QUESTION 1

Background information: In this practical you will work with models to study the combinations of alleles in a monohybrid cross. Remember, alleles usually occur in pairs where the one can be dominant over the other. In a gamete only one of the two alleles is present. When the dominant and recessive alleles are both present in the offspring, the dominant alleel will be expressed (phenotype).

The question:

Alleles combine in different ways. Can we predict the outcome of monohybrid crosses between parents with different alleel combinations?

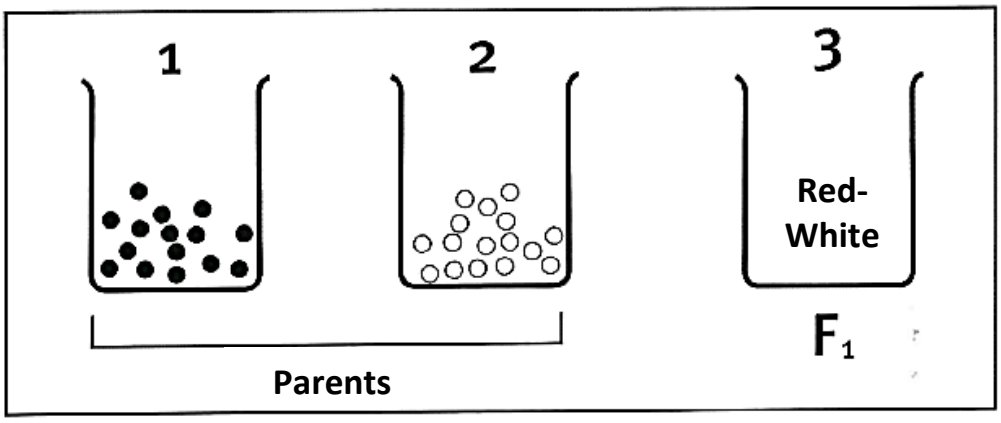
Hypothesis:

If the allele combinations of the parents it known, the ratio of the F_1-generation can be determined.

Material:

- 20 red beads
- 20 white beads
- 5 beakers

Method – INVESTIGATION A

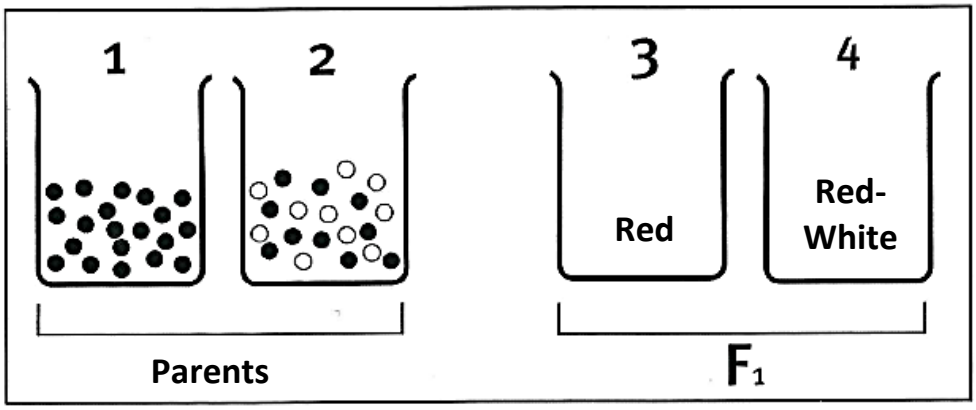


1. Place three beakers next to one another on the table.
2. Put 20 red beads in the first beaker.
3. Put 20 white beads in the second beaker.
4. Without looking, take one bead from beaker 1 and one from beaker 2.
5. Put both beads in to beaker 3.
6. Repeat steps 4 and 5 until no beads are left in beakers 1 and 2.
7. Record the amount of red bead and white beads in beaker 3 (the F_1-generation) in the block below:

INVESTIGATION A] **Amount of red beads in beaker 3: _____**

Amount of white beads in beaker 3: _____

Method - INVESTIGATION B



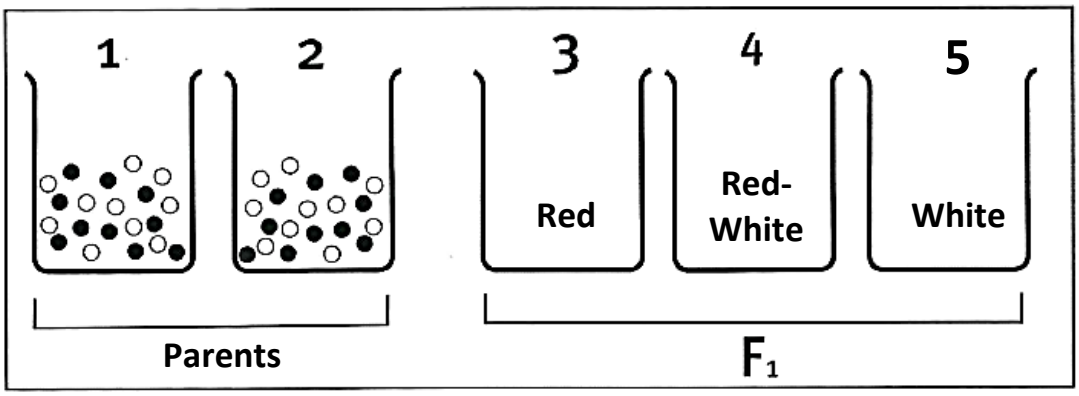
1. Place four beakers next to one another on the table.
2. Put 20 red beads in the first beaker.
3. Put 10 red beads and 10 white beads in the second beaker. Mix the beads well.
4. Without looking, take one bead from beaker 1 and one from beaker 2.
5. Look at the beads in your hand. If both beads are red, put them in beaker 3. If one bead is red and the other white, put them in beaker 4. The pairs of beads in beaker 3 and 4 represent the possible alleel combinations in the offspring.
6. Repeat steps 4 and 5 until no beads are left. Record the amount of beads in beaker 3 and 4.
7. Record the ratio of beads in beaker 3 and 4 (the F_1-generation) in the block below:

INVESTIGATION B] **Amount of red beads in beaker 3: _____**

Amount of red and white beads in beaker 4: _____

Ratio red : red-white beads = _____ : _____

Method - INVESTIGATION C



1. Place five beakers next to one another on the table.
2. Put 10 red beads and 10 white beads in the first beaker as well as the second beaker.
3. Mix the beads in each beaker well.
4. Without looking, take one bead from beaker 1 and one from beaker 2.
5. Look at the beads in your hand. If both are red, put them in beaker 3. If one is white and the other red, put them in beaker 4. If both are white, put them in beaker 5.
6. Repeat steps 4 and 5 until no beads are left. Record the amount of beads in beakers 3, 4 and 5.
7. Record the ration of beads in beakers 3, 4 and 5 (the F_1-generation) in the block below:

INVESTIGATION C] Amount of red beads in beaker 3: _____

Amount of red and white beads in beaker 4: _____

Amount of white beads in beaker 5: _____

Ratio of red : red-white : white beads = _____ : _____ : ____

ANSWER THE FOLLOWING QUESTIONS:

1. What are the independent and dependent variables in the investigation?

   Independent variable: _____

   Dependent variable: _____

(2)

2. Red beads are dominant over white ones. Use the letters **R** and **r** to fill in the genotypes in the table given below. Thereafter, complete the table by filling in the amount of each genotype of the F_1-generation as determined by the three investigations:

GENOTYPES OF THE F_1-GENERATION OF THE DIFFERENT INVESTIGATIONS A TO C			
Bead combinations	**Red**	**Red-white**	**White**
Genotypes	***3.1.1.***	***3.1.2.***	***3.1.3.***
Investigation A	-	***3.1.4.***	-
Investigation B	***3.1.5.***	***3.1.6.***	-
Investigation C	***3.1.7.***	***3.1.8.***	***3.1.9.***

(6)

3. Now use the information in the table to draw a column graph to display the resulting F_1-generations of your three investigations. Use the space provided below:

(6)

4. Explain the relationship between the dependent and independent variable in each investigation. ***HINT***: *use the words homozygous and heterozygous*.

Investigation A:

Investigation B:

Investigation C:

(6)

TOTAL QUESTION 1: [20]

QUESTION 2

1. Brown eyes are dominant over blue eyes. Anrie (brown eyes) and Johan (brown eyes) have four children, Susan (brown eyes), Rory (brown eyes), Janet (blue eyes) and Liam (brown eyes). Liam died in a car accident at the age of 15. Susan married Martin (brown eye) that has no family history of blue eyes. They have two daughters that both have brown eyes. Rory married Lelani (brown eyes). They have two sons (both have brown eyes) and one daughter (blue eyes). Janet moved to England with her husband Dean (blue eyes). They have one child on which the sex is unknown.

   Use the information given to draw a complete **pedigree diagram** using the correct symbols. Ensure that all genotypes and phenotypes (use a key for the phenotypes) are included on your diagram. Also ensure that you include the possible genotype of Janet and Dean's child. Use the space provided below to draw your diagram:

Mark allocation for pedigree diagram		
Correct symbol for Liam	1	0
Correct symbol for unknown child	1	0
Genotypes included	1	0
Genotype of unknown child	2	0
Phenotypes included with a key	2	0
Pedigree diagram correctly drawn (lines, levels etc.)	1	0
All sexes included and correct	2	0
All genotypes correct 1 – 2 genotypes incorrect 3 – 4 genotypes incorrect 5 – 6 genotypes incorrect More than 6 genotypes incorrect	4 3 2 1 0	
TOTAL	**14 marks**	

2. A woman wants to determine who the father of her child is via a blood test. She has a blood group O and the two possible fathers have the following blood groups: Male 1 – blood group AB and Male 2 – blood group B. The blood tests determined that Male 2 was the father of the child who also has a blood group O. Use punnet squares to explain why Male 2 is the biological father and not Male 1.

(6)

TOTAL QUESTION 2: [20]

GRAND TOTAL: [50]