MISSION 2: TRUE OR TRICK? Circle T (True) or F (False).

Part A: Mendel's First Law (_____)

STATEMENT	TRUE / FALSE	REMARK
1. During gamete formation, the two alleles for a gene remain together in the same gamete.	**T / F**	
2. According to the Law of Segregation, each gamete carries only one allele for each gene.	**T / F**	
3. A heterozygous individual with genotype **Pp** produces two types of gametes: **P** and **p**.	**T / F**	
4. The Law of Segregation explains why offspring receive one allele from each parent.	**T / F**	
5. Meiosis is the process responsible for the segregation of alleles.	**T / F**	

Part B: Monohybrid Cross

STATEMENT	TRUE / FALSE	REMARK
6. A monohybrid cross involves the inheritance of two different characteristics.	**T / F**	
7. Crossing **PP × pp** produces offspring that are all heterozygous.	**T / F**	
8. The F_1 generation from **PP × pp** all show the dominant phenotype.	**T / F**	
9. A homozygous dominant individual has two identical dominant alleles.	**T / F**	

Part C: Test Cross

STATEMENT	TRUE / FALSE	REMARK
11. A test cross is performed to determine the genotype of an individual with a dominant phenotype.	**T / F**	
12. In a test cross, the unknown individual is crossed with a homozygous dominant individual.	**T / F**	
13. If all offspring from a test cross have the dominant phenotype, the unknown parent is likely homozygous dominant.	**T / F**	
14. If a test cross produces approximately half dominant and half recessive offspring, the unknown parent is heterozygous.	**T / F**	
15. A test cross can only be used with recessive phenotypes.	**T / F**	

Part D: Mendel's Second Law (_____)

STATEMENT	TRUE / FALSE	REMARK
16. Mendel’s second law states that different pairs of alleles segregate independently during gamete formation.	**T / F**	
17. Independent assortment occurs only when one characteristic is studied.	**T / F**	
18. Mendel’s second law explain about segregation of two alleles	**T / F**	

19. Mendel's second law also known as Law of Independent Assortment	**T / F**	

Part E: Dihybrid Cross

STATEMENT	TRUE / FALSE	REMARK
20. In the cross **DDLL × ddll**, all F_1 offspring have genotype **DdLl**	**T / F**	
21. The offspring of **AABB × aabb** show the recessive phenotype for both characteristics	**T / F**	
22. A homozygous recessive individual produces only one type of gamete	**T / F**	
23. The possible gametes produced by **YyRr** are **YR, Yr, yR,** and **yr**.	**T / F**	
24. An individual with genotype **PpQq** can produce four different types of gametes.	**T / F**	
25. A dihybrid cross involves the inheritance of one different characteristic.	**T / F**	

Extra Mission: Complete the statements!

1. The Law of _____ states that the two alleles for heritable character segregate during gamete formation and end up at _____ gamete.
2. A parent with genotype Aa produces gametes carrying either _____ or _____.
3. In Mendel's Second Law, each pair of alleles segregates _____ of any other pair of alleles during gamete _____ .
4. A YyRr individual produces _____ types of gametes.
5. The four possible gametes for heterozygous, DdLl individual are: _____ , _____ , _____ , _____ .

MISSION 3: GENETIC DIAGRAM MYSTERY!

(A) MONOHYBRID SELF CROSS

Gregor Mendel crossed two true-breeding pea plants with contrasting flower colours. Construct the genetic diagram to show all F_2 generations produced

STEP 1: Define the allele STEP 2: State the parental generation - write the genotypes and phenotypes Tips! Must write **X** for crossing!	P – purple flower p – white flower Parental phenotype: Parental genotype:
STEP 3: Show the gametes formation – write all gametes produced from each parent. Since parents are HOMOZYGOUS, so each parent produces only one type of gamete Tips! Must show arrow from parental genotype Gamete must be in **CIRCLE**	Gamete:
STEP 4: State F_1 generation - Show fertilisation. Combine the gametes by using lines to show the product of fertilisation Tips! Write both F_1 genotype and phenotype accordingly Write both F_1 genotypic ratio and phenotypic ratio accordingly	F_1 genotype: F_1 phenotype: F_1 genotypic ratio: F_1 phenotypic ratio:
STEP 5: Show the crossing between two F_1 individuals with the same genotypes Tips! Must write **X** for crossing!	F_1 phenotype: F_1 X F_1 // F_1 self cross:

STEP 6: Show the gametes formation - Since F_1 generations are HETEROZYGOUS, so each produces only two types of gametes Tips! Must show arrow from F_1 genotype Gamete must be in **CIRCLE**	Gametes:
STEP 7: State F_2 generation - Show fertilisation. Combine the gametes by using lines to show the product of fertilisation Tips! Write both F_2 genotype and phenotype accordingly Write both F_2 genotypic ratio and phenotypic ratio accordingly	F_2 genotype: F_2 phenotype: F_2 genotypic ratio: F_2 phenotypic ratio:
CONCLUSION:	**MONOHYBRID INHERITANCE SELF CROSS OF PURE/TRUE BREEDING** F_2 genotypic ratio: F_2 phenotypic ratio:

(B) DIHYBRID SELF CROSS

Gregor Mendel crossed two **true-breeding pea plants** with different seed colours and shapes. Construct the genetic diagram to show all F_2 generations produced

STEP 1: Define the allele	Y – yellow seed y – green seed R - round seed r - wrinkle seed
STEP 2: State the parental generation - write the genotypes and phenotypes Tips! Must write **X** for crossing!	Parental phenotype: Parental genotype:
STEP 3: Show the gametes formation – write all gametes produced from each parent. Since parents are HOMOZYGOUS, so each parent produces only one type of gamete Tips! Must show arrow from parental genotype Gamete must be in **CIRCLE**	Gametes:
STEP 4: State F_1 generation - Show fertilisation. Combine the gametes by using lines to show the product of fertilisation Tips! Write both F_1 genotype and phenotype accordingly Write both F_1 genotypic ratio and phenotypic ratio accordingly	F_1 genotype: F_1 phenotype: F_1 genotypic ratio: F_1 phenotypic ratio:
STEP 5: Show the crossing between two F_1 individuals with the same genotypes Tips! Must write **X** for crossing!	F_1 phenotype: F_1 X F_1 // F_1 self cross :

<table>
<tr>
<td>STEP 6: Show the gametes formation

Since F_1 generations are HETEROZYGOUS, so each produces four types of gametes

Tips!
Must show arrow from F_1 genotype
Gamete must be in CIRCLE</td>
<td>Gametes:</td>
</tr>
<tr>
<td>STEP 7: State F_2 generation

Tips!
Use Punnet Square to show the gametes combination and write label F_2 genotype and phenotype

Write F_2 phenotypic ratio while F_2 genotypic ratio is negligible</td>
<td>F_2 genotype and phenotype:

<table>
<tr><td>Gamete</td><td>YR</td><td>Yr</td><td>yR</td><td>yr</td></tr>
<tr><td>YR</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Yr</td><td></td><td></td><td></td><td></td></tr>
<tr><td>yR</td><td></td><td></td><td></td><td></td></tr>
<tr><td>yr</td><td></td><td></td><td></td><td></td></tr>
</table>

F_2 phenotypic ratio:</td>
</tr>
<tr>
<td>CONCLUSION</td>
<td>DIHYBRID INHERITANCE SELF CROSS OF PURE/TRUE BREEDING

F_2 phenotypic ratio:</td>
</tr>
</table>

(C) MONOHYBRID TEST CROSS

Gregor Mendel crossed an F_1 generation of tall *Pisum sativum* with another pea plant which is dwarfed. Construct the genetic diagram to show the F_2 phenotypic ratio produced.

STEP 1: Define the allele STEP 2: State the F_1 test cross genotypes and phenotypes Tips! Must write **X** for crossing!	T – tall t – dwarf F_1 test cross : phenotype F_1 test cross: genotypes
STEP 3: Show all gametes produced from F_1 generation and homozygous recessive individual If F_1 generations are HETEROZYGOUS, two types of gametes are produced while only one type of gamete from homozygous recessive individual Tips! Must show arrow from F_1 generation and homozygous recessive individual Gamete must be in **CIRCLE**	Gametes:
STEP 7: State F_2 generation - Show fertilisation. Combine the gametes by using lines to show the product of fertilisation Tips! Write both F_2 genotype and phenotype accordingly	F_2 genotype: F_2 phenotype: F_2 genotypic ratio: F_2 phenotypic ratio:
CONCLUSION	**MONOHYBRID TEST CROSS** F_2 genotypic ratio: F_2 phenotypic ratio:

(D) DIHYBRID TEST CROSS

Gregor Mendel crossed an F_1 generation of tall *Pisum sativum* having purple flowers with another pea plant which is dwarfed with white flowers. Construct the genetic diagram to show the F_2 phenotypic ratio produced.

STEP 1: Define the allele STEP 2: State the F_1 test cross genotypes and phenotypes Tips! Must write **X** for crossing!	T – tall t – dwarf P - flower p - white F_1 test cross : phenotype F_1 test cross: genotypes
STEP 3: Show all gametes produced from F_1 generation and homozygous recessive individual If F_1 generations are HETEROZYGOUS, four types of gametes are produced while only one type of gamete from homozygous recessive individual Tips! Must show arrow from F_1 generation and homozygous recessive individual Gamete must be in **CIRCLE**	Gametes:
STEP 7: State F_2 generation - Show fertilisation. Combine the gametes by using lines to show the product of fertilisation Tips! Write both F_2 genotype and phenotype accordingly. Alternatively you can use Punnet Square	F_2 genotype: F_2 phenotype: F_2 genotypic ratio: F_2 phenotypic ratio:
CONCLUSION	**DIHYBRID TEST CROSS** F_2 genotypic ratio: F_2 phenotypic ratio: