

# Genetics

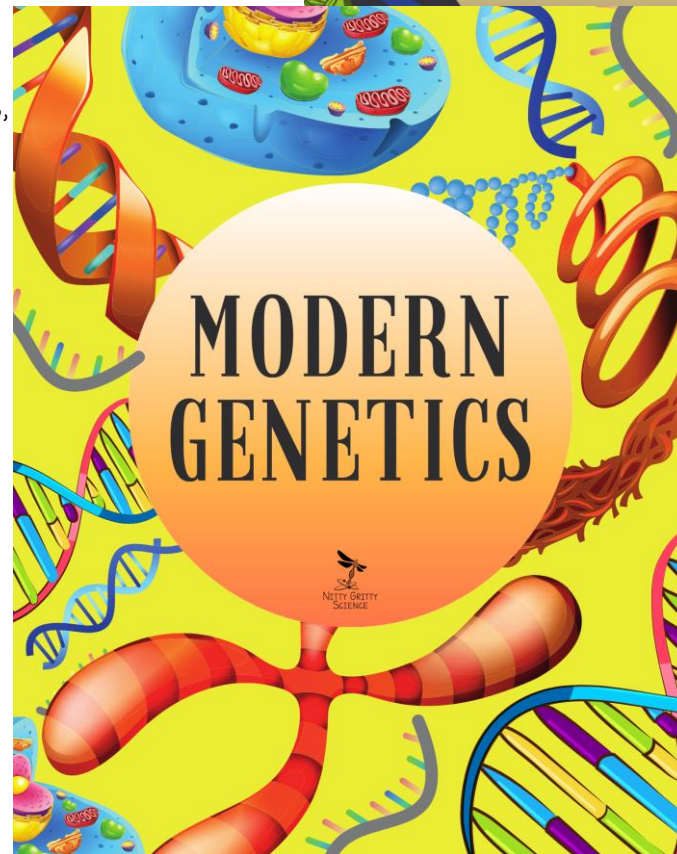
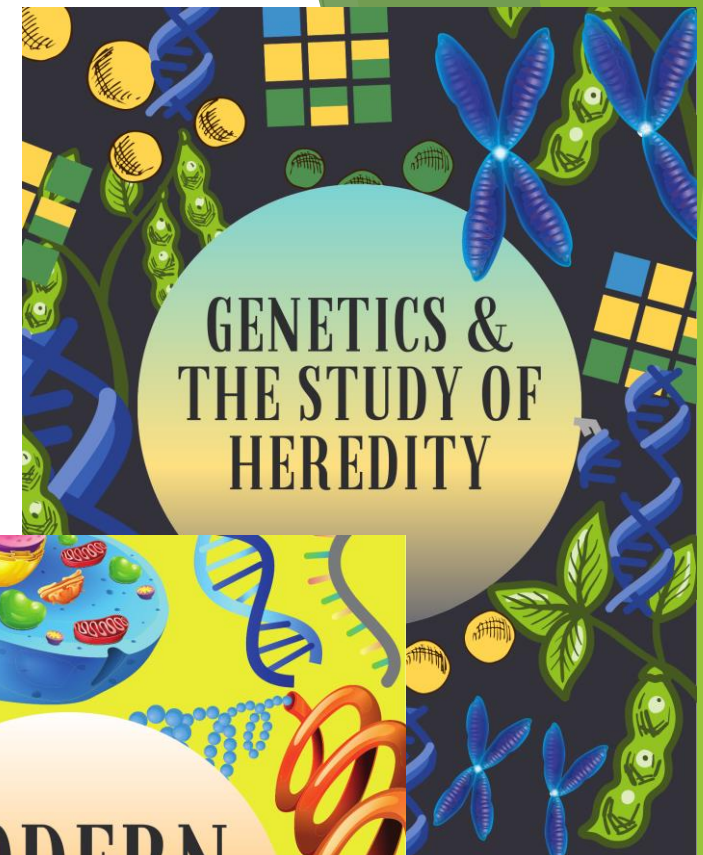


Genetics Unit includes two units –

Genetics & the Study of Heredity & Modern Genetics

Each unit includes:

- Print and digital Interactive Notebooks
- Editable Resources including notes, PowerPoints, and test
- Instructional Videos
- Teacher-led Demos & Guided Inquiry Labs
- Task Cards & Digital Task Cards
- Study Guides





## Suggested Pacing Guide



The following is a **suggested pacing guide** for my COMPLETE COURSES (Earth, Life or Physical Science) which are based on 50-minute class periods. There are three variations below. Each variation is based on the **number of sections in your SCIENCE INTERACTIVE NOTEBOOK chapter**.

Based on a **4-Section Chapter**

Day	Lesson/Activity	Engage	Explain	Explore	Elaborate	Evaluate
1	• Teacher Demo	x				
	• Section 1 Notes – INB input		x			
	• INB Activity – INB output (homework if not completed in class)			x		
2	• Mini-quiz					x
	• Section 2 Notes – use PowerPoint		x			
	• INB Activity			x		
3	• Mini-quiz					x
	• Guided Inquiry Lab – Student Led			x		
4	• Section 3 Notes – use PowerPoint		x			
	• INB Activity			x		
5	• Mini-quiz					x
	• Section 4 Notes – use PowerPoint		x			
	• INB Activity			x		
6	• Mini quiz					x
	• Science Stations				x	
7	• Science Stations				x	
8	• Final draft and testing for Creation Station (STEM)				x	x
9	• Task Card Review (game-style, full class, partner)				x	
10	• Chapter Test					x
	• Have students complete notes for next chapter*	x				

\* **Note-taking option:** Once students are done with chapter test, they get the next set of notes and work quietly on completing them while other students finish up. All notes are to be completed when they return to class. Have students glue each page of notes into the next few pages of their INB (right side only). This way, when you go over the PowerPoint each day, they have already reviewed topic and are ready for class.

### 5 E Model

**Engage** – Teacher-led demos foster wonder and classroom discussion and serve as the hook for the lesson. Videos and images of natural phenomena also foster questioning and communication. NGSS phenomena are aligned to middle school NGSS standards.

**Explain** – PowerPoints, instructional videos, and guided notes (input side of interactive notebooks) provide definitions, explanations, and information through mini-lecture, text, internet, and other resources which encourages students to explain concepts and definitions in their own words.

**Explore** – Students investigate problems, events, or situations. As a result of their mental and physical involvement in these activities, students question events, observe patterns, identify and test variables, and communicate results.

**Elaborate** – It is important to involve students in further experiences that apply, extend, or elaborate the concepts, processes, or skill they are learning. Elaborate activities provide time for students to apply their understanding of concepts and skills. They might apply their understanding to similar phenomena or problems.

**Evaluate** – Use a variety of assessment to gather evidence of student's understanding and provide opportunities for them to assess their own progress.

# Student Interactive Notebook



Each concept shares:

- Actual photos of both the INPUT and OUTPUT pages of Science Interactive Notebook
- Instructions on how to create/use/complete activity for OUTPUT side
- Mini-Quizzes for each concept to check students' understanding
- Answer Keys for all mini-quizzes
- Appendix with Teacher Notes for Interactive Notebook in LARGE print.

**Section 1: The Work of Gregor Mendel**

Directions: Flip a pair of coins to determine the genotype for the eight traits of the Doochickey Bug when flipping the coins, two heads (HH) is dominant, one head and one tail (HT) is the heterozygous mixed trait, and two tails (TT) is the recessive trait. The coins should be flipped for each trait. Then using the Doochickey Bug Trait Key in the table below with each genotype and phenotype, label your coins, draw your Doochickey Bug using the phenotypes listed in your table. Paste this in your Interactive Notebook.

Trait	Genotype	Phenotype
Body Shape		
Antennae Shape		
Wing Shape		
Wing Pattern		
Wing Color		
Body Color		
Eye Size		
Foot Color		

**Drawing of Doochickey**

**Section 2: Mendel's Laws of Heredity**

Instructions:

**Doochickey Bug Trait Key**

**Body shape**

Round (RR)	Oval (Rr)	Thin (rr)

**Antennae Shape**

Arched (AA)	Looped (Aa)	Angled (aa)

**Wing Shape**

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**Section 3: Punnett Squares**

Instructions:

Directions: Cut out four-door foldable and complete each Punnett square problem. On the front of each folded flap, paste a vocabulary word from below and write the definition. Paste into Interactive Notebook when complete.

		Genotype
		Phenotype

**Expected phenotype ratio:**

		Homozygous
		Heterozygous

**Section 4: Mendel's Laws of Heredity**

Instructions:

Directions: Cut out four-door foldable and complete each Punnett square problem. On the front of each folded flap, paste a vocabulary word from below and write the definition. Paste into Interactive Notebook when complete.

		Genotype
		Phenotype

**Expected phenotype ratio:**

		Homozygous
		Heterozygous

# Student Digital Notebook

The student notebook is on Google Drive and ready for you to share with your students. Here's a quick overview of the features:

Set up like a traditional interactive notebook with input and output sides.

Hyperlinked tabs so student can easily move through chapter for review

Students watch video < 6 min to complete notes.

The screenshot displays a digital notebook interface. On the left, there are several text boxes with definitions and instructions for Punnett squares. The main area is titled 'PUNNETT SQUARE PRACTICE' and contains two columns of problems. The first column is for a monohybrid cross of heterozygous plants (Tt x Tt), and the second is for a monohybrid cross of homozygous plants (YY x yy). To the right, there is a video player titled 'Punnett Squares' with a play button. Below the video player, there is a 'Digital Textbook' button and a 'Monohybrid Punnett Square' button. A vertical sidebar on the right contains tabs for 'Genetics', 'Unit of Heredity', 'Punnett Squares', 'Mendel', and 'Classroom Resources'.

Directions: Complete each Punnett square problem.

**Homozygous:** Some trolls have one eye (EE, Ee) while others have two (ee). Two heterozygous one-eyed trolls are crossed.

**Heterozygous:** In unicorns, having a white horn (W) is dominant to having a brown horn (w). Two heterozygous unicorns are crossed.

**Genotype:** In griffins, the allele for black feathers (B) is dominant over silver feathers (b) which are recessive. Two black griffins are crossed and have a silver offspring.

**Phenotype:** A homozygous red dragon (RR) is crossed with a heterozygous red dragon. (Rr)

**PUNNETT SQUARE PRACTICE**

**Homozygous:** when two alleles for trait are the same (ex. TT,tt)

**Heterozygous:** when alleles for a trait are different (ex. Tt)

**Punnett Square -**

One parent's genotype

Parent 1's alleles

Parent 2's alleles

Punnett square for a single trait

**Monohybrid cross: Heterozygous plants**

Crossing two pea plants that are \_\_\_\_\_ for seed color will produce offspring in the following ratio:

YY (homozygous dominant)  
Yy (heterozygous)  
yy (homozygous recessive)

**Monohybrid cross: Homozygous plants**

A cross between a yellow homozygous plant (YY) with a homozygous recessive green plant (yy) only produces \_\_\_\_\_ yellow (Yy) offspring.

4/4 - Yy (Heterozygous)

**Digital Textbook**

For further exploration, click button(s) below:

Monohybrid Punnett Square

Encouraging independent learners. Directions for output side are here along with what they need to complete the activity.

Notes are chunked into manageable sections with large spaces for textboxes

Some pages have links so students can go deeper into the topic if they need.

# Demos, Labs, & Science Stations

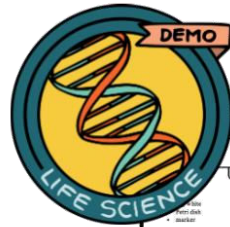
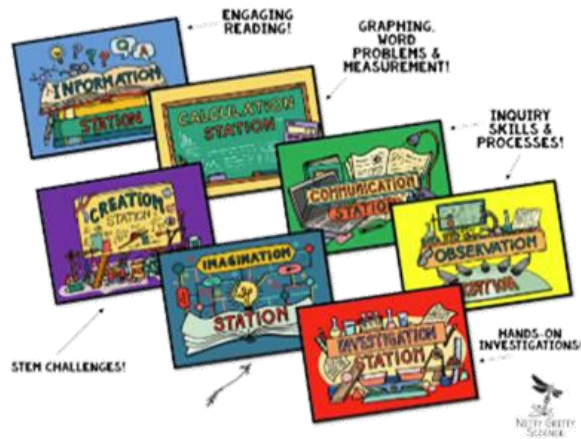


Working in the lab and being engaged in science experiments is the most exciting part of science.

Demo, Labs, and Science Stations Includes:

1. **SCIENCE STATION SIGNAGE** for all 7 stations is provided in color and in black and white (see preview) and all student answer sheets have icons that correspond with each station for ease of use.
2. **DEMONSTRATION** (teacher-led) allows teachers to invite scientific discussions and can help uncover misconceptions and, most importantly, lead to heightened curiosity and interest in the topic being studied.
3. **GUIDED INQUIRY LAB** which is a traditional lab that allows students to perform an investigation in order to solve a problem. Students will hypothesize, collect and analyze data and communicate their results.
4. **TEACHER GUIDES to DEMOS & SCIENCE STATIONS** help get you started and give you background information to make your science lessons engaging.
5. **7 SCIENCE STATIONS** which are designated locations in the classroom with activities that challenge students to extend their knowledge and elaborate on their science skills by working independently of the teacher in small groups or pairs. Stations included are:
  - **INFORMATION STATION** – Group members will read an interesting and relevant science passage then complete a task to help increase science literacy and deepen their understanding of the science concept.
  - **OBSERVATION STATION** – Group members will have images, illustrations, or actual samples at this station that show applications or processes of the science topic. Using what they've learned, they will need to apply their observation skills to complete the questions attached to each.
  - **CALCULATION STATION** – Group members use their math skills to complete the station challenge. Skills may include graphing, analyzing data, using models, measurement, and calculating formulas or word problems.
  - **INVESTIGATION STATION** – Group members will work with one another to explore the concept through hands-on activities so they may practice specific inquiry process skills as they learn.
  - **COMMUNICATION STATION** – There are three different options for this station: interviews, video, group essay. Depending on the option you choose, group members will communicate what they know by answering questions in creative ways.
  - **CREATION STATION** – Group members will work together to solve a STEM (Science, Technology, Engineering, Math) challenge by creating models or designs that demonstrate their understanding of the science topic being taught.
  - **IMAGINATION STATION** – This station makes science concepts relevant for students by asking them to imagine scenarios that will bring about discussion and critical thinking.
6. **INQUIRY PROCESS SKILLS CHECKLIST** is provided with each set to show teachers and administrators the inquiry skills used by students in each activity. These skills include, but are not limited to, communicating, creating models, inferring, classifying, identifying variables, measuring, observing, predicting, gathering and organizing data, comparing and contrasting, interpreting data, and manipulating materials.

# SCIENCE STATIONS



### Eye Safety

SCIENCE SKILLS AND LAB SAFETY

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Procedure:

1. Draw an eye on the underside of the Petri dish and display for class using the projector.
2. Crack open the egg and place the egg white only in the Petri dish.
3. Explain that the proteins in egg whites are similar to those found in the protective layer of the eye.
4. Tell them that someone was not being cautious and has splashed acid into their eye - add drops of acid to the egg white.
5. Ask students to make observations of what is happening to the egg white.
6. Try adding water to reverse the effects. Have students make observations.

What's Happening?

The proteins in the egg white become cloudy when the acid is causing a denaturation of the proteins. This can't be reversed chemically because acid at this level is so strong that it is altering the entire structure damage to their eyes or skin if not used properly. Students must be made aware of the safety procedure associated with such as wearing goggles, gloves and aprons. Make sure they are aware of safety equipment - eye wash station, shower, fire blanket, etc.

Discussion:

Q: What happened to the "eye"?

A: The protective layer became cloudy and damaged the eye.

Q: What type of safety equipment must be worn when doing Lab?

A: goggles, apron, lab kit, gloves

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Discussion questions and teacher set-up included!

Teacher guide and answer key offered for every lab!

Easy-to-get materials!



### Measure with SI Units

SCIENCE SKILLS AND LAB SAFETY

Name: \_\_\_\_\_ Date: \_\_\_\_\_

The standard system of measurement used by scientists around the world is known as the International System of Units, which is abbreviated as SI. SI units are easy to use because they are based on multiples of 10. Each unit is ten times larger than the next smallest unit and one-tenth the size of the next largest unit. The following table lists the prefixes used to name the most common SI units.

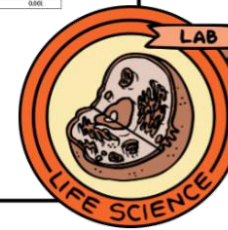
Prefix	Symbol	Abbreviation
kilo-	k-	1,000
hecto-	h-	100
deca-	da-	10
deci-	d-	0.1
centi-	c-	0.01
milli-	m-	0.001

Materials:

- scattered seeds
- tape
- balance
- postage scale
- capsaicin/pepper small milk cartons
- fertilizer solution
- metric ruler
- 50 mL graduated cylinder
- colored pencils

Safety:

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## USER-FRIENDLY PAGES:

Students easily recognize which answer sheet to use at each station by matching station icons located on each page!!

### Drip, Drop, Splat!

How does the density of a liquid and drop height affect the size and shape of droplet splatters?

Materials:

- colored water (graduated cylinder A)
- colored syrup (graduated cylinder B)
- eye dropper
- paper
- metric ruler
- meter stick

Procedure:

1. Make a hypothesis of how density of a liquid will affect splatter size on your lab sheet.
2. Place the piece of paper down on the lab table in order to catch splatters.
3. Measure the heights listed in the data table using a meter stick. Place meter stick with end starting at zero on paper and move up stick when increasing height of drop.
4. Use the eye dropper to drop ONE drop of colored water and ONE drop of colored syrup. Make sure to drop on different places on paper.
5. Measure the size of the splatter in MILLIMETERS. Record in data table on answer sheet.
6. Repeat for each height.
7. Use the collected data to graph the splatter size versus drop height for each liquid.

Analyze and Conclude

1. Was your hypothesis correct? Explain.
2. What are two controls in your experiment that helped you collect the most accurate data possible?

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TEACHERS SAVE TIME:  
Laminate station pages and reuse for each class and for years to follow!  
Inquiry skills used are timeless!

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Hypothesis

Drop Height (cm)

	3	25	50	75	100
Colored Water					
Colored Syrup					

Height of Drop vs. Splatter Size

Number of Drops (mm)

Size of Splatter (mm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Water																					
Syrup																					

Legend:

- Water
- Syrup

Analyze and Conclude:

1. \_\_\_\_\_
2. \_\_\_\_\_

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# Instructional Videos



The Intro to Life Science Instructional Videos and Digital Assessments are designed to help teachers move instruction from the group learning space to the individual learning space. Not only does this give students independence in their learning, but it also allows more time for dynamic and interactive learning when teachers meet with students in a group setting.

This resource is perfect for:

- Flipped Classroom
- Absent students
- 1:1 Classrooms
- Sub Plans
- Hybrid Schedules
- Teachers who want more time to guide students as they apply concepts and engage creatively in the subject matter

Features of this resource include:

- Instructional videos which are six minutes or less to keep students focus
- Videos and assessments can be completed independently
- Auto grading and reporting in Google Forms
- Share link with students through educational platforms or email
- Quizzes are editable with 5 – 8 questions per quiz
- Information in video pairs with Nitty Gritty Science Interactive Notebooks

# Task Cards & Digital Task Cards

Task cards are a great tool for concept review that can be used in a variety of ways - pairs, small groups, team games, or individually. The reason they are so effective is there is only ONE task per card, allowing students to focus on that single task until they have successfully completed it. Answers sheet and answer key for teachers are included.

The digital, self-checking task cards are hosted at Boom Learning™ and are compatible with Google Classroom. These are perfect for displaying on your interactive whiteboard and leading class games or review sessions.

Print Task Cards

Print Task Cards

1. **DECIDE**  
The passing of characteristics from parents to offspring is \_\_\_\_.  
a. crossing over c. dominance  
b. heredity d. meiosis

2. **DECIDE**  
The exchange of genetic material between homologous chromosomes is \_\_\_\_.  
a. crossing over c. dominance  
b. heredity d. meiosis

3. **EXPLAIN**  
What is the probability of producing a tall pea plant from a genetic cross between two hybrid tall pea plants?

4. **LIST**  
List four traits Mendel studied (one, separating his).

5. **DECIDE**  
Which combination of sex chromosomes results in a male human being?  
a. XX c. YY  
b. XY d. XXY

6. **IDENTIFY**  
Identify the phase of meiosis

7. **DECIDE**  
Cloning results in two organisms that are \_\_\_\_.  
a. genetically similar  
b. full-grown adults  
c. genetically identical  
d. always male

8. **DETERMINE**  
What type of blood will a child have if she inherits I<sup>A</sup> from her mom and I<sup>B</sup> from her dad?

9. **COMPLETE**  
\_\_\_\_ happens when homologous chromosomes fail to separate properly.

10. **COMPLETE**  
A \_\_\_\_ is a person who has one recessive and one dominant allele for a trait.

11. **EXPLAIN**  
Explain what must occur for a girl to be colorblind.

Digital Task Cards

Science of Heredity

What is the phenotype ratio of the offspring of this cross?

W w  
W WW Ww  
w Ww ww

2  
1  
3  
4

Science of Heredity

Identify the phase of

Metaphase II Anaphase

Modern Genetics

Why can a black chicken that mates with a white chicken have offspring that are both black and white, or speckled?

sex chromosomes  
cloning  
codominant alleles  
multiple alleles



# Study Guides: Includes *print* or *digital* options

Nitty Gritty Science Study Guides are directly aligned to the notes and assessments offered by Nitty Gritty Science and include a variety of review strategies which meet the needs of your learners for independent study and indirect instruction.

Each study guide provides a combination of strategies which may include:

- Graphic organizers
- Vocabulary building
- Compare and contrast
- Problem solving
- Concept mapping
- Interpreting data
- Critical thinking
- Theme connection
- Matching
- Fill-in-the-blank
- Short answer
- Real world application
- QR videos with accompanying questions

**STUDY GUIDE**

**GENETICS**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**SECTION 1**

Directions: Complete each sentence with the best term from the word bank and write below.

zygote      fertilization  
traits      heredity

1. Gregor Mendel, an Austrian, is recognized as the father of \_\_\_\_\_.
2. Characteristics that are passed to children are also known as \_\_\_\_\_.
3. These characteristics are used to \_\_\_\_\_.
4. Garden peas produce male \_\_\_\_\_ called \_\_\_\_\_.
5. When the male and female \_\_\_\_\_ is formed, \_\_\_\_\_ is formed.

**SECTION 2**

Directions: Complete the graphic organizer below with the correct information about each law.

Law of Segregation

Law of Independent Assortment

**SECTION 3**

Directions: Explain Mendel's law of heredity.

Directions: Use the clues to fill in the crossword puzzle below.

**SECTION 4**

Directions: Using the diagram below for reference, explain the purpose of the Punnett square, including what it is used for.

**Punnett Square**

	A	a
A	AA	Aa
a	Aa	aa

Directions: Complete each Punnett square and use the information to predict the potential of offspring.

Parent 1      Parent 2

Male

	b	b
B		
B		

Female

	B	b
B		
b		

Male

**SECTION 5**

Directions: Read each statement then determine whether each description occurs during mitosis, meiosis, or both.

1. Sister chromatids separate.
2. Cell division occurs once.
3. Cell division occurs twice.
4. Replicated chromosomes line up in the middle of the spindle.
5. Diploid cells are formed.
6. Two cells are the final result.
7. Four cells are the final result.
8. Occurs in the sex organs of an animal.
9. Purpose is cell regeneration and growth.
10. Production of gametes for sexual reproduction.

**SECTION 6**

Directions: Scan the QR code to watch the video about peas. Grab a yellow and green crayon and replicate the breeding Mendel discovered in both first- and second-generation pea plants. Label the alleles correctly on each Punnett square.

**PEA PLANTS**

1<sup>st</sup> Generation      2<sup>nd</sup> Generation


When alleles are the same, they are referred to as \_\_\_\_\_.

When alleles are different, they are referred to as \_\_\_\_\_.

Did you know that on a genetic level, humans are more than 99% identical?



# Assessments:

Teachers can use a variety of assessments to evaluate student progress throughout the unit. The curriculum provides mini-quizzes for each Interactive Notebook chapter and an online assessments that goes with the instructional videos. The chapter test includes multiple choice, short answer, interpreting diagrams, and an essay.

The image displays a collage of educational materials. On the left, two identical pages of a quiz titled "Quiz: The Work of Gregor Mendel" are shown. Each page includes a "Name" line, a "Circle the word that makes each statement true" instruction, and six numbered questions about Mendel's experiments. The questions cover topics such as the number of traits studied, the plants used, the first person to succeed in passing traits to the next generation, the types of breeding used, the definition of a gamete, and Mendel's title. In the center, a larger page titled "CHAPTER TEST" is shown, featuring a "Name" line, a "Multiple Choice" section with 10 questions, and a "Fill in the Blank" section with 5 questions. A red-bordered box is overlaid on the top right of this page, containing the text: "EDITABLE CHAPTER TEST INCLUDES MULTIPLE CHOICE, FILL IN THE BLANK, INTERPRETING DIAGRAMS, & SHORT ANSWERS QUESTIONS". At the bottom of the collage, another red-bordered box contains the text: "ANSWER KEY INCLUDED — IMAGES ARE BLURRED FOR COPYRIGHT REASONS".

Name \_\_\_\_\_

**Quiz: The Work of Gregor Mendel**

Circle the word that makes each statement true.

1. In the beginning, Mendel studied (one, two) traits and recorded his data.
2. Mendel used (tomato, pea) plants in his experiments.
3. Mendel was the first person to succeed in passing traits to the next generation.
4. Mendel used (fast-breeding, true-breeding) plants.
5. A (gamete, hybrid) is the offspring of parents with different traits.
6. Mendel is sometimes referred to as the Father of Genetics.

-----

Name \_\_\_\_\_

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Name \_\_\_\_\_

**CHAPTER TEST**

Multiple Choice

1. The factor that affects the color that flowers have is called \_\_\_\_\_.  
a. alleles  
b. chromosomes  
c. reproduction  
d. mutation
2. Which trait did Mendel study and consistently about pea plants?  
a. height  
b. color  
c. shape  
d. size
3. Using the Punnett square, what is the probability of a heterozygous dominant parent (Aa) and a heterozygous dominant parent (Aa) having a heterozygous dominant offspring (Aa)?  
a. 25%  
b. 50%  
c. 75%  
d. 100%
4. Why do the offspring of heterozygous parents have different traits?  
a. alleles  
b. chromosomes  
c. reproduction  
d. mutation
5. What is a gamete?  
a. a sex cell  
b. a chromosome  
c. a mutation  
d. a trait
6. The first person to get his ideas from experiments is called the \_\_\_\_\_.  
a. scientist  
b. biologist  
c. geneticist  
d. researcher
7. Using the Punnett square, what is the probability of a heterozygous dominant parent (Aa) and a heterozygous dominant parent (Aa) having a homozygous dominant offspring (AA)?  
a. 25%  
b. 50%  
c. 75%  
d. 100%
8. What is the first step in Mendel's experiment?  
a. choosing the traits to study  
b. choosing the parents to cross  
c. choosing the offspring to study  
d. choosing the results to study
9. Which of the following is not a trait?  
a. height  
b. color  
c. shape  
d. size
10. Which of the following is not a trait?  
a. height  
b. color  
c. shape  
d. size

Fill in the Blank

Complete each statement with the correct vocabulary term.

11. \_\_\_\_\_ are used to make small details of an object visible by a scientist.
12. \_\_\_\_\_ are used to make small details of an object visible by a scientist.
13. \_\_\_\_\_ are used to make small details of an object visible by a scientist.
14. \_\_\_\_\_ are used to make small details of an object visible by a scientist.
15. \_\_\_\_\_ are used to make small details of an object visible by a scientist.
16. \_\_\_\_\_ are used to make small details of an object visible by a scientist.

ANSWER KEY INCLUDED — IMAGES ARE BLURRED FOR COPYRIGHT REASONS

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Shop the website or use the following links from Teachers Pay Teachers

Nitty Gritty Science (Grades 6–9)

<https://www.teacherspayteachers.com/Store/Nitty-Gritty-Science>

Nitty Gritty Science Jr (Grades K–5)

<https://www.teacherspayteachers.com/Store/Nitty-Gritty-Science-Jr>

