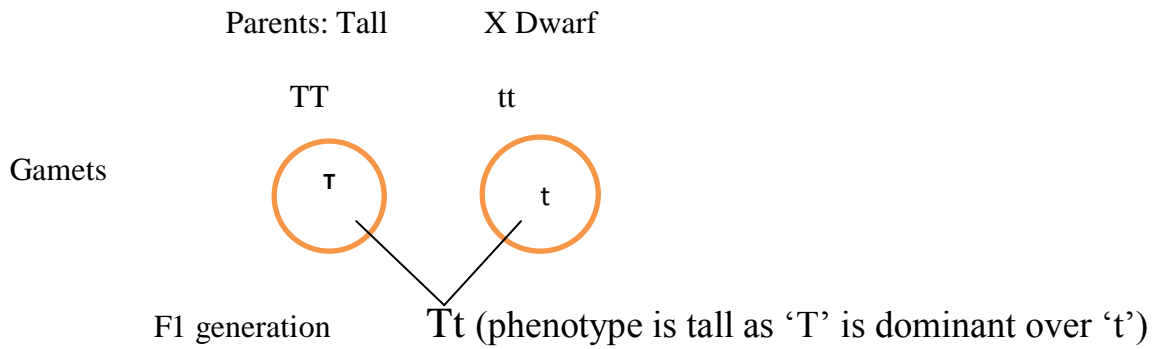


## GRADE 10 - BIOLOGY TOPIC-HEREDITY AND EVOLUTION

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- 1 What is meant by heredity?  
The transmission of characters or traits from the parents to the off springs.
- 2 What do you mean by the term variation?  
The difference in traits among the individuals of a species.
- 3 Name two human traits, which show variation?  
i) Height in humans (Very tall, less tall, medium height, short height and very short)  
ii) Attached and free ear lobes in humans.
4. Which of the processes, sexual reproduction or asexual reproduction, brings about maximum variation in the off springs? Why?  
In sexual reproduction, only one parent is involved. Hence a minor amount of variation can produce only by the error in DNA copying. In sexual reproduction, two parents are involved. Two parents contribute the offspring's genotype and hence chances of variations are high.
- 5 State the advantages of variations to a species?  
i) It increases the chances of its survival in a changing environment.  
ii) It is a tool for evolution
- 6 If a trait 'A' exists 10% of a population of an asexually reproducing species and a trait 'B' exists in 60% of the same population, which trait is like to have arisen earlier?  
Trait 'B'.
- 7 Name the first scientist who studied the inheritance of traits from one generation to the next?  
Gregor.J.Mendel.
- 8 Why did Mendel choose pea plants (*Pisumsativum*) for conducting his experiments?  
i) Pea can be termed as biennial plant, i.e. two generations of pea plant can grow in given year. Hence he could get enough time to observe a large number of generations.  
ii) It shows many contrasting traits.  
iii) It is a self-pollinating plant but can be cross-pollinated easily.
- 9 Explain with an example, how genes control the characteristics or traits?  
A gene is a segment of DNA, which codes for the formation of a protein controlling a specific trait of the organism  
Eg: Suppose a plant progeny has gene for the characteristic called 'tallness'. The gene for tallness will give instructions to the plant tells to make a lot of growth hormones. And due to the formation of excess plant growth hormones, the plant will grow too much and hence became tall.
- 10 10. What is monohybrid cross?  
The cross in which a pair of contrasting traits are studied is called monohybrid cross. Mendel did monohybrid cross for his first experiment. Based on this experiment, Mendel proposed the first law of inheritance.  
THE LAW OF SEGREGATION:  
Every individual possess a pair of alleles for a particular trait. During gamete formation, a gamete receives only one gene from the alleles. A particular trait can be dominant or recessive in a particular generation.
- 11 How do Mendel's experiments show that traits may be dominant or recessive?  
Ans: The trait appearing itself in the hybrid is the dominant one. Eg: When tall pea plants cross with dwarf pea plant, all the F1 hybrids were tall showing that tallness is dominant and shortness is recessive.



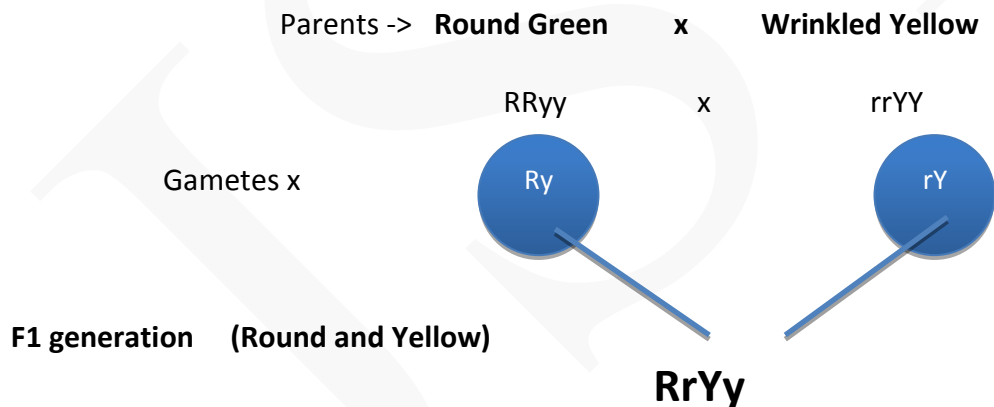
12 What is dihybrid cross? Explain.

The cross in which two pairs of characters are studied is called dihybrid cross. In the second experiment, Mendel used dihybrid cross. He chose Colour and shape of the seeds

Colour- Green (yy) and yellow seeds (YY)

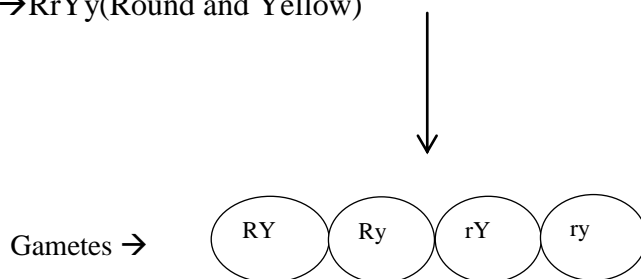
Shape- Round (RR) and wrinkled (rr)

He crossed Round and Green seeds (RRyy) with Wrinkled and Yellow seeds (rrYY)



**F1 generation is self-pollinated to produce F2 generation.**

Parents → RrYy (Round and Yellow)



F2 Generation:

Male Gamete → ↙ Female Gamete ↓	RY	Ry	rY	Ry
RY	RRYY Round & Yellow	RRYy Round & Yellow	RrYY Round & Yellow	RrYy Round & Yellow
Ry	RRYy Round & Yellow	RRyy Round & Green	RrYy Round & Yellow	Rryy Round & Green
rY	RrYY Round & Yellow	RrYy Round & Yellow	rrYY Wrinkled & Yellow	rrYy Wrinkled & Yellow
ry	RrYy Round & Yellow	Rryy Round & Green	rrYy Wrinkled & Yellow	rryy Wrinkled & Green

Round Yellow - 9

RRYY  
RrYY  
RrYy

Round Green - 3

RRyy  
Rryy

Wrinkled Yellow - 3

rYY  
rrYy  
rryy

Wrinkled Green - 1

- The genotype of Round & Green seed is RRyy.
- The genotype of Wrinkled & Yellow is rrYY.
- In the F1 generation, all offsprings were Round & Yellow (RrYy) because Roundness and Yellow was dominant over wrinkled and green traits.
- In the F2 generation produced round and yellow, round and green, wrinkled and green, and wrinkled and yellow in the ratio **9:3:3:1**.

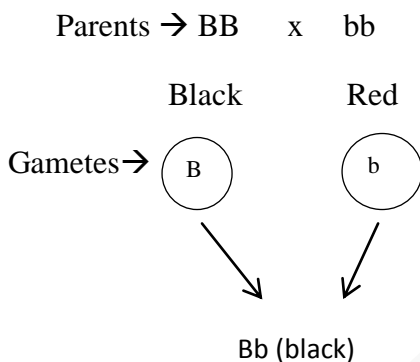
## Mendel's Second Law

### The Law of Independent Assortment:

It states that alleles of different traits separate independent from each other during gamete formation (means that the allele which determines shape of the seed is independent of the allele which determines the colour).

Q13. The gene for red hair is recessive to the gene for black hair. What will be the hair colour of a person if he inherits a gene for red hair from his mother and gene for black hair from his father?

Ans: As the black hair is dominant over red hair, the person will have black hair.



Q14. In humans, if gene 'B' gives for brown eyes and gene 'b' gives blue eyes, what will be the colour of eyes of the persons having the following combination of genes:

- a) Bb    b) bb    c) BB

Ans: a) Bb → Brown eyes (Gene 'B' is dominant)

      b) bb → Blue eyes ( Gene 'b' is recessive)

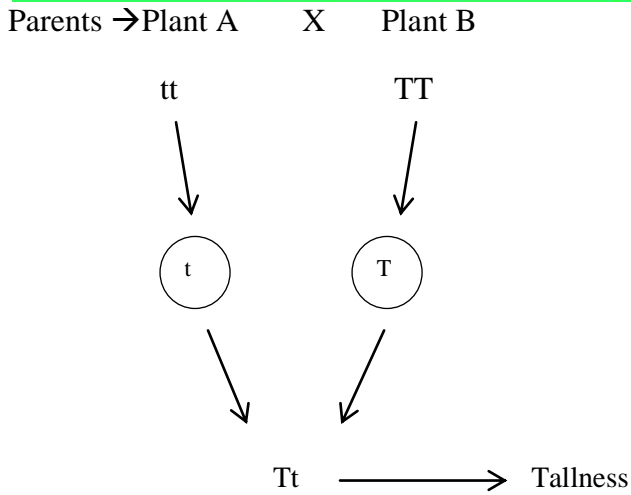
      c) BB → Brown eyes ( Gene 'B' is dominant)

Q15. What are genes? Where are they located in our body?

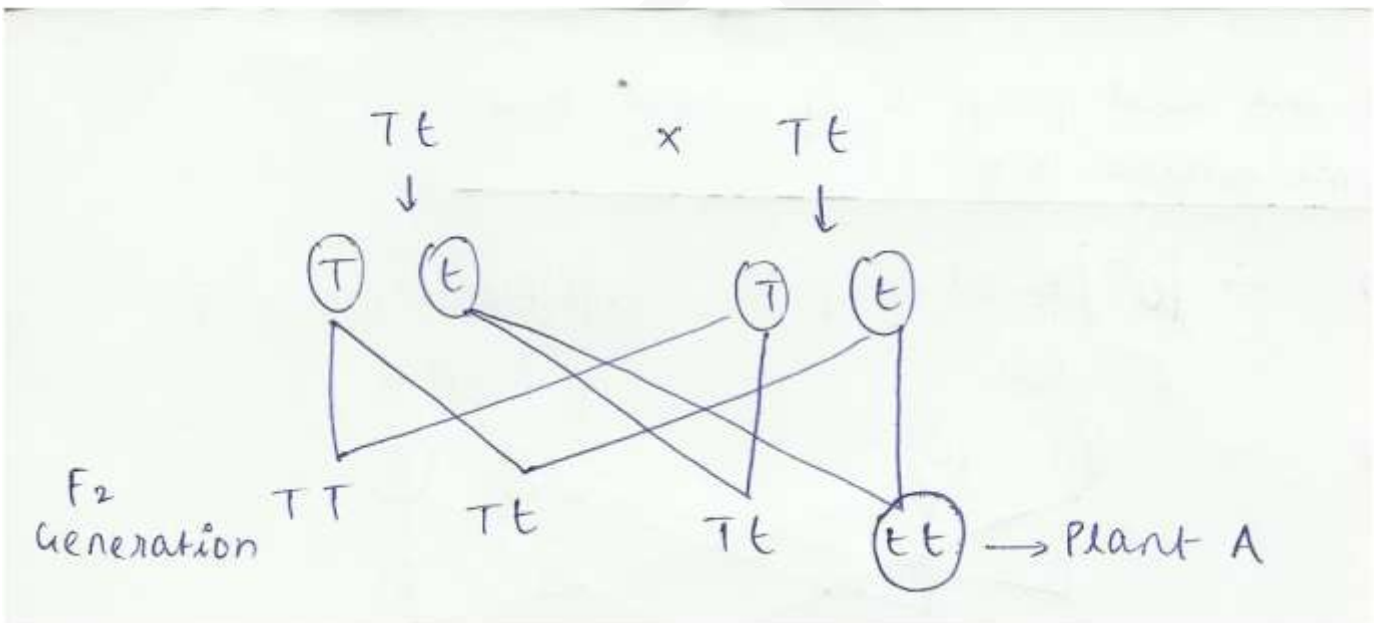
Ans: Genes are the segments of DNA that controls the appearance of traits in organisms. They are located in the chromosomes present in the nucleus of a cell.

Q16. Pure – bred pea plants 'A' are crossed with pure – bred pea plants 'B'. It was found that the plant which looks like 'A' do not appear in the F1 generation but re-emerge in F2 generation. Which of the plants A and B are: i) Tall    ii) Dwarf. Give reasons for your answer.

Ans: Plants B are tall, because it appears in the F1 generation which indicates that plant B contains the dominant gene i.e. tallness. Plant A is dwarf because it appears only in F2 generation which indicates that plant A contains the recessive gene i.e. dwarfness.



F1 is selfed



18. Which are the four blood groups in man ?

- 1) Group A – [AA or AO]
- 2) Group B -- [BB or BO]
- 3) Group AB –[AB]
- 4) Group O – [OO]

19. A man having blood group A marries a woman having blood group O and they have a child. What will be the blood group of the child ?

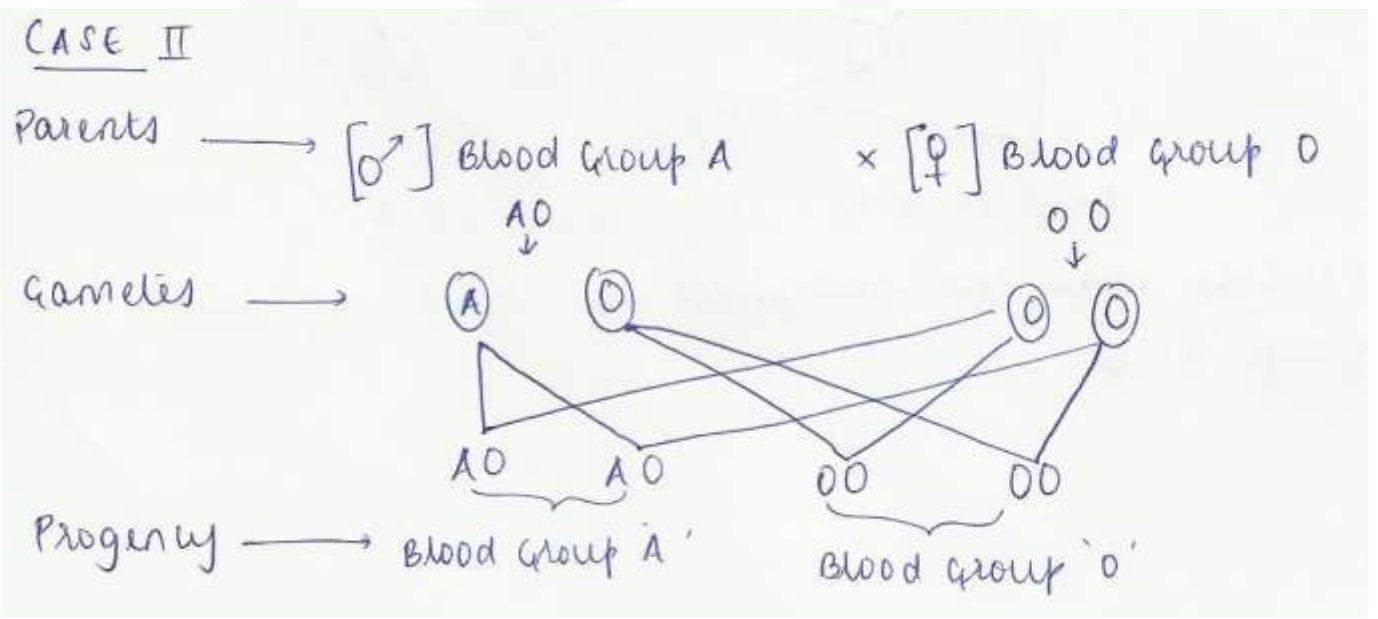
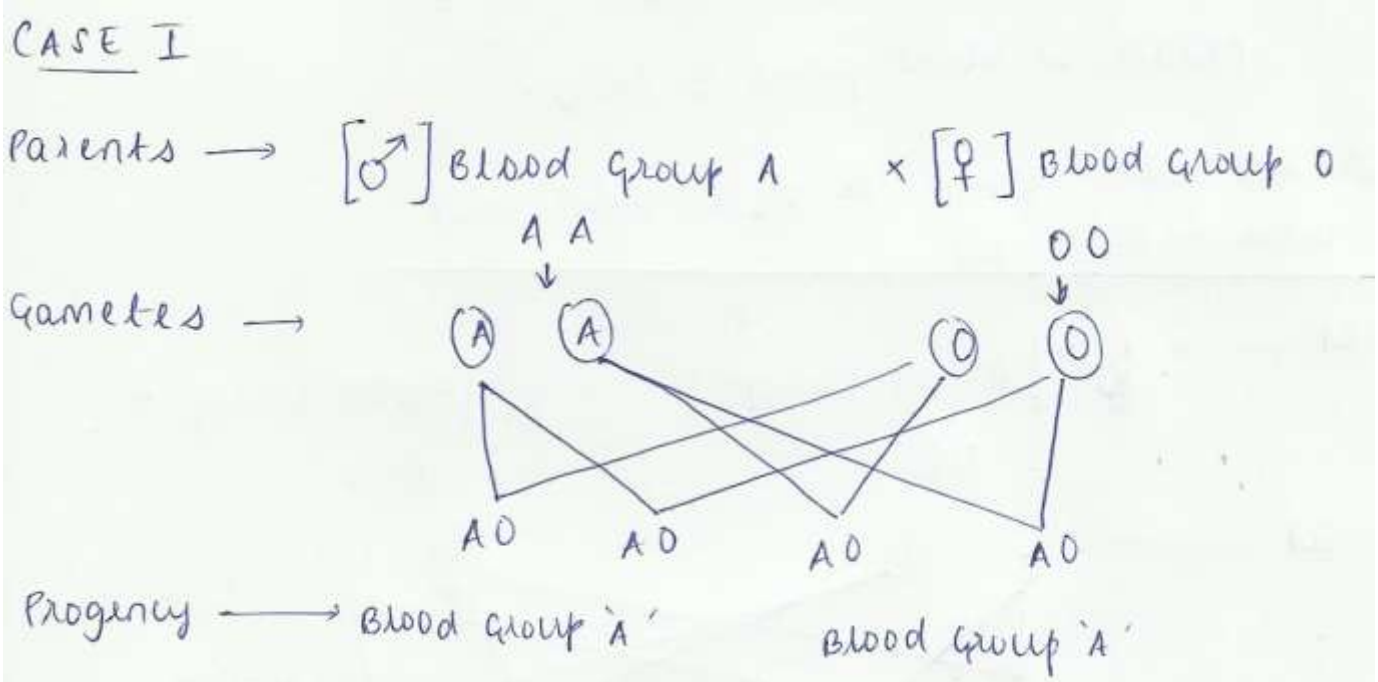
A- The answer depends on whether the blood group A of a man has gene combination AA or AO.

(a) **When the blood group A has genotype AA**

In this case the genotype of the man's blood is AA and that of the woman's blood is OO. So the child will have blood group A. (because the gene A is dominant over O).

(b) **When the blood group A has genotype AO**

Here the genotype of the man's blood is AO and that of the woman's blood is OO. So in this case there is an equal chance that the genotype of the child's blood can be either AO. Due to this there is an equal chance of the child acquiring blood group A or blood group O.



20. A man having a blood group O marries a woman having blood group B, and they have a daughter. What will be the blood group of the daughter?

A- The answer depends on whether the woman with blood group 'B' has gene combination BB or BO.





A- Human cells have 46 chromosomes(23 pairs). Among that 22 pairs of chromosomes are called autosomes, determine all the traits other than sex.

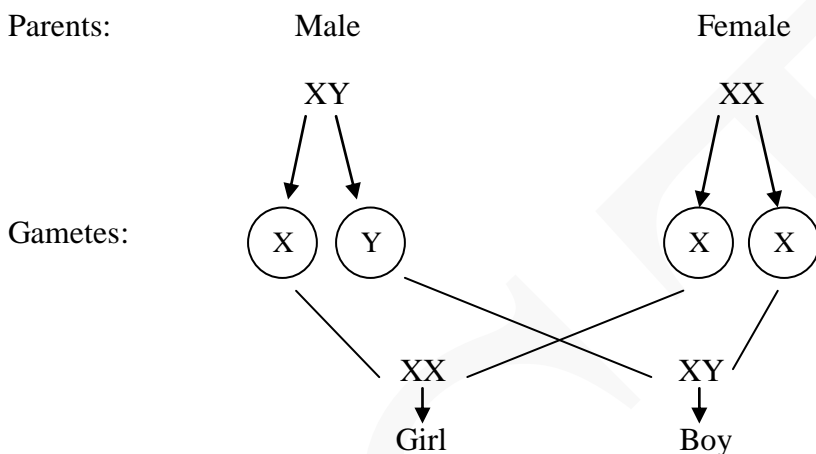
The 23<sup>rd</sup> pair of chromosomes(1 pair) determine the sex of a person.

In females the sex chromosomes are 'XX' and in males 'XY'.

All the eggs(female gametes) contain:

-One 'X' chromosome and the sperms (male gametes) have either 'X' or 'Y' chromosome. -When the sperm with 'X' chromosome fertilizes the egg (X), the zygote is female i.e. XX.

When the sperm with 'Y' chromosome fertilizes the egg (X), then the zygote is male i.e. XY.



23. How is sex determined in the following animals?

a. Turtle (Reptile)

b. Lizard

c. Snails

Ans:- a) Turtle : The sex is also controlled by environmental factors. The temperature at which the fertilized egg is incubated before hatching, plays a role in determining the sex of the offspring. If the egg is at high incubation temperature, then more female offspring are produced.

b) In lizards, high incubation temperature produces more male offspring.

c) Snails can change sex, indicating that sex is not determined genetically

24Q - What is meant by acquired and inherited trait? Explain with one example each.

- A trait of an organism which is not inherited but develops in response to the environment is called an acquired trait.
- The acquired traits are not inheritable because these traits are not inheritable because these traits hardly make any changes in the genes present in the reproductive cells of the parent organism.

Eg. If a beetle does not get enough food for a considerable time, its weight will be reduced due to starvation. This low weight doesn't make any changes in the genes present in the reproductive cells. Hence they are not inheritable.

Inherited traits

A trait of an organism which is caused by a change in its genes is called an inherited trait.



Eg. Suppose there is a population of red beetles in the green bushes. Again suppose that a colour variation arises during reproduction so that 1 beetle is green in colour. This change in green colour in beetle has been brought about by a change in the gene of the reproductive cells. Hence the green colour can be passed onto the next generation.

25.Q - what is evolution?

It's the sequence of gradual changes which take place in the primitive organisms over millions of years in which new species are produced.

26Q. Why are a small no. Of surviving tigers a cause of vary from the point of view of tigers?

When a population is small, the scope and no. Of variations is limited. And hence diversity and traits are reduced. This further reduces the chance of survival in the event of a disease or a disaster. If they all die out and become extinct, their genes will be lost forever.

27Q. What is organic evolution?

The evolution of living organisms is known as organic evolution.

28Q. What are the evidences of evolution?

The following are the evidences of evolution:-

### **a..Homologous Organs**

Those organs which have the same structure but different functions are called homologous organs.

Eg. The fore limbs of man, a lizard (reptile) , a frog ( amphibian),a bird and a bat (mammal) seem to have same basic structure but perform different functions.

Thus the presence of homologous organs in different animals provide evidences by telling us that they are derived from a common ancestor.

### **b..Analogous Organs**

Those organs which have different basic structure but have similar appearance and perform similar functions are called analogous organs.

For eg: The wings of an insect and a bird have different structures but perform the same function.

### **c.. Fossil evidences:**

The remains of dead animals and plants that lived in the remote past are known as fossils.

Eg: A fossil bird called Archaeopteryx looks like a bird but it has many other features which are found in reptiles. This is because Archaeopteryx has feathered wings like those of birds but teeth and tail like those of reptiles. Therefore Archaeopteryx is a connecting link between the reptiles and birds hence, this suggests that the birds have evolved from reptiles.

Q29. Who proposed the theory of inheritance of acquired traits?

Ans: J.B. Lamarck.

Q30. Write a brief account on salient points of Lamarck's theory. Who disapproved this theory?

Ans: Lamarckism:

1. The use and disuse of an organ leads to changes in the features of that organ.
2. These changes are inherited by offspring.
3. Favourable variations result in evolution of new species.

August Weisman disapproved this theory.

Q31. Cat's paw, human hand and horse's leg – are these organs homologous or analogous? Give reasons.

Ans: They are homologous because they have same basic structure but different functions.

Q32. Give one difference between eye and eye spot. Which animals possess eye spots?

Ans: Eyes are the well-developed organs helping to form an image. But eye spots just enable the animal to distinguish between light and darkness. Eg: Planaria and Euglena.

Evolution by eyes also supports the theory of organic evolution.

Q33. How does embryology and vestigial organs support the theory of organic evolution?

Ans: Embryology:

The study of the development of the embryo of an animal is called embryology. The embryos of different animals show similarities and a gradation supports evolution.

Vestigial Organs:

Organs which are functionless in an organism are called vestigial organs. Vermiform appendix in humans are the best example.

Q34. State the theory of natural selection.

Ans: This theory was put forth by Charles Darwin.

- a) All species produce large number of offsprings, hence there is a struggle for existence. Due to this struggle for existence, the population remains constant.
- b) The struggle eliminates the unfit individuals and the fittest survives (survival of the fittest).
- c) This gives the organ to variations which pass into progeny and over a long period of time, leads to the origin of new species.

But Darwin could not explain how variations arise.

Synthetic theory of evolution:

It states that there is an interaction between genetic variations and natural selection, which leads to the origin of new species.

Q35. What is speciation? What factors could lead to the rise of new species (speciation)?

Ans: A species is a population of organisms consisting of similar individuals which can breed together and produce fertile offsprings.

Speciation:- The process by which new species develop from existing species is known as speciation.

Factors leading to speciation:

- 1) Genetic variation(mutation)
- 2) Natural selection
- 3) Reproductive isolation(geographical isolation)
- 4) Gene flow and genetic drift.

Q36. Out of bacteria, spider, fish and chimpanzee, which organism has a better body design in evolutionary terms? Give reasons for your answer.

Ans: Bacteria: This is because bacteria 'still inhabit' some of the most unfavourable habitats such as hot springs, deep sea, thermal vents and the ice in Antarctica. Most other organisms cannot survive in such harsh environments.

37. Name five varieties of vegetables have been produced from 'wild cabbage' by the process of artificial selection. 1. Cabbage 2. Broccoli 3. Cauliflower 4. Kohlrabi 5. Kale From wild cabbage by artificial selection.

Ans: Cabbage- Have very short distances between the leaves of wild cabbage.

Broccoli- Arrested the flower development of wild cabbage plant, led to the production of broccoli.

Cauliflower- Sterile flowers of the wild cabbage plant, developed into cauliflower.

Kohlrabi- Swollen parts of the wild cabbage, led to the evolution of kohlrabi.

Kale- Larger leaves of the wild cabbage used for producing a leafy vegetable called Kale.

Wild cabbage is the ancestor of cabbage, broccoli, cauliflower, kohlrabi and kale.

38. Why are human beings who look so different from each other in terms of size, colour and look said to belong to the same species?

Ans . Human beings belong to the same species Homo Sapiens because they can interbreed and produce fertile offspring.

Early humans have developed in Africa. About hundred thousand years back, some of the ancestors left Africa and while others stayed back in Africa slowly spread across the whole earth. Based on the prevailing environment, they developed genetic variation which lead to difference in colour and other traits.

39. Evolution should not be equated with progress. Why?

Ans: Evolution does not mean progress in every case. It is just the production of diversity of life forms and shaping their diversity by the environmental (natural) selections.

For ex: Bacteria are the simplest and oldest organisms on earth.

Even though they have got a simple body design, they are able to survive in harsh environmental condition, which other complex or advanced organisms cannot.

40. Does geographical isolation of individuals of a species lead to formation of new species? Provide a suitable explanation?

Yes, geographical isolation leads to genetic drift. This may impose limitations to sexual reproduction of the separate population. Slowly the separated individuals will reproduce among themselves and generate new species. Continuous accumulation of those variations through a few generations may ultimately lead to the formation of new species.

41. What evidence do we have in the origin of life from inanimate matter?

Ans:

- Haldane theory was experimentally confirmed by Stanley L Miller and Harold Urey in 1953.
- They assembled an apparatus to create earth atmosphere which consists of methane, ammonia, hydrogen sulphide etc. over water.
- This was maintained at a temperature of below 100 C and electronic sparks were passed through the mixture of gases for about one week.
- They found that the formation of amino acids which make up protein molecules found in living organisms.
- This provides an evidence that the life originated from inanimate matter like inorganic molecule.

42. How can we find the age of a fossil?

The age of a fossil can be estimated by two methods:

1. **Relative Method:** The fossils which we find closer to the surface of the earth are more recent; the fossils which are found in deeper layers are older. Whereas the fossils found in the deepest layers of the earth are oldest ones.
2. **Carbon dating methods:** All living objects contain carbon-14 atoms which are radioactive. When a living object dies and forms fossils, its carbon-14 radioactivity goes on decreasing gradually. In this method, the age of the fossil is found by comparing the carbon-14 radioactivity left in fossils with C-14 radioactivity present in living objects.