



Project QuEST
Model Life Science Lessons
Genetics Set

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Project QuEST
Model Life Science Lesson
Teacher Guide: Asexual and Sexual
Reproduction

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Middle School Science: Life Science

Genetics Set: Asexual and Sexual Reproduction

Framework for K-12 Science Education: Dimension 3—Life Science

- **Disciplinary Core Idea (LS1.B)—Growth and Development of Organisms:** Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
- **Science and Engineering Practices:** Developing and Using Models
- **Crosscutting Concepts:** Cause and Effect

Connections to the Common Core State Standards (ELA)

- **RST.3:** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- **L6:** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Connection to the Common Core State Standards (Math)

- **MP.2:** Reason abstractly and quantitatively.

Connections to English Language Development Standards¹

- **ELD Standard 4: Language of Science**
 - **Reading:** Explain how organisms reproduce asexually by matching an illustration of their reproduction to the description.
 - **Writing:** Describe observations of a lab investigation on asexual reproduction using the sentence stems in a graphic organizer.
 - **Listening:** Draw conclusions about how a bacterium cell reproduces by watching a video and recording the answer using a word bank.
 - **Speaking:** Discuss findings from the budding lab investigation with a partner using the key terms.

¹ Because the WIDA English language development standards are currently used in 29 states, we reference these standards.

Overview of Activities

Focus Activity

- **Student Activity I: Rating and Discussion of Science, Language, and Vocabulary Objectives.** Teacher posts lesson objective poster; students rate their prior knowledge of each objective; brief discussion.

Engagement

- **Student Activity II: Preteaching of Science Content Words.** Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach the following: *asexual reproduction, sexual reproduction, offspring, genetic material, inherited trait*.

Explanation and Exploration

- **Student Activity III: Introduction to Reproduction.** Teacher displays slides 10–12; students turn to Student Charts 1.3–1.5; teacher defines the different types of reproduction and students fill in the charts with key terms; teacher displays slide #13 and plays video clip; students turn to Student Chart 1.6 and fill in key terms; whole class discussion of other examples of reproduction.
- **Student Activity IV: Matching Reproductive Processes.** Teacher pairs students and has them turn to Student Chart 1.7; students work in pairs to match the sentences with the pictures that illustrate the reproductive process; teacher displays slide #14, discusses answers and has students correct responses as necessary; whole class discussion of type of reproduction portrayed.
- **Student Activity V: Investigation of Budding.** Teacher groups students; teacher displays slide #18 and reads information; students fill in key terms in Student Chart 1.8; teacher displays slides 19–21 and reviews materials and procedures as students follow along in Student Charts 1.8–1.10; students complete investigation, recording observations in Student Chart 1.11; students complete questions #1–#3 in Student Chart 1.12; teacher displays slide #24, reviews answers and has students correct responses as necessary.

Elaboration

- **Student Activity VI: General Academic Word Cards.** Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach: *require, compare*.
- **Student Activity VII: Interactive Reading** (Glencoe, pages 359–362). Teacher discusses text illustrations; one student reads guiding questions; teacher and students participate in shared interactive reading; teacher and students discuss

guiding questions; students respond to guiding question; teacher posts correct response; students revise response if necessary.

Evaluation

- **Student Activity VIII: Glossary, Key Facts, and Further Study.** Students complete glossary for science content words, answer questions related to key content, and indicate if there is anything else they would like to learn about; whole class review.

Extension

- **Student Activity IX: Leveled Readers—Reproduction.**



QuEST Middle School Life Science

Asexual and Sexual Reproduction

Objectives

- Science:
 - Students will compare asexual and sexual reproduction.
 - Students will recognize that the genetic diversity of offspring is related to the type of reproduction.
- Language:
 - Students will match science vocabulary terms to illustrations.
 - Students will record observations during an investigation on asexual reproduction.

Vocabulary

- Science content: *asexual reproduction, sexual reproduction, offspring, genetic material*
- General academic: *compare, require*

Teacher Management

Estimated time for completion, in minutes: 90

Materials (per group of four)

- 1 package of active yeast
- 1 gram sucrose
- 2 balloons (helium quality work best)
- 50 mL of warm water
- 2 mL–50 mL Erlenmeyer flasks
- Optional, if available: microscope, slide, cover slip, eye dropper

Teacher Prep

1. Review detailed lesson plan in the Teacher Guide.
2. Pull out the Activity Overview page(s), PowerPoint lesson guides, and student charts and add any necessary notes to them from the detailed lesson plan to help guide the lesson.
3. If necessary, organize activities to fit school schedule.
4. Download PowerPoint presentation.
5. Download video clip or sign into Discovery Education.
6. Group students for partner/small group work.
7. Display vocabulary cards on the word wall.
8. Decide if students will use microscopes as an optional last step in the Budding Lab.

Safety Considerations:

Make sure the students handle and dispose of yeast solution properly.

Vocabulary-Building Strategies

- Explicit interactive presentation of vocabulary cards
- Word wall
- Glossary work

Background Information for Teacher

- ACCESS: pages 184–187
- Glencoe: pages 359–369
- Gateways: pages 188–195

Lesson Content



Focus Activity/Warm-Up

Student Activity I (slides 3–5; Lesson Objective poster; Student Charts 1.1 and 1.2)

10 minutes (There is additional time here because it is the first time the students have done this, so it may take some time to explain or model.)

Activity Overview: Rating and Discussion of Science, Language, and Vocabulary

Objectives. Teacher posts lesson objective poster; students rate their prior knowledge of each objective; brief discussion.

- Before students enter the room, display the science objectives.
- Make sure the ratings of the previous class have been erased.
- As they enter the classroom, have students rate their prior knowledge of each objective on a continuum of 1 to 4 (1=none, 4=a lot).
- Have students turn to Student Chart 1.1.
- Read the science objectives aloud, one at a time, reporting students' level of prior knowledge.
- Read the language objectives.
- Have students turn to Student Chart 1.2.
- Read vocabulary words aloud.
- As appropriate, have student use thumbs up/thumbs down to indicate prior knowledge.



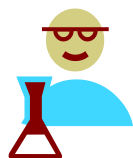
Engagement

Student Activity II (slides 6–9, Science Content Word Cards)

10 minutes (There is additional time here because it is the first time the students have done this, so it may take some time to explain or model.)

Activity Overview: Preteaching of Science Content Words. Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach the following: *asexual reproduction*, *sexual reproduction*, *offspring*, *genetic material*.

- Have students open their glossaries to this lesson's words.
- Read the target words aloud, one at a time.
- As you display the slides have students rewrite the target words one at a time in English and in Spanish (as appropriate) in their glossaries.
- Display the slides of the science content words one at a time, reading the text on the right side of each PowerPoint slide aloud and eliciting responses from student pairs.
- Point to the appropriate part of the pictures as you read through the notes.
- Depending on your class, you may want to read (or have a student read) the definitions in Spanish.
- Ask one student to answer each question. You can also choose to have students answer the questions with a partner.
- Tell students they may continue to use the science content word cards on the word wall for reference.
- **Teacher note: To save time you may want to eliminate partner talk and just ask one student to answer the question.**



Explanation and Exploration

Student Activity III (slides 10–14, Student Charts 1.3–1.6)

10 minutes

Activity Overview: Introduction to Reproduction. Teacher displays slides 10–12; students turn to Student Charts 1.3–1.5; teacher defines the different types of reproduction and students fill in the charts with key terms; teacher displays slide 13 and plays video clip; students turn to Student Chart 1.6 and fill in key terms; whole class discussion of other examples of reproduction.

- **Introduction**
- **Defining reproduction**
 - Display slide 10 and have students turn to Student Chart 1.3.
 - Read sentences #1 and #2, defining reproduction.
 - Display responses.
 - Have students fill #1 and #2 in their chart.
 - Read sentence #3 about the types of reproduction.
 - Display responses.
 - Have students fill in sentence #3 in their chart.

- Question #4, whole class discussion: **Do all organisms reproduce?** [Response: yes].
- Question #5, whole class discussion: **Do all organisms reproduce in the same way?** [Possible responses: no, sometimes there is one parent, sometimes two, sometimes offspring are the same as the parent, sometimes they are a new mix].
- **Defining sexual reproduction**
 - Display slide 11 and have students turn to Student Chart 1.4.
 - Display responses.
 - Read sentence #1, defining sexual reproduction.
 - Have students fill in #1 in their chart.
 - Elaborate by reading sentence #2.
- **Defining asexual reproduction**
 - Display slide 12 and have students turn to Student Chart 1.5.
 - Read sentence 1, defining asexual reproduction.
 - Have students fill in #1 in their chart.
 - Use the yeast cell illustration to explain how one parent yeast cell divides and has offspring identical to the parent.
 - Use the spider plant illustration to explain that one parent spider plant has identical offspring.
 - Display slide 13 and have students turn to Student Chart 1.6.
 - Have students turn to Student Chart 1.6.
 - Read the guiding question.
 - Play the video on the reproduction of bacteria.
 - Have students complete #1 in their chart.
 - Replay the video if necessary.
 - Display the responses.
 - Review the answer with students and have students correct their responses as necessary.
 - Display slide 14.
- **Asexual vs. sexual reproduction**
 - Discuss #1 and #2 with your class.
 - Question #1, whole class discussion: **Why could it be harmful that bacteria reproduce so rapidly?** [Anticipated response: If it's a harmful bacteria, it can cause food to spoil and disease to spread quickly].
 - Question #2, whole class discussion: **Can you think of other organisms that reproduce through asexual or sexual reproduction?** [Anticipated response: Asexual: bacteria, grasses, strawberries, when you take a cutting from a plant and grow a new plant; sexual: dogs, cats, and some types of plants]. If needed, prompt with the examples given in previous slides, but have students generate new responses.

Student Activity IV (slide 15, Student Chart 1.7)

10 minutes

Activity Overview: Matching Reproductive Processes. Teacher pairs students and has them turn to Student Chart 1.7; students work in pairs to match the sentences with the pictures that illustrate the reproductive process; teacher displays slide 14, discusses answers, and has students correct responses as necessary; whole class discussion of type of reproduction portrayed.

Teacher note: You may prefer to save this activity to use during the wait time in the Budding Lab that occurs next.

- Pair students.
- Have students turn to Student Chart 1.7.²
- Have students work in pairs to read the sentences in the right column and match them to the illustrations in the left column.
- Display responses.
- Have students correct responses as necessary.
- Discuss questions #1 and #2 with students.
- Question #1, whole class discussion: **Are these organisms reproducing through asexual or sexual reproduction?** [Anticipated response: Asexual reproduction.]
- Question #2, whole class discussion: **How do you know?** [Response: because there is one parent and the offspring have exactly the same genetic material as the parent].

Student Activity V (slides 16–22, Student Charts 1.8–1.12)

30 minutes

Activity Overview: Investigation of Budding. Teacher groups students; teacher displays slide 18 and reads information; students fill in key terms in Student Chart 1.8; teacher displays slides 19–21 and reviews materials and procedures as students follow along in Student Charts 1.8–1.10; students complete investigation, recording observations in Student Chart 1.11; Students complete questions #1–3# in Student Chart 1.12; teacher displays slide 24, reviews answers, and has students correct responses as necessary.

Teacher note: If microscopes are available, decide if students will take a small sample to analyze, draw, and label what they see (see item #7, Student Chart 1.10).

- **Background**
 - Group students.
 - Display slide 18 and have students turn to Student Chart 1.8.
 - Read the background information, displaying key terms.
 - Have students fill in the key terms.
- **Materials**
 - Have students turn to Student Chart 1.9.
 - Review list of lab materials and distribute them to students.
 - Have students make sure they have all materials by checking them off in their chart.
- **Procedure**

² Please note that the illustration in Student Chart 1.7 comes from the following source: McClane, A., & Linscomb, D. (2005). *Gateways to Science for Grade 7*. Houston, TX: Region 4 Education Service Center.

- Have students turn to Student Chart 1.10.
 - Review the lab procedures with students.
 - Have students complete the lab and record their observations in Student Chart 1.11.
 - There is an optional step on the slide 19 for classrooms with access to microscopes.
- **Observation and results**
 - Have students turn to Student Chart 1.11.
 - As they follow the procedures in Student Chart 1.10, have them record their observations and results.
- **Questions**
 - Have students turn to Student Chart 1.12.
 - Have students complete questions #1–#3.
 - Display the responses.
 - Have students correct their responses as necessary.



Elaboration

Student Activity VI (slides 23–25, General Academic Word Cards)

6 minutes

Activity Overview: General Academic Word Cards. Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach: *require, compare*.

- Read each general academic vocabulary word to students.
- As appropriate, have student use thumbs up/thumbs down to indicate prior knowledge.
- Have students turn to their Lesson 1 glossaries.
- Read the target words aloud, one at a time.
- Have students rewrite the target words in English and in Spanish (as appropriate) in their glossaries.
- Read through the notes on the right side of the slide.
- Point to the appropriate parts of the pictures as you read through the notes.
- Depending on your class, you may want to read (or have a student read) the definitions in Spanish.
- Display the slides of each of the general academic word, reading the script aloud and eliciting responses.
- Tell students they may continue to use the general academic word cards on the word wall for reference.

Student Activity VII (slides 26–33, Student Chart 1.13–1.16)

16 minutes

- Glencoe, pages 359–362

Activity Overview: Interactive Reading. Teacher discusses text illustrations; one student reads guiding questions; teacher and students participate in shared interactive reading; teacher and students discuss guiding questions; students respond to guiding question; teacher posts correct response; students revise response if necessary.

- **Preview**

- Display slide 25 and have students turn to Student Chart 1.13.
- Have students open their textbooks.
- Read the guiding questions aloud.
- Review all illustrations in the text with students using the document camera.
-

- **Text**

- Have students turn to Student Chart 1.14.
- Read text aloud to students as they follow in their Student Chart.
- Stop and clarify text if necessary.
- Ask students embedded questions. Elaborate on their responses as necessary.
- When you get to a figure, stop reading and have students look at the figure as you discuss it.

- **Review**

- Display slide 30 and have students turn to Student Chart 1.15.
- Discuss the guiding question.
- Have students work in pairs to complete the chart.
- Display responses.
- Have students correct their responses as necessary.
- Have students turn to Student Chart 1.16.
- Discuss the guiding question.
- Have students work in pairs to complete the chart.
- Display the responses.
- Have students correct responses as necessary.



Evaluate

Student Activity VIII (slides 34–37, Student Charts 1.17–1.19)

8 minutes

Activity Overview: Glossary and Key Facts. Students complete glossary for science content words, answer questions related to key content, and indicate if there is anything else they would like to learn about; whole class review.

- **Glossary work**
 - Have students locate Student Chart 1.17.
 - Have students complete glossary entries for the science content words.
 - For each glossary entry, have students work in pairs to indicate whether the word is a cognate and to fill in the rest of the information required by the glossary.
 - As time permits, have students elaborate their understanding in the last column.
 - Review glossary entries with class.
- **Key information**
 - Have students turn to Student Chart 1.18.
 - Give students several minutes to complete the activities listed in Student Chart 1.18.
 - Display responses.
 - Have students correct responses as necessary.
- **Questions for further study**
 - Have students turn to Student Chart 1.19.
 - Have students complete Student Chart.
 - As time permits, have students share their questions with a partner, with the whole class, or have them write them on a sticky note and put them on a “questions wall” on their way out of class. Students who finish an assessment or who have free time might be assigned to go online to find answers to class questions.

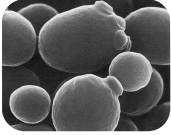
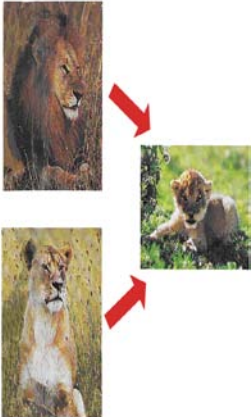


Extension/Differentiation


Student Activity IX: Leveled Reader—“Reproduction.” Teacher distributes reader according to the appropriate student level as shown below. Students can read selection for homework or when they complete assigned work during classes the following week.

- **Star: 1.5–2.2**
 - Circle: 3–3.5
 - Square: 4.5–5.2
 - Triangle: 6.5–7.2

Slide 1




Genetics Set



Lesson 1: Asexual and Sexual Reproduction


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Genetics Lesson 1: Teacher Preparation

- Download the video clip (or sign in to Discovery Education).
 - www.discoveryeducation.com
 - Film: “Cell Division” (Grades 6–8)
 - Segment: Asexual Reproduction [1:04]
- Erase the ratings from the previous class on the objectives poster.

Slide 3



Science Objectives

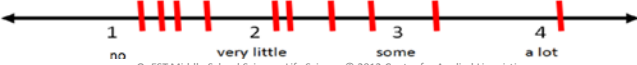
Students, as you enter the classroom...

- Go to the poster.
- Read each science objective.
- Use a marker to rate your knowledge of each objective on a scale of 1 to 4.

1= none 2= very little 3=some 4=a lot


- Class example:

Objective: Similarities and differences between asexual and sexual reproduction.



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- Before students enter the room, display the science objectives.
- Make sure the ratings of the previous class have been erased.
- As they enter the classroom, have students rate their prior knowledge of each objective on a continuum of 1-4 (1=no to 4=a lot).




1.1: Science and Language Objectives

- In Science, we will learn:
 - to compare asexual and sexual reproduction.
 - to recognize that the type of reproduction affects the genetic makeup of offspring.
- To develop our language skills, we will learn:
 - to match science vocabulary terms to illustrations.
 - to record observations during an investigation on asexual reproduction.

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- Have students turn to Student Chart 1.1.
- Read the science objectives aloud, one at a time, reporting students' level of prior knowledge.
- Read the language objectives.



1.2: Vocabulary Objectives


- Science content vocabulary:
 - asexual reproduction
 - sexual reproduction
 - offspring
 - genetic material
- General academic vocabulary:
 - require
 - compare

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- Have students turn to Student Chart 1.2.
- Read vocabulary words aloud.
- As appropriate, have student use thumbs up/thumbs down to indicate prior knowledge.

asexual
reproduction



reproducción
asexual

- Look at the picture. The green part of the potato will grow into a second potato.
- Asexual reproduction is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.
- Reproducción asexual es el tipo de reproducción en la que un progenitor da origen un nuevo organismo con el mismo ADN del organismo progenitor.
- Who can say what kind of DNA the new potato will have?

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- Have students turn to lesson 1 glossary words.
- Read the target word aloud.
- Have students rewrite the target word in English and in Spanish (as appropriate) in their glossaries.
- Read through the notes on the right side of the slide.
- Point to the appropriate part of the picture as you read through the notes.
- Depending on your class, you may want to read (or have a student read) the definition in Spanish.
- Ask one student to answer the question.
[Anticipated response: the same DNA as the parent potato].

Slide 7

sexual
reproduction



reproducción
sexuada

- Look at the picture. Sperm and egg come together to combine DNA in sexual reproduction.
- Sexual reproduction is a type of reproduction in which two cells, usually an egg and a sperm, join to form a zygote, which develops into a new organism with its own genetic identity.
- Reproducción sexuada es el tipo de reproducción en la que dos células, usualmente un huevo y un espermatozoide, se unen formando un cigoto, el que se desarrolla en un nuevo organismo con su propia identidad genética.
- Who can say what kinds of cells are involved in sexual reproduction?

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- Follow the same routine.
- Ask one student to answer the question.
[Anticipated response: Sperm and egg.]

Slide 8

offspring



descendencia


- Look at the picture. The children are the offspring of human parents.
- Offspring means one or more organisms born of a parent; in humans, offspring are children.
- Descendencia es el organismo que se origina a partir de un progenitor. En los seres humanos los hijos son los descendientes.
- Who can say what the word is for the offspring of cats?

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- Follow the same routine.
- Ask one student to answer the question.
[Anticipated response: kittens].

genetic
material




material
genético

- Look at the picture. The chromosome contains DNA and genes. All of it together is called genetic material.
- Genetic material is the genes, chromosomes, and DNA that are different for each cell or organism.
- Material genético se refiere a los diferentes genes, cromosomas y ADN de cada célula u organismo.
- Who can say what the different parts of genetic material are?

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- Follow the same routine.
 - Ask one student to answer the question.
- [Anticipated response: Chromosomes, genes, DNA].



1.3: Reproduction

1. Reproduction is the act or process of producing babies, young animals, or plants.
2. Living things reproduce to make young plants or animals.
3. There are two types of reproduction:
 - sexual reproduction
 - asexual reproduction
4. Do all organisms reproduce?
5. Do all organisms reproduce in the same way?

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- Have students turn to Student Chart 1.3.
- Read sentences #1 and #2, defining reproduction.
- Display responses.
- Have students fill in #1 and #2 in their chart.
- Read sentence #3 --types of reproduction.
- Display responses.
- Have students fill in #3 in their chart.
- #4--Whole class discussion: **Do all organisms reproduce?** [Response: yes].
- #5--Whole class discussion: **Do all organisms reproduce in the same way?** [Possible responses: no, sometimes there is one parent, sometimes two, sometimes offspring

are the same as the parent, sometimes they are a new mix].

1.4: Sexual Reproduction

1. Sexual reproduction: a type of reproduction in which two cells, usually an egg and a sperm join to form a zygote, which develops into a new organism with its own genetic identity.



2. Humans and monkeys are species that have two parents. Each offspring has the genetic material of both parents.

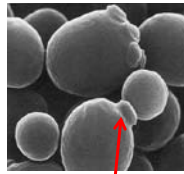
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- Have students turn to Student Chart 1.4.
- Display responses.
- Read sentence #1, defining sexual reproduction.
- Have students fill in #1 in their chart.
- Elaborate by reading sentence #2.

1.5: Asexual Reproduction

1. asexual reproduction : a type of reproduction in which a new organism is produced from one parent and has the same DNA or genetic material as the parent.



Yeast cells dividing (budding)



Spider plant offspring

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- Have students turn to Student Chart 1.5.
- Read sentence #1, defining asexual reproduction.
- Have students fill in #1 in their chart.
- Use the yeast cell illustration to explain how one parent yeast cell divides and has offspring identical to the parent.
- Use the spider plant illustration to explain that one parent spider plant has identical offspring.

1.6: Video on Asexual Reproduction

- While you are watching the video clip, think about this guiding question:
 - **How does a bacterium cell reproduce?**
 - It pinches in the middle and then the cell divides in two.

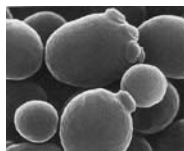
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- Have students turn to Student Chart 1.6.
- Read the Guiding question.
- Play the video on the reproduction of bacteria.
- Have students the sentence in their chart.
- Replay the video if necessary.
- Display the responses.
- Have students correct their responses as necessary.

1.6: Asexual vs. Sexual Reproduction (cont.)

Questions for discussion:

1. Why could it be harmful that **bacteria reproduce** so rapidly?
2. Can you think of other organisms that reproduce through asexual or sexual reproduction?



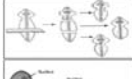
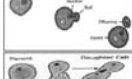

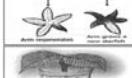

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- Discuss questions #1 and #2 with your class.
- #1- Whole class discussion [Anticipated response: If it's a harmful bacteria, it can cause food to spoil and disease to spread quickly].
- #2 -Whole class discussion [Anticipated response:
Asexual: bacteria, grasses, strawberries, when you take a cutting from a plant and grow a new plant; sexual: dogs, cats and some types of plants. If needed, prompt with the examples given in previous slides, but have students generate new responses.]

1.7: Asexual Reproduction

Match the picture with the description of how the organism reproduces:

	A whole new starfish can grow from a single arm that was cut off a starfish organism.
	A planarian is a tiny flatworm that lives in ponds. If a planarian is cut into pieces , each piece will grow into a new planarian.
	An ivy plant will reproduce a whole new plant if a piece of stem and leaf is placed into water or soil.
	A paramecium is a one-celled organism that reproduces by splitting in half to become two new cells .
	Yeast are one-celled organisms that produce offspring from a bulge that forms and breaks away from the parent.

Whole class discussion:

- Are these organisms reproducing through asexual or sexual reproduction?
- How do you know?

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Note to teachers: you may prefer to save this activity to use during the wait time in the Budding Lab that occurs next.

- Pair students.
- Have students turn to Student Chart 1.7.
- Have students work in pairs to read the sentences in the right column and match them to the illustrations in the left column.
- Display responses [Answers appear from top to bottom according to the text on the right, i.e. starting with the starfish].
- Have students correct responses as necessary.
- Discuss questions #1 and #2 with students.

- #1-[Anticipated response: Asexual reproduction]
- #2-[Anticipated response: because there is one parent and the offspring have exactly the same genetic material as the parent].

Please note that the illustration in Student Chart 1.7 comes from the following reference: McClane, A. & Linscomb, D. (2005). *Gateways to Science for Grade 7*. Houston, TX: Region 4 Education Service Center.




1.8: Budding Lab—Background

1. A yeast cell produces buds, or small offspring that grow into a new yeast organism that breaks away from the parent cell. This is called budding. When yeast cells grow and reproduce, they produce alcohol, carbon dioxide gas, and yeast offspring.

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- Group students for lab work.
- Have students turn to Student Chart **1.8**.
- Read the background information, displaying key terms.
- Have students fill in the key terms.



1.9: Budding Lab—Materials

Materials:

- 1 package active yeast
- 1 gram sucrose (sugar)
- 2 balloons
- 50 mL of warm water
- 2–50 mL Erlenmeyer flasks



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- Have students turn to Student Chart 1.9.
- Review list of lab materials and distribute them to students.
- Have students make sure they have all materials by checking them off in their chart.



1.10: Budding Lab—Procedure

1. Add **25 mL** of water to **each** flask.
2. **Divide** the yeast in the yeast package into two separate piles.
3. Add **one half** of the yeast package to each flask.
4. Add 1 gram of **sucrose** to **one** of the flasks. (Do NOT add sucrose to the other flask. It is the **control** in your experiment.)
5. Place the **open** end of the balloons tightly on the top of each flask.
6. **Observe** the changes in the balloons and flasks over the next **10–15** minutes. **Record** your observations in **Student Chart 1.11**.

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- Have students turn to Student Chart 1.10.
- Review the lab procedures with students.
- Have students complete the lab and record their results in Student Chart 1.11.
- There is an optional step on the next slide if you have access to microscopes.



1.10: Budding Lab (*cont.*)—Optional Step

- 7. Optional:** If microscopes are available, take a small sample from the flask with sucrose and make a wet mount slide. Look for individual yeast cells that are budding. Draw any that you see. Remember to give your drawing a title and label what magnification you were using.

- If you have microscopes, you may include this optional step.
- If you only have 1 microscope, use it to demonstrate.



1.11: Budding Lab— Observations and Results


Student Chart 1.11: Budding Lab Observations and Results
Use the chart below to record your observations by sketching and writing.

Flask #1 (no sucrose)	Flask #2 (with sucrose)
<p>Sketch:</p> <div style="height: 100px; border: 1px solid black;"></div>	<p>Sketch:</p> <div style="height: 100px; border: 1px solid black;"></div>
<p>Observations in words: The balloon _____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Observations in words: The balloon _____</p> <p>_____</p> <p>The sucrose caused _____</p> <p>_____</p>

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- Have students turn to Student Chart 1.11.
- As they follow the procedures in Student Chart 1.10, have them record their observations and results.



1.12: Budding Lab—Questions for Discussion

Choose from the following words answer the questions #1 and #2: *one, two, liquid, gas, identical, different*

1. How many parents are involved in the production of offspring during asexual reproduction, such as budding? One
2. The genetic information in the offspring produced by budding is identical to the parent.
3. The yeast in flask number #2 reproduced. I know this because it produced a gas that made the balloon expand or grow bigger.

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- Have students turn to Student Chart 1.12.
- Have students complete questions #1-3.
- Display the responses.
- Have students correct responses as necessary.




General Academic Vocabulary

- This lesson's general academic vocabulary:
 - require
 - compare

- Read each general academic vocabulary word to students.
- As appropriate, have student use thumbs up/thumbs down to indicate prior knowledge.

require




requerir

- Look at the picture of the gardeners. The plants require sunlight and water to survive.
- Require is to need.
- Requerir es necesitar o exigir.
- If you were going on a camping trip, what might you require?

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- Have students turn to lesson 1 glossaries.
 - Read the target word aloud.
 - Have students rewrite the target word in English and in Spanish (as appropriate) in their glossaries.
 - Read through the notes on the right side of the slide.
 - Point to the appropriate part of the picture as you read through the notes.
 - Depending on your class, you may want to read (or have a student read) the definition in Spanish.
 - Ask one student to answer the question.
- [Anticipated response: On a camping trip I might require a tent, sleeping bag, flashlight, water bottle, boots, etc.].

compare



comparar

- Look at the picture. If you compare “High School Musical” and “High School Musical 2,” “High School Musical” is older.
- To compare is to examine (two or more objects, ideas, etc.) in order to note similarities or differences.
- Comparar es examinar (dos o más objetos, ideas, etc.) para observar semejanzas o diferencias.
- Compare two movies that you have seen with your partner. Talk about how they were similar and how they were different.

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- Follow the same routine.
 - Ask one student to answer the question.
- [Anticipated response: responses will vary].




1.13: Interactive Reading— Preview

- Turn to Student Chart 1.13.
- Open your Glencoe book to page 359.
- Listen to the guiding questions:
 - What is the difference between asexual and sexual reproduction?
 - What is the difference between the hereditary material passed on through asexual or sexual reproduction?
- As the text is read aloud, read along silently and be prepared to answer the questions.

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- Have students turn to Student Chart 1.13 and open their textbooks.
- Read the guiding questions aloud.



1.14: Interactive Reading—Text

REPRODUCTION

Reproduction is the process by which an organism produces others of its same kind. Among living organisms, there are two types of reproduction—sexual and asexual. **Sexual reproduction** usually requires two organisms. In **asexual reproduction**, a new organism (sometimes more than one) is produced from one organism. The **offspring** will have **hereditary material** that is exactly the same as the genetic material of the parent organism.

What is reproduction?

What are the two types of reproduction?

How many organisms are required for sexual and asexual reproduction?

Cellular Asexual Reproduction (see Figure 7, page 359)

A potato growing in a jar of water is an example of asexual reproduction. All the stems, leaves, and roots that grow from the potato have been produced by cell division and have the same hereditary material. New strawberry plants can be reproduced asexually from stems called “runners.” Figure 7 shows asexual reproduction in a potato and strawberry plant.

Why is a potato an example of asexual reproduction?

Budding and Regeneration (see Figure 8, page 360)

Look at Figure 8A. A new organism is growing from the body of the parent organism. This organism, called a hydra, is reproducing by budding.

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- Have students turn to Student Chart 1.14.
- Read text aloud to students as they follow in their Student Chart.
- Stop and clarify text if necessary.
- Ask students embedded questions. Elaborate on their responses as necessary.
- When you get to a figure, stop reading and have students look at the figure as you discuss it.

Embedded Questions:

- What is reproduction?** [The process by which an organism produces others of its same kind].
- What are the two types of reproduction?** [Sexual and asexual reproduction].
- How many organisms are required for sexual and asexual reproduction?** [2 for sexual reproduction and 1 for asexual reproduction].

- **Why is a potato an example of asexual reproduction?** [A new organism is produced from one organism, not two organisms].

1.14

Budding is a type of asexual reproduction made possible because of cell division. When the bud on the adult becomes large enough, it breaks away to live on its own.

How does a hydra reproduce?
What is budding?
What happens when the bud becomes large enough?

Could you grow a new finger? Some organisms can **regrow** damaged or lost body parts, as shown in **Figure 8B**. **Regeneration** is the process that uses cell division to regrow body parts. Sponges, **planaria**, sea stars, and some other organisms can use regeneration for asexual reproduction. If these organisms break into pieces, a whole new organism will grow from each piece. Because sea stars eat oysters, oyster farmers dislike them.

What is regeneration?
Name some organisms that can use regeneration for asexual reproduction.
What would happen if an oyster farmer collected sea stars, cut them into pieces, and threw them back into the ocean?

Sexual Reproduction

Sexual reproduction is another way that a new organism can be produced. During sexual reproduction, two sex cells, called an **egg** and a **sperm**, come together. Sex cells are formed from cells in reproductive organs. Sperm are formed in the male reproductive organs. Eggs are formed in the female reproductive organs. The joining of an egg and a sperm is called **fertilization**, and the cell that forms is called **zygote**. Generally, the egg and the sperm come from two different organisms of the same species. Following fertilization, cell division begins. Thus sexual reproduction results

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- Follow the same routine.
- Embedded Questions:
- **How does a hydra reproduce?** [Budding].
- **What is budding?** [A type of asexual reproduction made possible by cell division].
- **What happens when the bud becomes large enough?** [It breaks away to live on its own].
- **What is regeneration?** [The process that uses cell division to regrow body parts].
- **Name some organisms that can use regeneration for asexual reproduction.** [Sponges, planaria and sea stars].
- **What would happen if an oyster farmer collected sea stars, cut them into pieces, and threw them back into**

the ocean? [A whole new sea star organism grows from each piece].

1.14

In a great variety, or diversity of offspring.

What happens during sexual reproduction?

What are the male sex cells called?

What are the female sex cells called?

What is fertilization?

What happens after fertilization?

Why does sexual reproduction result in a great variety or diversity of offspring?


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- Follow the same routine.

Embedded Questions:

- **What happens during sexual reproduction?** [Two sex cells, called an egg and a sperm, come together].
- **What are the male sex cells called?** [Sperm]
- **What are the female sex cells called?** [Eggs]
- **What is fertilization?** [The joining of an egg and a sperm to form a zygote].
- **What happens after fertilization?** [Cell division]
- **Why does sexual reproduction result in a great variety or diversity of offspring?** [Asexual reproduction makes exact copies of the parent while sexual reproduction

results in an endless combination of genes from the two parents].

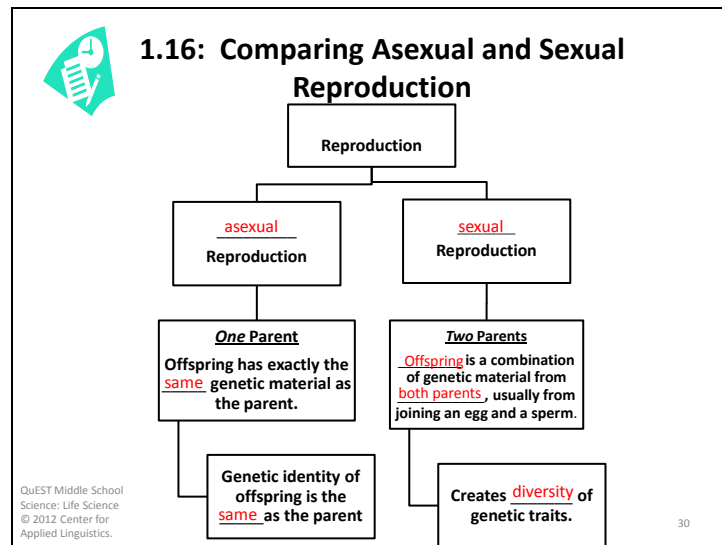


1.15: Guiding Questions– Review

- 1. What is the difference between asexual and sexual reproduction?**
 - In asexual reproduction there is only one parent.
In sexual reproduction there are two parents.
- 2. What is the difference between the hereditary material passed on to offspring through asexual or sexual reproduction?**
 - The hereditary material passed on to offspring through asexual reproduction is exactly the same as the parent organism, because the new offspring is a copy of only one parent.
 - The hereditary material passed on to offspring through sexual reproduction is more varied or diverse because it is a combination of the traits of two parents.

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- Have students turn to Student Chart 1.15.
- Discuss the guiding question.
- Have students fill in Student Chart 1.15.
- Display responses.
- Have students correct responses as necessary.



- Have students turn to Student Chart 1.16.
- Have students work in pairs to complete the chart.
- Display the responses [responses appear for the left side of the chart first, starting with asexual].
- Have students correct responses as necessary.




1.17: Closing Activity— Glossary Work

- **Complete glossary entries for the following science content words:**
 - asexual reproduction
 - sexual reproduction
 - offspring
 - genetic material

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- Have students locate Student Chart 1.17
- Have students complete glossary entries for the science content words.
- For each glossary entry, have students work in pairs to indicate whether the word is a cognate and to fill in the rest of the information required by the glossary.
- As time permits, have students elaborate their understanding in the last column.
- Review glossary entries with class.



1.18: Closing Activity— Key Information


Use these words or phrases to complete the sentences below: *asexual reproduction, sexual reproduction, one, two*

- Some organisms reproduce by asexual reproduction, which requires only one parent.
- Some organisms reproduce by sexual reproduction, which requires two parents.
- Asexual reproduction results in offspring that are exactly the same as the parent.
- Sexual reproduction results in offspring that are a combination of the two parents.

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- Have students turn to Student Chart 1.18.
- Give students several minutes to complete the activities listed in Student Chart 1.18.
- Display responses.
- Have students correct responses as necessary.



**1.19: Closing Activity—
Questions for Further Study**

- One question I still have or something I want to learn more about is:

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- Have students turn to Student Chart 1.19.
- Have students complete Student Chart.
- As time permits, have students share their questions with a partner, with the whole class, or have them write them on a sticky note and put them on a “questions wall” on their way out of class. Students who finish an assessment or who have free time might be assigned to go online to find answers to class questions.



Project QuEST
Model Life Science Lesson
Student Guide: Asexual and Sexual
Reproduction

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Genetics Set: Asexual and Sexual Reproduction



Student Chart 1.1: Science and Language Objectives

Listen and follow along as your teacher reads this lesson's objectives.

In Science we will learn:

- to compare asexual and sexual reproduction.
- to recognize that the type of reproduction affects the genetic makeup of offspring.

To develop our language skills, we will learn:

- to match science vocabulary terms to illustrations.
- to record observations during an investigation on asexual reproduction.



Student Chart 1.2: Vocabulary Objectives

Listen and follow along as your teacher reads this lesson's vocabulary.

Science content vocabulary:

- asexual reproduction
- sexual reproduction
- offspring
- genetic material

General academic vocabulary:

- require
- compare



Student Chart 1.3: Defining Reproduction

Listen as your teacher reads the definitions. Fill in the key terms below: *reproduction, reproduce, asexual, sexual*.

1. _____ is the act or process of producing babies, young animals, or plants.
2. Living things _____ to make young plants or animals.
3. There are two types of reproduction:
 - _____ reproduction
 - _____ reproduction

Questions for discussion:

4. Do all organisms reproduce?
5. Do all organisms reproduce in the same way?



Student Chart 1.4: Sexual Reproduction

Listen as your teacher reads the definitions. Fill in the key terms below: *egg, genetic, sexual, sperm, two cells, zygote*.

1. _____: a type of reproduction in which _____, usually an _____ and a _____ join to form a _____, which develops into a new organism with its own _____ identity.
2. Humans and monkeys have two parents and are a mixture of the genetic material of the two parents.

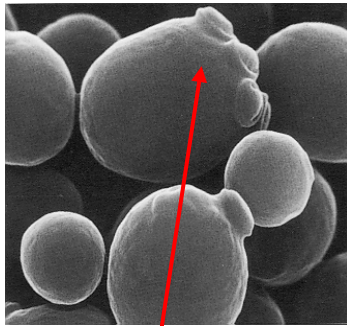




Student Chart 1.5: Asexual Reproduction

Listen as your teacher reads the definitions. Fill in the key terms below: *asexual reproduction*, *one*, *same*.

1. _____: a type of reproduction in which a new organism is produced from _____ parent and has the _____ DNA or genetic material as the parent.



Yeast cells dividing
(budding)



Spider plant offspring



Student Chart 1.6: Video on Asexual Reproduction

While you are watching the video clip, think about the guiding question. After you watch the video, fill in the sentence with the following words: *divides in two*, *middle*, *pinches*.

How does a bacterium cell reproduce?

It _____ in the _____ and then the cell
_____.

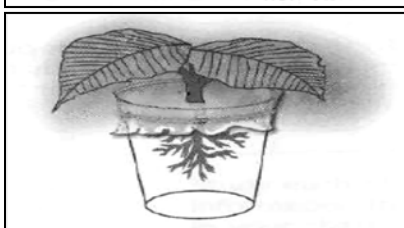
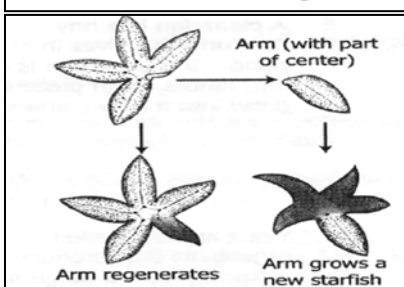
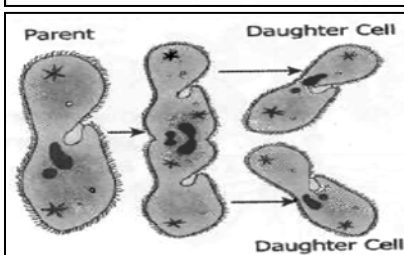
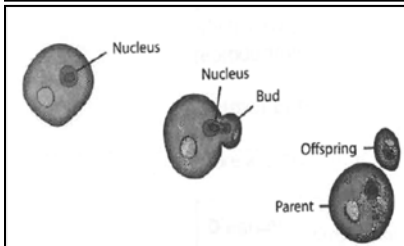
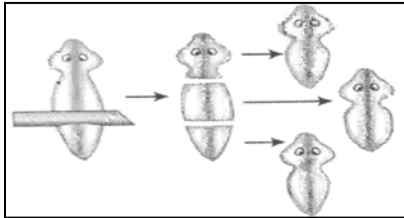
Whole class discussion:

1. Why could it be so harmful that bacteria reproduce so rapidly?
2. Can you think of other organisms that reproduce through asexual or sexual reproduction?



Student Chart 1.7: Asexual Reproduction

Match the definition on the right with the picture on the left.



A whole new **starfish** can grow from a single arm that was **cut off** a starfish organism.

A **planarian** is a tiny flatworm that lives in ponds. If a planarian is **cut into pieces**, each piece will grow into a new planarian.

An **ivy plant** will reproduce a whole new plant if a **piece** of stem and leaf is placed into water or soil.

A **paramecium** is a one-celled organism that reproduces by splitting in half to become **two new cells**.

Yeast are one-celled organisms that produce offspring from a bulge that forms and **breaks away** from the parent.

Whole class discussion:

1. Are these organisms reproducing through asexual or sexual reproduction?
2. How do you know?



Student Chart 1.8: Budding Lab Background

Listen to the background information about this lab, then fill in the key terms below: *alcohol*, *budding*, *buds*, *carbon dioxide gas*, *offspring*.

1. A yeast cell produces _____, or small offspring that grow into a new yeast organism that breaks away from the parent cell. This is called _____. When yeast cells grow and reproduce, they produce _____, _____, and yeast _____.

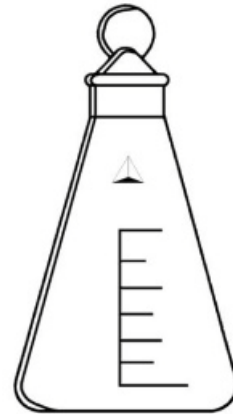


Student Chart 1.9: Budding Lab Materials

Check each box to make sure you have all of the lab materials.

Materials:

- ☐ 1 package active yeast
- ☐ 1 gram sucrose (sugar)
- ☐ 2 balloons
- ☐ 50 mL of warm water
- ☐ 2–50 mL Erlenmeyer flasks





Student Chart 1.10: Budding Lab Procedures

Listen and follow along as your teacher reads the lab procedures, then follow the procedure with your partner.

Procedures

1. Add **25 mL** of water to **each** flask.
2. **Divide** the yeast in the yeast package into two separate piles.
3. Add **one half** of the yeast package to each flask.
4. Add 1 gram of **sucrose** to **one** of the flasks. (Do NOT add sucrose to the other flask. It is the **control** in your experiment.)
5. Place the **open** end of the balloons tightly on the top of each flask.
6. **Observe** the changes in the balloons and flasks over the next **2** minutes. **Record** your observations in Student Chart 1.11.
7. **Optional:** If microscopes are available, take a small sample from the flask with sucrose and make a wet mount slide. Look for individual yeast cells that are budding. Draw any that you see. Remember to give your drawing a title and label what magnification you were using.



Student Chart 1.11: Budding Lab Observations and Results

Use the chart below to record your observations by sketching and writing.

Flask #1 (no sucrose)	Flask #2 (with sucrose)
Sketch: 	Sketch:
Observations in words: The balloon _____ _____. _____ _____. 	Observations in words: The balloon _____ _____. The sucrose caused _____ _____.



Student Chart 1.12: Questions for Discussion

After recording your observations in Student Chart 1.11, answer the following questions with a partner. Choose from the following words to answer questions #1 and #2: *one, two, different, identical*.

1. How many parents are involved in the production of offspring during asexual reproduction, such as budding? _____
2. The genetic information in the offspring produced by budding is _____ to the parent.
3. The yeast in flask number #2 reproduced. I know this because it produced a _____.



Student Chart 1.13: Interactive Reading Questions

Read the guiding questions.

1. What is the difference between asexual and sexual reproduction?
2. What is the difference between the hereditary material passed on through asexual or sexual reproduction?



Student Chart 1.14: Interactive Reading

(Glencoe, pages 359–362)

Listen and follow along as the text is read aloud. Be prepared to answer the questions.

REPRODUCTION

Reproduction is the process by which an organism produces others of its same kind. Among living organisms, there are two types of reproduction—sexual and asexual. **Sexual reproduction** usually requires two organisms. In **asexual reproduction**, a new organism (sometimes more than one) is produced from one organism. The **offspring** will have **hereditary material** that is exactly the same as the genetic material of the parent organism.

What is reproduction?

What are the two types of reproduction?

How many organisms are required for sexual and asexual reproduction?

Cellular Asexual Reproduction (see Figure 7, page 359)

A potato growing in a jar of water is an example of asexual reproduction. All the stems, leaves, and roots that grow from the potato have been produced by cell division and have the same hereditary material. New strawberry plants can be reproduced asexually from stems called “runners.” **Figure 7** shows asexual reproduction in a potato and strawberry plant.

Why is a potato an example of asexual reproduction?

Budding and Regeneration (see Figure 8, page 360)

Look at Figure 8A. A new organism is growing from the body of the parent organism. This organism, called a hydra, is reproducing by budding.

Budding is a type of asexual reproduction made possible because of cell division. When the bud on the adult becomes large enough, it breaks away to live on its own.

How does a hydra reproduce?

What is budding?

What happens when the bud becomes large enough?

Could you grow a new finger? Some organisms can regrow damaged or lost body parts, as shown in **Figure 8B**. **Regeneration** is the process that uses cell division to regrow body parts. Sponges, planaria, sea stars, and some other organisms can use regeneration for asexual reproduction. If these organisms break into pieces, a whole new organism will grow from each piece. Because sea stars eat oysters, oyster farmers dislike them.

What is regeneration?

Name some organisms that can use regeneration for asexual reproduction.

What would happen if an oyster farmer collected sea stars, cut them into pieces, and threw them back into the ocean?

Sexual Reproduction

Sexual reproduction is another way that a new organism can be produced. During sexual reproduction, two sex cells, called an egg and a sperm, come together. Sex cells are formed from cells in reproductive organs. Sperm are formed in the male reproductive organs. Eggs are formed in the female reproductive organs. The joining of an egg and a sperm is called **fertilization**, and the cell that forms is called zygote. Generally, the egg and the sperm come from two different organisms of the same species. Following fertilization, cell division begins. Thus sexual reproduction results

in a great variety, or diversity of offspring.

What happens during sexual reproduction?

What are the male sex cells called?

What are the female sex cells called?

What is fertilization?

What happens after fertilization?

Why does sexual reproduction result in a great variety or diversity of offspring?



Student Chart 1.15: Interactive Reading—Guiding Questions

Answer questions #1 and #2.

1. What is the difference between asexual and sexual reproduction?

In asexual reproduction there is only _____ parent. In sexual reproduction there are _____ parents.

2. What is the difference between the hereditary material passed on to offspring through asexual and sexual reproduction?

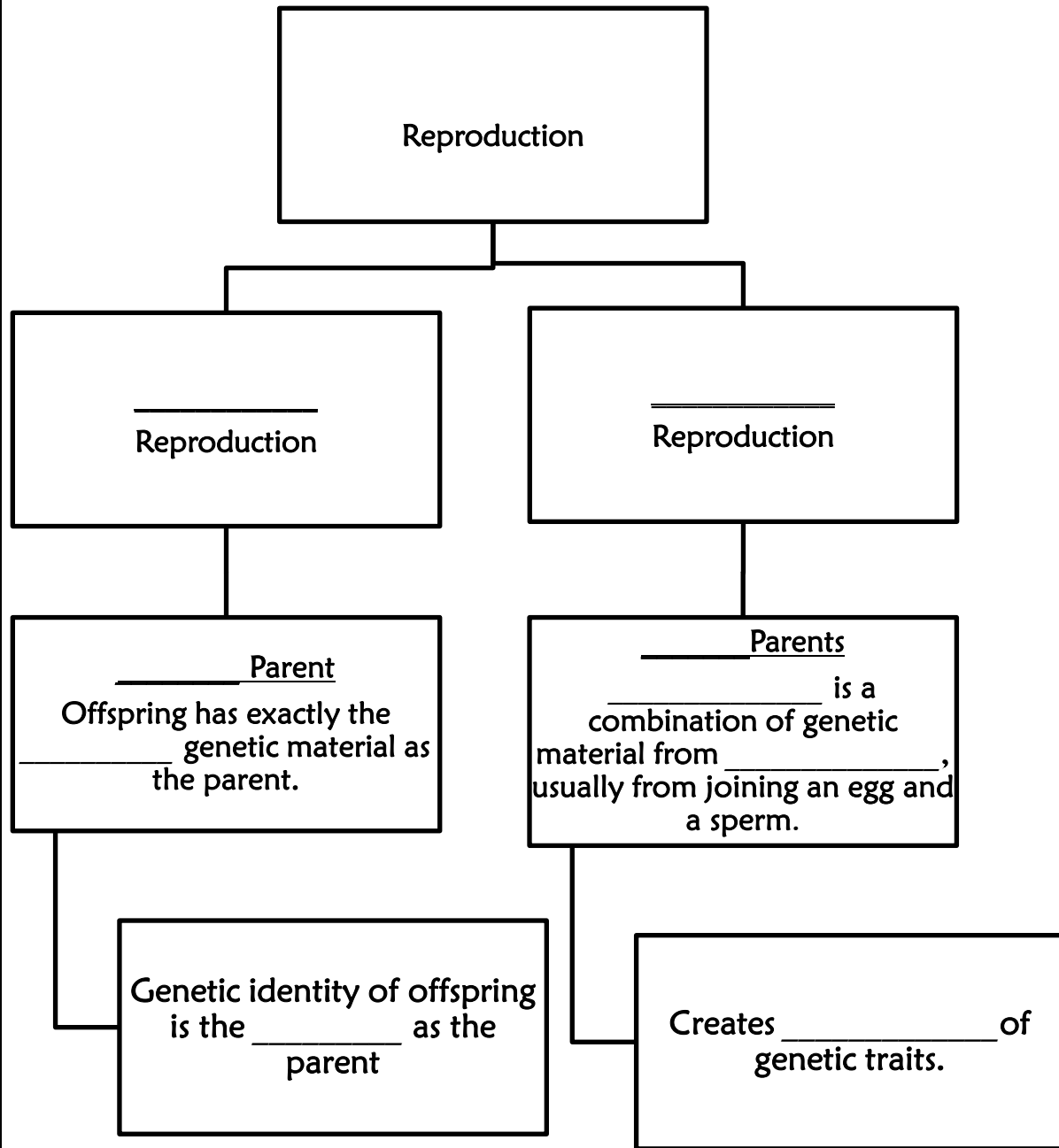
Use the following words: *asexual reproduction, diverse, one, two, sexual reproduction.*

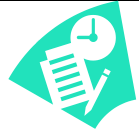
- The hereditary material passed on to offspring through _____ is exactly the *same* as the parent organism, because the new offspring is a copy of only _____ parent.
- The hereditary material passed on to offspring through _____ is more varied or _____ because it is a combination of the traits of _____ parents.



Student Chart 1.16: Comparing Sexual and Asexual Reproduction

Based on what you learned about reproduction, fill in the chart below choosing from these words (note that some words are not used and some words are repeated): *asexual*, *both parents*, *diversity*, *offspring*, *one*, *same*, *sexual*, *two*.





Student Chart 1.17: Glossary

Complete glossary entries for these science content words.

- sexual reproduction
- asexual reproduction
- offspring
- genetic material



Student Chart 1.18: Key Information

Use these words or phrases to complete the sentences below: *asexual reproduction*, *sexual reproduction*, *one*, *two*.

- Some organisms reproduce by asexual reproduction, which requires only _____ parent.
- Some organisms reproduce by sexual reproduction, which requires _____ parents.
- _____ results in offspring that are exactly the same as the parent.
- _____ results in offspring that are a combination of the two parents.



Student Chart 1.19: Question for Further Study

Write a sentence about what you still want to learn.

One question I still have or something I want to learn more about is:



Project QuEST
Model Life Science Lesson
Teacher Guide: Introduction to Genetics

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*Middle School Science: Life Science*

Genetics Set: Introduction to Genetics

Framework for K-12 Science Education: Dimension 3—Life Science

- **Disciplinary Core Idea (LS1.A)—Growth and Development of Organisms:** Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
- **Disciplinary Core Idea (LS3.A)—Inheritance of Traits:** Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes.
- **Science and Engineering Practices:** Developing and Using Models
- **Crosscutting Concepts:** Cause and Effect

Connections to the Common Core State Standards (ELA)

- **RST.4:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to Grades 6–8 and topics.
- **RST.7:** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- **L6:** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Connection to the Common Core State Standards (Math)

- **MP.2:** Reason abstractly and quantitatively.
- **5.0 A:** Analyze patterns and relationship.

Connections to English Language Development Standards¹

- **ELD Standard 4:** Language of Science
 - **Reading:** Interpret the written procedures to complete the steps of a lab investigation on extracting strawberry DNA.
 - **Writing:** Label a diagram of genetic material using the terms *chromosome*, *genes*, and *DNA*.

¹ Because the WIDA English language development standards are currently used in 29 states, we reference these standards.

- **Listening:** Determine whether traits are environmental traits or inherited traits and record them in the chart.
- **Speaking:** Discuss your family's inherited traits with a partner.

Overview of Activities

Focus Activity

- **Student Activity I: Rating and Discussion of Science, Language, and Vocabulary Objectives.** Teacher posts lesson objective poster; students rate their prior knowledge of each objective; brief discussion.

Engagement

- **Student Activity II: Lesson 1 Review.** Students answer review questions from previous lesson; teacher displays the answers; students correct responses as necessary.
- **Student Activity III: Pre-teaching of Science Content Words.** Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach the following: *gene, chromosome, DNA, inherited trait*.
- **Student Activity IV: Introduction to Genetics.** Teacher displays slide 13; students turn to Student Chart 2.4; teacher defines genetics; students fill in key words; partner talk and sharing ideas with the whole class on what students learned last year related to genetics; teacher displays slide 14; students analyze picture for similar traits and reason why; whole class discussion.

Explanation and Exploration

- **Student Activity V: Comparing Environmental With Genetic Traits.** Teacher displays PowerPoint slide 15; students turn to Student Chart 2.6; teacher defines traits and students fill in the definition; students partner talk about family traits; in pairs, students fill in the table in Student Chart 2.7, listing environmental and inherited traits; students pairs share their answers; teacher reviews concepts of inherited traits versus environmental factors.
- **Student Activity VI: Introduction to Terms Chromosomes, DNA, and Genes.** Teacher displays slide 17 and reads guiding questions; teacher shows the presentation from the genetics website; students turn to Student Chart 2.8, teacher reads definitions; students fill in key words; students turn to Student Chart 2.9; students use definitions to fill in diagram and sentence; teacher displays slide 20 and reviews answers; students correct their answers.

- **Student Activity VIII: DNA Extraction Lab.** Teacher defines extraction; teacher reads background information; students fill in key terms; whole class discussion of hypotheses; teacher reads over lab materials and procedures; student pairs work on lab; students answer questions in Student Chart; teacher displays the answers; whole class discussion.

Elaboration

- **Student Activity IX: General Academic Word Cards.** Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach the following: *model, represent*.
- **Student Activity X: Interactive Reading.** Teacher discusses text illustrations; one student reads guiding questions; teacher and students participate in shared interactive reading; teacher and students discuss guiding questions; students respond to guiding question; teacher posts correct response; students revise response if necessary.

Evaluation

- **Student Activity XI: Glossary and Key Facts.** Students complete glossary for science content words, answer questions related to key content, and indicate if there is anything else they would like to learn about; whole class review.

Extension/Differentiation

- **Student Activity XII: Discussion Question on Twins.**



QuEST Middle School Life Science

Introduction to Genetics

Objectives

- Science:
 - Students will recognize that reproduction is a characteristic of living organisms and that the instructions for inherited traits are found in the genetic material.
 - Students will investigate the genetic material found in the genes within chromosomes in the nucleus of a strawberry cell.
- Language:
 - Students will label diagrams of genetic material using the content vocabulary.
 - Students will use illustrations and diagrams to understand a text on genetic material.

Vocabulary

- Science content: *gene, chromosome, DNA, inherited trait*
- General academic: *model, represent*

Teacher Management

Estimated time for completion, in minutes: 90

Materials

For each pair of students:

- 1 or 2 fresh or frozen strawberries (bring to room temperature)
- 1 quart-size freezer Ziploc bag
- 1 coffee filter or square of cheesecloth
- 1 coffee stirrer or toothpick (flat, wooden)
- 1 funnel
- 1 cup or beaker
- 1 test tube

For Class

- Extraction buffer (100 mL dishwashing liquid, 900 mL distilled water, and 15 g NaCl/salt)
- 250 mL ethanol (rubbing alcohol)

Teacher Prep

1. Review detailed lesson plan in the Teacher Guide.
2. Pull out the Activity Overview page(s), PowerPoint lesson guides, and student charts and add any necessary notes to them from the detailed lesson plan to help guide the lesson.
3. If necessary, organize activities to fit school schedule.
4. Download PowerPoint slides.

5. Display vocabulary cards on the word wall.
6. Group students for partner/small group work.

Safety Considerations:

None.

Vocabulary-Building Strategies

- Explicit interactive presentation of vocabulary cards
- Word wall
- Glossary work

Background Information for Teacher

- ACCESS, page 183
- Glencoe, pages 368–369

Lesson Content**Focus Activity/Warm-Up****Student Activity I (slides 3, 7–8, Lesson Objective poster, Student Charts 2.1– 2.3)**

5 minutes

Activity Overview: Rating and Discussion of Science, Language, and Vocabulary

Objectives. Teacher posts lesson objective cards; students rate their prior knowledge of each objective; brief discussion.

- Before students enter the room, display the science objectives.
- Make sure the ratings of the previous class have been erased.
- As they enter the classroom, have students rate their prior knowledge of each objective on a continuum of 1 to 4 (1=none, 4=a lot).
- Have students begin the review questions in Student Chart 2.1 until all students have rated their knowledge of the objectives.
- Review correct responses to review activity.
- Have students turn to Student Chart 2.2.
- Read the science objectives aloud, one at a time, reporting students' level of prior knowledge.
- Read the language objectives.
- Have students turn to Student Chart 2.3.
- Read vocabulary words aloud.
- As appropriate, have students use thumbs up/thumbs down to indicate prior knowledge.



Engagement

Student Activity II (slides 4–6, Student Chart 2.1)

6 minutes

Activity Overview: Lesson 1 Review. Students answer review questions from previous lesson; teacher displays the answers; students correct responses as necessary.

- After students have rated their knowledge of the objectives and as they wait for their peers to enter the room, students should begin working on Student Chart 2.1.
- Once all students have displayed their knowledge of the objectives poster and have had 2 minutes to answer the review questions, have students read the review questions and answer them aloud.
- Display responses.
- Have students correct their responses as necessary.

Student Activity III (slides 9–12, Science Content Word Cards)

8 minutes

Activity Overview: Pre-teaching of Science Content Words. Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach the following: *gene*, *chromosome*, *DNA*, *inherited trait*.

- Have students turn to Lesson 2 glossary words.
- Read the target words aloud, one at a time.
- Have students rewrite the target words in English and in Spanish (as appropriate) in their glossaries.
- Display the slides of the science content words one at a time, reading the text on the right side of each PowerPoint slide aloud and eliciting responses from student pairs.
- Point to the appropriate parts of the pictures as you read through the notes.
- Depending on your class, you may want to read (or have a student read) the definitions in Spanish.
- Tell students they may continue to use the science content word cards on the word wall for reference.

Student Activity IV (slides 13–14, Student Charts 2.4 and 2.5)

6 minutes

Activity Overview: Introduction to Genetics. Teacher displays slide 13; students turn to Student Chart 2.4; teacher defines genetics; students fill in key words; partner talk and sharing ideas with the whole class on what students learned last year related to genetics; teacher displays slide 14; students analyze picture for similar traits and reason why; whole class discussion.

- **Defining genetics**
 - Have students turn to Student Chart 2.4.
 - Define genetics by reading question #1.
 - Have students fill in question #1 in their Student Charts.
 - Have students answer question #2 with a partner.
 - Call on several pairs.
- **Analyzing family traits**
 - Display slide 14 and have students turn to Student Chart 2.5.
 - Give students a minute to look at the picture with a partner and discuss the questions below.
 - Question #1, whole class discussion: **What are the physical traits or characteristics that are similar among the members of this family?** (Response: all have dark hair, straight hair, similar noses, wide smiles, similar skin tone, etc.).
 - Question #2, whole class discussion: **What makes the people in this family look alike?** (Responses: they share the same genes).



Explanation and Exploration

Student Activity V (slides 15 and 16, Student Charts 2.6 and 2.7)

8 minutes

Activity Overview: Comparing Environmental With Genetic Traits. Teacher displays PowerPoint slide 15; students turn to Student Chart 2.6; teacher defines traits and students fill in the definition; students partner talk about family traits; in pairs, students fill in the table in Student Chart 2.7, listing environmental and inherited traits; student pairs share their answers; teacher reviews concepts of inherited traits versus environmental factors.

- **Introduction**
 - Have students turn to Student Chart 2.6.
 - Define traits by reading sentence #1.
 - Have students fill in sentence #1.
 - Give students 2 minutes to discuss question #2 with their partner.
 - Call on several pairs.
- **Contrasting environmental and genetic factors**
 - Have students turn to Student Chart 2.7.
 - Ask students to make a list of traits and categorize them as environmental or inherited traits. Give an example of a scar (environmental) versus eye color (genetics).
 - Give students several minutes to complete the activity with a partner.
 - Call on several pairs.

- Make sure students understand the difference between inherited traits and those due to environmental factors (e.g., braces).

Student Activity VI (slide 17–19, Student Charts 2.8 and 2.9)

15 minutes

Activity Overview: Introduction to the Terms *Chromosomes*, *DNA*, and *Genes*. Teacher displays slide 17, reads guiding questions; teacher shows the presentation from the genetics website; students turn to Student Chart 2.8, teacher reads definitions; students fill in key words; students turn to Student Chart 2.9; students use definitions to fill in diagram and sentence; teacher displays slide 20 and reviews answers; students correct their answers.

- **Defining *chromosomes*, *DNA*, and *genes***
 - Display slide 17 and have students turn to Student Chart 2.8.
 - Read guiding questions.
 - Go to the Learn Genetics website:
 - <http://learn.genetics.utah.edu/content/begin/tour/>
 - Choose “Tour the basics”
 - Use the animated website as a slideshow presentation to narrate “What is DNA?” “What is a gene?” and “What is a chromosome?”
- **Labeling chromosomes, DNA, and genes**
 - Display slide 18.
 - Have students turn to Student Chart 2.8 and answer questions #1–#3 with a partner.
 - Call on students to read each answer aloud.
 - Display responses.
 - Have students correct responses as necessary.
 - Have students turn to Student Chart 2.9.
 - Have students use the words in the word bank to label the diagram.
 - Display responses (slide 19).
 - Have students correct responses as necessary.

Student Activity VII (slides 20–26, Student Charts 2.10–2.13)

20 minutes

Activity Overview: DNA Extraction Lab. Teacher defines *extraction*; teacher reads background information; students fill in key terms; whole class discussion of hypotheses; teacher reads over lab materials and procedures; student pairs work on lab; students answer questions in Student Chart; teacher displays the answers; whole class discussion.

- **Preview**
 - Display slide 20 and define extraction.
- **Background information**
 - Have students turn to Student Chart 2.10.
 - Pair students.
 - Read sentence #1 and have students fill in key terms.
 - Display responses.

- Have students correct responses as necessary.
 - Read sentence #2 and have students predict and discuss questions a and b.
- **Materials**
 - Have students turn to Student Chart 2.11.
 - Review list of lab materials and distribute them to students.
 - Have students check off materials.
- **Procedure**
 - Have students turn to Student Chart 2.12.
 - Review the lab procedures with students.
 - Give students 15 minutes to complete the lab with a partner.
 - Alternatively, complete the lab as a whole class.
 - Circulate around the room and provide help as needed.
 - When students complete the lab, have students answer questions #1–#3 in Student Chart 2.13.
- **Results/observations**
 - Have students turn to Student Chart 2.13.
 - Have students answer questions #1–#3.
 - Display responses.
 - Have students correct responses as necessary.



Elaboration

Student Activity VIII (slides 27–29, General Academic Word Cards)

4 minutes

Activity Overview: General Academic Word Cards. Teacher displays PowerPoint slides of science content words one at a time; teacher reads script aloud and elicits responses to teach the following: *model*, *represent*.

- Read each general academic vocabulary word to students.
- As appropriate, have student use thumbs up/thumbs down to indicate prior knowledge.
- Have students turn to Lesson 2 glossary words.
- Read the target words aloud.
- Have students rewrite the target words in English and in Spanish (as appropriate) in their glossaries.
- Read through the notes on the right side of each slide.
- Point to the appropriate part of the picture as you read through the notes.
- Depending on your class, you may want to read (or have a student read) the definition in Spanish.
- Display the slides of each of the general academic word, reading the script aloud and eliciting responses.

- Tell students they may continue to use the general academic word cards on the word wall for reference.

Student Activity IX (slides 30–35, Student Charts 2.14–2.16)

12 minutes

- ACCESS, page 190
- Glencoe, pages 368–369

Activity Overview: Interactive Reading. Teacher discusses text illustrations; one student reads guiding question; teacher and students participate in shared interactive reading; teacher and students discuss guiding questions; students respond to guiding question; teacher posts correct response; students revise response if necessary.

- **Preview**
 - Have students turn to Student Chart 2.14 and open their textbooks.
 - Read the guiding question aloud.
 - Review all illustrations in the text with students using the document camera.
- **Text**
 - Have students turn to Student Chart 2.15.
 - Read text aloud to students as they follow in their Student Chart.
 - Stop and clarify text if necessary.
 - Ask students embedded questions. Elaborate on their responses as necessary.
 - When you get to a figure, stop reading and have students look at the figure as you discuss it.
- **Guiding questions**
 - Have students turn to Student Chart 2.16 and to page 369 in Glencoe.
 - Using the diagram in the book (Figure 14, part C) and PowerPoint slide 34, have students complete question #1 in Student Chart 2.16.
 - Review question #1 with students.
 - Have students turn back to Student Chart 2.15.
 - Read text aloud to students as they follow in their Student Chart.
 - Stop and clarify text if necessary.
 - Have students turn back to Student Chart 2.16.
 - Have students complete question #2.
 - Display responses.
 - Have students correct responses as necessary.



Evaluation

Student Activity X (slides 36–39, Student Charts 2.17-2.19, Glossary)

6 minutes

Activity Overview: Glossary and Key Facts. Students complete glossary for science content words, answer questions related to key content, and indicate if there is anything else they would like to learn about; whole class review.

- **Glossary work**
 - Have students locate Student Chart 2.17.
 - Have students complete glossary entries for the science content words.
 - For each glossary entry, have students work in pairs to indicate whether the word is a cognate and to fill in the rest of the information required by the glossary.
 - Review glossary entries with class.
- **Key information**
 - Have students turn to Student Chart 2.18.
 - Give students several minutes to complete the questions.
 - Display responses.
 - Have students correct responses as necessary.
- **Questions for further study**
 - Have students turn to Student Chart 2.19.
 - Have students complete Student Chart.
 - As time permits, have students share their questions with a partner, with the whole class, or have them write them on a sticky note and put them on a “questions wall” on their way out of class. Students who finish an assessment or who have free time might be assigned to go online to find answers to class questions.

Genetics Lesson 2: Teacher Preparation

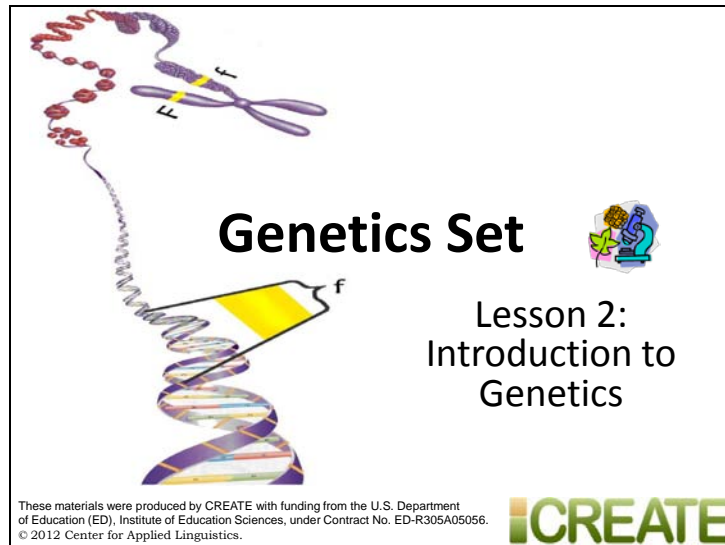
- Erase the ratings from the previous class on the objectives poster.

For DNA extraction lab:

- Chill alcohol in freezer for at least 1 hr (make sure alcohol is 90% proof)
- Mix the DNA extraction solution.
 - For each class, combine 5 mL salt, 160 mL water, 30 mL Dawn *clear* liquid dish detergent
- Make sure strawberries are at room temperature.

- liquid dish detergent should be clear in order to see results.


Slide 2




Genetics Set

Lesson 2:
Introduction to
Genetics

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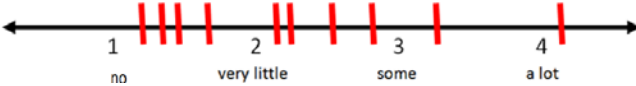
The cover art for the 'Genetics Set' features a stylized DNA double helix on the left, with a yellow rectangular segment highlighted. Above the helix, a purple chromosome with yellow bands is shown. To the right of the DNA, there is a small circular icon containing a magnifying glass over a DNA strand. The title 'Genetics Set' is prominently displayed in the center, with 'Lesson 2: Introduction to Genetics' below it. At the bottom left, a small block of text provides production and copyright information. The 'CREATE' logo is at the bottom right.



Science Objectives

Students, as you enter the classroom...

- Go to the poster.
- Read each objective.
- Use a marker to rate your knowledge of each objective on a scale of 1 to 4.
- Begin the review questions.



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- Before students enter the room, display the science objectives.
- Make sure the ratings of the previous class have been erased.
- As they enter the classroom, have students rate their prior knowledge of each objective on a continuum of 1-4 (1=no to 4=a lot).
- Have students begin the review questions in Student Chart 2.1.

**2.1: Review Questions**

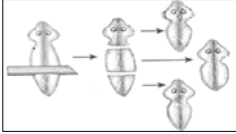
1. Which of the following is true of plants and animals that reproduce sexually?
 - a.They have offspring that are exactly like the parents.
 - b.They have only one parent.
 - c.They have offspring with genetic material from two parents.
 - d.They have no DNA.

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- Have one student read the review question and answer it aloud.
- Display response.
- Have students correct student response as necessary.

2.1: Review Questions (cont.)

Look at the picture below and then answer questions 2 and 3.



2. Circle the type of reproduction that this picture illustrates:

☒ asexual reproduction ☐ sexual reproduction

3. The offspring of this planaria have genetic material that is:

- a. identical (the same) to the parent's genetic material.
- b. not identical to the parent's genetic material.
- c. a combination of the genetic material of both parents.
- d. not existent.

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- Have students read the review questions and answer them aloud.
- Display responses.
- Have students correct responses as necessary.

2.1: Review Question (*cont.*)

Use these words to complete the sentences below:


genetic material, requires, offspring

4. Genetic material is the genes, chromosomes, and DNA that are different for each cell or organism.
5. Offspring is one or more organisms born of a parent; in humans, these are children.
6. Sexual reproduction requires two parents.

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- Call on students to complete sentences aloud.
- Display responses one at a time.
- Have students correct responses as necessary.




2.2 Science and Language Objectives

- In science, we will learn:
 - to recognize that reproduction is a characteristic of living organisms and that instructions for inherited traits are found in the genetic material.
 - to investigate the genetic material found in the genes within chromosomes in the nucleus of a strawberry cell.
- To develop our language skills, we will learn:
 - to label diagrams of genetic material using the content vocabulary.
 - to use illustrations and diagrams to understand a text on genetic material.

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- Have students turn to Student Chart 2.2.
- Read the science objectives aloud, one at a time, reporting students' level of prior knowledge.
- Read the language objectives.




2.3 Vocabulary Objectives

- Science content vocabulary:
 - gene
 - chromosome
 - DNA
 - inherited trait
- General academic vocabulary:
 - model
 - represent

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- Have students turn to Student Chart 2.3.
- Read vocabulary words aloud.
- As appropriate, have students use thumbs up/thumbs down to indicate prior knowledge.

gene




gen

- Look at the picture. A gene is one part of a DNA chain that controls a specific trait like eye color or height.
- A gene is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.
- Un gen es una sección del ADN de un cromosoma que contiene las instrucciones para que las características genéticas de un progenitor sean transferidas a su descendencia.
- What kinds of characteristics are controlled by genes?

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- Have students turn to lesson 2 glossary words.
 - Read the target word aloud.
 - Have students rewrite the target word in English and in Spanish (as appropriate) in their glossaries.
 - Read through the notes on the right side of the slide.
 - Point to the appropriate part of the picture as you read through the notes.
 - Depending on your class, you may want to read (or have a student read) the definition in Spanish.
 - Ask one student to answer the question.
- [Anticipated responses: skin color, eye color, height, straight or curly hair, etc].

chromosome




cromosoma

- Look at the picture. The chromosome is an X-shaped pair of proteins tied together that carries two copies of genes.
- A chromosome is a structure in the cell nucleus that carries genes.
- Un cromosoma es una estructura localizada en el núcleo de la célula y contiene el material genético.
- Why might human chromosomes come in pairs?

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- Follow the same routine.
 - Ask one student to answer the question.
- [Anticipated response: Because they come from the mother and from the father].

DNA



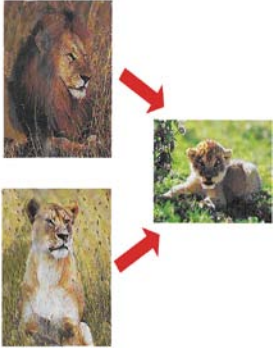
ADN

- Look at the picture. The twisting chain shows how the molecules that make DNA fit inside every cell.
- Deoxyribonucleic Acid (DNA) is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of an organism.
- Ácido desoxirribonucleico (ADN) está formado por dos cadenas de moléculas entrelazadas en forma de espiral. El ADN contiene el material genético de un organismos vivo.
- What kind of information does DNA give us?

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- Follow the same routine.
- Ask one student to answer the question.
[Anticipated response: genetic material].

inherited trait



característica heredada

- Look at the picture. The baby lion's short yellow fur is an inherited trait passed down from her parents.
- An inherited trait is a trait that is received from one or more parents during reproduction.
- Una característica heredada es la que se recibe de uno o más progenitores durante la reproducción.
- Who can say which parent passed on the baby lion's inherited trait for hair?

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- Follow the same routine.
- Ask one student to answer the question.
[Anticipated responses: the mother].



2.4: Defining *Genetics*

1. **Genetics:** the study of how traits are inherited from parents to offspring .
2. Partner talk: What do you remember from last year when you studied heredity and genetics?


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- Have students turn to Student Chart 2.4.
- Define genetics by reading question #1.
- Have students fill in question #1 in their Student Charts.
- Have students answer question #2 a partner.
- Call on several pairs.

2.5: Family Traits

Look at the picture and examine the traits of this family with your partner:



Questions for discussion:

1. What are the physical traits or characteristics that are similar between the members of this family?
2. Why do the people in this family look alike?

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- Have students turn to Student Chart 2.5.
- #1-Give students a minute to look at the picture with a partner and discuss the questions below.
- #2-Whole class discussion: **What are the physical traits or characteristics that are similar between the members of this family?** [Response: all have dark hair, straight hair, similar noses, wide smiles, skin tone, etc.].
- #3-Whole class discussion: **What makes the people in this family look alike?** [Responses: they share the same genes].




2.6: Defining *Traits*

1. **Traits:** Characteristics that can be controlled by **genes** (such as **eye color**, **hair color**, and **height**) or by the **environment**.
2. Partner talk: How are your traits the same as your family's traits? How are your traits different from your family's traits?

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- Have students turn to Student Chart 2.6.
- Define traits by reading sentence #1.
- Have students fill in sentence #1. This is a note-taking exercise.
- Give students 2 minutes to discuss question #2 with their partner.
- Call on several pairs.



2.7: Traits


Make a list of the types of family traits and decide if they are environmental (experience in life) or inherited (from birth).

Environmental traits	Inherited traits
<i>a scar from falling off a bike</i>	<i>eye color</i>

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- Have students turn to Student Chart 2.7.
- Ask students to make a list of traits and categorize them as environmental or inherited traits. Give an example of a scar (environmental) vs. eye color (genetics).
- Give students several minutes to complete the activity with a partner.
- Call on several pairs.
- Make sure students understand the difference between inherited traits and those due to environmental factors (i.e. braces).



2.8: Defining *Chromosomes, DNA,* and *Genes*

<http://learn.genetics.utah.edu/content/begin/tour/>

Guiding questions:

- What is DNA?
- What is a gene?
- What is a chromosome?

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- Have students turn to Student Chart 2.8.
- Read the guiding questions aloud.
- Go to the Learn Genetics website:
 - <http://learn.genetics.utah.edu/content/begin/tour/>
 - Choose “Tour the basics”
 - Use the animated website to narrate the three segments: “What is DNA?” “What is a gene?” and “What is a chromosome?”

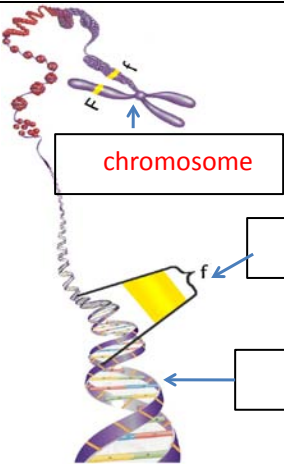
2.8: Defining *Chromosomes, DNA, and Genes*

1. Deoxyribonucleic Acid (**DNA**) is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of an organism.
2. **Genes** are a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.
3. **Chromosomes** are structures in the cell nucleus that carry genes.

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- Have students turn to Student Chart 2.8 and answer questions #1-3 with a partner.
- Call on students to read each answer aloud.
- Display responses.
- Have students correct responses as necessary.



chromosome

gene

DNA

2.9: Genetic Material

Use the vocabulary words *DNA*, *gene*, and *chromosome* to label the diagram.

•Chromosomes are made of genes. Genes are a specific section of DNA.

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- Have students turn to Student Chart 2.9.
- Have students use the words in the word bank to label the diagram.
- Display responses.
- Have students correct responses as necessary.

extraction




extracción

- Extraction is a word we will use in today's investigation. Look at the pictures. The dentist is extracting a tooth. The machine is extracting oil.
- Extraction is taking out or removing with force.
- Extracción es sacar o remover algo usando la fuerza.




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- Read the English vocabulary word.
- Read the Spanish vocabulary word or have a Spanish-speaking student read it.
- Read through the notes on the right side of the slide.
- Depending on your class, read (or have a student read) the definition in Spanish.



2.10: DNA Extraction Lab Background


1. In this lab we will be extracting DNA from the nucleus of strawberry cells.
2. Hypothesize or predict:
 - a. What do you think the DNA of strawberries will look like?
 - b. Why would scientists want to study DNA?



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- Have students turn to Student Chart 2.10.
- Pair students.
- Read sentence #1 and have students fill in key terms.
- Display responses.
- Have students correct responses as necessary.
- Read sentence #2 and have students predict and discuss questions a and b.



2.11: DNA Extraction Lab Materials

For each pair of students

- 1 or 2 fresh or frozen strawberries with stems removed (bring to room temperature)
- 1 quart-size freezer Ziploc bag
- 1 coffee filter or square of cheesecloth
- 1 toothpick
- 1 pipette/eye dropper
- 1 funnel
- 1 cup or beaker
- 1 test tube



For Class

- Extraction buffer (100 mL Dawn clear liquid dish detergent, 900 mL distilled water, and 15 grams NaCl/salt)
- 16 oz of cold isopropyl alcohol (rubbing alcohol)

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- Have students turn to Student Chart 2.11.
- Review list of lab materials and distribute them to students.
- Have students check off materials.



2.12: DNA Extraction Lab Procedure

1. Wear **safety goggles** throughout lab.
2. Line a **funnel with the coffee filter** and put funnel into beaker or cup.
3. **Remove the stem** and leaves from your strawberry.
4. Place one large (or two small) **strawberries** into the **baggie** and push out all the air. Seal bag tightly.

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- Have students turn to Student Chart 2.12.
- Review the lab procedures with students.




2.12: DNA Extraction Lab Procedure (*cont.*)

5. Using your fingers, squeeze and **smash strawberry** for **2** minutes. Be careful not to break the bag.
6. Add 10 mL of the **DNA extraction solution** (salt, water, and Dawn dish detergent) and reseal bag. **Mash** for **1** more minute.
7. **Pour strawberry liquid** from bag into funnel. Let it drip into beaker/cup until there is no liquid left in funnel.

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- Review lab procedures with students.




2.12: DNA Extraction Lab Procedure (*cont.*)


8. Throw away cheesecloth/filter. **Pour what is in the beaker into a test tube.**
9. **Tilt** the test tube and use the pipette to **very slowly drip** ice-cold alcohol down the side of the test tube until it is **half full**. The alcohol should form **a layer** on top of the red strawberry liquid. **Do not mix** the layers.
10. Dip the toothpick into the test tube where the two layers meet. **Use the toothpick to pick up the stringy white stuff**, which is DNA.
11. **Answer questions #1–#3** in Student Chart 2.13.

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- Review the lab procedures with students.
- Give students 15 minutes to complete the lab with a partner.
- Alternatively, complete the lab as a whole class.
- Circulate around the room and provide help as needed.
- When students complete lab, have students answer questions 1-3 in Student Chart 2.13.



2.13: DNA Extraction Lab Results



1. The strawberry DNA looked like White, stringy globs.

2. Were you seeing individual DNA molecules?

Yes
No

 - Individual DNA molecules are too small to be seen without a microscope.
 - Instead of individual DNA molecules, about how many DNA molecules do you think you observed?
Billions and billions of DNA molecules bunched up together.

3. Would DNA from other organisms look the same without a microscope?

Yes
No

 - The DNA would look **the same**, but the base pairs would be **different**.

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- Have students turn to Student Chart 2.13.
- Have students answer questions 1-3.
- Display responses.
- Have students correct responses as necessary.





General Academic Vocabulary

- This lesson's general academic vocabulary:
 - model
 - represent

- Read each general academic vocabulary word to students.
- As appropriate, have student use thumbs up/thumbs down to indicate prior knowledge.

model

modelo



- Look at the pictures. The picture on the top is a picture of the Earth from outer space. The picture on the bottom is a globe. A globe is a model or a copy of the Earth.
- A model is a copy of something, often used as a guide to making the thing in full size.
- Un modelo es una copia a pequeña escala que a menudo se usa como base para construir algo en tamaño real.
- What are some problems with using the globe as a model of the Earth? Is it a perfect model?

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- Have students turn to lesson 2 glossary words.
 - Read the target word aloud.
 - Have students rewrite the target word in English and in Spanish (as appropriate) in their glossaries.
 - Read through the notes on the right side of the slide.
 - Point to the appropriate part of the picture as you read through the notes.
 - Depending on your class, you may want to read (or have a student read) the definition in Spanish.
 - Ask one student to answer the question.
- [Anticipated response: the globe is small; it is

always daytime on the globe; the tilt is not accurate; it is not a perfect model].

represent

- Look at the pictures to the left. The letter *f* on the chromosome represents an inherited trait. The candles on the cake represent how old the child is on her birthday.
- Represent means to present a sign or symbol for something. It can stand for something else.
- Representar es expresar o designar usando un término, carácter, símbolo, o algo parecido.
- What do the stars on the American flag represent?

representar

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- Follow the same routine.
 - Ask one student to answer the question.
- [Anticipated response: the stars represent the 50 American states].




2.14: Interactive Reading— Preview

- Turn to Student Chart 2.14.
- Open your Glencoe book to page 368.
- Listen to the guiding question:
 - What are the parts of a DNA molecule and its structure?
- As the text is read aloud, read along silently in your Student Chart and be prepared to answer the questions.


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- Have students turn to Student Chart 2.14 and open their textbooks.
- Read the guiding question aloud.



2.15: Interactive Reading--Text



Student Chart 2.15: Interactive Reading Text
(ACCESS, page 190; Glencoe, pages 368–369)
Listen and follow along as the text is read aloud. Be prepared to answer the questions.

GENES

Why are your eyes different from your neighbor's eyes? Why can your uncle wiggle his ears and you can't? These questions all have the same answer: genes! Genes are instruction books for our bodies.

Why do we have different traits like eye color?
What is the function of genes?

Genes pass from parent to offspring in different combinations. Unless you are an identical twin, your combination of genes belongs only to you. Each gene controls a different trait, such as eye color or ear wiggling.

If you are an identical twin, what do you share with your twin?
What are some traits that each gene controls?

CHROMOSOMES

The chromosomes in cells are full of genes. Every species has a set number of chromosomes in each cell. Bacteria each have one chromosome. Fruit flies have eight. Humans have 46 in all cells except half that number (23) in sex cells. Your 46 chromosomes are arranged in 23 pairs. In each pair, one chromosome comes from your father. The other comes from your mother.

- Have students turn to Student Chart 2.15.
- Read text aloud to students as they follow in their Student Chart.
- Stop and clarify text if necessary.
- Ask students embedded questions. Elaborate on their responses as necessary.
- When you get to a figure, stop reading and have students look at the figure as you discuss it.

Embedded Questions:

- Why do we have different traits like eye color?**
[Genes]
- What is the function of genes?** [They give instructions for our bodies].

- **If you are an identical twin, what do you share with your twin?** [You have the same combination of genes].
- **What are some traits that each gene controls?** [eye color, ear wiggling, hair color, etc].

2.15

What are chromosomes made of?
 How many chromosomes do bacteria and fruit flies have in each cell?
 In people, how many chromosomes are in each cell that is not a sex cell?
 For each pair of chromosomes, how many chromosomes come from the mother? How many from the father?

What is DNA? (See Figure 14 in Glencoe, pages 368–369)
 Why was the alphabet one of the first things you learned when you started school? Letters are a code that you need to know before you learn to read. A cell also uses a code that is stored in its hereditary material. The code is a chemical called *deoxyribonucleic acid* (dee AHK eib oh nook lay ikk) acid, or DNA. It contains information for an organism's growth and function.

What information is stored in DNA?

DNA is stored in cells that have a nucleus. When a cell divides, the DNA code is copied and passed to the new cells. In this way, new cells receive the same coded information that was in the original cell. Every cell that has ever been formed in your body or in any other organism contains DNA.

Where is DNA stored?
 What happens to DNA when a cell divides?

Discovering DNA
 Since the mid-1800s, scientists have known that the nuclei of cells contain large molecules called nucleic acids. By 1950, chemists had learned what the

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- Follow the same routine.

Embedded Questions:

- **What are chromosomes made of?** [Genes]
- **How many chromosomes do bacteria and fruit flies have in each cell?** [one; eight]
- **In people, how many chromosomes are in each cell, besides sex cells?** [46]
- **For each pair of chromosomes, how many chromosomes come from the mother? How many from the father?** [Half come from the father; half from the mother].
- **What information is stored in DNA?** [genetic information for an organism's growth and function]
- **Where is DNA stored?** [in cells that have a nucleus]

- **What happens to DNA when a cell divides?** [the DNA is copied and pasted into the new cells]

2.15

nucleic acid DNA was made of, but they didn't understand how the parts of DNA were arranged.

DNA's Structure

In 1952, scientist Rosalind Franklin discovered that DNA is two chains of molecules in a spiral form. By using an X-ray technique, Dr. Franklin showed that the large spiral was probably made up of two spirals. As it turned out, the structure of DNA is similar to a twisted ladder. In 1953, using the work of Franklin and others, scientists James Watson and Francis Crick made a model of a DNA molecule.

What did scientists discover about the structure of DNA?

What does it look like?

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- Follow the same routine.
- Embedded questions:
 - **What did scientists discover about the structure of DNA?** [it is made of two chains of molecules in a spiral form].
 - **What does it look like?** [it looks like a twisted ladder]

2.16: Interactive Reading—Guiding Questions

1. Look at this section from the diagram on page 369 of Glencoe and write in the base pairs.

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- Have students turn to Student Chart 2.16 and to page 369 in Glencoe.
- Using the diagram in the book (Figure 14, part C) and this PowerPoint slide, have students complete question #1 in Student Chart 2.16.
- Review question #1 with students.

2.15


A DNA Model (Look at the diagram on page 369 of Glencoe, and write in the base pairs in Student Chart 2.16 before reading the paragraph below.)

What does DNA look like? According to the Watson and Crick DNA model, each side of the ladder is made up of sugar-phosphate molecules. Each molecule consists of the sugar called *deoxyribose* (dee AHK sih ri boh) and a phosphate group. The rungs of the ladder are made up of other molecules called nitrogen bases. Four kinds of nitrogen bases are found in DNA—adenine (AD un egn), guanine (GWAHN egn), cytosine (SITE uh seen), and thymine (THI men). The bases are represented by the letters A, G, C, and T. The amount of cytosine in cells always equals the amount of guanine, and the amount of adenine always equals the amount of thymine. This led to the hypothesis that these bases occur as pairs in DNA. Adenine always pairs with thymine and guanine always pairs with cytosine. Like interlocking pieces of a puzzle, each base bonds only with its correct partner.

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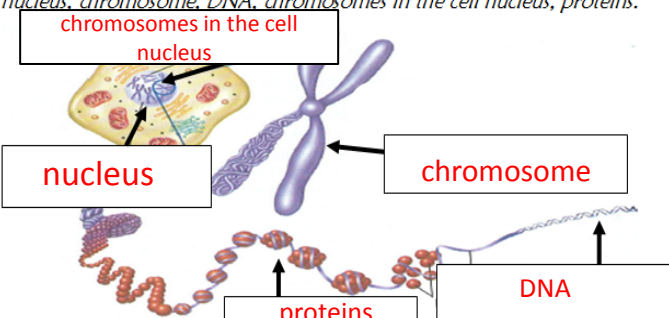
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- Have students turn back to Student Chart 2.15.
- Read text aloud to students as they follow in their Student Chart.
- Stop and clarify text if necessary.



2.16: Interactive Reading—Guiding Questions

2. Identify the parts of genetic material of a cell using the following labels:
nucleus, chromosome, DNA, chromosomes in the cell nucleus, proteins.



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- Have students turn back to Student Chart 2.16.
- Have students complete question #2.
- Display responses.
- Have students correct responses as necessary.
- Teacher's note: responses enter clockwise, starting with nucleus.**




2.17: Closing Activity— Glossary Work

- Complete glossary entries for the following science content words:
 - gene
 - chromosome
 - DNA
 - inherited trait

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- Have students locate Student Chart 2.17
- Have students complete glossary entries for the science content words.
- For each glossary entry, have students work in pairs to indicate whether the word is a cognate and to fill in the rest of the information required by the glossary.
- Review glossary entries with class.



2.18: Closing Activity— Key Information


Use these words or phrases to complete the sentences below in Student Chart 2.18: *genes (2), nucleus, DNA, spiral, traits (2), chromosomes, genetic, deoxyribonucleic acid*

- When living things reproduce, their offspring inherit genes, which determine inherited traits.
- Individuals have different traits because they have different combinations of genes.
- Chromosomes are structures in the cell nucleus that carry genes.
- DeoxyriboNucleic Acid (or DNA) is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of an organism.

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- Have students turn to Student Chart 2.18.
- Give students several minutes to complete the questions.
- Display responses.
- Have students correct responses as necessary.



**2.19 : Closing Activity—
Question for Further Study**



- One question I still have or something I want to learn more about is:

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- Have students turn to Student Chart 2.19.
- Have students complete Student Chart.
- As time permits, have students share their questions with a partner, with the whole class, or have them write them on a sticky note and put them on a “questions wall” on their way out of class. Students who finish an assessment or who have free time might be assigned to go online to find answers to class questions.

Extension Question for Discussion

Do twins have the same DNA?

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- Whole class discussion: Do twins have the same DNA? [if they are identical twins, their DNA is exactly the same; if they are fraternal, some of it will be the same, just like any siblings, but it is not exact].



Project QuEST
Model Life Science Lesson
Student Guide: Introduction to Genetics

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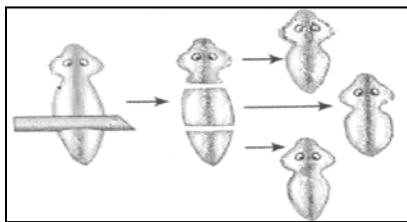
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**Genetics Set: Introduction to Genetics****Student Chart 2.1: Review of Sexual and Asexual Reproduction**

Complete the following questions.

1. Which of the following is true of plants and animals that reproduce sexually?
 - a. They have offspring that are exactly like the parents.
 - b. They have only one parent.
 - c. They have offspring with genetic material from two parents.
 - d. They have no DNA.

Look at the picture below and then answer questions #2 and #3.



2. Circle the type of reproduction that this picture illustrates:

asexual reproduction

sexual reproduction

3. The offspring of this planaria have genetic material that is:
 - a. identical (the same) to the parent's genetic material.
 - b. not identical to the parent's genetic material.
 - c. a combination of the genetic material of both parents.
 - d. not existent.

Use these words to complete the sentences below:

genetic material, requires, offspring

4. _____ is the genes, chromosomes, and DNA that are different for each cell or organism.
5. _____ is one or more organisms born of a parent; in humans, these are children.
6. Sexual reproduction _____ two parents.

**Student Chart 2.2: Science and Language Objectives**

Listen and follow along as your teacher reads this lesson's objectives.

In science we will learn:

- to recognize that reproduction is a characteristic of living organisms and that the instructions for inherited traits are found in the genetic material.
- to investigate the genetic material found in the genes within chromosomes in the nucleus of a strawberry cell.

To develop our language skills, we will learn:

- to label diagrams of genetic material using the content vocabulary.
- to use illustrations and diagrams to understand a text on genetic material.

**Student Chart 2.3: Vocabulary Objectives**

Listen and follow along as your teacher reads this lesson's vocabulary.

Science content vocabulary:

- gene
- chromosome
- DNA
- inherited trait

General academic vocabulary:

- model
- represent



Student Chart 2.4: Defining Genetics

Use these words to answer question #1: *inherited, offspring*.
Talk with your partner to answer question #2.

1. **Genetics**- the study of how traits are _____
from parents to _____.
2. Partner talk: What do you remember from last year when you studied heredity and genetics?



Student Chart 2.5: Family Traits

Look at the picture with a partner. Then answer questions #1 and #2 orally.

Look at the picture and examine the traits of this family:



Questions for discussion:

1. What are the physical traits or characteristics that are similar among the members of this family?
2. What makes the people in this family look alike?



Student Chart 2.6: Defining Traits

Listen as your teacher defines traits and fill in the key terms in sentence #1. Answer question #2 with your partner.

Key terms: *environment, eye color, genes, hair color, height*

1. *Traits*: characteristics that can be controlled by _____ (such as _____, _____, and _____) or by the _____.

2. Partner talk: How are your traits the same as your family's traits?

How are your traits different from your family's traits?



Student Chart 2.7: Traits

Make a list of the types of family traits and decide if they are because of the environment or because of genetics.

Environmental traits	Inherited traits
<i>a scar from falling off a bike</i>	<i>eye color</i>



Student Chart 2.8: Defining *Chromosomes*, *DNA*, and *Genes*

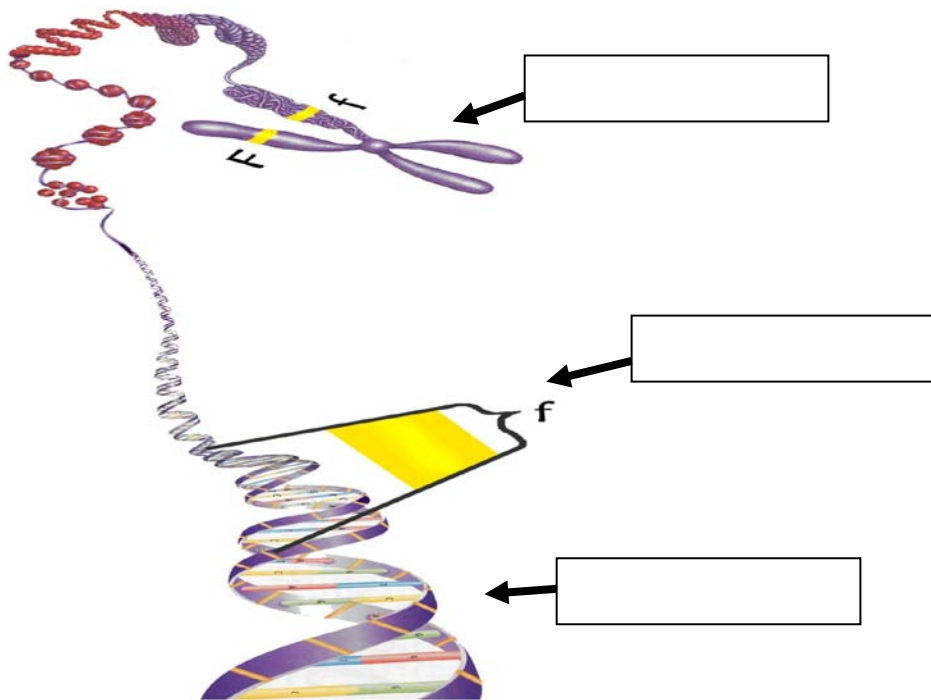
Listen to the presentation on chromosomes, DNA, and genes, then fill in the blanks using these key terms: *genes*, *genetic*, *instructions*, *offspring*, *spiral*.

- Deoxyribonucleic Acid (**DNA**) is made up of two chains of molecules that are twisted together in a _____ and hold the _____ material of an organism.
- **Genes** are a section of DNA on a chromosome that contains _____ for passing on traits from parents to _____.
- **Chromosomes** are structures in the cell nucleus that carry _____.



Student Chart 2.9: Labeling Chromosomes, DNA, and Genes

Use the words *chromosomes*, *genes*, and *DNA* to fill in the diagram and the sentence below:



- Chromosomes are made of _____. Genes are a specific section of _____.



Student Chart 2.10: DNA Extraction Lab Background

Listen to the background information about this lab; then fill in the key terms below (*cells*, *extracting*, *nucleus*) and answer the questions as a class.

1. In this lab we will be _____ DNA from the _____ of strawberry _____.
2. Hypothesize or predict:
 - a. What do you think DNA will look like?
 - b. Why would scientists want to study DNA?

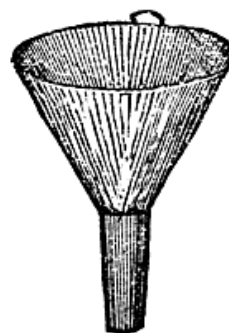


Student Chart 2.11: DNA Extraction Lab Materials

Check each box to make sure you have all of the lab materials.

For each pair of students

- ☐ 1 or 2 strawberries with stems removed (allow to come to room temperature)
- ☐ 1 Ziplock bag
- ☐ 1 coffee filter
- ☐ 1 toothpick
- ☐ 1 pipette
- ☐ 1 funnel
- ☐ 1 cup or beaker
- ☐ 1 test tube



For class

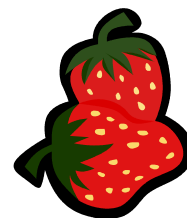
- Extraction buffer (100 mL Dawn clear liquid dish detergent, 900 mL distilled water, and 15 grams NaCl/salt)

- 16 oz of cold isopropyl alcohol (rubbing alcohol)



Student Chart 2.12: DNA Extraction Lab Procedures

Listen as your teacher reads the lab procedures, then follow the procedure with your partner to extract DNA from a strawberry.



Procedures

1. Wear **safety goggles** throughout lab.
2. Line a **funnel** with the **coffee filter** and put funnel into beaker or cup.
3. **Remove the stem** and leaves from your strawberry.
4. Place one large (or two small) **strawberries into the baggie** and push out all the air. Seal bag tightly.
5. Using your fingers, squeeze and **smash strawberry** for **2** minutes. Be careful not to break the bag
6. Add 10 mL of the **DNA extraction solution** (salt, water, and Dawn dish detergent) and reseal bag. Mash for **1** more minute.

7. **Pour strawberry liquid** from bag into funnel. Let it drip into beaker/cup until there is no liquid left in funnel.
8. Throw away filter. **Pour what is in the beaker into a test tube.**
9. **Tilt** the test tube and use the pipette to **very slowly drip** ice-cold

alcohol down the side of the test tube until it is **half full**. The alcohol should form a **layer** on top of the red strawberry liquid. **Do not mix** the layers.

10. Dip the toothpick into the test tube where the two layers meet. **Use the toothpick to pick up the stringy white stuff**, which is DNA.
11. Answer questions #1–#3 in Student Chart 2.13.



Student Chart 2.13: DNA Extraction Lab Observations and Results

Use the results from your lab to answer questions #1–#3 below.

1. The strawberry DNA looked like _____.

2. Were you seeing individual DNA molecules?

Yes

No

– Individual DNA molecules are too _____ to be seen without a microscope.

large/small

– Instead of individual DNA molecules, about how many DNA molecules do you think you observed?

3. Would DNA from other organisms look the same without a microscope?

Yes

No



Student Chart 2.14: Interactive Reading—Preview

Read the guiding question.

- What are the parts of a DNA molecule and its structure?

**Student Chart 2.15: Interactive Reading Text**

(ACCESS, page 190; Glencoe, pages 368–369)

Listen and follow along as the text is read aloud. Be prepared to answer the questions.

GENES

Why are your eyes different from your neighbor's eyes? Why can your uncle wiggle his ears and you can't? These questions all have the same answer: genes! Genes are instruction books for our bodies.

Why do we have different traits like eye color?

What is the function of genes?

Genes pass from parent to offspring in different combinations. Unless you are an identical twin, your combination of genes belongs only to you. Each gene controls a different trait, such as eye color or ear wiggling.

If you are an identical twin, what do you share with your twin?

What are some traits that each gene controls?

CHROMOSOMES

The chromosomes in cells are full of genes. Every species has a set number of chromosomes in each cell. Bacteria each have one chromosome. Fruit flies have eight. Humans have 46 in all cells except half that number (23) in sex cells. Your 46 chromosomes are arranged in 23 pairs. In each pair, one chromosome comes from your father. The other comes from your mother.

What are chromosomes made of?

How many chromosomes do bacteria and fruit flies have in each cell?

In people, how many chromosomes are in each cell that is not a sex cell?

For each pair of chromosomes, how many chromosomes come from the mother? How many from the father?

What Is DNA? (*See Figure 14 in Glencoe, pages 368–369*)

Why was the alphabet one of the first things you learned when you started school? Letters are a code that you need to know before you learn to read. A cell also uses a code that is stored in its hereditary material. The code is a chemical called *deoxyribonucleic acid* (dee AHK sih rib oh nook lay ihk) acid, or DNA. It contains information for an organism's growth and function.

What information is stored in DNA?

DNA is stored in cells that have a nucleus. When a cell divides, the DNA code is copied and passed to the new cells. In this way, new cells receive the same coded information that was in the original cell. Every cell that has ever been formed in your body or in any other organism contains DNA.

Where is DNA stored?

What happens to DNA when a cell divides?

Discovering DNA

Since the mid-1800s, scientists have known that the nuclei of cells contain large molecules called nucleic acids. By 1950, chemists had learned what the

nucleic acid DNA was made of, but they didn't understand how the parts of DNA were arranged.

DNA's Structure

In 1952, scientist Rosalind Franklin discovered that DNA is two chains of molecules in a spiral form. By using an X-ray technique, Dr. Franklin showed that the large spiral was probably made up of two spirals. As it turned out, the structure of DNA is similar to a twisted ladder. In 1953, using the work of Franklin and others, scientists James Watson and Francis Crick made a model of a DNA molecule.

What did scientists discover about the structure of DNA?

What does it look like?

A DNA Model *(Look at the diagram on page 369 of Glencoe, and write in the base pairs in Student Chart 2.16 before reading the paragraph below.)*

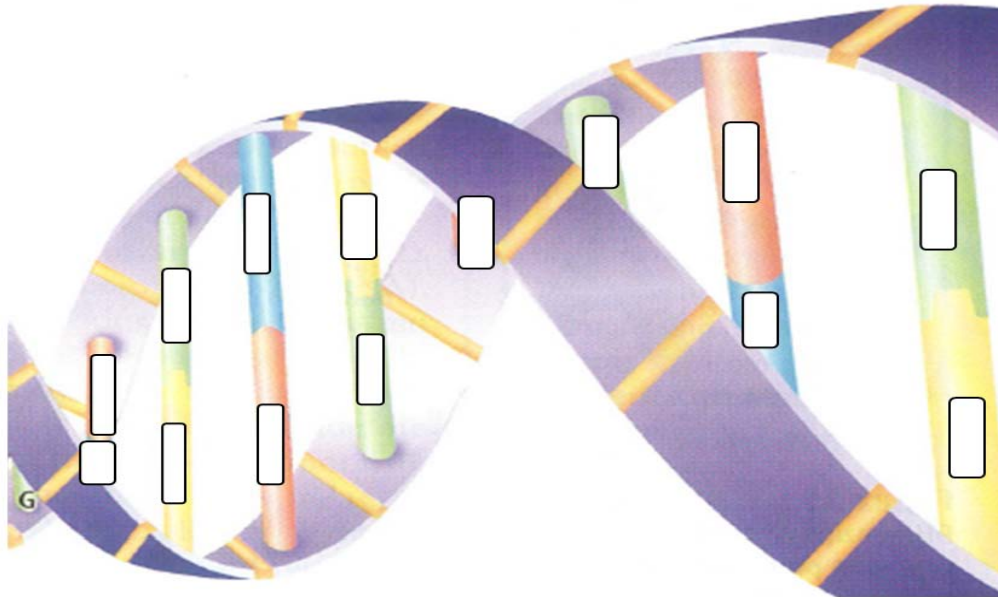
What does DNA look like? According to the Watson and Crick DNA model, each side of the ladder is made up of sugar-phosphate molecules. Each molecule consists of the sugar called *deoxyribose* (dee AHK sih ri boh) and a phosphate group. The rungs of the ladder are made up of other molecules called nitrogen bases. Four kinds of nitrogen bases are found in DNA—adenine (AD un een), guanine (GWAHN een), cytosine (SITE uh seen), and thymine (THI men). The bases are represented by the letters A, G, C, and T. The amount of cytosine in cells always equals the amount of guanine, and the amount of adenine always equals the amount of thymine. This led to the hypothesis that these bases occur as pairs in DNA. Adenine always pairs with thymine and guanine always pairs with cytosine. Like interlocking pieces of a puzzle, each base bonds only with its correct partner.



Student Chart 2.16: Interactive Reading Question

Answer questions #1 and #2.

1. Look at this section from the diagram on page 369 of Glencoe and write in the base pairs. Then read the paragraph on page 369, "A DNA Model."



Key

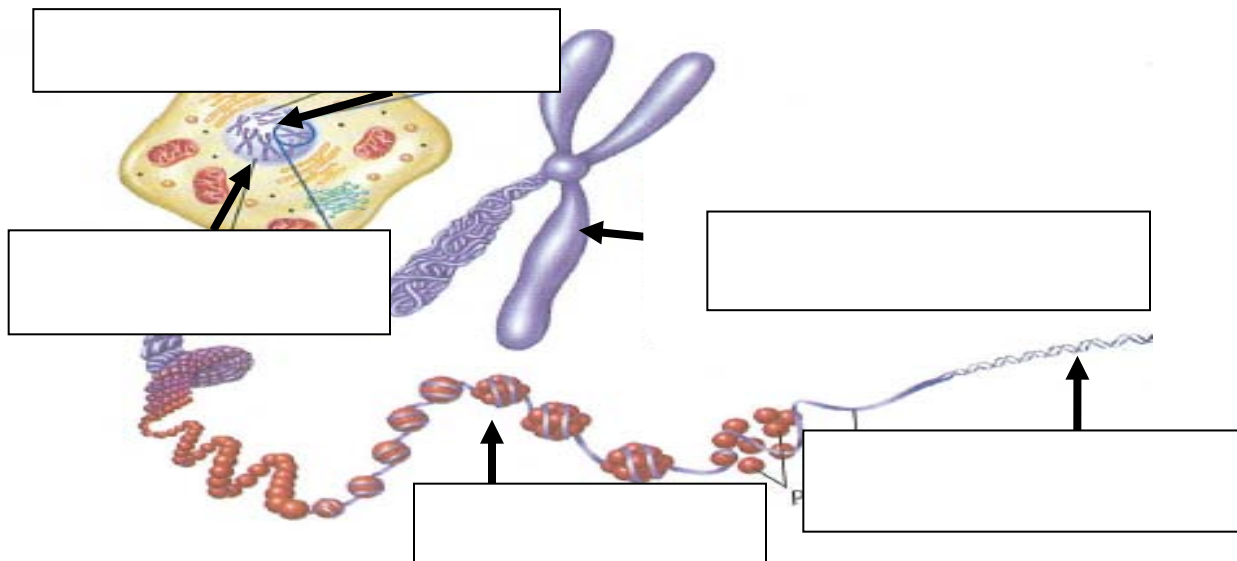
A=Adenine

C=cytosine

G=guanine

T=thymine

2. Identify the parts of genetic material of a cell using the following labels: *nucleus, chromosome, DNA, chromosomes in the cell nucleus, proteins.*





Student Chart 2.17: Glossary

Complete glossary entries for these science content words:

- gene
- chromosome
- DNA
- inherited trait



Student Chart 2.18: Key Information

Use these words or phrases to complete the sentences below (note that you will use some words twice): *genes (2), nucleus, DNA, spiral, traits (2), chromosomes, genetic, deoxyribonucleic acid.*

- When living things reproduce, their offspring inherit _____, which determine inherited _____.
- Individuals have different _____ because they have different combinations of _____.
- _____ are structures in the cell _____ that carry genes.
- _____ (or _____) is made up of two chains of molecules that are twisted together in a _____ and hold the _____ material of an organism.



Student Chart 2.19: Question for Further Study

Write a sentence about what you still want to learn.

One question I still have or something I want to learn more about is:



Project QuEST
Model Life Science Lesson
Teacher Guide: Genetics Set Review

These materials were produced by CREATE with funding from the U.S Department of Education (ED), Institute of Education Sciences, under Contract No. ED-R305A05056. The opinions expressed herein do not necessarily reflect the positions or policies of ED.

2012 Center for Applied Linguistics

*Middle School Science: Life Science***Genetics Set Review****Framework for K-12 Science Education: Dimension 3—Life Science**

- **Disciplinary Core Idea (LS1.B)—Growth and Development of Organisms:** Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
- **Disciplinary Core Idea (LS3.A)—Inheritance of Traits:** Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes.
- **Science and Engineering Practices:** Developing and Using Models
- **Crosscutting Concepts:** Cause and Effect

Connections to the Common Core State Standards (ELA)

- **L6:** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Materials

- **Engagement Activity I**
 - Mix and Match Cards

Teacher Prep

- Review instructions for review activity.
- Review Teacher and Student Charts.

Objectives

- **Science**
 - Students will review science content.
- **Language:**
 - Students will write vocabulary terms to match definitions.
- **Vocabulary:**
 - Students review vocabulary from Week 1:
 - General academic: *require, compare, model, represent.*
 - Science content: *asexual reproduction, sexual reproduction, offspring, genetic material, gene, chromosome, DNA, inherited trait*

Overview of Activities

Engagement

- **Activity I: Memory.** Teacher groups students; teacher distributes cards; teacher reviews instructions with students; students play for 10 minutes; teacher circulates and ensures students are following directions.

Evaluation

- **Activity II: Vocabulary and Science Assessments.** Teacher hands out Student Charts 3.1, 3.2, and 3.3; teacher reviews instructions for each assessment; students complete assessment in allotted time—20 minutes.
- **Activity III: Review of Vocabulary and Science Assessment.** Teacher reviews assessment questions, one by one; students correct incorrect responses; teacher asks students if they have any questions; teacher reviews crossword puzzle from previous week.

Extension/Differentiation Activity

- **Activity IV: Crossword Puzzles.** Students complete crossword puzzles when they finish their assessments or as homework.
- **Activity IV: Leveled Readers.** Teacher distributes reader according to the appropriate student level as shown below. Students can read selection for homework or when they complete assigned work during classes the following week.

Lesson Content



Engagement

Student Activity I (Memory word cards)

10 minutes

Activity Overview: Memory Review for Assessment. Teacher groups students; teacher distributes cards; teacher reviews instructions with students; students play for 10 minutes; teacher circulates and ensures students are following directions.

- **Teacher introduces game**
 - Tell students the game is to review for the quiz.
 - Group students.
 - Hand out Memory cards.
 - Review instructions.
- **Students play Memory**
 - Have students play for 10 minutes.

- Circulate and make sure that students understand the game and are matching correct definitions and reading them aloud to their group.



Evaluation

Student Activity II (Student Charts 3.1 and 3.2)

20 minutes

Activity Overview: Vocabulary and Science Assessment. Teacher hands out Student Charts 3.1, 3.2, and 3.3; teacher reviews instructions for each assessment; students complete assessment in allotted time—20 minutes.

Teacher note: For students who have not finished in 20 minutes, the answers will be reviewed in Student Activity III.

- Hand out Student Charts 3.1 and 3.2.
- Tell students to turn to the Vocabulary Assessment in Student Chart 3.1 and the Science Assessment in Student Chart 3.2.
- Review instructions with students.
- Give students 20 minutes to complete the Charts.
- Students who finish early can work on crossword puzzle (Student Chart 3.3). Those who don't finish early can complete crossword for homework or the following week if they complete activities early.

Student Activity III

20 minutes

Activity Overview: Review of Vocabulary and Science Assessment. Teacher reviews assessment questions, one by one; students correct incorrect responses; teacher asks students if they have any questions; teacher reviews crossword puzzle from previous week.

Teacher note: Please devote up to 15 minutes to this activity. It is very important that you review assessment results with students and they correct their mistakes.

- Review assessment items by displaying responses one by one.
- Ask students to highlight the number of each incorrect response and correct it.
- Clarify any misunderstandings.



Extension

- **Student Activity IV: Crossword Puzzle.**
- **Student Activity V: Leveled Reader—"Reproduction."** Teacher distributes reader according to the appropriate student level as shown below. Students can read

selection for homework or when they complete assigned work during classes the following week.

- Star: 1.5–2.2
- Circle: 3–3.5
- Square: 4.5–5.2
- Triangle: 6.5–7.2

Student Assessments



Teacher Chart 3.1: Vocabulary Assessment

Write the letter of the word that matches each definition in the space provided.

D 1. _____ is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of all organisms.

L 2. _____ is a type of reproduction in which two cells, usually an egg and a sperm, join to form a zygote.

H 3. _____ is a small copy of something, often used as a guide to making the thing in full size.

J 4. _____ means to present a sign or symbol for something.

I 5. _____ means one or more organisms born of a parent; in humans, _____ are children.

B 6. A(n) _____ is a structure in the cell nucleus that carries genes.

G 7. A(n) _____ is a trait that is received from one or more parents during reproduction.

C 8. _____ is to examine two or more of something in order to note similarities or differences.

E 9. A(n) _____ is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.

K 10. _____ means to need.

F 11. _____ is the genes, chromosomes, and DNA that are different for each cell or organism.

A 12. _____ is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.

A. asexual

reproduction

B. chromosome

C. compare

D. DNA

E. gene

F. genetic

material

G. inherited trait

H. model

I. offspring

J. represent

K. require

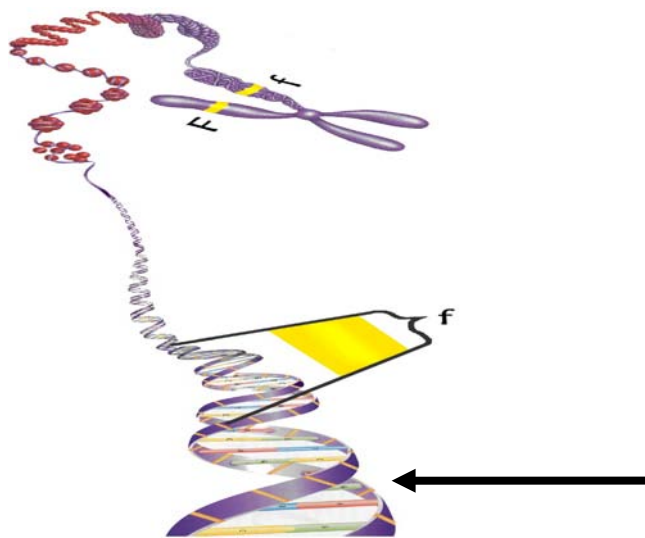
L. sexual

reproduction

**Teacher Chart 3.2: Science Assessment Answers**

Read each question and choose the best answer.

1. Which of the following is an example of a characteristic that is caused by factors in the environment instead of by genetics?
 - A. Two tulips grow in different flowerbeds in the same garden. One tulip is yellow, and the other is red.
 - B. Two dogs are born from the same mother. One dog has a straight tail, and the other dog has a curly tail.
 - C. Two thoroughbred horses are raised by the same trainer. One horse runs very fast, and the other is not a good runner.
 - D. Two kittens are born from the same mother. One kitten has a limp due to an accident.**
2. Which of the following human traits is due mostly to genetics?
 - A. strength
 - B. length of life
 - C. shape of ears**
 - D. weight
3. A gene contains ...
 - A. nutrients and gases
 - B. the DNA code for a trait**
 - C. chloroplasts
 - D. only recessive alleles
4. Genes are found in...
 - A. the chloroplasts of cells
 - B. plant cells only
 - C. the nucleus of each cell**
 - D. animal cells only
5. Look at the picture of genetic material. Then answer the question below.



The arrow in the picture is pointing to the *DNA*.

6. All of the following are examples of asexual reproduction EXCEPT ...

- A. budding in yeast
- B. fission in protists
- C. **pollination of a flower with male and female parts**
- D. a potato eye developing a bud

7. All of the following are types of sexual reproduction EXCEPT ...

- A. **budding in yeast**
- B. fertilization
- C. plant pollination
- D. baby chickens

Fill in a number in the blank:

8. Sexual reproduction involves *two* parent(s).

9. Asexual reproduction involves *one* parent(s).

Write *more* or *less* in the blank:

10. Offspring from asexual reproduction are *less* diverse than offspring from sexual reproduction.

11. Offspring from sexual reproduction are *more* diverse than offspring from

asexual reproduction.

Write true or false:

12. *false*. In sexual reproduction, all of the chromosomes come from one parent.

13. *true*. Offspring inherit genes from their parents.



Teacher Chart 3.3: Student Crossword Puzzle Answers

Use your glossary to complete the crossword puzzle.

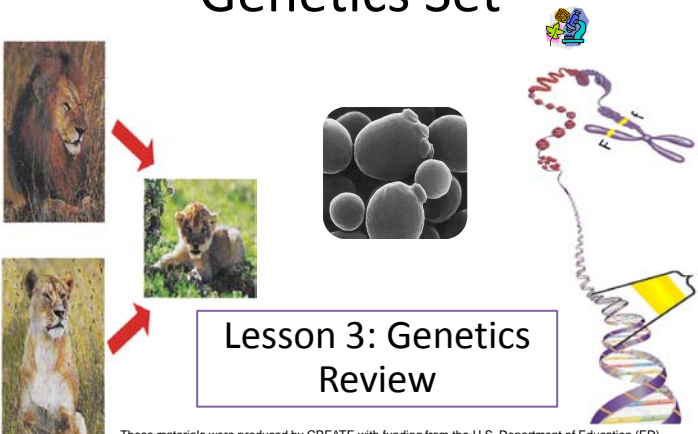
Across

2. [DNA] is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of all organisms.
3. [Model] is a small copy of something, often used as a guide to making the thing in full size.
5. [Genetic] material is the genes, chromosomes, and DNA that are different for each cell or organism.
8. [Represent] means to present a sign or symbol for something.
11. [Chromosome] is a structure in the cell nucleus that carries genes.

Down


1. [Inherited] trait is a trait that is received from one or more parents during reproduction.
4. [Offspring] means one or more organisms born of a parent; in humans, [offspring] are children.
6. [Compare] is to examine (two or more objects, ideas, etc.) in order to note similarities or differences.
7. A [gene] is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.
8. [Require] means to need.
9. [Asexual] reproduction is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.
10. [Sexual] reproduction is a type of reproduction in which two cells, usually an egg and a sperm, join to form a zygote, which develops into a new organism with its own genetic identity.

Genetics Set



Lesson 3: Genetics Review

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Memory

- Play in **groups** of two to four.
- **Mix** up your cards.
- Put your cards face up.
- Match the vocabulary words with their definitions.
- **Divide** the deck into two parts. Make sure each part has both cards in a pair.
- Put one part aside.
- Put the cards in the other part **face down** in a square on your desks.
- Choose who will go **first**.
- When it is **your turn**:
 - **Turn over** one card, leaving it on the desk so that **everyone** can see it.
 - **Choose one more card** by turning it over and leaving it on the desk.
 - **Decide if it is a match.**
 - If it is **not a match**, turn it back over and it is the next person's turn.
 - If it is a **match**, read it out loud to your group to see if you are right. **Your turn again!** After that turn it is the next person's turn.
- If it is **not your turn**:
 - **Watch** where the words and definitions are.
 - **Listen** to the definitions to see if the matching is correct.

2

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- Tell students the game is to review for the quiz.
- Group students.
- Hand out Memory cards.
- Review instructions.
- Give students 10-15 minutes to play.
- Circulate and make sure that students understand the game and are matching correct definitions and reading them aloud to their group.



Assessment

- Turn to **Student Charts 3.1 and 3.2**.
- These charts assess vocabulary and science knowledge covered in the last 2 lessons.
- Do your best to complete the answers to both assessments.
- You have **20 minutes**.
- If you finish, start the **crossword puzzle**, Student Chart 3.3.
- Now we will review the instructions to both assessments and then you can begin.

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3

- Hand out Student Charts 3.1 and 3.2.
- Review instructions with students.
- Give students 20 minutes to complete the Charts.

3.1: Assessment Answers

D 1. DNA is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of all organisms.

L 2. Sexual reproduction is a type of reproduction in which two cells, usually an egg and a sperm join to form a zygote.

H 3. Model is a small copy of something, often used as a guide to making the thing in full size.

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4

- Have students turn to Student Chart 3.1.
- Display responses.
- Have students correct responses as necessary.
- Explain any misunderstandings.

3.1: Assessment Answers, cont.

J 4. Represent means to present a sign or symbol for something.

I 5. Offspring means one or more organisms born of a parent; in humans, offspring are children.

B 6. A chromosome is a structure in the cell nucleus that carries genes.

- Follow the same routine.

3.1: Assessment Answers, cont.

G 7. An inherited trait is a trait that is received from one or more parents during reproduction.

C 8. Compare is to examine two or more of something in order to note similarities or differences.

E 9. A gene is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.

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6

- Follow the same routine.

3.1: Assessment Answers, cont.

K 10. Require means to need.

F 11. Genetic material is the genes, chromosomes, and DNA that are different for each cell or diagram.

A 12. Asexual reproduction is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.

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7

- Follow the same routine.

3.2: Science Assessment

1. Which of the following is an example of a characteristic that is caused by factors in the *environment* instead of by genetics?

- a. Two tulips grow in different flowerbeds in the same garden. One tulip is yellow, and the other is red.
- b. Two dogs are born from the same mother. One dog has a straight tail, and the other dog has a curly tail.
- c. Two horses are raised by the same trainer. One horse runs very fast, and the other is not a good runner.
- ☒ d. Two kittens are born from the same mother. One kitten has a limp due to an accident.

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8

- Have students locate Student Chart 3.2.
- Display responses.
- Have students correct responses as necessary.
- Explain any misunderstandings.

Slide 9

2. Which of the following human traits is due mostly to genetics?

- A. strength
- B. length of life
- ☒ C. shape of ears
- D. weight

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9

•Follow the same routine.

Slide 10

3. A gene contains...

- A. nutrients and gases
- ☒ B. the DNA code for a trait
- C. chloroplasts
- D. only recessive alleles

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10

•Follow the same routine.

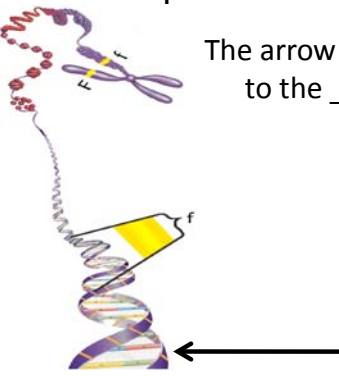
4. Genes are found in ...

- a. the chloroplasts of cells
- b. plant cells only
- ☒ c. the nucleus of each cell
- d. animal cells only

- Follow the same routine.

5. Look at the picture of genetic material. Then answer the question below.

The arrow in the picture is pointing to the DNA.



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- Follow the same routine.

6. All of the following are examples of asexual reproduction EXCEPT...

- A. budding in yeast
- B. fission in protists
- ☒ C. pollination of a flower with male and female parts
- D. a potato eye developing a bud

•Follow the same routine.

7. All of the following are examples of sexual reproduction EXCEPT ...

- ☒ A. budding in yeast
- ☐ B. fertilization
- ☐ C. plant pollination
- ☐ D. baby chickens

- Follow the same routine.

Fill in a number in the blanks:

8. Sexual reproduction involves two parent(s).
9. Asexual reproduction involves one parent(s).

Write *more* or *less* in the blanks:

10. Offspring from asexual reproduction are less diverse than offspring from sexual reproduction.
11. Offspring from sexual reproduction are more diverse than offspring from asexual reproduction.

- Follow the same routine.

Write *true* or *false*:

12. false. In sexual reproduction, all of the chromosomes come from one parent.
13. true. Offspring inherit genes from their parents.

- Follow the same routine.



Project QuEST
Model Life Science Lesson
Student Guide: Genetics Set Review

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Lesson 3 Genetics Set Student Assessments



Student Chart 3.1: Vocabulary Assessment

Write the letter of the word that matches each definition in the space provided.

___ 1. ___ is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of all organisms.

___ 2. ___ is a type of reproduction in which two cells, usually an egg and a sperm join to form a zygote.

___ 3. ___ is a small copy of something, often used as a guide to making the thing in full size.

___ 4. ___ means to present a sign or symbol for something.

___ 5. ___ means one or more organisms born of a parent; in humans, ___ are children.

___ 6. A(n) ___ is a structure in the cell nucleus that carries genes.

___ 7. A(n) ___ is a trait that is received from one or more parents during reproduction.

___ 8. ___ is to examine two or more of something in order to note similarities or differences.

___ 9. A(n) ___ is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.

___ 10. ___ means to need.

___ 11. ___ is the genes, chromosomes, and DNA that are different for each cell or organism.

___ 12. ___ is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.

A. asexual

reproduction

B. chromosome

C. compare

D. DNA

E. gene

F. genetic

material

G. inherited trait

H. model

I. offspring

J. represent

K. require

L. sexual

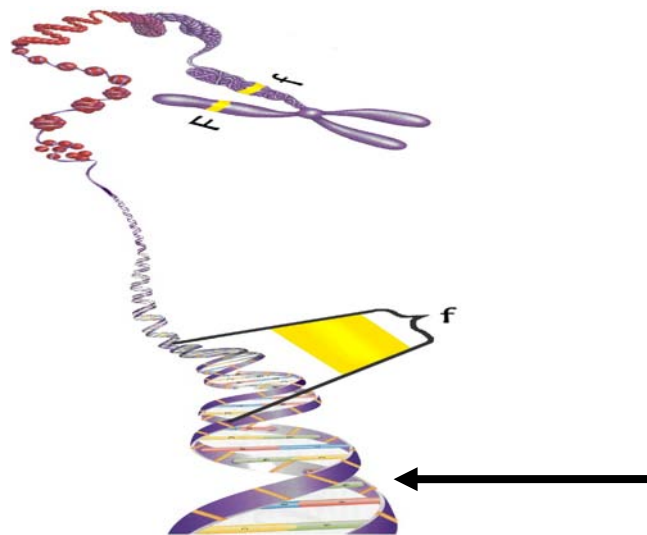
reproduction

**Student Chart 3.2: Science Assessment**

Read each question and choose the best answer.

1. Which of the following is an example of a characteristic that is caused by factors in the *environment* instead of by genetics?
 - A. Two tulips grow in different flowerbeds in the same garden. One tulip is yellow, and the other is red.
 - B. Two dogs are born from the same mother. One dog has a straight tail, and the other dog has a curly tail.
 - C. Two horses are raised by the same trainer. One horse runs very fast, and the other is not a good runner.
 - D. Two kittens are born from the same mother. One kitten has a limp due to an accident.
2. Which of the following human traits is due mostly to genetics?
 - A. strength
 - B. length of life
 - C. shape of ears
 - D. weight
3. A gene contains...
 - A. nutrients and gases
 - B. the DNA code for a trait
 - C. chloroplasts
 - D. only recessive alleles
4. Genes are found in...
 - A. the chloroplasts of cells
 - B. plant cells only
 - C. the nucleus of each cell
 - D. animal cells only

5. Look at the picture of genetic material. Then answer the question below.



The arrow in the picture is pointing to the _____.

6. All of the following are examples of asexual reproduction EXCEPT ...

- A. budding in yeast
- B. fission in protists
- C. pollination of a flower with male and female parts
- D. a potato eye developing a bud

7. All of the following are types of sexual reproduction EXCEPT...

- A. budding in yeast
- B. fertilization
- C. plant pollination
- D. baby chickens

Fill in a number in the blank:

8. Sexual reproduction involves _____ parent(s).

9. Asexual reproduction involves _____ parent(s).

Write *more* or *less* in the blank:

10. Offspring from asexual reproduction are _____ diverse than offspring from sexual reproduction.
11. Offspring from sexual reproduction are _____ diverse than offspring from asexual reproduction.

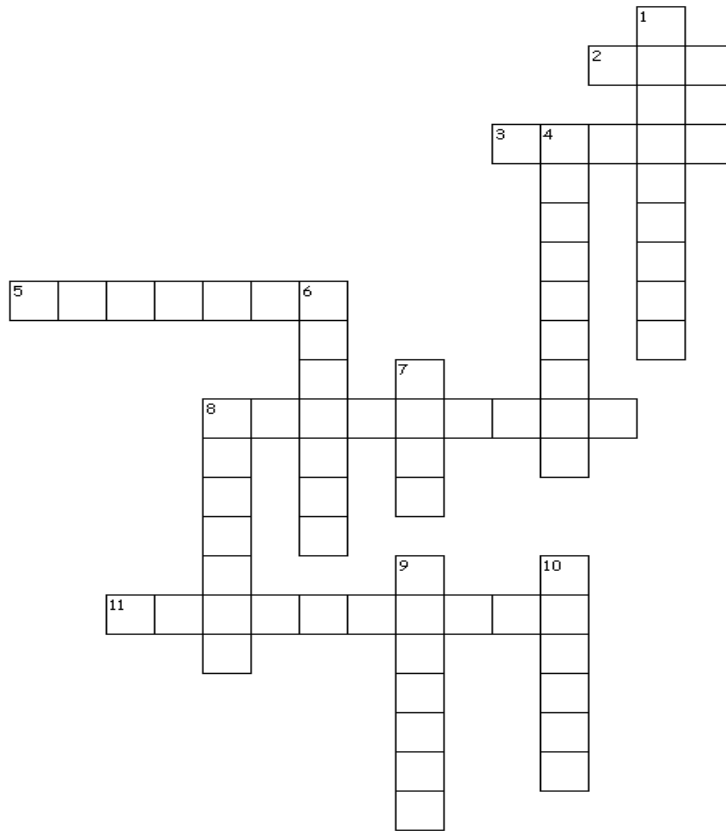
Write *true* or *false*:

12. _____ In sexual reproduction, all of the chromosomes come from one parent.
13. _____ Offspring inherit genes from their parents.



Student Chart 3.3: Student Crossword Puzzle

Use your glossary to complete the crossword puzzle.



Word Bank

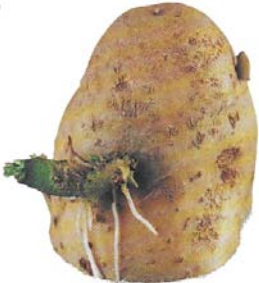
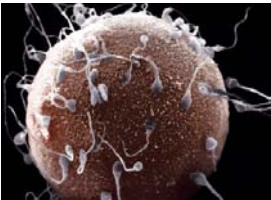
asexual [reproduction]
sexual [reproduction]
offspring
genetic material
require
compare
gene
chromosome
DNA
inherited [trait]
model
represent

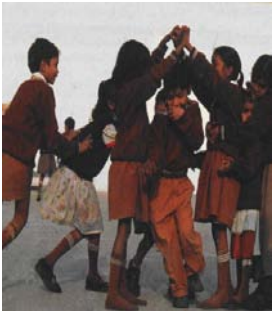


Across



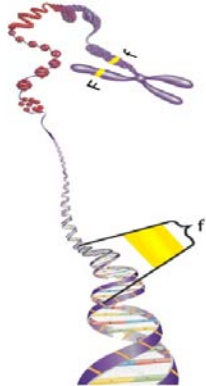

2. _____ is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of all organisms.
3. _____ is a small copy of something, often used as a guide to making the thing in full size.
5. _____ material is the genes, chromosomes, and DNA that are different for each cell or organism.
8. _____ means to present a sign or symbol for something.
11. _____ is a structure in the cell nucleus that carries genes.


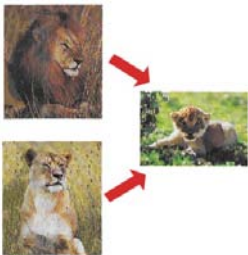

Down


1. A(n) _____ trait is a trait that is received from one or more parents during reproduction.
4. _____ means one or more organisms born of a parent; in humans, _____ are children.
6. _____ is to examine (two or more objects, ideas, etc.) in order to note similarities or differences.
7. _____ is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.
8. _____ means to need.
9. _____ reproduction is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.
10. _____ reproduction is a type of reproduction in which two cells, usually an egg and a sperm, join to form a zygote, which develops into a new organism with its own genetic identity.

Genetics Unit Glossary					
Vocabulary Words	Cognate ?	Definition	Question	Picture	My Understanding: drawing, examples, or notes
Lesson 1					
<hr/> <hr/> <hr/> <hr/>		<p><u>Asexual reproduction</u> is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.</p> <p><u>Reproducción asexual</u> es el tipo de reproducción en la que un progenitor da origen un nuevo organismo con el mismo ADN del organismo progenitor.</p>	<p>Name two organisms that reproduce asexually:</p> <hr/> <hr/>		
<hr/> <hr/> <hr/> <hr/>		<p><u>Sexual reproduction</u> is a type of reproduction in which two cells, usually an egg and a sperm, join to form a zygote, which develops into a new organism with its own genetic identity.</p> <p><u>Reproducción sexual</u> es el tipo de reproducción en la que dos células, usualmente un huevo y un espermatozoide, se unen formando un cigoto, el que se desarrolla en un nuevo organismo con su propia identidad genética.</p>	<p>Give examples of organisms that reproduce sexually:</p> <hr/> <hr/> <hr/> <hr/>		

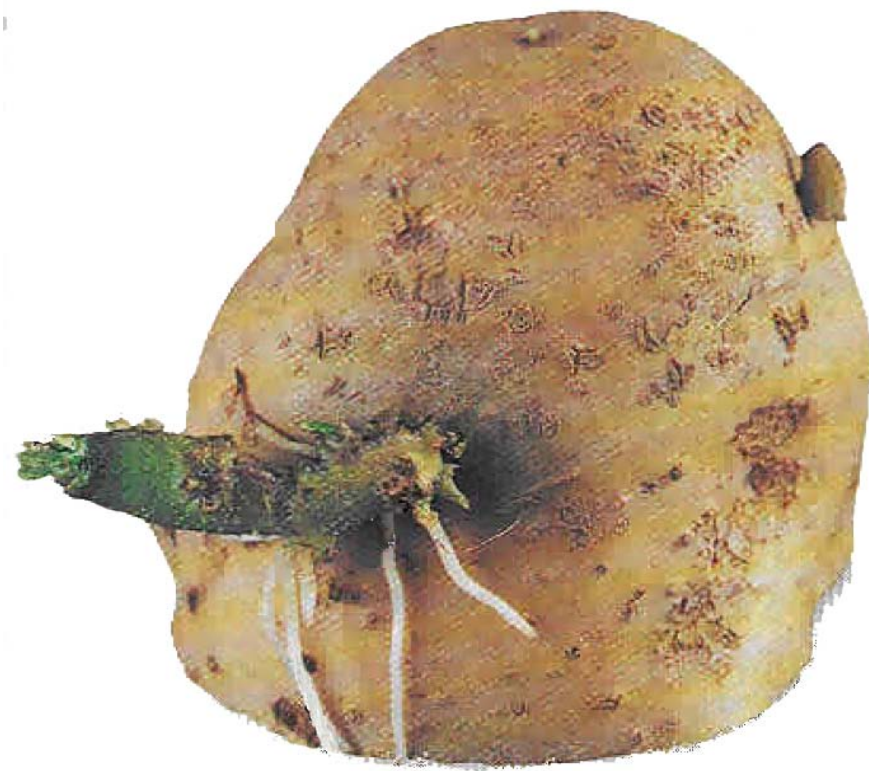
<p>_____</p> <p>_____</p>	<p><u>Offspring</u> means one or more organisms born of a parent; in humans, offspring are children.</p> <p><u>Descendencia</u> es el organismo que se origina a partir de un progenitor. En los seres humanos los hijos son los descendientes.</p>	<p>The offspring of cats are called _____.</p> <p>The offspring of dogs are called _____.</p>		
<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p><u>Genetic material</u> is the genes, chromosomes, and DNA that are different for each cell or organism.</p> <p><u>Material genético</u> se refiere a los diferentes genes, cromosomas y ADN de cada célula u organismo.</p>	<p>Look at the <u>genetic material</u> in the picture on the right. Circle the chromosome. Put a rectangle around the DNA. Put an arrow towards a section of</p>		
<p>_____</p> <p>_____</p> <p>_____</p>	<p><u>Require</u> is to need.</p> <p><u>Requerir</u> es necesitar o exigir.</p>	<p>When you go on a camping trip, what do you require?</p> <p>_____</p> <p>_____</p> <p>_____</p>		

<p>_____</p> <p>_____</p>		<p>To <u>compare</u> is to examine (two or more objects, ideas, etc.) in order to note similarities or differences.</p> <p><u>Comparar</u> es examinar (dos o más objetos, ideas, etc.) para observar semejanzas o diferencias.</p>	<p>When people <u>compare</u> me to one of my family members, they might notice</p> <p>_____</p> <p>_____</p> <p>_____</p>	 	
Lesson 2					
<p>_____</p> <p>_____</p>		<p>A <u>gene</u> is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.</p> <p>Un <u>gen</u> es una sección del ADN de un cromosoma que contiene las instrucciones para que las características genéticas de un progenitor sean transferidas a su descendencia.</p>	<p>Genes control inherited traits such as</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>		
<p>_____</p> <p>_____</p>		<p>A <u>chromosome</u> is a structure in the cell nucleus that carries genes.</p> <p>Un <u>cromosoma</u> es una estructura localizada en el núcleo de la célula y contiene el material genético.</p>	<p><u>Chromosomes</u> come in pairs because</p> <p>_____</p> <p>_____</p> <p>_____</p>		

<p>_____</p> <p>_____</p>	<p>Deoxyribonucleic Acid (<u>DNA</u>) is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of an organism.</p> <p>Ácido desoxirribonucleico (<u>ADN</u>) está formado por dos cadenas de moléculas entrelazadas en forma de espiral. El ADN contiene el material genético de un organismo vivo.</p>	<p>Crime investigators use <u>DNA</u> as evidence because</p> <p>_____</p> <p>_____</p> <p>_____</p>		
<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>An <u>inherited trait</u> is a trait that is received from one or more parents during reproduction.</p> <p>Una <u>característica heredada</u> es la que se recibe de uno o más progenitores durante la reproducción.</p>	<p>One inherited trait that was passed to the lion cub is</p> <p>_____.</p>		
<p>_____</p> <p>_____</p>	<p>A <u>model</u> is a small copy of something, often used as a guide to making the thing in full size.</p> <p><u>Model</u> quiere decir "modelo": es una copia a pequeña escala que a menudo se usa como base para construir algo en tamaño real.</p>	<p>If the globe is a model of the Earth, a _____ could be a model of the sun.</p>		

<p>_____</p> <p>_____</p>		<p><u>Represent</u> means to present a sign or symbol for something. It can stand for something else.</p> <p>Represent quiere decir <u>representar</u>: expresar o designar usando un término, carácter, símbolo, o algo parecido.</p>	<p>On your next birthday cake, how many candles will represent your age?</p> <p>_____</p>		
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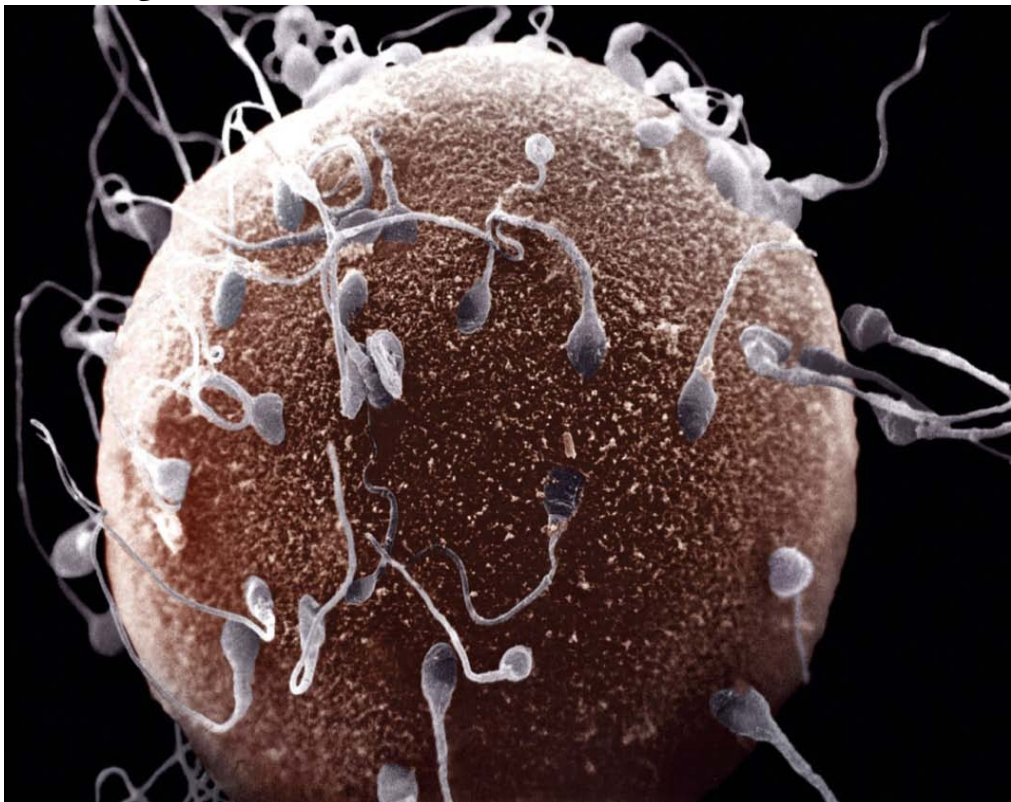
asexual reproduction



reproducción asexuada

- Asexual reproduction is a type of reproduction in which a new organism is produced from one parent and has the same DNA as the parent.
- Reproducción asexual es el tipo de reproducción en la que un progenitor da origen a un nuevo organismo con el mismo ADN del organismo progenitor.

sexual reproduction



reproducción sexuada

- Sexual reproduction is a type of reproduction in which two cells, usually an egg and a sperm, join to form a zygote, which develops into a new organism with its own genetic identity.
- Reproducción sexual es el tipo de reproducción en la que dos células, usualmente un huevo y un espermatozoide, se unen formando un cigoto, el que se desarrolla en un nuevo organismo con su propia identidad genética.

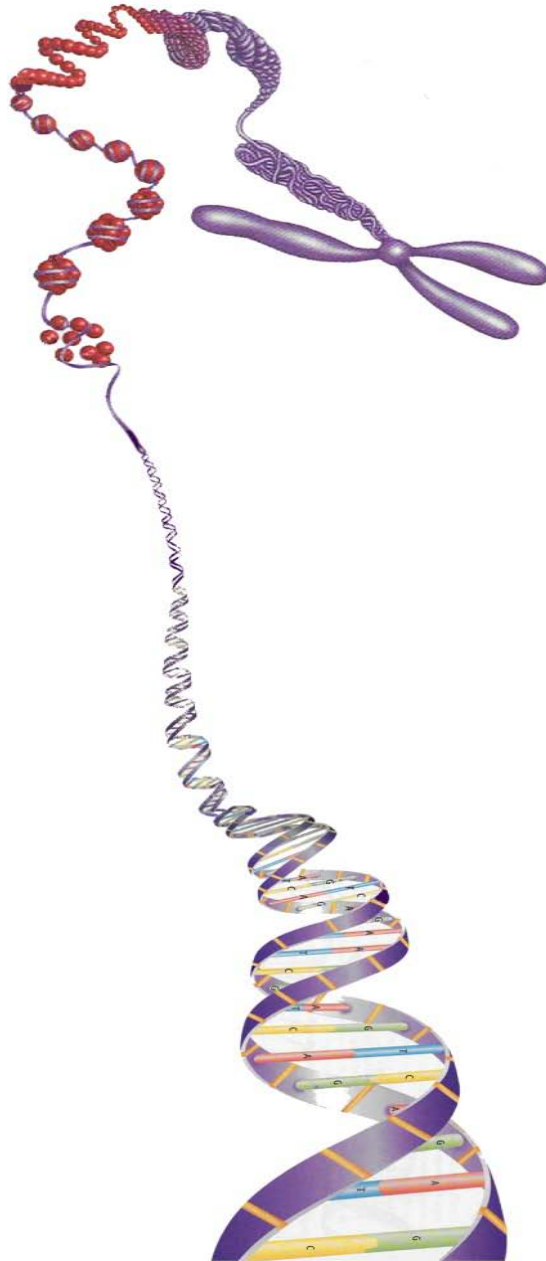
offspring



descendencia

- Offspring means one or more organisms born of a parent; in humans, offspring are children.
- Descendencia es el organismo que se origina a partir de un progenitor. En los seres humanos los hijos son los descendientes.

genetic material



material genética

- Genetic material is the genes, chromosomes, and DNA that are different for each cell or organism.
- Material genético se refiere a los diferentes genes, cromosomas y ADN de cada célula u organismo.

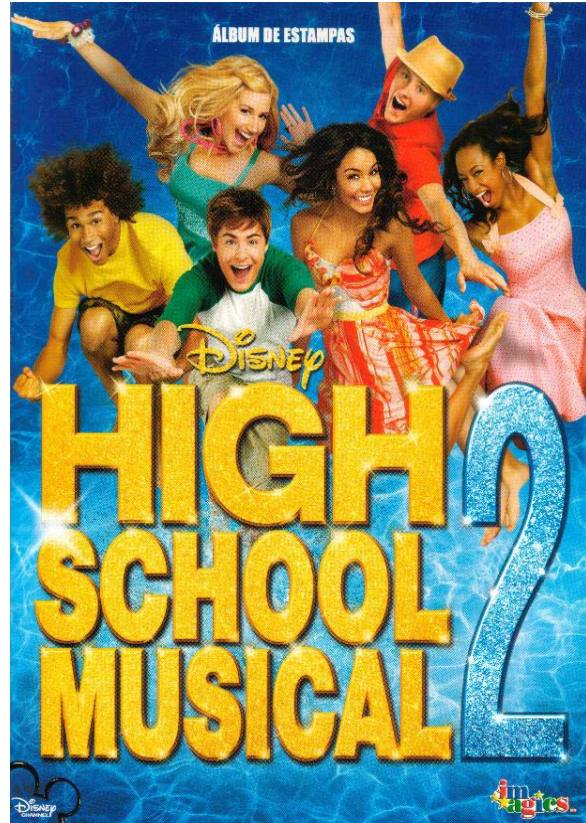
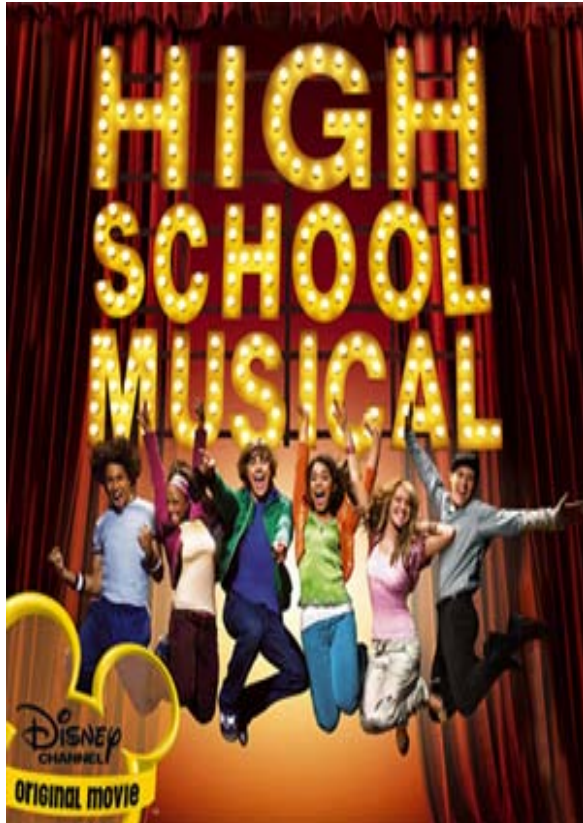
require



requerir

- Require is to need.
- Requerir es necesitar o exigir.

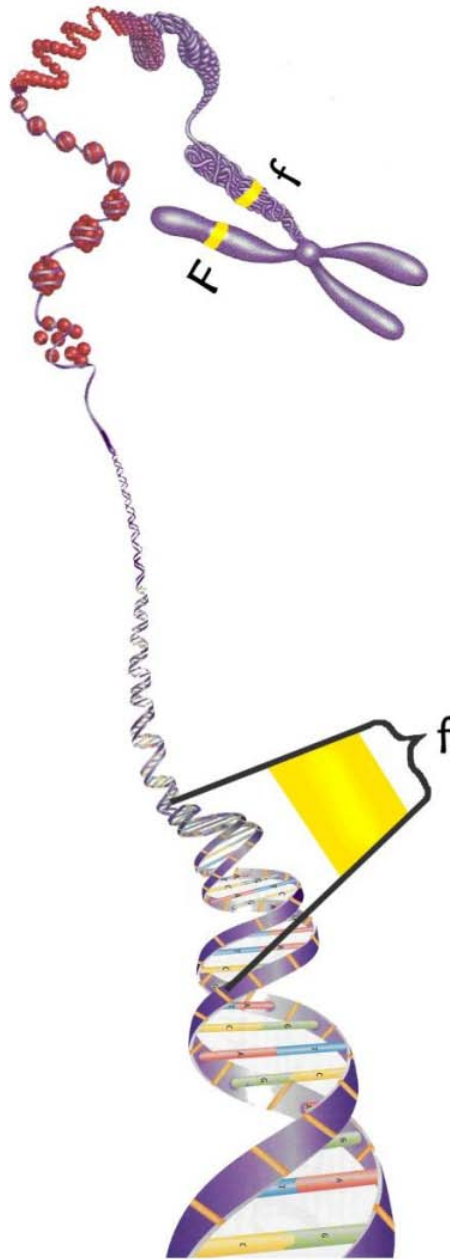
compare



comparar

- To compare is to examine (two or more objects, ideas, etc.) in order to note similarities or differences.
- Comparar es examinar (dos o más objetos, ideas, etc.) para observar semejanzas o diferencias.

gene



gen

- A gene is a section of DNA on a chromosome that contains instructions for passing on traits from parents to offspring.
- Un gen es una sección del ADN de un cromosoma que contiene las instrucciones para que las características genéticas de un progenitor sean transferidas a su descendencia.

chromosome



cromosoma

- A chromosome is a structure in the cell nucleus that carries genes.
- Un cromosoma es una estructura localizada en el núcleo de la célula y contiene el material genético.

DNA



ADN

- Deoxyribonucleic Acid (DNA) is made up of two chains of molecules that are twisted together in a spiral and hold the genetic material of an organism.
- Ácido desoxirribonucleico (ADN) está formado por dos cadenas de moléculas entrelazadas en forma de espiral. El ADN contiene el material genético de un organismo.

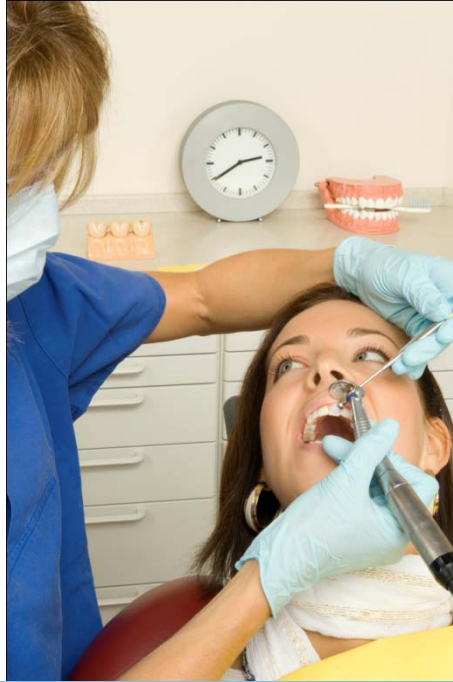
inherited characteristic



característica
heredada

- An inherited trait is a trait that is received from one or more parents during reproduction.
- Una característica heredada es la que se recibe de uno o más progenitores durante la reproducción.

extraction



extracción

- Extraction is taking out or removing with force.
- Extracción es sacar o remover algo usando la fuerza.

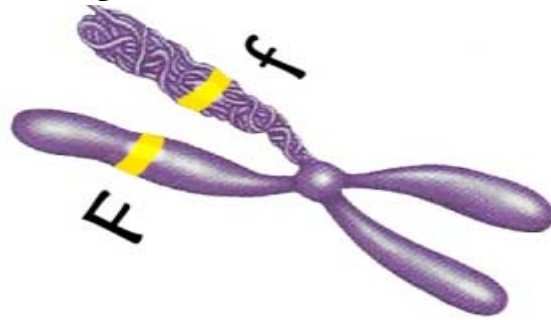
model



modelo

- A model is a small copy of something, often used as a guide to making the thing in full size.
- Un modelo es una copia a pequeña escala que a menudo se usa como base para construir algo en tamaño real.

represent



representar

- Represent means to present a sign or symbol for something. It can stand for something else.
- Representar es expresar o designar usando un término, carácter, símbolo, o algo parecido.