

Solution
WORKSHEET
Class 10 - Science

1. **(c) Friedrich**
Explanation:
DNA isolation is a process of purification of DNA from a sample using a combination of physical and chemical methods. The first isolation of DNA was done in 1869 by Friedrich Miescher.
2. **(a) Tt and Tt**
Explanation:
Tt and Tt
3. **(b) Both maternal & Paternal DNA**
Explanation:
As during fertilisation, sperm only gives nucleus, but ova gives nucleus as well as cytoplasm. Therefore, the mitochondrial DNA and other cytoplasmic factors are inherited directly from mother. there are some traits which are exclusively linked with Y- chromosome and they are inherited by the male child directly from father.
4. **(d) round and green**
Explanation:
Since roundness and green colour are shown by capital letters in the genotype so they are dominant traits. We know that only dominant traits are expressed in F₁ generation.
5. **(d) Alleles**
Explanation:
An alternative form of a gene is known as an allele. Alleles vary in their sequence which may or may not result in a variant phenotype of a particular trait. Alleles represent variations of a gene that is responsible for a particular trait.
6. **(b) tallness is the dominant trait**
Explanation:
According to the law of dominance, the character that is expressed in the F₁ generation is called the dominant trait whereas character that is not expressed in F₁ generation is known as recessive trait. Thus, tallness is the dominant trait.
7. **(a) one**
Explanation:
A zygote has 23 pairs of chromosomes i.e., 46. Out of them, one pair is the sex chromosome.
8. **(a) two individuals of a species**
Explanation:
species is the lowest level of classification and shows the high level of similarities among the organisms. so two individuals of a species have the maximum common characteristics.
9. **(a) Genetics**
Explanation:
Genetics is the study of genes, genetic variation, and heredity in living organisms. It is generally considered a field of biology, but intersects frequently with many other life sciences and is strongly linked with the study of information systems.

10. **(d)** Gregor Mendel
Explanation:
 Gregor John Mendel is considered as the father of genetics as he laid down the principles or laws of inheritance for the first time. Though his works were based on plants but the laws governing inheritance patterns are also applicable to humans and hence we call them as “Mendel's Laws of Inheritance”.
11. **(a)** 3 : 1
Explanation:
 All of the colours in F_1 will be Vv (violet) when VV crosses with vv. When Vv crosses with Vv, the resulting F_2 will contain VV, Vv, vV, and vv, only one of which has white flowers while the others have violet ones. Ratio is thus 3 to 1.
12. **(b)** Statement (i) is correct.
Explanation:
 In humans, females have homomorphic sex chromosomes, i.e., two X chromosomes. Thus, they are homogametic, i.e., produce only one type of gametes which contain X chromosomes. Sex chromosomes of human males are heteromorphic or dissimilar, i.e., XY. Human males are therefore heterogametic, i.e., produce two types of gametes.
13. **(d)** Genotype
Explanation:
 The genotype is the part (DNA sequence) of the genetic makeup of a cell, and therefore of an organism or individual, which determines a specific characteristic of that cell/organism/individual.
14. **(b)** (iii) and (iv)
Explanation:
 Males have two distinct sex chromosomes (XY) and are called the heterogametic sex (Chromosome-23). Females have two of the same kind of sex chromosome (XX)(Chromosome-23) and are called the homogametic sex. In human males, all the chromosomes (22- Autosomes) are paired perfectly except one (23rd). These unpaired chromosomes are X and Y (Chromosome-23).
15. **(c)** Tt and tt
Explanation:
 Tt Tall plant and tt short plant.
16. **(d)** 1 : 1
Explanation:
 A cross between (TT) and (tt) would produce progenies with following genotypes-
 In F_2 generation - selfing of F_1 progeny-
- | Gametes Tt | T | t |
|------------|----|----|
| T | TT | Tt |
| t | Tt | tt |
- Pure tall (TT), Mixed tall (Tt) and Short (tt). The ratio of pure tall and pure short plant is 1 : 1.
17. **(a)** Back cross
Explanation:

Backcrossing is a crossing of a hybrid with one of its parents or an individual genetically similar to its parent, in order to achieve offspring with a genetic identity which is closer to that of the parent. It is used in horticulture, animal breeding and in production of gene knockout organisms.

18.

(c) $TT : Tt : tt$

Explanation:

$TT : Tt : tt$

19.

(c) Round and yellow

Explanation:

Since roundness and yellow colour are shown by capital letters in the genotype so they are dominant traits. We know that only dominant traits are expressed in the F₁ generation.

20.

(c) Cricket

Explanation:

- The XO sex-determination system is a system that determines the sex of offspring among grasshoppers, crickets, cockroaches, and some other insects. In this system, there is only one sex chromosome, referred to as X. Males only have one X chromosome (XO), while females have two (XX).
- The zero (sometimes, the letter O) signifies the lack of a second X. Maternal gametes always contain an X chromosome, so the sex of the animals' offspring depends on whether a sex chromosome is present in the male gamete. Its sperm normally contain either one X chromosome or no sex chromosomes at all.

21. Variations increases the adaptability of an individual to its changing environment thus promotes survival of the species.

22. 2 visible characters of garden pea plants are:

- Tallness (dominant), Dwarfness (recessive)
- Yellow seeds (dominant), Green seeds (recessive)

23. The generation which is produced by the offsprings of F₁ -generation is called F₂ generation.

- 24.
- F₁ generation: Round and Yellow seeds
 - F₂ generation: Four combinations

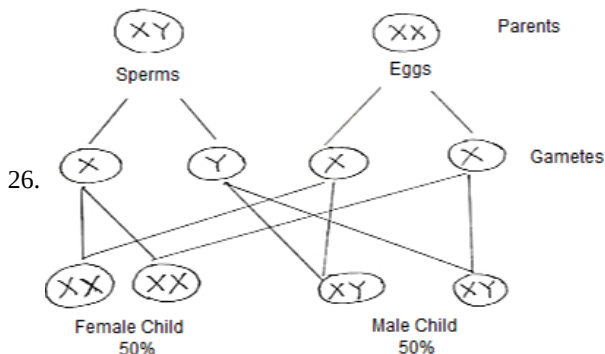
Round and Yellow - 9

Round and Green - 3

Wrinkled and Yellow - 3

Wrinkled and Green - 1

25. There are 23 pairs of chromosomes present in human beings. One pair is sex chromosome. They are XX and XY. So there are two types of sex chromosomes.



27. The trait which represents the tallness (T) in a pea plant is dominant over the dwarf trait (t), so progeny becomes tall. both are inherited but the dominant is expressed.

28. Gene is a physical unit of heredity.

- 29.
- Parents produce germ cells in specialised organs which have only half the number of chromosomes as compared to non-reproductive body cells. When these germ cells from two parents combine during sexual reproduction to obtain a progeny/zygote, it restores the original number of chromosomes as in the parents.

- Meiosis

30. Genotype of father with blood group A are: $I^A I^O$, $I^A I^A$

31. Mendel selected true breeding tall (TT) and dwarf (tt) pea plants. Then, he crossed these two plants. The seeds formed after fertilization were grown and these plants that were formed represent the first filial or F1 generation. All the F1 plants obtained were tall. Then, Mendel self-pollinated the F1 plants and observed that all plants obtained in the F2 generation were not tall. Instead, one-fourth of the F2 plants were short. From this experiment, Mendel concluded that the F1 tall plants were not true breeding. They were carrying traits of both short height and tall height. They appeared tall only because the tall trait is dominant over the dwarf trait. Then he concluded that (T) trait for tallness is dominant and (t) trait for shortness is recessive.

32. a. i. Gametes
ii. Zygote
b. Female

33. Colour of hair, eye colour are inherited characters but weight of the body is an acquired character.

Inherited characters	Acquired characters
(i) These are controlled by genes and are passed from one generation to another generation.	(i) They are acquired by organisms in their life time are not passed from one generation to another generation.
(ii) These are genetic variations caused in reproductive tissues.	(ii) These are somatic variations caused in non-reproductive tissues.

34. It is due to biparental percentage. The genes on chromosomes which pass over to the next generation is partly derived from both the parents (mother and father). During fertilisation of egg by the sperm, new combination of chromosomes enter the zygote, due to which certain variations occur in the offsprings. Thus, brothers and sisters show variations in their complexion, habits and behaviour.

35. Though human beings who look so different from each other in terms of colour, size and looks are said to belong to the same species because :

- DNA studies i.e., study of DNA sequences through molecular phylogeny show that they belong to same species.
- Constant or same chromosome number.
- They have a common ancestor.
- They can interbreed among themselves to produce offspring of their own kind.
- They have common body design, structure, physiology and metabolism.
- Study of fossils also reveals that humans belong to same species.

36. a. Violet flowers

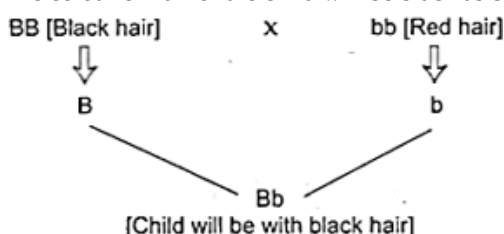
Violet colour dominates over white colour of flowers.

b. 25%, It could not express itself in the presence of dominant gene/white colour is a recessive gene.

c. $VV : Vv$

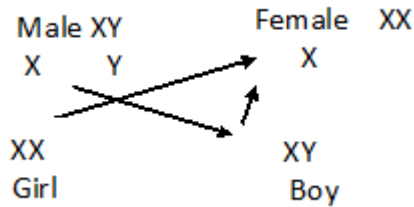
1 : 2

37. The colour of hair of the child will be black as black is dominant over red.



38. No, mother have no role in determining the sex of a new born. As female have only a pair of X chromosome all children will inherit only one X chromosome from the mother. As males have X and Y chromosome its the father, who determines the sex of a

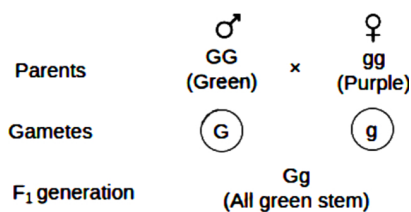
new born.



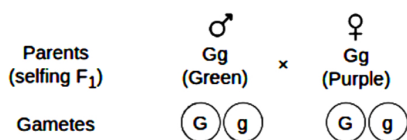
39. Human females have a pair of X chromosomes called sex chromosomes. Hence, after gametogenesis, an X chromosome will always be present in each gamete. Hence all the gametes possess an X chromosome.
40. Gregor Johann Mendel in 1866 demonstrated the way in which characters are transmitted from one generation to another and suggested that each cell of an organism contains two factors for each character, both of which separate and are passed on to different progeny through different gametes. Thus Mendel laid the foundation of genetics, the science of heredity and variation, hence it is proper to call him father of Genetics.
41. a. Mendel.
b. DNA is made up many units of nucleotides.
c. Important features-
i. Both the chains in helix runs anti-parallel.
ii. There are two types of nitrogenous bases Purine (A, G) and pyrimidine (T, C).
iii. A always pairs with T and C always pairs with G.
42. On this basis we cannot say that light eye colour is dominant or recessive until a cross is made between parent having light eye colour and another with dark eye colour is made. Only then it will be possible to predict the dominant or recessive nature of gene.
43. i. Genetics is the study of mechanism by which variations are created and inherited. These variations are far more in sexual reproduction due to crossing over in meiosis and also new diploid recombination.
ii. Evolution is used for studying the development of new species of organisms from the existing ones through accumulation of variation.
44. a. Genotypes. Man ($I^A I^O$) Mother $I^B I^O$ and child $I^O I^O$.
b. Blood group of the future offspring. A type, B type, O type and AB type. It is based on the following cross:

♀ \ ♂	I^A	I^O
I^B	$I^A I^B$	$I^B I^O$
I^O	$I^A I^O$	$I^O I^O$

45. a. All the plants in F_1 progeny will be of green coloured stem.



- b. Cross for F_2 progeny is:



F_2 progeny-

♂	G	g
♀		
G	Gf (Green)	Gf (Green)
g	Gf (Green)	gg (Purple)

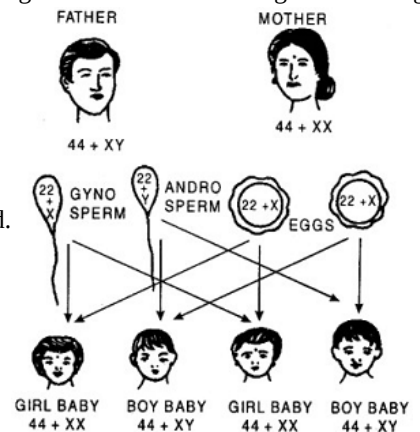
Phenotypic ratio = Green : Purple = 3 : 1

c. According to the finding above, purple stems are subordinate to green stems. Thus, according to the rule of dominance, only the dominant characteristic was present in F_1 . Purple stem in F_2 indicates that the alleles for purple stem were inherited but were not expressed in F_1 , nevertheless. Only in F_2 under homozygous circumstances did they get expressed.

46. Determination of the sex of child. Sex chromosomes determine sex in human beings. In males, there are $44 + XY$ chromosomes, whereas, in female there are $44 + XX$ chromosomes. Here X and Y chromosomes determine sex in human beings. Two types of gametes are formed in male, one type is having 50%, X-chromosome, whereas, other type is having Y-chromosome. In female, gametes are of one type and contain X-chromosome.

The females are homogametic. If male gamete having Y-chromosome (endosperm) undergoes fusion with female gamete having

X-chromosome the zygote will have X Y chromosomes and this gives rise to male child.



If male gamete having X-chromosome undergoes fusion with female gamete having X-chromosome, the zygote will be having XX-chromosome and this gives rise to female child.

47. i. The traits which do not show their characteristics in the presence of dominant genes are called recessive traits. OR The traits which are not often expressed and commonly observed are called recessive traits.
- ii. The F_1 progeny of a tall plant with round seed (TTRR) and a short plant with wrinkled seed (ttrr) would be Tall plant with round seeds (TtRr).
- iii. When F_1 progeny (TtRr) are cross-bred by self pollination, then four types of progeny are produced in F_2 generation. Out of these four types of progeny, two types will have traits like parents and the other two will have combination of traits. Thus,
- Progeny with tall plants and round seeds- 9
 - Progeny with tall plants and wrinkled seeds- 3
 - Progeny with short plants and round seeds- 3
 - Progeny with short plants and wrinkled seeds- 1

Thus, the phenotypic ratio in F_2 generation will be- 9 : 3 : 3 : 1

OR

The F_2 progeny would be having 9:3:3:1 phenotypic ratio. So, if 1600 plants were obtained,

$$9 : 3 : 3 : 1 = 16$$

$$= \frac{1600}{16} = 100$$

$$\text{So, } 9 = 9 \times 100 = 900 = \text{Tall with round seeds.}$$

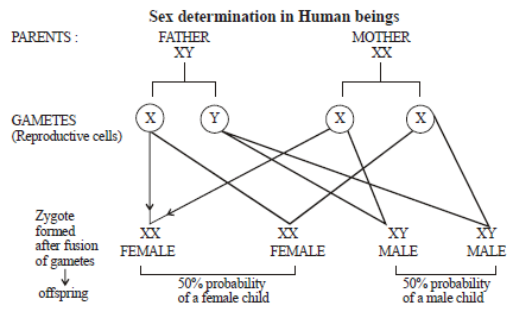
$$3 = 3 \times 100 = 300 = \text{Tall with wrinkled seeds.}$$

$$3 = 3 \times 100 = 300 = \text{short with round seeds.}$$

$$1 = 1 \times 100 = 100 = \text{short with wrinkled seeds.}$$

48. i. Humans contain total of 23 pairs out of which 1 pair have sex chromosomes. So 22 pairs are there apart of sex chromosomes. Male parent has mismatched pair of chromosomes i.e. XY.
- ii. The X chromosome is bigger than Y chromosomes. The mismatched pair of sex chromosome is XY.
- iii. Examples of organisms in which sex is not genetically determined are crocodiles, alligators, bonellia viridid. For example, in crocodiles, if the egg is incubated at around 30°C , it leads to the development of female whereas if the egg is incubated at around 34°C , it results in the development of the male. Another example may include Bonellia Viridis in which sex is determined by the location of larvae. If larvae make physical contact with a female, it becomes male. If it is located on the bare sea floor, it becomes female.

OR



49.

(c) A is true but R is false.

Explanation:

Gene for black hair colour is dominant to gene for red hair colour in humans. Mother has black hair and can be represented by (BB) whereas father can be represented by (bb).

Parents : ♀ BB × bb ♂

Gametes : B b

Progeny : Bb
Heterozygous black

So, the child will be heterozygous for black hair colour.

50. (a) Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.