Q. Discuss with examples the different types of single factor inheritance in man.

Ans: There is interrelation between genes and traits or characters. The phenotypic expression of the genotype may be influenced by single factor. The phenotypic expressions are derived from genic action. The result of interaction between the genic content and its non-genetic environment determines the phenotype making it variable. Though single factor are inherited by following Mendelian principle of inheritance, it has some variation according to sex. The inheritance nature of some single factor genes is autosomal dominant, autosomal recessive, sex-controlled, sex limited and sex linked.

Brachydactyly, woolly hair and congenital stationary night blindness are dominant trait. Both male and female is affected by these single factor traits. An affected person has transmitted the trait to almost half of his or her offspring.

Colour blindness and hemophilia are single factor X-linked recessive traits. In this case if the father is normal and the mother is affected, then all the sons will be affected, while half of the daughters will be carrier of that gene. On the other hand, a normal father and carrier mother will gave birth to sons, half of whom are affected and the other normal.

The multiple phenotypic effects associated with a single gene is called pleiotrophy and the gene is known as pleiotropic gene. Phenylketonuria is a hereditary abnormality, where a particular enzyme is absent, as a result of which a number of other biochemical aspects are affected. Urine of such persons contains large amount of phenylpyruvic acid. They exhibit mental impairment. Their pigment formation is also showing light hairs. These happen because of

abnormal metabolism. Arachnodactyly is caused by a gene. In such persons the finger and toe bones are abnormally long. They possess other skeletal abnormalities and also heart and eye effects. The Laurence-Morn-Biedle syndrome is also caused by a single gene. There obesity is associated with polydactyly, mental defects and hypogenitalism.

The expression of an allele may be influenced by the sex of the individual or it may be limited to one sex only.

Q. Sex-limited traits.

Ans: Some genes are expressed phenotypically in one sex only. Such traits are known as sex-limited traits. Most of the sex-limited genes are autosomal, though a few are sex-linked. The sex-limited trait depends on genes common to both sexes, but their expressions are not the same in both sexes. Some of the sex-limited male characters are growth and amount of beard and moustache, and distribution of hair in different parts of the body. Prostate cancer is limited to male sex only. On the other hand, milk yielding capacity is confined to the female sex only. Menstruation, proportion of bodily parts, e.g., width of pelvic, etc. are sex-limited female traits.

Q. Sex-controlled traits.

Ans: Sex-controlled traits are also known as sex-modified traits. It could be said that sex-limited traits are extreme examples of sex-controlled traits. Baldness is hereditary. Both sexes may be affected. But its frequency is relatively very high in males. Because it is controlled by sex. It is suggested that an allele B^1 in homozygous condition, B^1B^1, makes persons of both sexes normal as regards growth of head hairs, while homozygous B^2B^2 makes them bald. The heterozygous B^1B^2 males are also bald, but the heterozygous females are not bald. Taste sensitivity to PTC is also to some extent is controlled by sex. Females are more sensitive tasters than males. Some congenital malformations are more frequent in female than in male.

Q. Sex-linked traits.

Ans: The traits which expression is govern by sex-chromosomes i.e., X or Y chromosome, is known as sex-linked traits. It has been observed that the genes occurring only in the X-chromosomes are represented twice in female and once in male. Moreover, it the recessive type of genes occur in X-chromosomes of males, they themselves phenotypically. Because in such case Y-chromosome

contains dominant allelomorph or gene to overcome the recessive gene of X-chromosome. There are three types of sex-linked traits: X-linked, Y-linked and XY-linked.

a) X-linked trait: The X-linked type sex-linked inheritance is performed by those genes which are localized in the non-homologous sections of X-chromosomes and that have no corresponding allele in Y-chromosome. The X-linked genes are commonly known as sex-linked genes.

b) Y-linked traits: The Y-linked type sex-linked inheritance is performed by those genes which are localized in the non-homologous section of Y-chromosome, and that heve no alleles in X-chromosome. The Y-linked genes are commonly known as holandric genes.

c) XY-linked traits: The XY-linked type sex-linked inheritance is performed by those genes which are localized in homologous sections of X and Y chromosomes.

Inheritance of X-linked genes in man: In man about fifty six X-linked genes have been reported. The most important and common X-linked genes of man are colour blindness, haemophilia, anhidrotic ectoderma, juvenile glaucoma, night blindness, white fore lock, etc. These diseases are associated with X-linked recessive genes and are most common in man. Certain X-linked diseases such as defective tooth enamel, however, are caused by dominant genes.

Q. Write about the inheritance of autosomal dominant and autosomal recessive trait.

Ans: The inheritance of autosomal dominant and autosomal recessive trait is as follows:

Inheritance of autosomal dominant trait: Autosomal dominant is one of several ways that a trait or disorder can be passed down through families. If a disease is autosomal dominant, it means one person only needs to get the abnormal gene from one parent in order to inherit the disease. One of the parents may often have the disease. Dominant inheritance means an abnormal gene from one parent can cause disease, even though the matching gene from the other parent is normal. For example, if the first child has the disorder, the next child has the same 50% risk of inheriting the disorder. Children who do not inherit the abnormal gene will not develop or pass on the disease. If someone has an abnormal gene that is inherited in an autosomal dominant manner, then the

parents should also be tested for the abnormal gene. Examples of autosomal dominant disorders include Huntington's disease and neurofibromatosis-1.

Inheritance of autosomal recessive trait: Autosomal recessive is one of several ways that a trait, disorder, or disease can be passed down through families. Genes come in pairs. Recessive inheritance means both genes in a pair must be defective to cause disease. People with only one defective gene in the pair are considered carriers. However, they can pass the abnormal gene to their children. If one is born to parents who both carry an autosomal recessive trait he has a 1 in 4 chance of getting the malfunctioning genes from both parents and developing the disease. In other words, if four children are born to a couple who both carry the gene but do not have signs of disease, the statistical expectation is as follows:

- One child is born with two normal genes (normal)
- Two children are born with one normal and one abnormal gene (carriers, without disease)
- One child is born with two abnormal genes (at risk for the disease)