a	**24**	c	**25**	a
26	a	**27**	b	**28**	c	**29**	d	**30**	b
31	b	**32**	c	**33**	a	**34**	a	**35**	b
36	d	**37**	d	**38**	b	**39**	d	**40**	d
41	c								