CHAPTER 2

Parents and Offspring

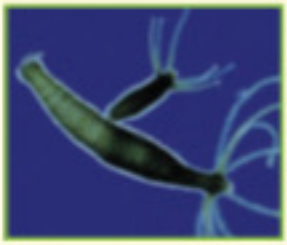
The Big Idea

How do organisms pass traits to their offspring?

Possible answer: When organisms reproduce, their genetic material is contained in the cells that combine to form offspring. These genes ensure that the offspring will have similar traits to its parents.

Vocabulary

sexual reproduction the production of a new organism from a female sex cell and a male sex cell



asexual reproduction the production of a new organism from only one cell

vegetative propagation asexual reproduction in plants that produces new plants from leaves, roots, or stems

pollination the transfer of a pollen grain to the egg-producing part of a plant

metamorphosis a series of distinct growth stages that are different from one another

heredity the passing down of inherited traits from one generation to the next

Parents and Offspring		
What We Know	**What We Want to Know**	**What We Learned**
All living things reproduce.	How do living things reproduce?	Reproduction can be sexual or asexual.
Most plants grow from seeds.	How do plants reproduce without seeds?	Mosses use spores to reproduce.
Animals grow and develop during their life cycle.		Butterflies and moths go through complete metamorphosis.

Lesson 1 Reproduction

Objectives

- Explain sexual and asexual reproduction.
- Compare and contrast sexual and asexual reproduction.

1 Introduce

▶ Assess Prior Knowledge

Ask students to describe how plants and animals reproduce. Write their responses on the board. Possible answers: Animal parents give birth to small animals. Some plants grow from seeds. Ask:

- How do plants produce new plants? Possible answers: Some plants grow from seeds. Some plants grow from other parts of plants.
- How do animal parents produce new animals? Accept all reasonable answers about sexual reproduction in animals.

Look and Wonder

Each little plant is an identical copy of the kalanchoe plant it is growing on. How did these plants grow without seeds or spores?

Possible answer: Maybe the plants grew from a part of the original plant. The new plants are a kind of offshoot that has the same traits as the parent.

Essential Question How do living things reproduce?

Possible answer: Living things reproduce by combining cells from a male and female to form a new organism. They can also reproduce by dividing their own individual cells or growing new versions of themselves on their own.

Explore

Can some flowering plants grow without seeds?

Make a Prediction

You have learned that flowering plants use seeds to reproduce. Can some flowering plants reproduce without seeds? Can you use part of a plant to create a new plant? Make a prediction.

Possible prediction: A stem placed in water can grow into a new plant.

Materials

- philodendron plant
- safety scissors
- hand lens
- plastic cup
- water
- 2-week-old cutting in a plastic cup (optional)

Test Your Prediction

1. Cut a piece of stem from the philodendron plant that measures 15 centimeters in length. Cut off the leaves that are closest to the plant. Leave two leaves at the very tip of the cutting.

2. **Observe** Look at your cutting with the hand lens. Record your observations.

Possible answer: The stem has no roots, but has bumps along the stem where the leaves grew.

3. Fill the plastic cup $\frac{2}{3}$ of the way with water. Place the cutting into the plastic cup.

4. **Interpret Data** Examine your cutting each day with the hand lens. Record your observations and any changes.

Answers will vary. Students should observe long, hair-like roots growing from the stem.

Draw Conclusions

5 **Infer** What happened to the cutting in the plastic cup with water?

Answers will vary. Possible answer: Roots began sprouting from the cutting.

6 Is it possible to grow a new plant without planting a seed? Explain.

Yes, a new plant began growing from the stem of the plant. It did not need a seed to grow.

Explore More

Could other plants grow in a way that is similar to the philodendron plant? Plan an investigation to answer the question. Write a report of your results and present it to the class.

Answers will vary.

Open Inquiry

Do you think other parts of a plant could grow into another plant? Why or why not?

Possible answer: Yes, I think other parts could sprout a new plant because they all contain the genetic material of the plant and all have the potential to grow.

Quick Check

1. What is the first step of sexual reproduction?

A sperm cell and an egg cell join to form a fertilized egg cell.

2. Asexual reproduction produces an exact copy of the parent organism. When could this be a disadvantage?

Possible answer: This could be a disadvantage if the parent organism does not have desirable traits.

Quick Check

3. Describe the steps in bacteria reproduction.

The organism produces a copy of its genetic material.

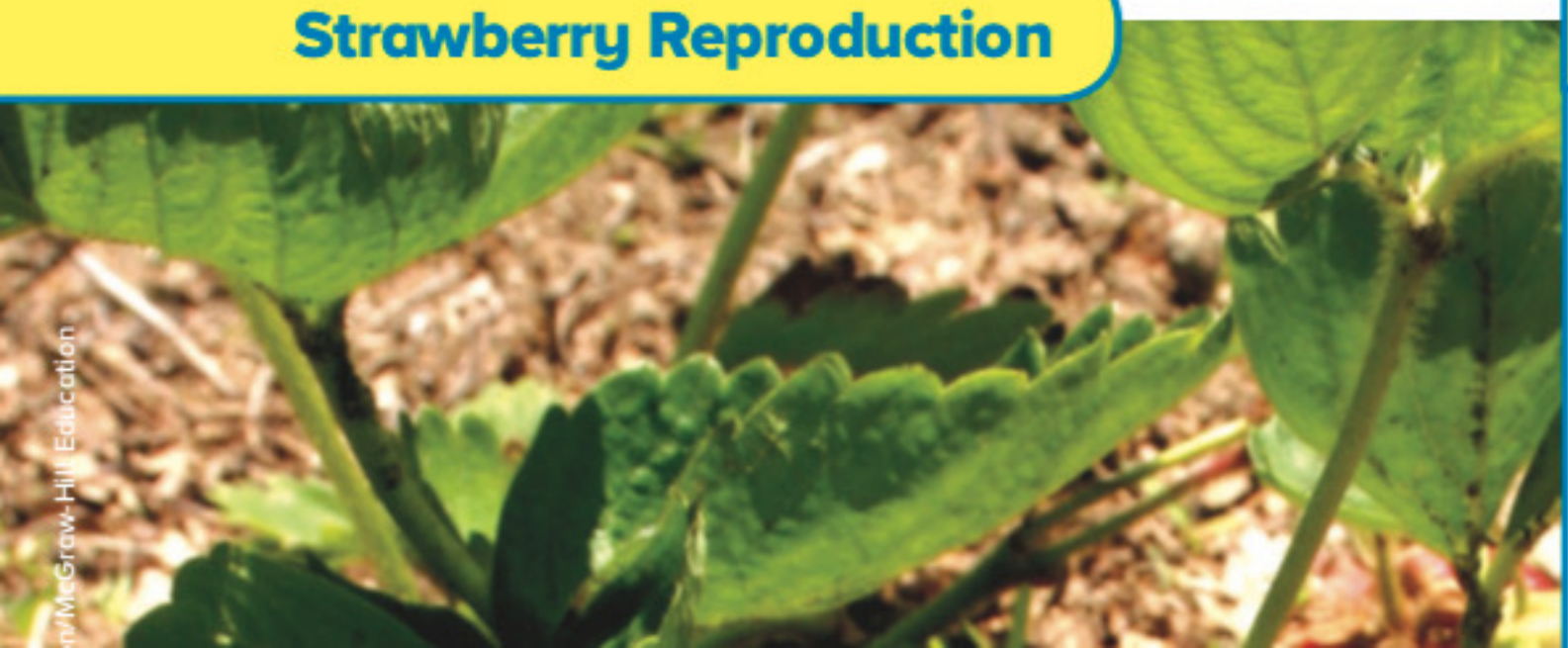
↓

The organism splits into two individuals.

Other Forms of Asexual Reproduction in Animals

Some species of fish, insects, frogs, and lizards go through asexual reproduction in a different way. The females of these animals produce egg Normally these eggs would be fertilized by mal sex cells, but in some cases, fertilization never take place. The eggs just develop into a new animal without fertilization. For example, when queen honeybees lay eggs, some are fertilized and othe are not. The fertilized eggs develop into females, workerbees. Theunfertilizedeggsbecomemales, drone bees.

Strawberry Reproduction



e well suited to their environment
produce equally well-suited
pring.

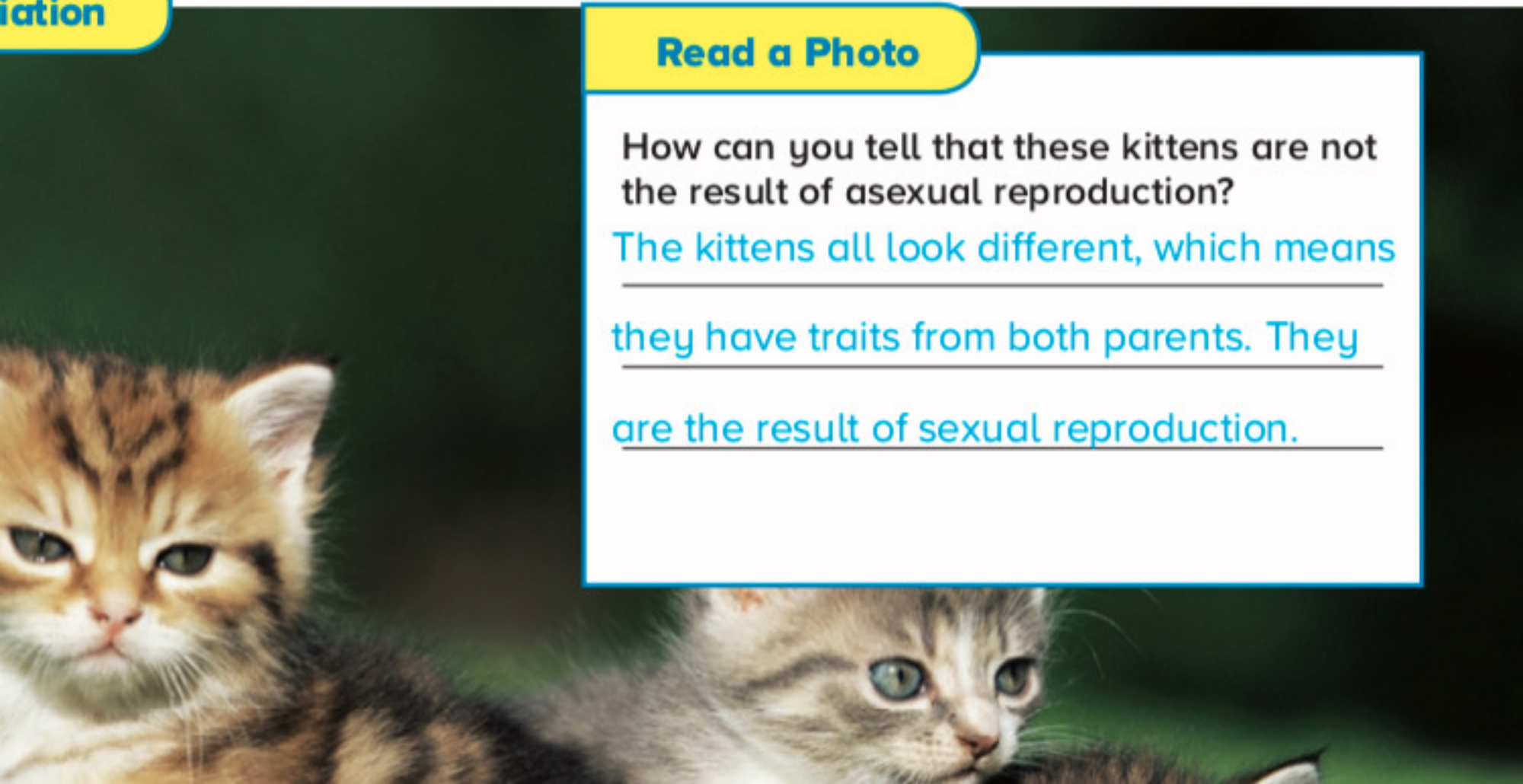
So why do organisms bother with
ual reproduction? One major
antage of sexual reproduction is that
omotes variety in a species. Sexual
roduction can give rise to offspring
are better suited to environmental

Quick Check

4. What is an advantage of asexual reproduction?

One advantage is that asexual reproduction can occur without a mate.

iation



Read a Photo

How can you tell that these kittens are not the result of asexual reproduction?

The kittens all look different, which means they have traits from both parents. They are the result of sexual reproduction.

Visual Summary

Complete the lesson summary in your own words.

Reproduction Possible answer: Living things come from other living things through reproduction.

Asexual Reproduction Possible answer: Splitting, budding, and vegetative propagation are methods of asexual reproduction used by a variety of organisms.

Sexual Reproduction Possible answer: Sexual reproduction promotes variety in a species.

Think, Talk, and Write

1. **Vocabulary** A runner is a form of asexual reproduction called

vegetative propagation

2. **Sequence** What happens after a bud forms on an organism?

small bud grows on parent

↓

bud may break off

↓

bud grows apart or attached to parent

3. **Critical Thinking** What are the advantages of sexual reproduction?

Sexual reproduction produces individuals with new traits that may be better suited to changes in the environment.

4. **Test Prep** Which best describes budding?

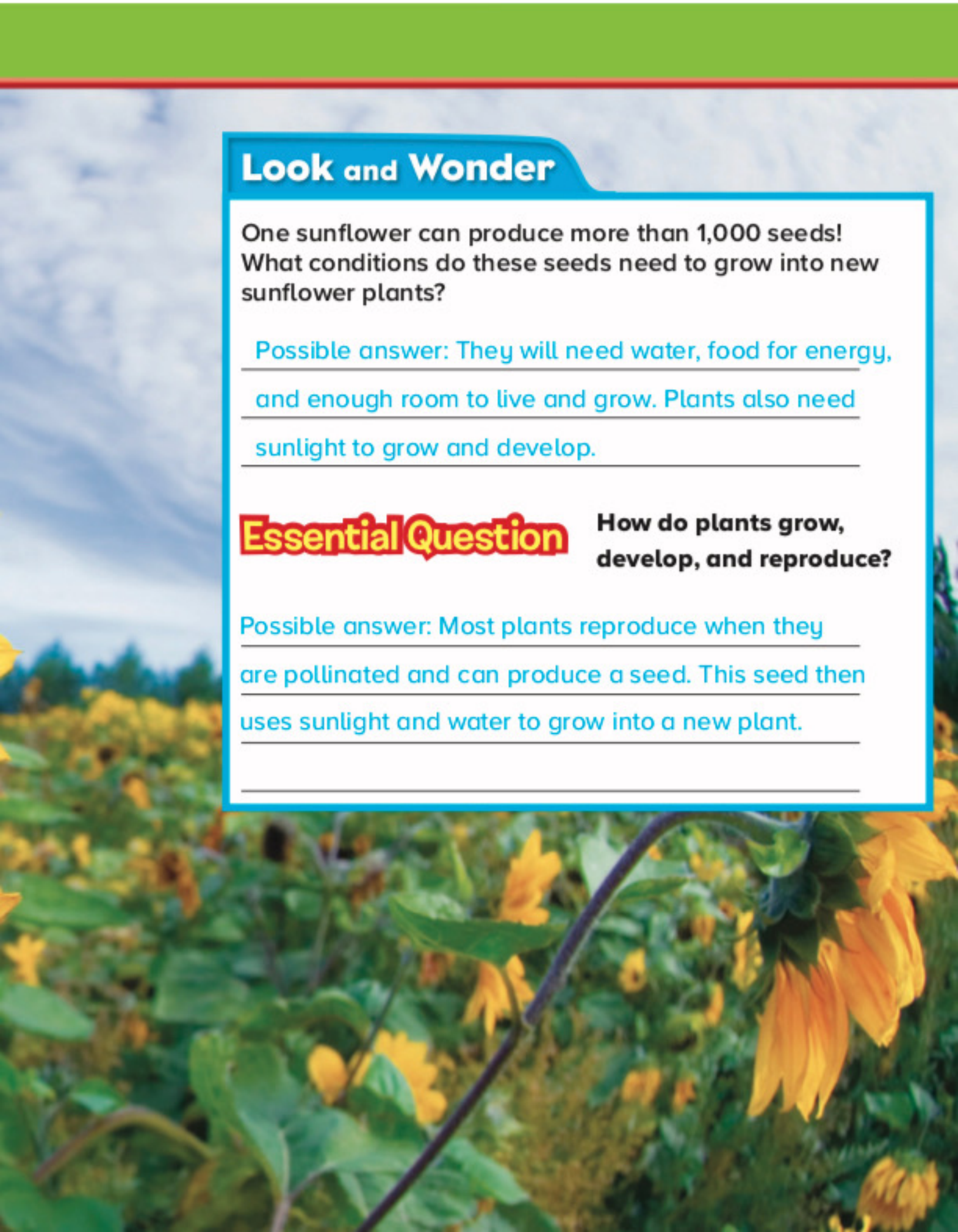
A offspring develop from a fertilized egg
B offspring develop on a parent
C offspring develop from a stem
D offspring develop from two parents

5. **Test Prep** Which organisms reproduce by splitting?

A bacteria **C** strawberries
B jellyfish **D** honeybees

Essential Question How do living things reproduce?

Budding, splitting, and vegetative propagation are types of asexual reproduction, which requires only one parent. Some organisms reproduce sexually when a male sperm cell joins with a female egg cell.



Look and Wonder

One sunflower can produce more than 1,000 seeds! What conditions do these seeds need to grow into new sunflower plants?

Possible answer: They will need water, food for energy, and enough room to live and grow. Plants also need sunlight to grow and develop.

Essential Question

How do plants grow, develop, and reproduce?

Possible answer: Most plants reproduce when they are pollinated and can produce a seed. This seed then uses sunlight and water to grow into a new plant.

Lesson 2

Plant Life Cycles

Look and Wonder

One sunflower can produce more than 1,000 seeds! What conditions do these seeds need to grow into new sunflower plants?

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5. After 5 days, fill 2 cups with potting soil.

6. Take each seed and place it into a cup with soil. Cover each seed with soil and sprinkle some water on top.

7. **Observe** Place the cups in a sunny spot. Water the seeds daily and look for any changes. Record your observations in your data table.

Draw Conclusions

8. What were the independent and dependent variables in this experiment?

The independent variable was the amount of moisture on the paper towel and the dependent variable was whether the seed germinated.

9. **Infer** What conditions were needed for your seeds to grow?

sunlight, proper placement in soil, regular watering

10. Did your results support your hypothesis?

Possible answer: Yes, my results supported my hypothesis. The seed in the moist environment germinated and sprouted.

Explore More

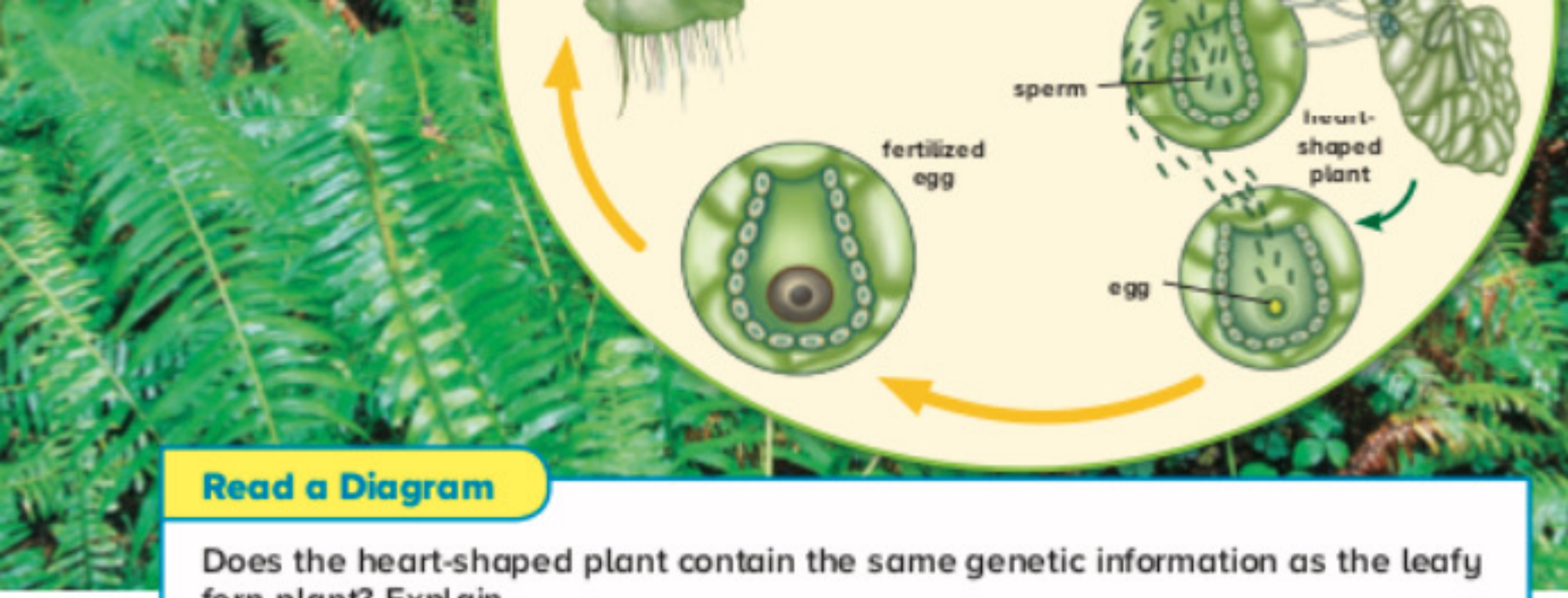
Keep observing your plant over time. What does your plant need to produce seeds? Make a prediction. Test your prediction and present your results to the class.

Answers will vary. Students should understand that their plant will need to produce flowers in order to produce seeds.

Open Inquiry

How important are seeds for a plant's survival?

Answers will vary.



Read a Diagram

Does the heart-shaped plant contain the same genetic information as the leafy fern plant? Explain.

Yes, the heart shaped plant comes from the spores produced by the leafy fern plant. Spores are the asexual stage of reproduction, so the heart-shaped plant has the same genetic information as the leafy plant.

Fern Life Cycle

Like mosses, ferns begin their life cycle with asexual reproduction. Ferns produce spores on the undersides of their fronds, or leaves. Spores are usually in clusters inside a spore case. When the spore case opens, the spores are released.

Fern spores that find the right conditions grow into small heart-shaped plants with male and female structures. Here, the fern undergoes sexual reproduction. The heart-shaped plant produces male and female sex cells.

If a male sex cell fertilizes a female sex cell, the fertilized egg forms a new plant. The new plant develops into a leafy fern plant. Spore cases on the fern's fronds produce spores, and the cycle continues.

Quick Check

1. **What causes the stalk and spore capsule to form in mosses?**

The fertilized egg develops on the female structure and forms the stalk and a spore capsule.

perfect/incomplete flower

nperfect/incomplete flower (female)

nperfect/incomplete flower (male)

flowers.

Quick Check

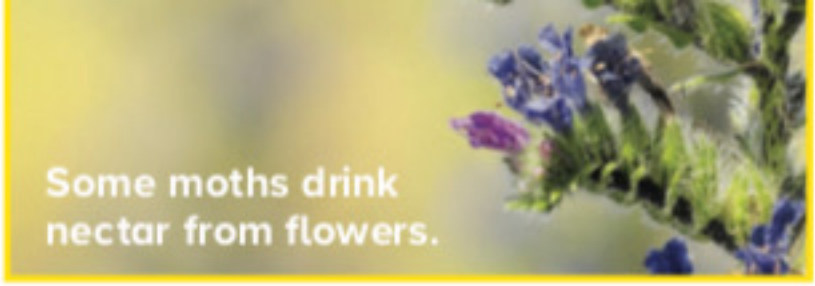
2. What is the main effect of being an imperfect flower?

An imperfect flower does not produce both egg and sperm cells.

Read a Chart

How do complete and incomplete flowers differ?

Complete flowers have petals, sepals, stamens, and pistils. Incomplete flowers are missing one or more of these parts.



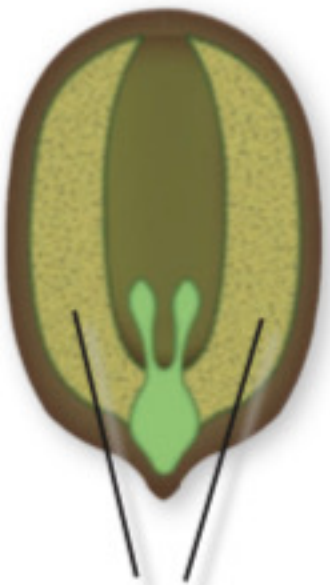
Some moths drink nectar from flowers.

Quick Check

3. Can pollination take place without fertilization? Explain your answer.

Yes, pollination means that the pollen has reached the female part of the flower. For fertilization to occur, male sex cells in pollen must move down the style and fertilize the egg in the ovary.

branched veins

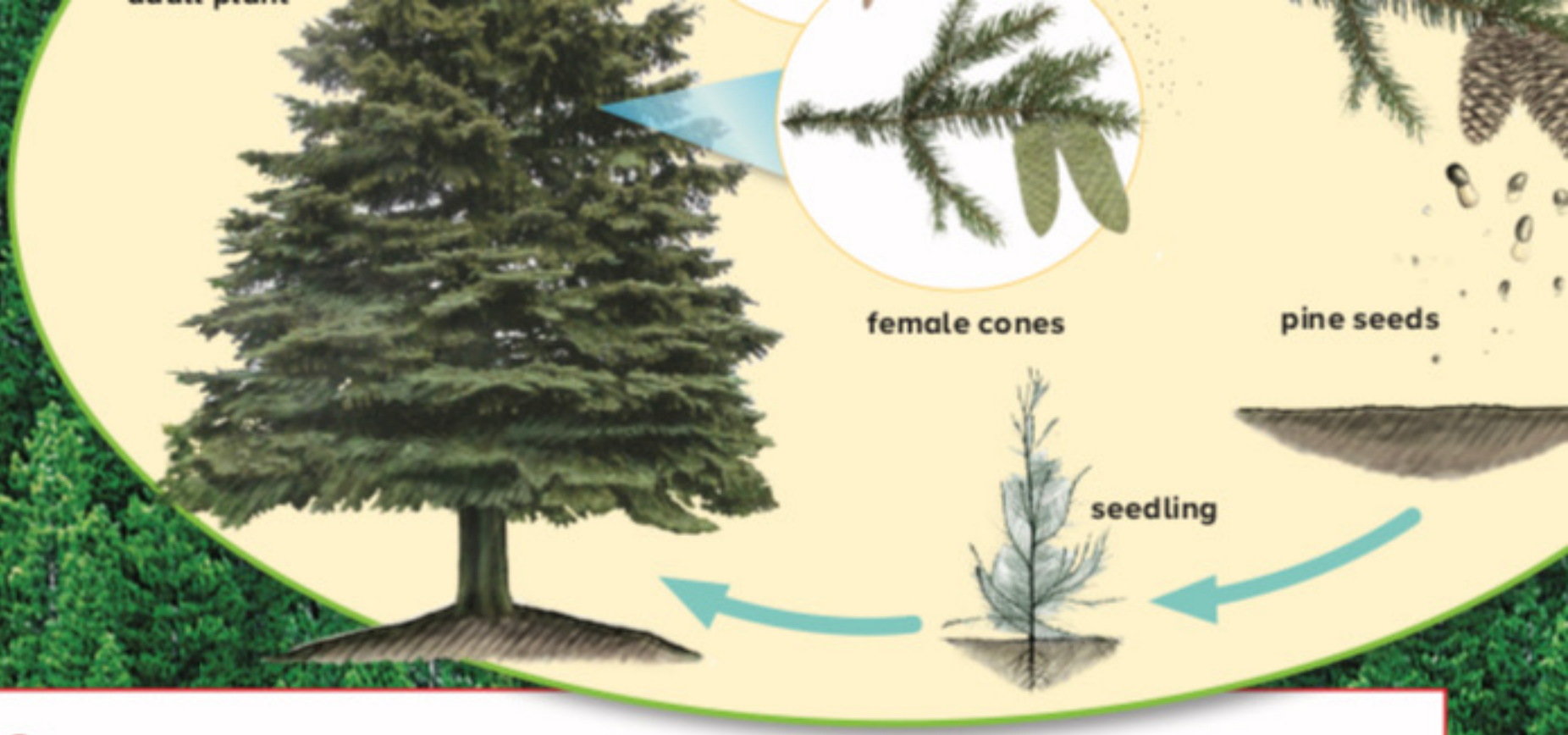


two cotyledons

Quick Check

4. Why are seeds able to wait for the proper conditions to germinate?

Seeds have tough seed coats for protection and to keep from drying out. They also contain a food supply.



Quick Check

5. How does the sticky fluid produced in female cones affect the conifer life cycle?

Pollination occurs when pollen grains land on the sticky fluid.

Visual Summary

Complete the lesson summary in your own words.

Plant Life Cycles Possible answer: All living things have life cycles. Plant life cycles include an alternation of generations.

Angiosperms Possible answer: Flowers are the reproductive organs of angiosperms. Angiosperm embryos are packaged in seeds.

Conifers Possible answer: Conifers are seed plants that produce cones rather then flowers.

Think, Talk, and Write

1 **Vocabulary** Plants with flower petals that appear in groups of three are monocots

2 **Cause and Effect** What effect does water have in the moss life cycle?

Cause	Effect
water carries sperm to female	→ fertilization takes place

3 **Critical Thinking** Can fertilization take place without pollination occurring in flowering plants?

Fertilization cannot take place without pollination.

4 **Test Prep** Flowers that are wind-pollinated are generally

(A) small and dull.
B colorful and small.
C dull and scented.
D large and colorful.

5 **Test Prep** Which is not part of a seed?

A embryo
B seed coat
C cotyledon
(D) stamen

Essential Question How do plants grow, develop, and reproduce?

Plants such as mosses and ferns reproduce using spores. Angiosperms are flowering plants that produce seeds. Conifers produce seeds, but they have cones. Plants grow and develop in different ways.

Skill Builder

▶ Apply It

1. Now it is time to use your diagram and other observations to answer questions. Which senses were used to **observe** this flower? Is this a perfect or imperfect flower? How can you tell?

Answers will vary. Students can use sight, touch, and smell to observe the flower. The flower is perfect if it has both stamen and pistils.

2. Continue to use your observation skills. Choose an object in your classroom, such as a stapler, a pencil sharpener, a TV, or the intercom system.

3. **Observe** Look at the object you chose. Make a diagram of the object. Include labels to identify any parts and how they are used. Write other observations, such as how it feels to the touch or the sound it

Lesson 3

Animal Life Cycles

Look and Wonder

After a duck lays eggs, it takes about 30 days for the eggs to hatch. How do ducklings develop into adults?

Possible answer: Ducklings grow and develop inside an egg, which provides them with protection, a moist environment, and food from the yolk.

Essential Question How do animals grow, develop, and reproduce?

Possible answer: Animals create offspring through sexual reproduction. Some lay eggs and others have live babies. The young organisms then go through a variety of growth stages.

Draw Conclusions

4 What was the shortest stage in frog development? What was the longest stage?

The shortest stage is from single cell to tadpole and the longest is between stages 2 and 3.

5 **Infer** When did the organism seem to change the most?

Possible answer: between the egg and the tadpole stage

6 How is the organism in stage 2 different from the organism in stage 4?

Stage 2 is more like a fish with gills and a tail. In stage 4, the tail is much shorter and the tadpole has four legs and no gills.

Explore More

How does the fertilized frog egg develop into a tadpole? Research for photographs of the first four days of a tadpole's life. Describe the changes you see.

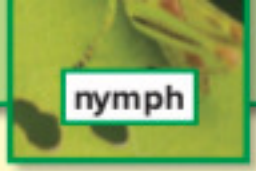
Answers will vary. Students should observe the fertilized egg dividing into more and more cells. The resulting embryo should be comma-shaped.

Open Inquiry

What does the tadpole look like as it gets older?

Answers will vary.

Metamorphosis
Grasshopper



Read a Diagram

Which metamorphosis stage is skipped in incomplete metamorphosis?

The nymph stage is the same as the larva stage in complete metamorphosis, and the pupa stage is skipped.

Incomplete Metamorphosis

a mammal. Instead, it sheds its

Quick Check

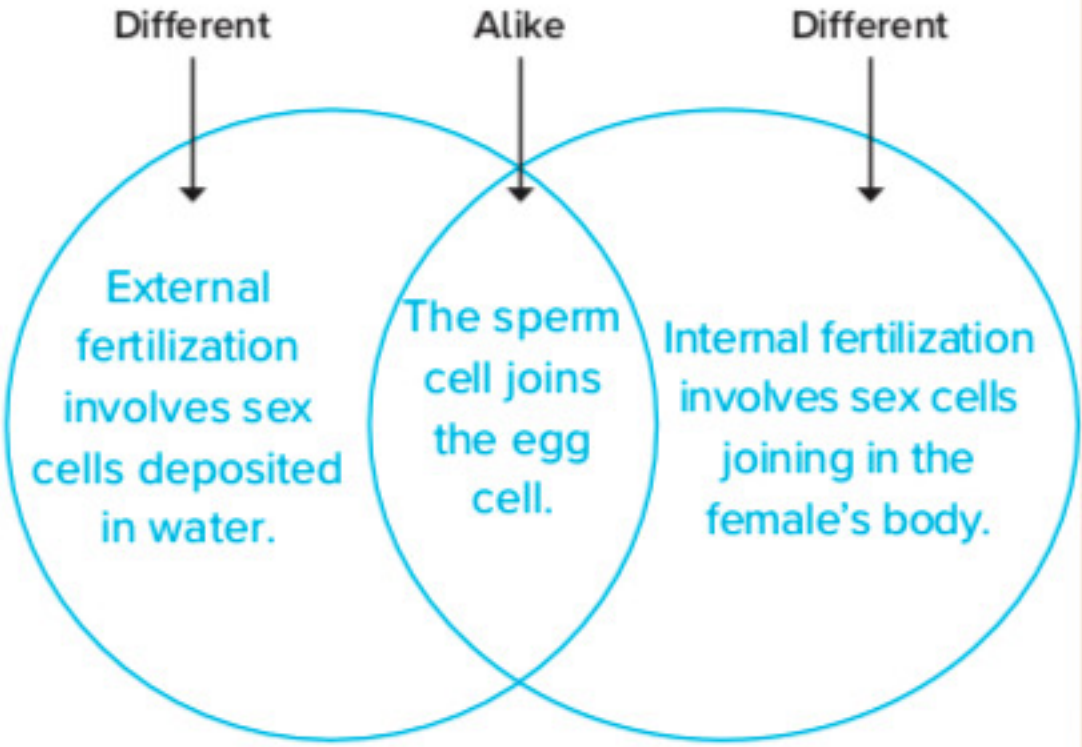
1. Why can't grasshoppers grow gradually?

They must shed their outer skeletons

to make room for a larger body size.

Quick Check

2. How are external and internal fertilization similar? How are they different?



s in water. A jellylike
provides some
ryos. The embryos
s of the eggs.

ggs have tough
tery liquid.
mbryo the wet
to develop and
g out. Because
rds can lay their
k inside the egg
with food.

te the safety of the
p further. Instead

Quick Check

3. Animals that lay more eggs, such as reptiles, tend to give less care to their offspring. Why might this be true?

Possible answer: Since reptiles invest less energy into caring for their young, they are forced to have more eggs to get a reasonable number of them to survive.

crocodile egg

chicken eggs

Read a Photo

Which egg provides the least protection for the developing embryo?

The frog egg provides the least protection because it is softer.

Visual Summary

Complete the lesson summary in your own words.

Metamorphosis Possible answer: Insects and amphibians develop in distinct growth stages as they go through the process of metamorphosis.

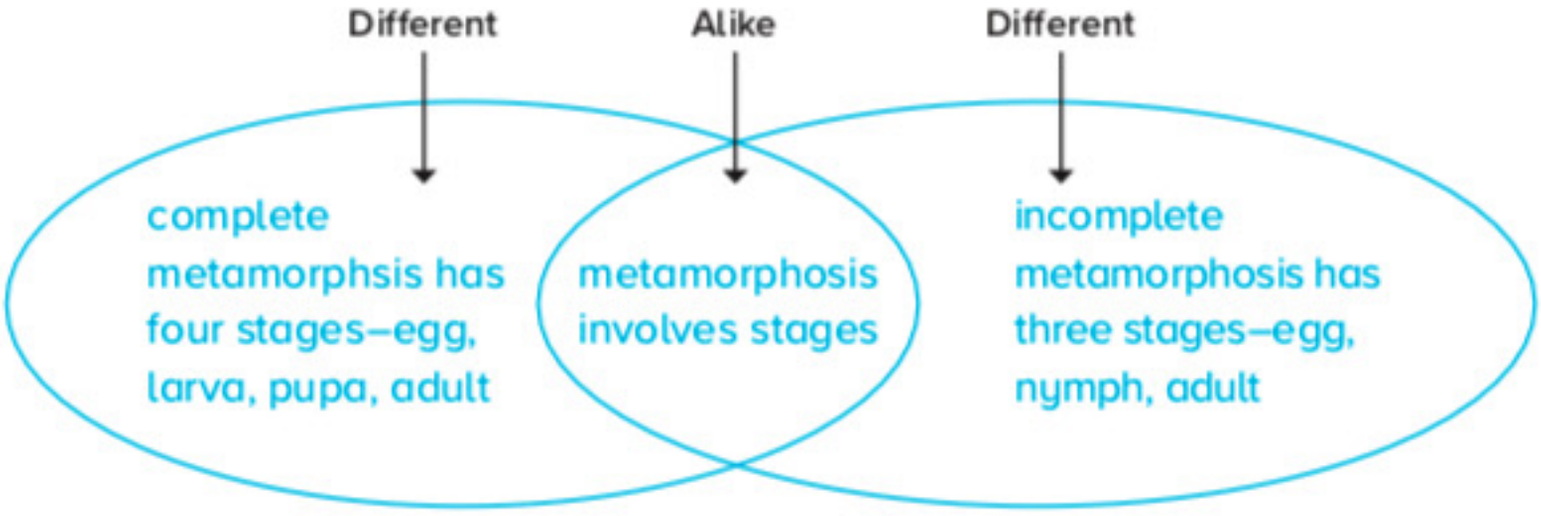
External and Internal Fertilization Possible answer: Eggs get fertilized outside of the body in the process of external fertilization. Some animals use internal fertilization to protect their eggs and developing offspring.

Eggs Possible answer: Animals have different types of eggs depending on their environments and life cycles.

Think, Talk, and Write

1 **Vocabulary** A hard, caselike cocoon forms during the pupa stage.

2 **Compare and Contrast** How do complete metamorphosis and incomplete metamorphosis compare?



3 **Critical Thinking** Chicken eggs have a large food supply for the embryo. Why don't most mammal eggs have this? Explain.

Most mammal eggs grow inside the female's body and get the nutrition they need from the mother.

4 **Test Prep** Animals that carry out internal fertilization generally
A produce many eggs.
B produce only one egg their entire life.
C produce thousands of offspring.
D produce a small number of eggs.

5 **Test Prep** Which stage is a caterpillar?
A egg
B larva
C pupa
D adult

Essential Question How do animals grow, develop, and reproduce?

Answers will vary. Animals grow, develop, and reproduce in different ways.

CHAPTER 2 Review

Visual Summary

Summarize each lesson in your own words.

Reproduction

All living things come from other living things.

Plant Life Cycle

The life cycles of all plants involve different stages of development.

Animal Life Cycle

Animals use different strategies to reproduce and ensure the survival of their offspring.

Vocabulary

Fill each blank with the best term from the list.

embryo	**metamorphosis**
fertilization	**pollination**
germination	**pupa**

1. The beginning of a new life form is called a(n) embryo
2. The stage in which a caselike cocoon forms around the organism is called the pupa.
3. Pollen is transferred from the stamen to the pistil of a flower during pollination
4. A sperm cell and an egg cell join into a single new unit during fertilization.
5. During its life cycle, a butterfly goes through a complete metamorphosis.
6. The development of a seed into a new plant is called germination.

CHAPTER 2 Review

Skills and Concepts

Answer each of the following.

7. Which part of the flower below is the arrow pointing to?

A a sepal
B a stamen
C a pistil
D a petal

8. **Observe** Look at a flower and draw it. Label any traits you notice. These may include the color of the flower's center and petals, the number of petals, and the length of the stem.

9. **Compare and Contrast** Compare wind-pollinated flowers and animal-pollinated flowers. Is this flower pollinated by animals or by the wind? Explain.

The flower is probably pollinated by animals or insects. It is large and bright to attract pollinators. Wind-pollinated flowers tend to be smaller and duller.

10. **Explanatory Writing** Explain the disadvantages of external fertilization.

The sperm cells may not be able to find and fertilize the egg cells. Sex cells can be lost or eaten by other animals. Sex cells are exposed to pollution and extreme temperature.

Test Prep

Circle the best answer for each question.

1. Study this picture.

This plant is reproducing using

A seeds.
B budding.
C cones.
D vegetative propagation.

2. Mosses and ferns reproduce using

A seeds. **C** spores.
B cones. **D** roots.

3. When complete metamorphosis occurs, an animal

A has the same structures in its adult and immature forms.
B becomes a nymph.
C goes through four distinct stages.
D goes through three distinct stages.

4. A perfect flower must have

A stamens and a pistil.
B petals and stamens.
C petals and leaves.
D sepals and an ovary.

5. What is the purpose of the yolk in a bird's egg?

A It protects the embryo from drying out.
B It contains food for the embryo.
C It keeps the embryo safe from other animals.
D It keeps the embryo warm.

6. Which diagram shows the pupa stage of the butterfly's life cycle?

A

B

C

D

7. The flowers of some plants are bright and colorful to

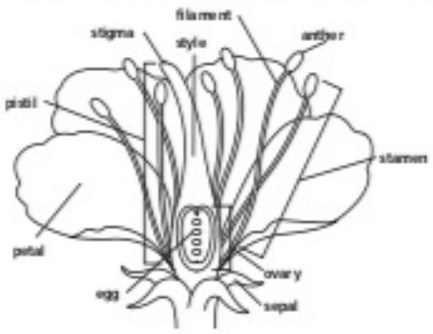
A entice people to cut them.

B warn other organisms that they are dangerous.

C capture light from the Sun.

D attract pollinators.

8. Study this diagram of a flower.



Identify the male and female parts of the flower. What is pollen and where it is produced? Explain how the egg is fertilized.

The male part of the flower is the stamen. The female part is the pistil. Pollen is a yellow powder that contains sperm cells and is produced in the anther on the stamen. The pollen is carried to the stigma. From there it passes down the style to the ovary, where it fertilizes the egg.