

Mendelian Genetics & The Inheritance of Traits Comprehensive Question Bank



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ← المناهج الإماراتية ← الصف الثاني عشر العام ← أحياء ← الفصل الأول ← ملفات متنوعة ← الملف

تاريخ إضافة الملف على موقع المناهج: 11-09-2026 12:41:02

ملفات اكتب للمعلم اكتب للطالب | اختبارات الكترونية | اختبارات | حلول | عروض بوربوينت | أوراق عمل
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المزيد من مادة
أحياء:

إعداد: Adel Rania

التواصل الاجتماعي بحسب الصف الثاني عشر العام



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

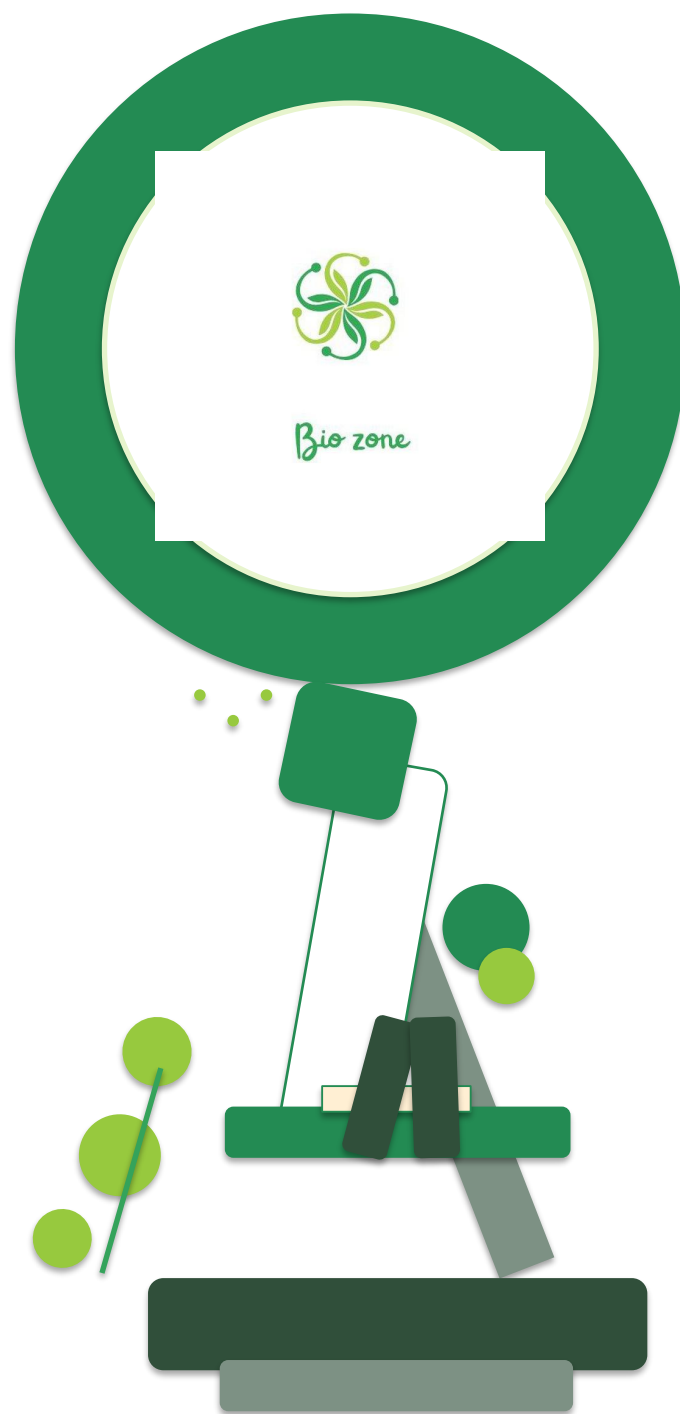
التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف الثاني عشر العام والمادة أحياء في الفصل الأول

الجهاز التنفسي - عام بريدج

1



BIO

Introduction to genetics and patterns of inheritance

Mendelian genetics Review



DATE

11/ 09 / 2026



TEACHER

Rania
Adel



GRADE

ثاني عشر
أنسباير



SUBJECT

Biology

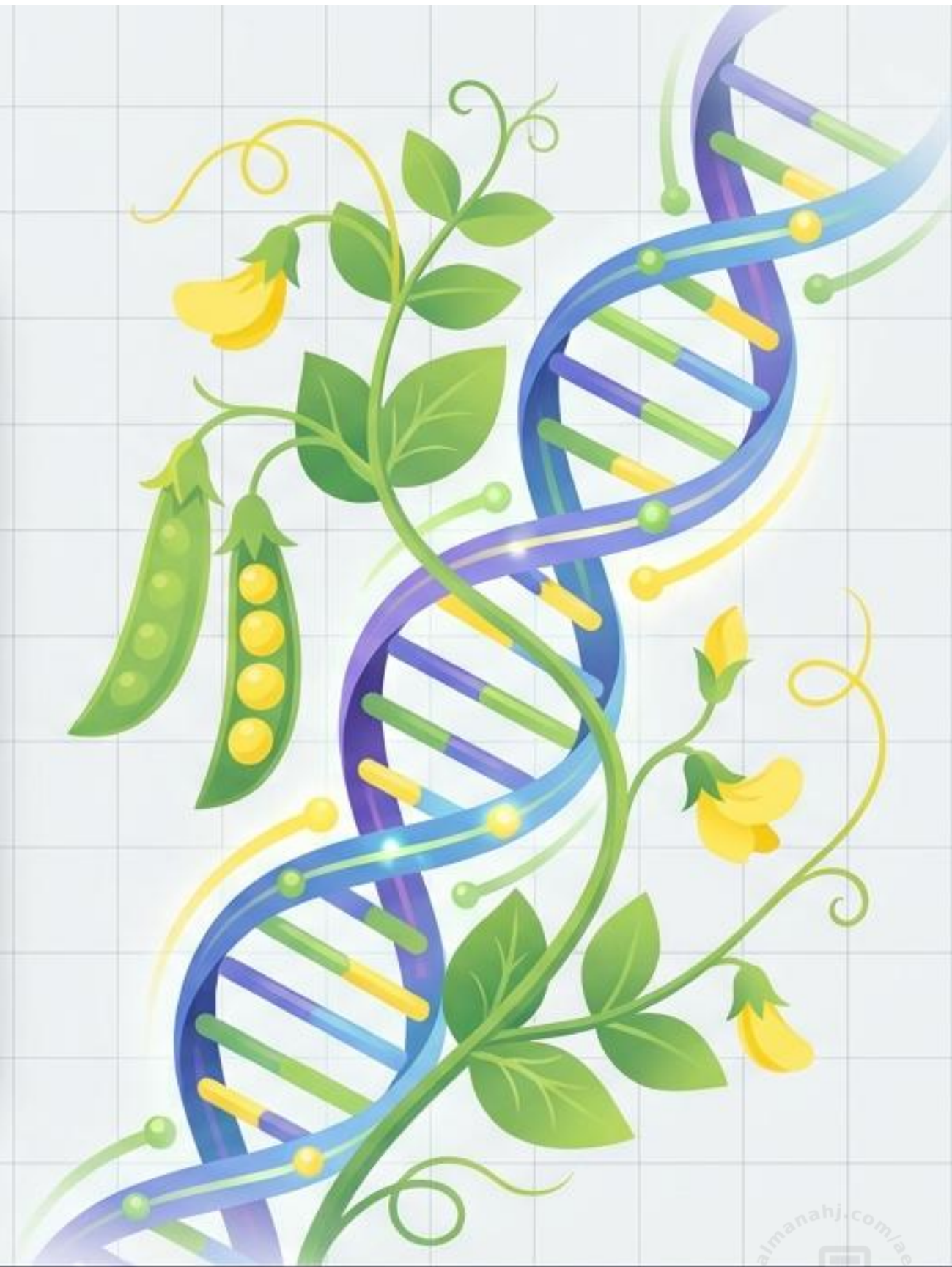
Learn • Understand • Apply



Mendelian Genetics & The Inheritance of Traits

Comprehensive Question Bank

Progressive difficulty from basic recall to **higher-order thinking**. Complete all sections before advancing to the **Answer Key**.





LEVEL 1: EASY | Terminology Matrix

Match the term to its exact definition.

Allele

Drop here

Genotype

Drop here

Phenotype

Drop here

Homozygous

Drop here

Heterozygous

Drop here

1. An alternative form of a single gene passed from generation to generation.
2. An organism with two of the same alleles for a particular trait.
3. An organism with two different alleles for a particular trait.
4. The observable characteristic or outward expression of an allele pair.
5. The organism's allele pairs.

Mendel called the form of the trait that appeared in the F1 generation

and the form of the trait that was masked in the F1 generation .



LEVEL 1: EASY | Fact Check

Mendel's F1 generation from a cross of true-breeding green and yellow seed plants produced 50% green and 50% yellow seeds.

[T ☐ F]

A bean plant that is heterozygous for seed color is represented by Yy.

[T ☐ F]

In Mendel's experiments, which generation is produced by allowing the F1 generation to self-fertilize?

- ☐ A) The P generation
- ☐ B) The F2 generation
- ☐ C) The true-breeding generation
- ☐ D) The recombinant generation



LEVEL 2: MEDIUM | Visual Analysis

Parental generation (P)
(pure-breeding)



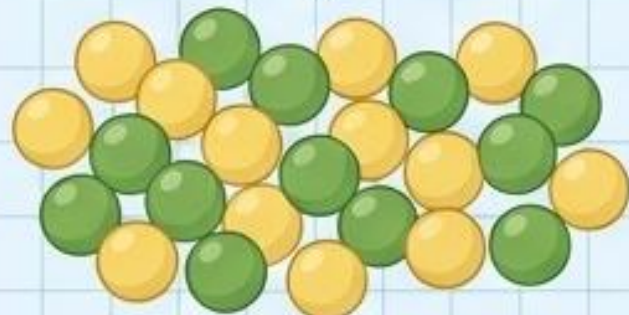
First filial generation (F₁)



All yellow peas

Self-fertilization

Second filial generation (F₂)



6022 yellow : 2001 green
3:1

Based on the provided diagram of Mendel's cross, explain why the green-seed trait disappeared in the F₁ generation but reappeared in the F₂ generation.

Briefly contrast the Law of Segregation with the **Law of Independent Assortment**. What exactly is separating or assorting in each law?

LEVEL 2: MEDIUM | Concept Application

Specific Example	Genotype (Check)	Phenotype (Check)
Yy	☐	☐
Green seeds	☐	☐
YY	☐	☐
Yellow seeds	☐	☐
rr	☐	☐



What is the effect of **meiosis** on the chromosome number of a cell, and how does this cellular process provide the physical basis for Mendel's Law of Segregation?

LEVEL 3: HARD | Application

In garden peas, freckles (F) are a dominant trait, while missing freckles (f) is a recessive trait. A heterozygous plant is crossed with a plant without freckles.

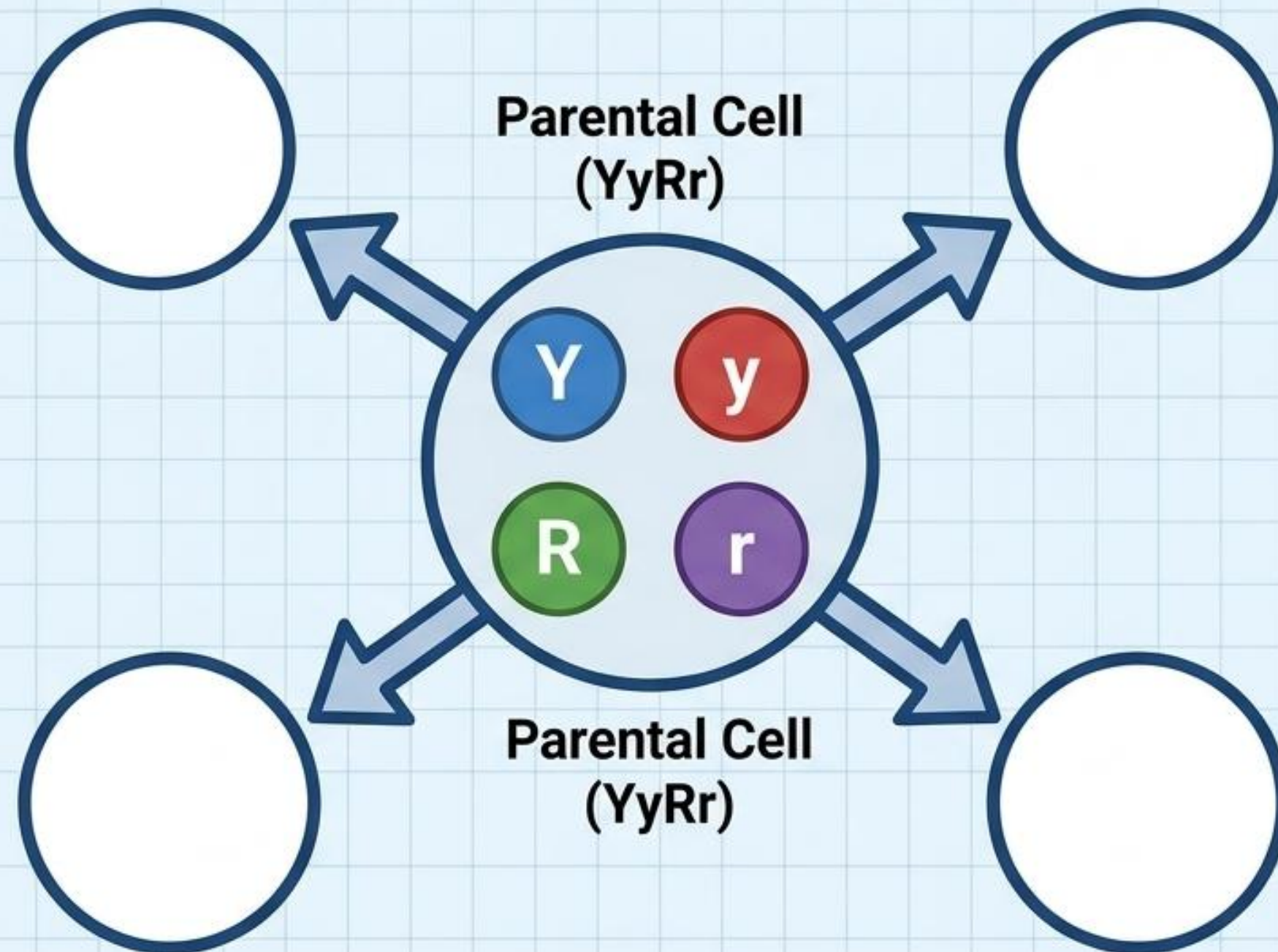
A) Draw the Punnett square for this cross in the grid provided.

B) What is the genotypic ratio of the offspring? _____

C) What is the phenotypic ratio of freckles to non-freckles? _____

LEVEL 3: HARD | Assortment & Gametes

Gamete Formation & Independent Assortment



Analyze the diagram showing **gamete formation** for a dihybrid parental cell (YyRr). Based on the Law of Independent Assortment, predict and fill in the four possible allele combinations that will appear in the resulting blank gametes.

Application: If a different plant has the homozygous/recessive genotype YYrr, what is/are the **ONLY** type(s) of gamete(s) it can produce?

CRITICAL THINKING

Mendel consistently found a 9:3:3:1 phenotypic ratio in his F₂ dihybrid crosses (e.g., YyRr x YyRr).



Analysis A: What do the “3”s in this ratio represent in terms of physical phenotypes, and why are they specifically referred to as “recombinants”?

Analysis B: If you changed the cross to YyRr x yyrr, would you expect to see the same 9:3:3:1 ratio? Justify your reasoning using Mendel’s laws.



Evaluate the biological significance of the statement: "Actual data might not perfectly match the predicted ratios of a Punnett square." Why does a larger number of offspring improve the accuracy of predictions?

Probability Synthesis: If flipping a coin twice gives a $1/4$ ($1/2 \times 1/2$) chance of landing heads twice, how does this exact mathematical principle apply to two heterozygous parents (Yy) producing an offspring with a homozygous recessive genotype (yy)?



STOP.
END OF STUDENT QUESTIONS.
ANSWER KEY AHEAD.

(Do not proceed until all questions have been attempted).

ANSWER KEY | LEVEL 1: EASY

Terminology Matrix:

- ✓ 1. **Allele**
- ✓ 2. **Homozygous**
- ✓ 3. **Heterozygous**
- ✓ 4. **Phenotype**
- ✓ 5. **Genotype**

Fill-in-the-blank:

- ✓ **Dominant; Recessive**

Fact Check (True/False):

- ✓ Q1: **False** (It produced 100% yellow seeds / 0% green).
- ✓ Q2: **True.**

Fact Check (Multiple Choice):

- ✓ B) **The F2 generation.**

ANSWER KEY | LEVEL 2: MEDIUM

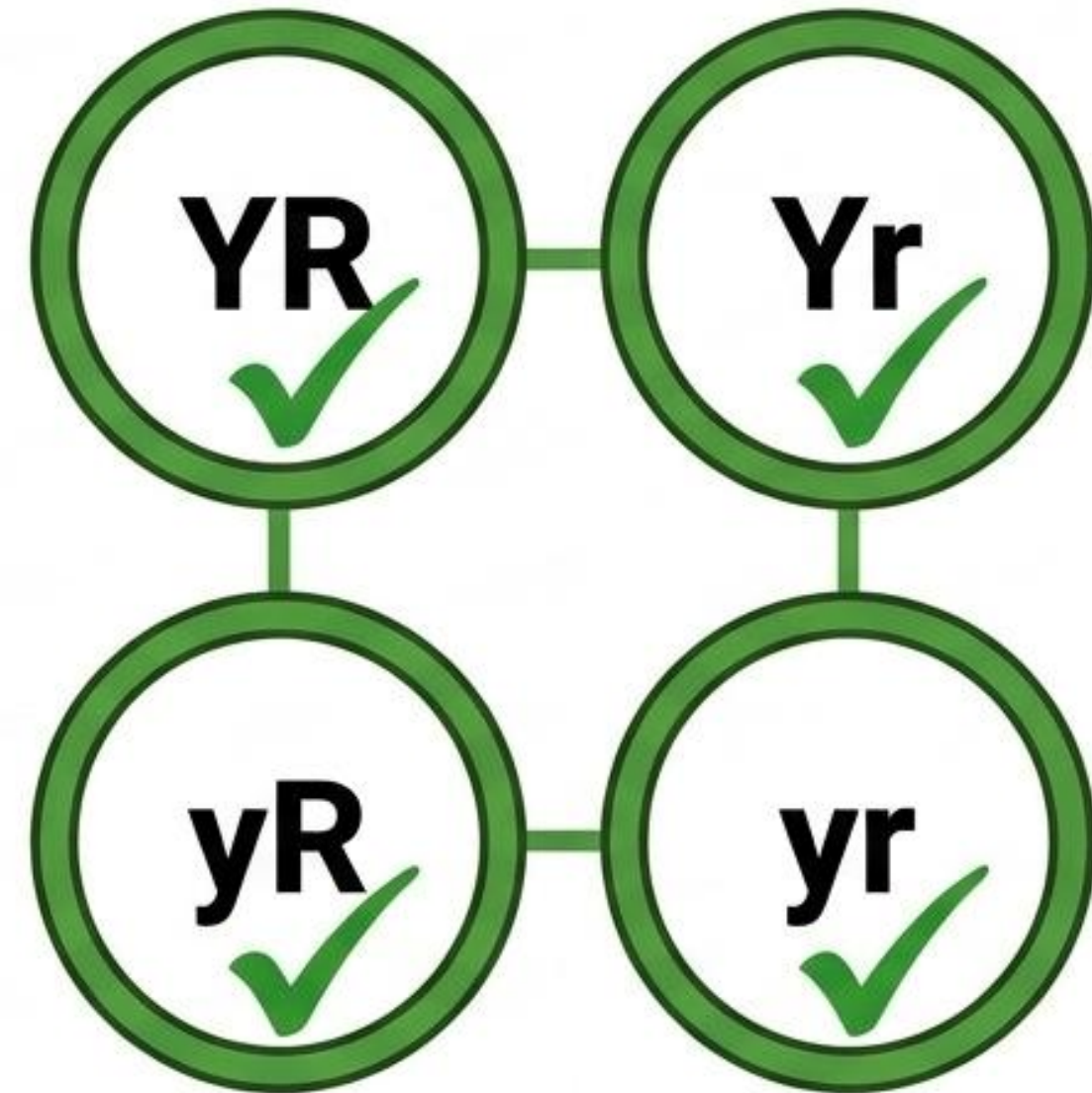
Specific Example	Genotype	Phenotype
Yy	✓	
Green seeds		✓
YY	✓	
Yellow seeds		✓
rr	✓	

- **Visual Analysis:** The green trait is recessive, so it was masked by the dominant yellow allele in the heterozygous F1 generation. It reappeared in F2 because the F1 plants passed on the recessive allele during segregation, allowing some F2 plants to inherit two recessive alleles (yy).
- **Compare/Contrast:** Segregation refers to the separation of the two alleles for a single trait into different gametes. Independent Assortment refers to the random distribution of alleles for different traits sorting independently of one another.
- **Cause & Effect:** Meiosis cuts the chromosome number in half. This separation of homologous chromosomes is the physical mechanism that causes the two alleles for each trait to segregate into separate gametes.

ANSWER KEY | LEVEL 3: HARD

	F	f
f	Ff ✓	Ff ✓
f	ff ✓	ff ✓

- ✓ **Genotypic ratio:** 1 Ff : 1 ff (or 1:1 / 50% to 50%)
- ✓ **Phenotypic ratio:** 1 Freckles : 1 No freckles (or 1:1)



- ✓ **Application Answer:** A YYrr plant can only produce one type of gamete: Yr.

ANSWER KEY | LEVEL 4: HOT

- ✓ **Dihybrid Analysis A:** The '3's represent the **RECOMBINANT** phenotypes:
 - ✓ Yellow/wrinkled and Green/round. They are recombinants because they show a **NEW COMBINATION** of traits not seen in the original true-breeding P generation.
- ✓ **Dihybrid Analysis B:** No. Crossing YyRr x yyrr yields a 1:1:1:1 ratio because the yyrr parent only provides yr gametes, revealing the exact 1:1:1:1 **GAMETE RATIO** of the heterozygous parent.
- ✓ **Probability Data:** Actual data relies on **CHANCE** events (fertilization). A **LARGER SAMPLE SIZE** reduces statistical variance, bringing actual results closer to the mathematical probability predicted by the square.
- ✓ **Probability Synthesis:** Each parent (Yy) has a 1/2 chance of passing on the recessive y allele. Because these are **INDEPENDENT EVENTS**, you **MULTIPLY** the probabilities: $1/2 \times 1/2 = 1/4$ (or 25%) chance of inheriting yy.

Assessment Complete.

If you struggled with Level 3 or 4, review Mendel's Law of Independent Assortment and the mathematical rules of probability.



BIO ZONE | Prepared by Rania Adel



Bio zone

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