GENETICS

HEREDITY AND VARIATIONS

It is commonly seen that members of a species are largely alike. An elephant resembles other elephants, a rose plant looks alike other rose plants, and children resemble their parents, even grandparents or great grandparents. This resemblance among the individuals of a species has given rise to a general truth **'like begets like'** which implies continuity of life. It is, however, not absolutely true as the members of a species are seldom exactly alike. For instance, in human beings, the children often have some individual characters in which they differ from one another, and also from their parents. In fact, their differences are as marked as their resemblances. This is true about other species as well.

The similarities and differences among the members of a species are not coincidental. They are received by the youngones from their parents. The hereditary information, in fact, is present in the gametes (egg and sperm) which fuse to form the fertilized egg or zygote during sexual reproduction. The zygote then develops into an organism of a particular type. For instance, fertilized eggs of sparrows hatch into sparrows only and the fertilized eggs of pigeons hatch into pigeons only. Similarly, a cow gives birth to calves only. The wheat plant gives rise to seeds which, in turn, develop into wheat plants.

Heredity :- The transmission of characters [or traits] from one generation to another generation.

or

The transmission of characters from the parents to their offsprings.

Variations :- The differences in the characters [or traits] among the individuals of a species are called variations. e.g. Plant height - Tall, dwarf & middle.

Ear lobe in human being :- The lowest part of our ear is called earlobe.

- In most of the people, the ear lobe is hanging and it is called free earlobe.
- In some people, the earlobe is closely attached to the side of the head and it is called attached ear lobe.

ACCUMULATION OF VARIATIONS DURING REPRODUCTION

Heredity involves inheritance of basic body design (similarities) as well as subtle changes (variations) in it from one generation to the next generation, i.*e.,* from parents to the offspring. When individuals of this new generation reproduce, the offsprings of second generation will have the basic body design, the differences that they inherit from first generation as well as newly developed differences.

Asexual reproduction involves single parent. When a single individual reproduces asexually, the resultant two individuals again after sometime reproduce to form four individuals. All these individuals would be similar. However, there would be only very minor differences between them. These very minor differences arise due to small inaccuracies in **DNA** copying.

Sexual reproduction, on the other hand, generates even greater diversity. This is so because sexual reproduction involves two parents (father and mother) and every offspring receives some characters of father and some characters of mother. Since, different offsprings receive different combination of characters of their parents (father and mother), they show distinct differences (variations) among themselves as well as from their parents. The variations accumulate and pass on to more and more individuals with each generation.

During sexual reproduction the variation caused by -

- (i) Chance separation of chromosomes during gamete formation (gametogenesis).
- (ii) Crossing over during meiosis.
- (iii) Chance coming together of chromosomes during fertilization.
- (iv) Mutations, i.e., alterations in the genetic material.

All the variations in a species do not have equal chances of surviving in the environment in which they are generated. Depending upon the nature of variations, different individuals would have different kinds of advantages. For instance, bacteria that can withstand heat will survive better in a heat wave than the others. In other words, environmental factors select the variants and this selection forms the basis of evolution.

GREGOR JOHANN MENDEL (1822 - 1884)

Mendel was born on 22 July 1822 at Heinzendorf in Austria at Silesia village. Mendel was worked in Augustinian Monastry as monk at Brun city, Austria.

In 1856-57, he started his historical experiments of heredity on pea(**Pisum sativum**) plant. His experimental work continued on pea plant till 1865 (19th centuary).

The results of his experiments were published in the science journal. "Nature For Schender Varein" in 1866.

This journal was in Germen language. Title is ' Verschue Uber Pflangen Hybridan'.

This journal was published by 'Natural History society of Bruno'.

A paper of Mendel by the name of **Experiment in plant Hybridization** published in this journal.

Mendel were unable to got any popularity no one understand of him. He died in 1884 (due to kidney disease (Bright disease)) without getting any credit of his work.

After 16 years of Mendel's death in 1900 Mendel's postulates was rediscovered. Mendel experiment remain hidden for 34 years.

Rediscovery by three scientist independently.

- 1. Carl Correns Germany (Experiment on Maize)
- 2. Hugo deVries (Holland) (Experiment on Evening Primerose)
- 3. Erich von Tschermak Seysenegg (Austria) (Experiment on different flowering plants)

CHARACTER

A recognisable feature of human beings or any other organisms are called characters.

eg. (i) Height

- (ii) Complexion
- (iii) Shape of hair
- (iv) Colour of eyes
- (v) Shape of nose

S. No.	Character	Dominant	Recessive
1.	Length of Plant	Tall	Dwarf
2.	Flower position	Axial	Terminal
3.	Shape of pod	Inflated	Constricted
4.	Colour of pod	Green	Yellow
5.	Shape of seed	Round	Wrinkled
6.	Colour of cotyledon	Yellow	Green
7.	Colour of flower	Violet	White

Traits :- Various forms of a character are called traits.

MENDEL'S MONOHYBRID CROSS

A breeding experiment dealing with a single character is called a monohybrid cross.

Mendel first selected '**pure line' plants** (i.e., the plants that produced similar traits generation after generation). He, then, cross pollinated such plants having the contrasting traits, considering one trait at a time. For instance, in one such cross breeding experiment, he cross bred garden pea plant having round seeds with plant having wrinkled seeds. In this monohybrid cross, the pollen grains from the flower of the desired plant raised from round seeds were transferred over the previously emasculated flower of a plant raised from wrinkled seeds or vice-versa. After the transfer of pollen grains, the cross pollinated flower was properly covered and seeds produced were allowed to mature. All the seeds of $\mathbf{F_1}$ generation were carefully observed. Mendel observed that all the seeds of $\mathbf{F_1}$ generation were of round type and there were no intermediate characteristics.

He raised plants from F_1 seeds and allowed the flowers to self-pollinate to produce the seeds of F_2 generation. The flowers were kept covered from the beginning to avoid unwanted pollens to reach these flowers. In F_2 generation, Mendel observed the appearance of both round and wrinkled seeds in approximately 3:1 proportion.



MENDEL'S DIHYBRID CROSS

A cross involving two pairs of contrasting characters.

OR

A cross in which two pair of contrasting characters are studied at a time.

In one such cross, Mendel considered **shape** as well as **colour of the seeds** simultaneously. He selected pure line plants and then cross pollinated flowers raised from seeds of round shape and yellow colour with those from wrinkled seeds and green colour. Mendel observed that in F_1 generation all seeds had the features of only one parental type, i.e., round shape and yellow colour. He raised plants from F_1 generation seeds and allowed the flowers to self pollinate to produce the seeds of F_2 generation. These flowers were kept covered from the beginning. In F_2 generation, Mendel observed the appearance of four types of combinations. These included two **parental types** (round shaped and yellow coloured seeds, and wrinkled shaped and green coloured seeds) and **two new combinations** (round shape d and green coloured seeds, and wrinkled and yellow coloured seeds) in approximately same proportion.



	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
	Round Yellow	Round Yellow	Round Yellow	Round Yellow
Ry	RRYy	RRyy	RrYy	Rryy
	Round Yellow	Round Green	Round Yellow	Round Green
rY	RrYY	RrYy	rrYY	nrYy
	Round Yellow	Round Yellow	Wrinkled Yellow	Wrinkled Yellow
ry	RrYy	Rryy	rrYy	nyy
	Round Yellow	Round Green	Wrinkled Yellow	Wrinkled Green

SOME IMPORTANT DEFINITIONS

Dominant gene :- The gene which decided the appearance of an organism even in the presence of an alternative gene.

Recessive Gene :- The gene which can decide the appearance of an organism only in the presence of another identical gene.

Chromosomes :- A thread - like structure in the nucleus of a cell formed of DNA which carries the genes.

Genotype :- The genetic constitution of an organism.

OR

The description of genes present in an organism e.g. TT, tt, Tt.

Phenotype :- External and morphological appearance of an organism for a particular character.

Allele :- Alternative forms of a gene which are located on same position [loci] on the homologous chromosome.

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 F_1 Generation :- When two parents cross or breed to produce progeny [or offsprings], then their progeny is called F_1 generation or first filial generation.

OR

The offspring produced by the parental generation.

 F_2 generation :- When the first generation progeny cross or breed among themselves to produce second progeny, then this progeny is called second filial generation or F_2 generation.

OR

The offspring produced by the F_1 generation

Hybrid :- A new form of plant resulting from a cross or breeding of different varieties of a plant is known as a hybrid.

Pure-breeding :- Characteristics that appear unchanged generation after generation.

Dominant characters :- Any character that appears in the F_1 generation offspring from a cross between parents possessing contrasting characters such as tallness & dwarfness in pea plants.

Recessive characters :- Any character present in the parental generation that does not appear in the F_1 generation but reappears in the F_2 generation.

Homozygous :- A condition in which the 2 members of an allelic pair are similar. e.g. TT, tt.

Heterozygous :- A condition in which the 2 members of an allelic pair are dissimillar. e.g. Tt.

Offspring :- Organisms produced as a result of sexual reproduction.

Homologous chromosomes :- All chromosomes found in pair & chromosomes of a pair are called homologous chromosomes.

Non-homologous chromosomes :- Chromosomes of different pair are called non-homologous chromosomes.

Genes :- Unit of heredity which transfers characters from parents to their offsprings during reproduction.

Gene \rightarrow Protein synthesis \rightarrow Enzymes [Controls phenotype of a charater]

LAWS OF MENDEL

On the basis of Mendel's work, 3 basic laws of inheritance were proposed.

- (i) Law of Dominance
- (ii) Law of Segregation
- (iii) Law of Independent Assortment

Law of dominance :- In crossing between organisms pure for contrasting characters of a pair, only one character of the pair appears in the F_1 generation. This character is termed dominant while the one which does not express itself in F_1 generation is termed recessive.

Law of segregation :- Allele or genes remain together and segregate at the time of gamete formation. This means that the alleles donot mix in the hybrids [Non-mixing of alleles]

This is also known as the Law of Purity of Gametes.

Law of Independent Assortment :- This law states that - when individuals differing in 2 or more than 2 pairs of contrasting characters are crossed, the inheritance of any one pair is not affected by the presence of the other.

e.g. The inheritance of tall character is not way related to the smooth character of the seed. Rather, the 2 characters are inherited independent of each other.

REVIEW QUESTION

GIVE ANSWER OF FOLLOWING QUESTIONS

- 1. Give definition of heredity.
- 2. What do you mean by variations?
- 3. Where genes present in organisms ?
- 4. Differentiate between autosomes & sex chromosomes.
- 5. Explain the terms genotype & phenotype.
- 6. Differentiate between Monohybrid cross & Dihybrid cross.
- 7. Give definition of hybridization.
- 8. What do you mean by pure breeding ?
- 9. Differentiate character and trait.
- 10. Give definition of Allele.

FILL IN THE BLANKS

- 1. Father of genetics is known as
- 2. The term genetics was coined by
- 3. A cross in which a single pair of contrasting characters is studied at a time is called
- 4. A condition in which the 2 members of an allelic pair are similar is called
- 5. Cross between two individuals having atleast one different character is called
- 6. External appearance of an organism for a particular character is called
- 7. The gene which expresses himself in the presence of another or in heterozygous condition is called
- 8. An unit of heredity which is responsible for a character is called

DEOXYRIBONUCLEIC ACID (DNA)

The expanded form of DNA is deoxyribonucleic acid. It was first isolated by the scientist **Frederick Meisher** from the nucleus of the pus cells in 1869. He named it as 'nuclein' or nucleic acid because of its acidic nature. Later, it was experimentally proved by the scientists **Griffith (1928)**, **Avery, McLeod and McCarty (1944)** that DNA is the carrier of the genetic information from generation to generation. It transmits the hereditary characters in a coded language from parents to the offsprings (i.e., from one generation to another).

DNA is a macromolecule or polymer. It is made of very large number of 'nucleotide' units and hence is termed **polynucleotide**.

Each nucleotide unit in a DNA molecule is made up of three components

- 1. Deoxyribose sugar :- It is a pentose sugar.
- 2. Nitrogenous base :- Each nucleotide unit has a nitrogen containing base. In a DNA molecule, nitrogenous bases are of two types :
- (a) Purines :- The purines in a DNA molecule are Adenine (A) and Guanine (G).
- (b) Pyrimidines :- The pyrimidines in a DNA molecule are Cytosine (C) and Thymine (T).

3. Phosphate group :- The phosphate group contains one phosphorus atom and four specifically linked oxygen atoms.

Thus, there are four types of nucleotides in a DNA molecule depending upon the kind of nitrogenous base present in **each** nucleotide.

Double Helical Model of DNA

J. D. Watson and F.H.C. Crick proposed the double helical model of DNA in 1953. They were awarded the Nobel Prize for this discovery in 1962. The important features of the double helical model are

(i) DNA molecule is made up of two **long polynucleotide strands** forming a **double helical structure** (double helix) just like a spiral staircase. Each helical turn of the DNA molecule is 3.4 nm in length in which ten nucleotide base pairs are present.

(ii) **Deoxyribose sugar and phosphate molecules** are joined alternately to form the backbone of each polynucleotide strand. The **nitrogenous base** of each nucleotide is attached to the sugar molecule and projected towards the interior of the double helix.

(iii) In the interior of double helix, the nitrogenous bases of two polynucleotide strands form a pair with the help of hydrogen bonds. Adenine (A) always pairs with thymine (T) and guanine (G) always pairs with cytosine (C).

Thus, the two polynucleotide strands of the DNA molecule are joined *by hydrogen bonds between* specific nitrogenous bases. Such a specific pairing of the bases of the opposite strands of the DNA molecule is called complementary pairing. Adenine (A) and thymine (T) are complementary to each other. Similarly, guanine (G) and cytosine (C) are complementary to each other. The hydrogen bonding between the specific nitrogenous bases keeps the two strands to hold together. Therefore, all the base pairs remain stacked between the two strands.

BLOOD GROUPS

Four different types of blood groups in human beings are : A, B, O, AB

 $O \rightarrow$ universal donor

Blood group	Genotype	Dominant	Recessive	Antigen	Antibody
А	I ^A I ^A I ^A I ^O	I ^A	Io	А	В
В	I ^B I ^B	I^{B}	Io	В	А
AB	$I^A I^B$	I^A, I^B	_	Α, Β	-
О	$I_O I_O$	_	Io	_	AB

 $AB \rightarrow$ universal recepient

SEX DETERMINATION

How is the sex of newborn individual determined ? In human beings, the sex of the individual is largely genetically determined. In other words, the genes inherited from our parents have assumed that similar gene sets are inherited from both parents. If that is the case, how can genetic inheritance determine sex ?

All human beings these are 23 pairs of chromosomes are present out of these 23 pairs, are autosomes (similar in males and females) and 1 pair is called sex chromosome (different in males and females). In males sex chromosome are XY and in females sex chromosome are XX.



So, it is clear from the above that male is responsible for producing male child.

POINTS TO REMEMBER

- + The term Genetics comes from "gene" word means "to grow".
- + The term "Genetics" coined by Bateson.
- + Study of *heredity and variations* is called **Genetics**.
- + Father of Genetics Gregor Johann Mendel.
- + Father of Modern Genetics Bateson.
- + Father of Experimental Genetics Thomus Hunt Morgan.
- + "Heredity" term coined by Spencer.
- + Bateson coined terms Genetics, Allele, Homozygous, Heterozygous, F_1 and F_2 Generation.

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EXERCISE # 1

FOR SCHOOL / BOARD EXAM.

VERY SHORT ANSWER TYPE QUESTION

- **1**. What is a gene ?
- 2. Write the scientific term used for 'science of heredity and variation'.
- **3.** Define inheritance.
- 4. What term did Mendel use for what we now call the genes ?
- 5. How does the creation of variations in a species promote survival ?
- 6. Name the plant on which Mendel performed his experiments.
- 7. Define Variation.
- 8. What are the carriers of factors or genes ?
- 9. Name two human traits which show variation.
- 10. Write down five inherited 'characters' or traits.
- 11. Which of the following combinations of sex chromosomes produces a male child, XX or XY ?
- 12. Which type of sex chromosomes are carried by male gametes sperms in human male ? What is their percentage?
- 13. What experiment would we do to confirm that the F_2 generation did in fact have a 1:2:1 ratio of TT, Tt and tt trait combinations ?

SHORT ANSWER TYPE QUESTIONS

- 1. Why did Mendel choose pea plants for his experiment ?
- 2. What is Mendel's genetics ?
- **3.** If a trait A exists in 10% of a population of an asexually reproducing species and a trait B exists in 60% of the same population, which trait is likely to have arisen earlier ?
- **4.** A Mendelian experiment consists in breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them are short. This suggests that the genetic makeup of the tall parent can be depicted as :-

(i) TTWW (ii) TTww (iii) TtWW (iv) TtWw

- 5. Explain the mechanism of sex determination in human beings.
- 6. Define genetics. What is the contribution of Mendel in this branch of Biology ?
- 7. Why are asexually reproducing organisms capable of showing the hereditary features more ?
- 8. With suitable example highlight how temperature has an effect on sex determination in the animal world.
- 9. Explain with an example how trait is inherited in human beings.
- 10. Why are traits acquired during the life-time of an individual not inderited ?

- 11. How does the creation of variations in a species ensure survival ?
- 12. A man with blood group A marries a woman with blood group O and their daughter has blood gruop O. Is this information enough to tell you which of the traits - blood group A or O — is dominant ? Why or why not ?
- 13. Why are the small numbers of surviving tigers a cause of worry from the point of view of genetics ?
- **14.** Draw a schematic diagram to explain the independent inheritance of two separate traits, shape and colour of seeds.
- 15. How do Mendel's experiments show that traits are inherited independently ?

LONG ANSWER TYPE QUESTIONS

- 1. Explain diagramatically a Mendel's dihybrid cross.
- 2. Briefly explain contributions of Mendel in Genetics.

FILL IN THE BLANKS

- 1. The transmission of characters from the parents to their offsprings is called ______.
- 2. The differences in the characters [or traits] among the individuals of a species are called ______.
- 3. A recognisable feature of human beings or any other organisms are called ______.
- 4. Various forms of a character are called ______.
- 5. A cross in which a single pair of contrasting characters is studied at a time, called ______.

6. A cross involving two pairs of contrasting characters is called ______.

- 7. The gene which decided the appearance of an organism even in the presence of an alternative gene is called
- The gene which can decide the appearance of an organism only in the presence of another identical gene is called _______.
- 9. Unit of heredity which transfers characters from parents to their offsprings during reproduction is called
- 10. The genetic constitution of an organism is called ______.

	ANSWERS KEY FOR SCHOOL / BOARD EXAMS.											
	FILL IN THE BLANKS											
1.	Heredity	2.	Variations.	3.	Character	4.	Traits	5.	Monohybrid cross			
6.	Dihybrid cross	7.	Dominant Gene	8.	Recessive Gene	9.	Genes	10.	Genotype			
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EXERCISE # 2

FOR SCHOOL / BOARD EXAM.

1.	Genetics is the branch	of science which deals with t	the study of :-	
	(A) cell function		(B) cell structure	
	(C) heredity and variation	on	(D) relation between plant	and environment
2.	The term 'genetics' was	s coined by :-		
	(A) William Bateson	(B) Gregor Mendel	(C) Thomas Hunt Morgan	(D) W. Johannsen
3.	The term 'gene' was int	troduced by :-		
	Genetics is the branch of science which deals with iter study of :- (A) cell function (B) cell structure (A) cell function (D) relation between plant and envirou The term 'genetics' was	(D) Johannsen		
4.	When a gene exists in	more than one form, the dif	ferent forms are termed :-	
	(A) alleles	(B) heterozygotes	(C) genotypes	(D) complementary genes
5.	The contrasting pairs of	f factors in Mendelian cross	es are called :-	
	(A) alloloci	(B) paramorphs	(C) allelomorphs	(D) multiple alleles
6.	Alleles of a gene are fo	ound on :-		
	(A) same chromosome		(B) any chromosomes	
	(C) homologous chromo	osomes	(D) nonhomologous chrom	osomes
7.	Which statement about	alleles is not true :-		
	(A) There may be sever	ral at a locus	(B) One may be dominant	over another
	(C) They may show inco	s is the branch of science which deals with the study of :- unction (B) cell struc dity and variation (D) relation b n 'genetics' was coined by :- am Bateson (B) Gregor Mendel (C) Thomas I n 'gene' was introduced by :- del (B) Bateson (C) Morgan gene exists in more than one form, the different forms a gene exists in more than one form, the different forms a gene exists in more than one form, the different forms a gene exists of factors in Mendelian crosses are called :- boci (B) paramorphs (C) allelomor of a gene are found on :- e chromosome (B) any chron ologous chromosomes (D) nonhomo tatement about alleles is not true :- re may be several at a locus (B) One may y may show incomplete dominance (D) They occ nism which receives identical alleles of a particular gene : ozygote (B) hemizygote (C) hemotha tetic complement of an organism is known as :- rotype (B) physiotype (C) phenotyp ysical appearance of an individual is known as :- rotype (B) genotype (C) morphotyp ms 'genotype' and 'phenotype' were introduced by :- son (B) Darwin (C) Johannse as Mendel's most important contribution to the modern un concept of meiosis (B) The conc concept that genes are ordered along chromosomes concept that genes are ordered along chromosomes concept that hereditary information comes in discrete uni Mendel was born in :- ria (B) Russia (C) Czechosle sm is related with :- edity in living organisms (D) None of	(D) They occupy different l	loci on the same chromosome
8.	An organism which rec	ceives identical alleles of a pa	articular gene from both par	ents is :-
	(A) homozygote	(B) hemizygote	(C) homothallic	(D) heterozygote
9.	The genetic compleme	nt of an organism is known	as :-	
	(A) genotype	(B) physiotype	(C) phenotype	(D) morphotype
10.	The physical appearan	ce of an individual is known	as :-	
	(A) heterotype	(B) genotype	(C) morphotype	(D) Phenotype
11.	The terms 'genotype' a	nd 'phenotype' were introdu	ced by :-	
	(A) Bateson	(B) Darwin	(C) Johannsen	(D) Mendel
12.	What was Mendel's mo	st important contribution to	the modern understanding c	of biology :-
	(A) The concept of mei	osis	(B) The concept of chromo	osome
	(C) The concept that ge	enes are ordered along chro	mosomes	
	(D) The concept that he	ereditary information comes	in discrete units	
13.	Gregor Mendel was bo	rn in :-		
	(A) Austria	(B) Russia	(C) Czechoslovakia	(D) United Kingdom
14.	Mendelism is related w	ith :-		
	(A) Heredity in living be	lings	(B) Meiosis during sexual r	eproduction
	(C) Mutations in living o	rganisms	(D) None of the above	
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С	BSE : CLASS-X	
15.	Mendel published the results of his expe	riments in the year :-
	(A) 1568	(B) 1773
	(C) 1866	(D) 1921
16.	In 1900 AD, three biologists independer	ntly rediscovered Mendel's principles. They were :-
	(A) Sutton, Morgan and Bridges	
	(B) Bateson, Punnett and Bridges	
	(C) Avery, MacLeod and McCarty	
	(D) Hugo de Vries, Correns and Tscherm	nak
7.	How many contrasting traits of pea were	e studied by mendel :-
	(A) Two	(B) Four
	(C) Seven	(D) Three
8.	Which one of the following traits of gard	len pea studied by Mendel was a recessive feature ?
	(A) Green seed colour	(B) Green pod colour
	(C) Round seed shape	(D) Axial flower position
9.	Which of the following contributed to the	e success of Mendel :-
	(A) His knowledge of biology	
	(B) Qualitative analysis of data	
	(C) Observation of distinct inherited traits	3
	(D) consideration of one character at a ti	ime
0.	The reason why pea plants were suitable	e than dogs for Mendel's experiments :-
	(A) Dogs have many genetic traits	
	(B) Pea plants can be self fertilized	
	(C) There are no pedigree records of dog	gs
	(D) The pea plants favour cross-fertilizati	on
1.	Mendel chose pea plants because they :-	-
	(A) were cheap	
	(B) were easily available	
	(C) have great economic importance	
	(D) were having contrasting characters	
2.	Selection of homozygous plant is :-	
	(A) mass selection	(B) pure line selection
	(C) mixed selection	(D) none of the above
3.	When a cross is made between two pare	ents with respect to a single character, it is called :-
	(A) dihybrid	(B) monohybrid
	(C) trihybrid	(D) none of these

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24. Which of the following is the monohybrid ratio :-

	(A) 3 : 1		(B) 9 : 7	
	(C) 1 : 2		(D) 9 : 3 : 3 : 1	
25.	Mendel formulated t	the law of purity of gamete	es on the basis of :-	
	(A) test cross		(B) dihybrid corss	
	(C) back cross		(D) monohybrid c	ross
26.	How many types of	gametes will be produced	in F ₂ generation of a m	onohybrid cross of Mendel :-
	(A) 3	(B) 4	(C) 8	(D) 16
27.	Recessive gene can	express only in :-		
	(A) homozygous cone	dition	(B) heterozygous	condition
	(C) both above condi	itions	(D) none of these	conditions
28.	Considering tallness	and dwarfness, tallness is	more wide spread amo	ng pea plants because :-
	(A) Tallness is domin	ant over dwarfness		
	(B) Tallness is deterr	nined by one gene having	many effects	
	(C) Tallness is deterr	nined by many genes having	ng multiple effects	
	(D) None of these			
29.	A red-flowered pea	plant was crossed with whit	te-flowered plant. In F_1 g	generation all plants were red. It confirms
	that white colour is :	-		
	(A) Recessive charac	cter	(B) Dominant cha	aracter
	(C) nongenetic expre	ession	(D) none of the a	bove
30.	A woman with straig	ht hair mates with a man w	ith curly hair who is kno	wn to be heterozygous for that trait. What
	is the chance that th	neir first child will have curl	y hair :-	
	(A) No chance	(B) One in two	(C) It is certain	(D) One in four
		ANSWERS KEY FOR	R SCHOOL / BOAR	D EXAMS.
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•	Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Ans.	С	А	D	А	С	С	D	А	А	D	С	D	А	А	С
•	Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
-	Ans.	D	С	А	D	В	D	В	В	А	D	В	А	А	А	В

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EXERCISE # 3

COMPETITIVE EXAMS.

1.	The main reason of Mend	el's successs in discovering	the principles of inheritance	was :-
	(A) He considered each cl(C) The plant was pure be	naracter separately reeding	(B) He was lucky not to end(D) All the above	counter linkage problem
2.	Mendel was lucky in the ch to his success ?	noice of the material of his	experiments, among the follo	wing, which contributed,
	(A) He observed distinct in	herited traits	(B) He qualitatively analysed	his date
	(C) He liked pea plants		(D) He considered only one	character at one time
3.	The year 1990 AD is high	hly significant for genetics	due to :-	
	(A) Principle of linkage		(B) Chromosome theory of h	neredity
	(C) Rediscovery of Mendel	ism	(D) Discovery of genes	
4.	Genotype means :-			
	(A) Genetic composition o	f the individual	(B) Genetic composition of t	the germ cell
	(C) Genetic composition of	f plastids	(D) Genetic compositon of a	n organ
5.	An organism with two ide	ntical alleles of a gene is a	a cell is called :-	
	(A) Homozygous	(B) Domainant	(C) Heterozygous	(D) Hybrid
6.	When an individual is have	ing both the alleles of con	trasting characters it is said to	o be :-
	(A) Heterozygous		(B) Dioecious	
	(C) Monoecious		(D) Linked genes	
7.	When an allele fails to exp be :-	press itself in F_1 generation	n in the presence of other alle	ele, the former is said to
	(A) Recessive		(B) Codominant	
	(C) Complementary		(D) Epistatic	
8.	If a plant is heterozygous fo of :-	r tallness, the F_2 generation	has both tall and dwarf plants.	This proves the principle
	(A) dominance		(B) segregation	
	(C) independent assortmen	t	(D) incomplete dominance	
9.	Mendel crossed a pure wh first generation of hybrids	nite flowered recessive pea from the cross should sho	plant with a dominant pure w :-	red flowered plant. The
	(A) 50% white flowers and	d 50% red flowers	(B) all red flowered plants	
	(C) 75% red flowered and	25% red flowered plants	(D) all white flowered plants	
10.	If a couple has three daug	ghters, what are the chanc	es that the fourth child will b	be a son ?
	(A) 100%	(B) 75%	(C) 50%	(D) 0%
11.	If a heterozygous tall palnt	is crossed with a homozyge	ous dwarf palnt, the proportio	n of dwarf progeny will:-
	(A) 50%	(B) 75%	(C) 100%	(D) 25%

- 12. The crossing of a homozygous tall plant with a dwarf would yield plants in the ratio of :-
 - (A) two tall and two dwarf
 - (B) one homozygous tall, one homozygous dwarf and two heterozygous tall
 - (C) all homozygous dwarf
 - (D) all homozygous tall
- 13. When a true breeding tall plant is crossed with a true breeding short plant and the F_1 produced is self pollinated to produce F_2 ratio of true breeding tall and true breeding short plant in F_2 will be :-
 - (A) 1 : 2 (B) 1 : 1
 - (C) 2 : 1 (D) 1 : 3
- 14. Blue eye colour in human is recessive to brown eye colour. The expected children of a marriage between blue-eyed woman and brown-eyed male who had a blue-eyed mother are likely to be :-

(D) one blue-eyed and one brown-eyed

- (A) all blue-eyed (B) three blue-eyed and one brown-eyed
- (C) all brown-eyed
- 15. Allosomes are :-
 - (A) bead like structures (B) on chromosomes
 - (C) sex chromosomes (D) rounded bodies
- **16.** Mutation is :-
 - (A) a change that is inherited
 - (B) a change, which affects the parents only but never, inherited
 - (C) a change, which affects the offspring of F_2 generation only
 - (D) a factor responsible for plant growth
- 17. The paint that was made popular by "De Vries mutation theory" :-
- (A) Triticum vulgare (B) Oenothera lamarkiana (C) Pisum sativum (D) Primula vulgaris 18. "Barr body" is derived from :-(A) autosomes in males (B) autosomes in females (C) X-chromosome in female (D) X-chromosome in males 19. The DNA is the genetic material was proved conclusively by :-(A) J D Watson (B) Hershey and Chase (D) Boveri and Sutton (C) Alfred Griffith
- 20. Nobel Prize for "one gene one enzyme theory" was given to :-
 - (A) Beadle and Tatum(B) Schleiden and Schwann(C) Watson and Crick(D) H Harris

C	CBSE : CLASS-X	
21.	Retrovirus has the following as its genetic materia	d :-
	(A) single stranded DNA	(B) double stranded duplex DNA
	(C) DNA-RNA hybrid	(D) RNA
22.	Of the following, which sequence is present in Ro	ous Sarcoma Virus ?
	(A) DNA \rightarrow RNA \rightarrow proteins	(B) DNA \rightarrow DNA \rightarrow proteins
	(C) RNA \rightarrow DNA \rightarrow proteins	(D) RNA \rightarrow DNA \rightarrow RNA \rightarrow proteins
23.	The term genome is used for :-	
	(A) diploid set of chromosomes	(B) polyploid set of chromosomes
	(C) triploid set of chromosomes	(D) haploid set of chromosomes
24.	The first successfully cloned mammal that gained	world-wide publicity was :-
	(A) Molly, a sheep (B) Polly, a sheep	(C) Chance ; a bull (D) Dolly, a sheep
25.	The transgenic animals are those that have :-	
	(A) foreign DNA in some of its cells	(B) foreign DNA in all its cells

(C) foreign RNA in all its cells (D) both (A) and (C)

	ANSWERS KEY FOR COMPETITIVE EXAMS.														
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	D	D	С	А	А	А	A	В	В	С	A	В	В	D	С
Que.	16	17	18	19	20	21	22	23	24	25					
Ans.	А	В	С	В	A	D	D	D	D	В					