Inspiring Excellence

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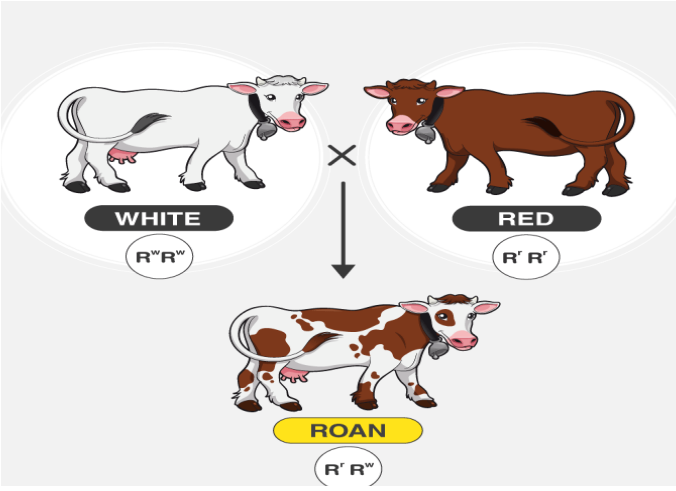
ASSIGNMENT-02

Answer to the Question No.-01

While researching the inheritance of polygenic features, Gregor Mendel made the discovery of codominance.

When two different "alleles," or variants, of the same gene are present in a living entity and both alleles are expressed differently in various organs (F1 generation), this condition is known as “Codominance”. Here, both features are present, rather than one trait being more prominent than the other.

In the given figure, it shows that between a cross of a red and a white cow, roan cow is produced. And the roan cow has both red and white intermixed spotted hair; which indicates codominance.



It can be explained through ‘Punnett Square’:

Red cow--> $R^r R^r$

White cow--> $R^W R^W$

Roan--> $R^r R^W$

Now, for F1 generation:

	$\mathbf{R^w}$	$\mathbf{R^w}$
$\mathbf{R^r}$	$R^r R^w$	$R^r R^w$
$\mathbf{R^r}$	$R^r R^w$	$R^r R^w$

Here, all 4 cases indicate to roan; that means that each and every cow has heterozygous alleles.

Because of this, all of the F1 generation's progeny will be Roan (white and Red mixed). Furthermore, the genotypic and phenotypic ratios of the F1 generation are each 100% (Roan).

And now, in F2 generation, the punnett square will give us the result-

	R^r	R^w
R^r	$R^r R^r$	$R^r R^w$
R^w	$R^r R^w$	$R^w R^w$

Here, 50% offspring will be roan, 25% offspring will be white and the rest 25% offspring will be red. This phenotypic ratio is indicating the monohybrid cross of F2 generation.
So, the roan variety of cow is created when red-coated cow is bred with white-coated cow. When F1 generation is being self-bred, the F2

generation 4 phenotypes with ratio of 1 red:2 roan:1 white. So, the ratio between genotype and phenotype is 1:2:1. Therefore, this cross breeding indicates Codominance.

Monohybrid crosses should have one gene that is recessive and one that is dominant based on the genotype of the parents. Due to this, neither genotype can express simultaneously in the F1 or F2 generation. All children in the F1 generation will be heterozygous dominant. Also, the genotypic to phenotypic ratio in the F2 generation will be 1:2:1 and 3:1, correspondingly.

Answer to the Question No.-02

The ABO group system includes four main blood types. Each blood group is different because of the combination of antigens and antibodies they contain. The ABO group system identifies the letter component of one's blood type. So, the primary cause is the presence of antibodies and antigens on the RBC surface.
The combination of antigens can be: -

- **no antigens**
- **A antigens**
- **B antigens**
- **both A and B antigens.**

In the given question, Naima's blood group is AB negative. AB negative is the rarest blood type in the ABO blood group, accounting for just 1% of our blood donors. In total only 3% of donors belong to the AB blood group.

Blood Type Compatibility

Blood Type	Gives	Receives
A+	A+, AB+	A+, A-, O+, O-
O+	O+, A+, B+, AB+	O+, O-
B+	B+, AB+	B+, B-, O+, O-
AB+	AB+	Everyone
A-	A+, A-, AB+, AB-	A-, O-
O-	Everyone	O-
B-	B+, B-, AB+, AB-	B-, O-
AB-	AB+, AB-	AB-, A-, B-, O-

Red blood cells in AB Blood are bound with A, B antigens. They differ from other blood types due to these antigens.
From the chart shown above, An AB negative blood holder can receive blood from the donors who have AB-, A-, B- and O^-.

Additionally, it is very significant to donate or receive blood only after matching the required combination of antigens in that blood type. Otherwise, blood will clot if blood types don't match because of the interaction between their antigens and antibodies. it can cause death to the recipient.

Finally, it is now clear that Naima can receive blood from Wasim (O negative) and Tania (B negative) as they match with AB negative blood type's antigen's combination. Thus, Naima can be saved.

Answer to the Question No.-03

No.	Chromosome	Sister Chromatid
1.	The nucleus of most living cells contains a threadlike structure made of nucleic acids and proteins that carries genetic information in the form of genes called chromosomes.	A sister chromatid is one of two identical copies (chromatids) of a chromosome that are linked by a common centromere during the DNA replication process.
2.	A single, double-stranded DNA molecule makes up a chromosome.	Two double-stranded DNA strands called chromatids are connected in the middle by a centromere.
3.	The structure of the chromosome is like a thin ribbon.	Chromatids have a long, thin structure made of fibrous connective tissue.
4.	All cells include chromosomes at all stages of their development.	Chromatids are created during the interphase and persist through the cell division's metaphase stage.
5.	Chromosomes are accountable for transmitting genetic data from one generation of organisms to the next.	After cell division, chromatids assist in maintaining the correct quantity or number of DNA in the cell.
6.	Chromosomes have the capacity to duplicate or replicate.	Chromatids are unable to reproduce or divide.

Reference

1.	https://www.britannica.com/science/codominance
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3.	https://www.medicalnewstoday.com/articles/326279
4	https://biologydictionary.net/sister-chromatids/
5.	https://www.genome.gov/genetics-glossary/Chromosome