

TEACHING GUIDE



For Ages
9 to 13 years

English • STEM • Environment • Social Studies • Citizenship

Engage

LEARNING

Vol. 1, Issue 1, Levels 3-4

Dear Educator,

Welcome to the first issue of *Engage*, a classroom magazine for students from pre-K through class 6. *Engage* has four reading levels. Since all levels carry the same articles, adjusted for appropriate content load and reading level, you can mix and match levels, or use just one level. All the levels will engage your students with great nonfiction content.

Each of the six issues in the year will take your students on amazing adventures around the globe. Join scientists as they advance our knowledge of the world and its cultures. Each article is correlated to your curriculum. You can use the articles to engage students in learning or to review what you have already taught them.

In this issue, students will learn about the solar system, animal adaptations, and the cultural traditions of the Gurung of Nepal.

- Introduce your students to India's first interplanetary spacecraft as it explores the Red Planet in 'Mars on a Budget'. Then blast off to the eight planets in our solar system.
- In 'Honey Hunters', journey to Nepal to join the Gurung as they hunt for honey on steep cliffs in the foothills of the Himalayas.
- Travel around the world to discover odd animal adaptations in 'Crazy Critters'.

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MEET THESE STANDARDS

- ✓ **Space Science:** Understand that eight planets make up the solar system, and each planet has its own characteristics.
- ✓ **Life Science:** Understand that adaptations are traits that help animals survive.
- ✓ **Social Studies:** Understand that cultures have unique traditions.

MARS ON A BUDGET

Learning Outcomes

Students will learn that all objects with matter have gravity, and that gravity is a force that pulls on objects. Students will also learn about the planets in the solar system.

Before Reading

BUILD BACKGROUND

Before handing out this issue, ask students: What is the solar system? Have students discuss the objects in the solar system.

Level 3 Students should include the sun and eight planets.

Level 4 Students should add moons, asteroids, comets, and dwarf planets. Make sure that students know the differences between each of these objects, especially planets and dwarf planets. A dwarf planet is smaller than a planet and does not have the gravity to clear a path around the sun.

After finishing the discussion about the objects in the solar system, pick up an object and drop it on the floor. *Then ask:* What happened? Explain to students that gravity caused the book to fall to the floor. *Say:* Gravity is an invisible force that all objects made of matter have. The more matter there is in an object, the more gravity it has. Make sure that students understand that the size of an object doesn't affect the amount of gravity it has. A large object with little matter can have less gravity than a small object with lots of matter. You can illustrate this point by asking students which has more gravity, a ball made of iron that is 5 cm in diameter or a basketball? A basketball is larger than the iron ball, but a basketball does not have as much matter as the iron ball, so the iron ball has more gravity.

STEM Connection

For **Level 3 Students**, continue the discussion by explaining that gravity is a force that pulls objects. You may want to explain the difference between a push and a pull. Earth is an object that has matter and gravity. The amount of



matter in an object is called mass. Earth's gravity pulls on other objects. Tell students that they can move away from Earth's gravity by moving very fast. They must move at least as fast as 11.2 km/sec to escape from Earth's gravity.

For **Level 4 Students**, add to this discussion by explaining that the speed that they have to reach to move away from an object's gravity is called escape velocity. *Ask them:* How fast is Earth's escape velocity. They should repeat the velocity you gave them earlier, 11.2 km/sec.

You can illustrate how fast this is by asking students to imagine that they are in a car driving at 100 km/hr from Mumbai to New Delhi, which are 1,410 km apart. Tell younger students that it will take them 14.1 hours to reach their destination. Have older students calculate the time by dividing 1,410 km by 100 km. Then tell students that they are in a rocket racing from Mumbai to reach their destination. Have older students calculate the time in seconds (*125.9 seconds*) and then in minutes by dividing the number of seconds by 60. (*21 minutes*).

Build Word Power

For **Level 3 Students**, write the words below on the board. Then write their definitions in reverse order. Ask students to match each word with its correct definition.

Mangalyaan: Sanskrit for Mars craft

escape velocity: the speed needed to move away from an object's gravitational force

gravity: an attractive force that all objects have

After discussing the definitions, have students add the words to their science notebook.

For **Level 4 Students**, write the words on the board without their definitions.

Ask them what each word means. After discussing each definition, write it next to the word it defines. Then have students add the words to their science notebook.

Ready to Read

Hand out copies of *Engage Magazine* and have students turn to pages 2-3.

Pages 2-3

Direct students' attention to the photo on the spread and ask them what it shows. (*India's first interplanetary spacecraft.*) Then Hand out the KWL diagram in this Teaching Guide, and have them complete the first two columns—'What I Know' and 'What I Want to Know'. After students finish reading have them complete the last column 'What I have Learned'. Then ask them how they can find the answers to their questions.

Pages 4-5

Ask **Level 3 Students** to explain why the rocket had to reach 11.2 km/sec. (*to escape Earth's gravity.*)

Ask **Level 4 Students** to explain 'escape velocity'. (*The speed a rocket has to reach in order to escape an object's gravity. On Earth, the escape velocity is 11.2 km/sec.*)

STEM Connection

Ask students to calculate their weight on Mars using the formula on the page.

Ask **Level 3 Students** if they weigh more or less on Mars than they do on Earth (*less*). Then ask them to explain why. (*Mars has less matter and gravity than Earth.*)

Ask **Level 4 Students** if they weigh more or less on Mars than they do on Earth (*less*). Then ask them to explain why. (*Mars has less mass than Earth, and has less gravity.*) Continue the discussion by asking students to predict if they would weigh more or less on each of the other six planets. Then have students use the following formulas to calculate their weight on each planet:

Mercury: Your weight $\times 38 \div 100$

Venus: Your weight $\times 91 \div 100$

Mars: Your weight $\times 38 \div 100$

Jupiter: Your weight $\times 234 \div 100$

Saturn: Your weight $\times 106 \div 100$

Uranus: Your weight $\times 92 \div 100$

Neptune: Your weight $\times 119 \div 100$

After students finish their calculations, ask them to discuss their weights on each planet. They should be able to identify the planets on which they weigh less than on Earth (*Mercury, Venus, and Mars*), and on which planets they weigh more (*Jupiter, Saturn, Uranus, and Neptune*).

Have **Level 3 Students** make a table that shows their weight on each planet. The table should have two columns, one of the name of each planet and one for their weight in kilograms.

Have **Level 4 Students** make a bar graph that shows their weight on each planet. The name of each planet must be across the x-axis and their weight on the y-axis.

Pages 6-7

Direct students' attention to the photos of Mars. Invite them to read the captions. Discuss the photos by asking students to talk about the features they see and how those features compare to features they would find on Earth. Make sure to point out that students would see water on Earth, but not on Mars.

STEM Connection

Direct **Level 3 Students'** attention to the photo of Vallis Marineris and tell them that it would stretch across the widest part of India. Have them use the Internet or other resources to find out how wide India is and then infer the length of Vallis Marineris. (*India is 2,933 km wide; Vallis Marineris is 3,000 km long.*)

For **Level 4 Students**, explain that the Grand Canyon in the United States is the largest canyon on Earth. Tell them that the Grand Canyon is about 800 km long. Ask them to calculate how much longer Vallis Marineris is. (*Divide 3,000 km by 800 km, which is 3.75, so compared to the Grand Canyon, Vallis Marineris is 3.75 times longer. In other words you could fit nearly four Grand Canyons inside Vallis Marineris.*)

Pages 8–9

Write the names of the first four planets on the board—Mercury, Venus, Earth, and Mars. Ask students what these planets have in common. (*The planets are all small, rocky worlds that are close to the sun.*)

Then have students read the two pages.

Pages 10–11

Write the names of the remaining four planets on the board—Jupiter, Saturn, Uranus, and Neptune. Ask students what these planets have in common. (*The planets are all very large and made mostly out of gasses. They are also far from the sun.*)

Then have them read the spread.

sciQ

Share this amazing Mars fact:

Even though Mars is about one-quarter the size of Earth, Mars and Earth have about the same amount of dry land. This is because water covers about 70 percent of Earth's surface.

After Reading

Extension Activities

Use these activities for Level 3 Students.

1 Your Mission: Split students into eight groups and then assign each group a planet. Then tell them that they are ISRO scientists

who are going to design a mission to their assigned planet. Ask each group to come up with one question they would like to learn about their planet. Have one student write the question down, and write all eight questions on the board. Discuss the questions with the whole class, asking for ways that they could improve their questions. Explain that this is what scientists do so that they are asking the best questions. Then have them think about how a spacecraft would explore that planet to answer their question. Direct them to think about the equipment that the spacecraft would have to answer the question. Ask them if the spacecraft would have to orbit the planet, land on the planet, or both. Then ask them: Would it have to move around on the ground or in the air? What would it need to do that? Explain that they will also have to think of the unique environmental conditions on each planet.

2 Draw Your Spacecraft: Ask students to draw the spacecraft and label the scientific equipment needed to answer their question. Have them explain how the equipment will answer the question. Also have them label all the different parts on the spacecraft and write a sentence that explains what each part does. Also ask each group to name its spacecraft and to explain the name.

3 Mission Log: Have students write three or four sentences to explain what the conditions on the planet are like. Then have them write a hypothesis or possible answer to their question. Tell students that this is what a scientist does. A scientist first asks questions. Then develops a hypothesis that might answer the question. Then the scientist tests the hypothesis through observations or experiments to see if it is correct. If the hypothesis is incorrect, the scientist develops a new hypothesis.

Use these activities for Level 4 Students.

1 Your Mission: Split students into groups and tell them that they are ISRO planetary scientists. Assign each group a planet and tell them they are going to design a spacecraft to study that planet. Have them research their planet on the Internet and in books. After the teams conclude their research, have them develop questions they would like to learn

about their assigned planet. Have each group select three questions they would like to answer and write each team's three questions on the board. Have the teams discuss the questions and try to improve them. Explain that this is what teams of scientists do.

2 Draw Your Spacecraft: Tell students that they are going to design a spacecraft that ISRO will launch to study their assigned planet. Have them identify the equipment that the spacecraft will need to answer the questions. Also have them discuss the other equipment that the spacecraft will need: Will the craft orbit the planet, land on the planet, or both? Will the craft land on a solid surface or will it fly through a gassy atmosphere? What will the terrain on the planet look like? Will the craft need wheels, tracks, or wings? How will the craft send information back to Earth? Have students draw the spacecraft and label the scientific equipment needed to answer their questions. Have them write a sentence or two that explains what the equipment does. Have them label the other parts on the craft and write a sentence about what each part does. write a sentence about what each part does.

3 Mission Log: Have students write a hypothesis that answers each of their three questions. Explain that a hypothesis is a thoughtful guess that answers a question. An example of a question is: Does water flow on Mars? A hypothesis that goes along with this question is: Water flows on Mars, but not on the surface. It flows just under the surface. Have students explain how their spacecraft will prove the hypothesis is correct. Explain that this is what a scientist does. Scientists then run tests and make observations to prove whether the hypothesis is correct. If the hypothesis turns out to be false, a scientist develops a new one.

Video Hub

Watch these exciting videos:

Travel to Mars with Mangalyaan: <https://www.youtube.com/watch?v=OIKunbW-Ch4>

Learn about Mangalyaan: <https://www.youtube.com/watch?v=S6bZEJ9Pk3Y>

Launching Mangalyaan: <https://www.youtube.com/watch?v=BhGI5jHnPIQ>

Mangalyaan orbits Mars: <https://www.youtube.com/watch?v=vzPUXOckWF8>

MARS—KWL

Before, reading, write what you know about Mars and the planets, and what you want to know about Mars and the planets. After reading, write what you learned.

What I already know about Mars and the planets	What I want to learn about Mars and the planets	What I learned about Mars and the planets

MARS: Level 3 Comprehension Check

After reading 'Mars on a Budget', answer the questions.

1. How fast does a rocket have to move to escape Earth's gravity? _____

2. On what date did *Mangalyaan* begin orbiting Mars? _____

3. How much did the *Mangalyaan* mission cost? _____

4. To revolve is another way of saying to orbit. What does revolve mean? _____

5. Why are the four planets closest to the sun called rocky planets? _____

• _____

6. What do the last four planets in the solar system have in common? _____

7. What is the hottest planet? _____

8. On which planet would you find the Great Red Spot? _____

9. Which planet rolls like a ball around the sun? _____

10. Explain what might have caused the planet named in question 9 to tip over. _____

Answer Key

MARS: Level 3 Comprehension Check

After reading 'Mars on a Budget', answer the questions.

1. How fast does a rocket have to move to escape Earth's gravity? 11.2 km/sec
2. On what date did *Mangalyaan* begin orbiting Mars? 24 September 2014
3. How much did the *Mangalyaan* mission cost? 4.5 billion rubies
4. To revolve is another way of saying to orbit. What does revolve mean? To go around

5. Why are the four planets closest to the sun called rocky planets? They are all made out of rocks.

6. What do the last four planets in the solar system have in common? They are all made out of gas.

7. What is the hottest planet? Venus.
8. On which planet would you find the Great Red Spot? Jupiter.
9. Which planet rolls like a ball around the sun? Uranus.
10. Explain what might have caused the planet named in question 9 to tip over. Answers will vary, but should involve another large space object colliding with Uranus, pushing it over.

MARS: Level 4 Comprehension Check

After reading 'Mars on a Budget', answer the questions.

1. What is escape velocity? _____

2. On what date did *Mangalyaan* begin orbiting Mars? _____

3. How much did the *Mangalyaan* mission cost? _____

4. Why, do you think, the story is called 'Mars on a Budget'? _____

5. Why are the four planets closest to the sun called rocky planets? _____

6. What do the last four planets in the solar system have in common? _____

7. Is the closest planet to the sun the hottest planet? If not, explain why _____

8. On which planet would you find the Great Red Spot? _____

9. Which planet rolls like a ball around the sun? _____

10. Based on what you know, if there is an undiscovered planet beyond Neptune, would it be a small, rocky world or a gas giant? _____

Answer Key

MARS: Level 4 Comprehension Check

After reading 'Mars on a Budget', answer the questions.

1. What is escape velocity? The velocity a rocket has to reach to pull away from Earth.

2. On what date did *Mangalyaan* begin orbiting Mars? 24 September 2014

3. How much did the *Mangalyaan* mission cost? 4.5 billion rubies

4. Why, do you think, the story is called 'Mars on a Budget'? Because Mangalyaan was developed for fewer rubies than a bridge in Mumbai for the movie *The Martian*.

5. Why are the four planets closest to the sun called rocky planets? They are all made out of rocks.

6. What do the last four planets in the solar system have in common? They are all made out of gas.

7. Is the closest planet to the sun the hottest planet? If not, explain why No. Venus is the hottest planet. The clouds on Venus trap the sun's heat, causing the temperature to rise.

8. On which planet would you find the Great Red Spot? Jupiter.

9. Which planet rolls like a ball around the sun? Uranus.

10. Based on what you know, if there is an undiscovered planet beyond Neptune, would it be a small, rocky world or a gas giant? A gas giant. All the planets beyond Mars are gas giants.

I would expect this pattern to continue.

HONEY HUNTERS

Learning Outcomes

Students will learn that cultures pass traditions from generation to generation. They will also learn that some animals pollinate flowers.

Before Reading

BUILD BACKGROUND

Before reading 'Honey Hunters', ask students: Do animals need plants? Discuss the different ways animals depend on plants.

Level 3 Students should discuss how some animals depend on plants for food and shelter.

Level 4 Students should discuss how some animals depend on plants for food and shelter. They should add to the discussion that plants give off oxygen, a gas that animals need to breathe. Without plants, animals could not survive.

After students finish the discussion about how animals depend on plants, change the topic and ask: How do plants depend on animals.

Level 3 students should discuss how plants depend on animals, such as bees, to reproduce. Animals move pollen from one flower to another flower to help plants reproduce. They could also discuss how animals move seeds around. This helps new plants grow in different places.

Level 4 students should discuss how animals give off carbon dioxide, a gas that plants need to survive. Plants also depend on animals, such as bees to reproduce. Animals move pollen from one flower to another flower to help plants reproduce. Then discuss how animals move seeds around. This helps new plants grow in different places. Since plants make oxygen and provide food for animals, all animal life on Earth depends on plants.

Build Word Power

For **all students**, write the following words on the board. Then read aloud one of the definitions. Ask which word it defines and then write the definition next to the correct word. Repeat this for each word.



tradition: to pass on a custom or belief from generation to generation

migrate: to move from one place to another

pollen: a powder that forms on a flower's anther

pollination: to deposit pollen on a stigma

pollinator: something that moves pollen

After discussing the definitions, have students add the words to their science notebook.

For **all students**, circle the word **tradition** and then ask: What traditions do you have? Have students discuss their various traditions. Then ask students to pick one of their traditions and write a paragraph or two about it. You could select certain students to volunteer to read their paragraphs to the rest of the class.

Have **Level 4 students** look at the words **pollen, pollination, and pollinator**. Ask students what these three words have in common. (*the word 'pollen'*). Explain that **pollen** is a root word. A root word is a word that can be used to make other words.

Ready to Read

Have students turn to pages 12–13 of *Engage Magazine*.

Pages 12–13

Direct students' attention to the photo and ask what it shows. (*A honey hunter is using a pole to cut a honeycomb off a cliff.*) Then ask them to predict what they think the article will be about. Write student predictions on the board and then come back to the predictions after students finish reading to check the them. (*The story is about people who hunt honey by cutting honeycombs off of cliffs.*)

Pages 14–15

On a map, locate Nepal and Tibet.

Ask students what traditions have the Gurung passed on. (*honey hunting, the methods to gather honey, and the religious ceremonies the Gurung practice before going on a honey hunt.*)

STEM Connection

Ask students to explain what migration is. After discussing how the Gurung migrated, ask: Do animals migrate? (*yes*) Then ask: Why might animals migrate? (*Their habitat might change with the seasons. They might need food. They might have special places to reproduce.*)

Tell students that all bees have the same parts. Hand out the diagram of a bee and have students answer the questions that go with the diagram.

Direct **Level 4 students** to find a similar diagram of a spider and then have them compare the similarities between a bee, which is an insect and a spider, which is an arachnid. (*An insect has three main body parts and six legs. A bee and some other insects have wings. A spider has two main body parts and eight legs. No spiders have wings.*)

Pages 16–17

Direct students' attention to the photo of the bee on page 16. Using the diagram of the bee you handed out earlier, ask students to identify each body part that they can find in the photo. You could have students make labels and affix them to the photo to turn the photo into a labeled diagram. Direct **Level 4 students** to

research the terms head, thorax, and abdomen. Have them write a sentence describing each part and affix it to the diagram, too.

STEM Connection

Explain to students that plants have ways to attract pollinators. They use shape, color, and smell to attract animal pollinators. Hand out the 'Designer Flower' reproducible and have them complete it. It will help them understand that flowers have adaptations that help them attract specific pollinators. You might refer back to this after students read 'Crazy Critters', which is about adaptations.

Have **Level 4 students** cut photos of flowers out of magazines or print them from the internet. Ask students to identify how the flowers attract pollinators.

Pages 18–19

Copy the 'What's in a Flower?' Reproducible and hand it out to students. Have them use the diagram on page 17 of their issue to label the parts of a flower. Also, have them explain why each part is important.

STEM Connection

Tell all students that bees take nectar from 1 million flowers to make 454 grams of honey. Ask **Level 3 students**: How many flowers are needed to make 4,540 grams of honey (*10 million*). Ask **Level 4 students**: How many flowers will it take to make 1 kilogram of honey. (*There are 1,000 grams in 1 kilogram, so students will need to divide 1,000 by 454 and then multiply the answer by 1 million, which is 2.2 million flowers.*)

Pages 20–21

Ask students what they can do to help protect the environment. Discuss other activities that they could do that involve reducing, reusing, and recycling. Ask students what they could do at school, at home and in their communities to make people aware that their individual decisions could help improve the environment for everyone. Have them make posters that they can hang around the school to tell fellow students about the importance of protecting the environment.

sclQ

Share this amazing bee fact:

- A bee flaps its wings about 11,400 times a minute. This is what causes a bee's distinctive buzzing sound. If bees beat their wings faster, the buzzing sound would have a higher pitch. If they beat their wings less frequently, the buzzing sound would have a lower pitch. If possible, ask students if they could compare the sound a bee makes to the sound a fly or a mosquito makes. Have them discuss which insect beats its wings the fastest and which beats its wings the slowest. Ask them to support their answer.

After Reading

Extension Activities

- 1 Tell students that all living organisms in a habitat are connected. Have students research the animals that live in the foothills of the Himalayas. Then have them draw a diagram that shows how these organisms are connected to bees. They should include both plants and animals in their diagrams.
- 2 Explain to students that three different kinds of bees live in a hive. They are the queen, workers and drones. Have them research these bees and then draw a diagram of a hive that shows what these three kinds of bees do. Have **Level 4** students write a short paragraph that tells about each kind of bee.
- 3 Tell students that scientists estimate that animals pollinating plants contributes to three-fourths of the world's crops. Have students pick their favourite food. Then list all the different pollinators that could pollinate that plant.

Video Hub

Watch these exciting videos.

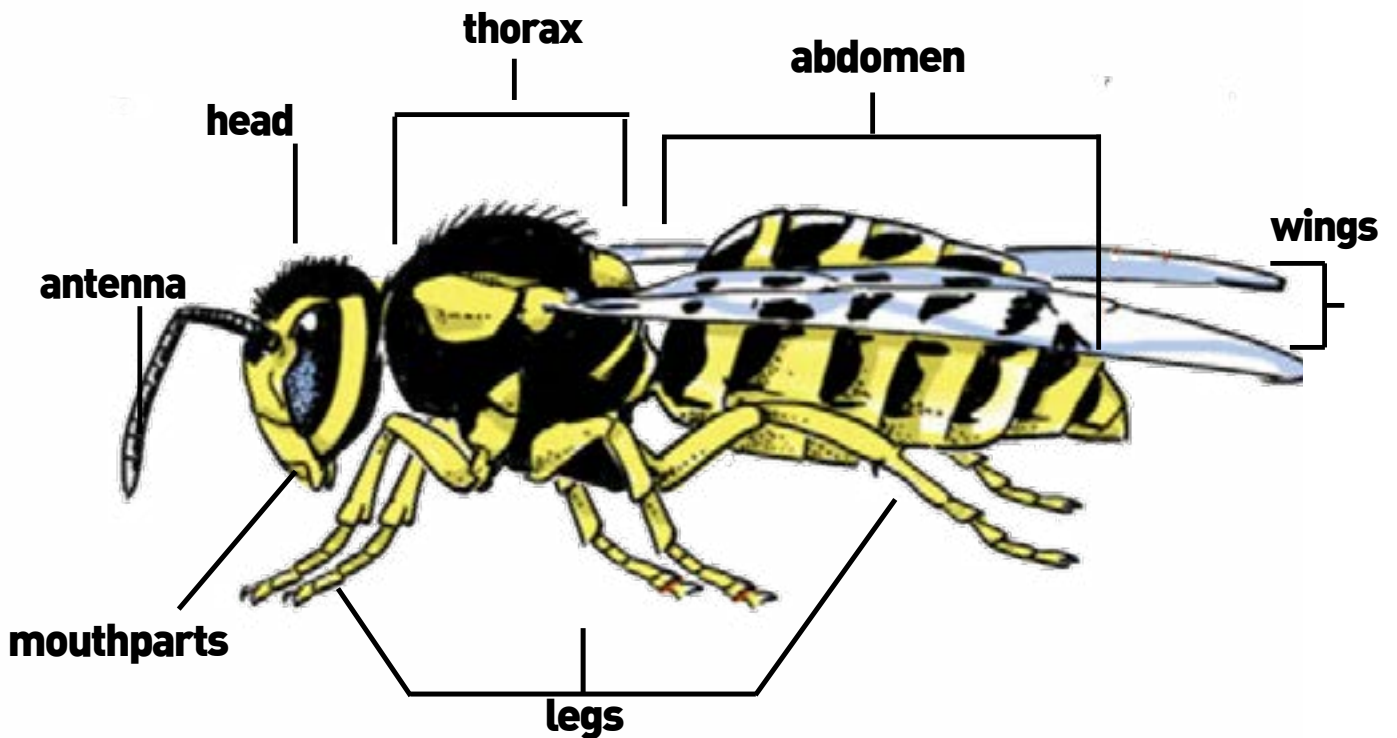
Watch a slideshow about the honey hunters: <https://www.youtube.com/watch?v=LZrwTTpSWCM>

Meet the Gurung: <https://www.youtube.com/watch?v=twNayHO9Mg8>

Watch a talk about pollination: https://www.ted.com/talks/louie_schwartzberg_the_hidden_beauty_of_pollination

Fly with a Bee

Study the diagram. Then answer the questions.



1. How many main body parts does a bee have? _____

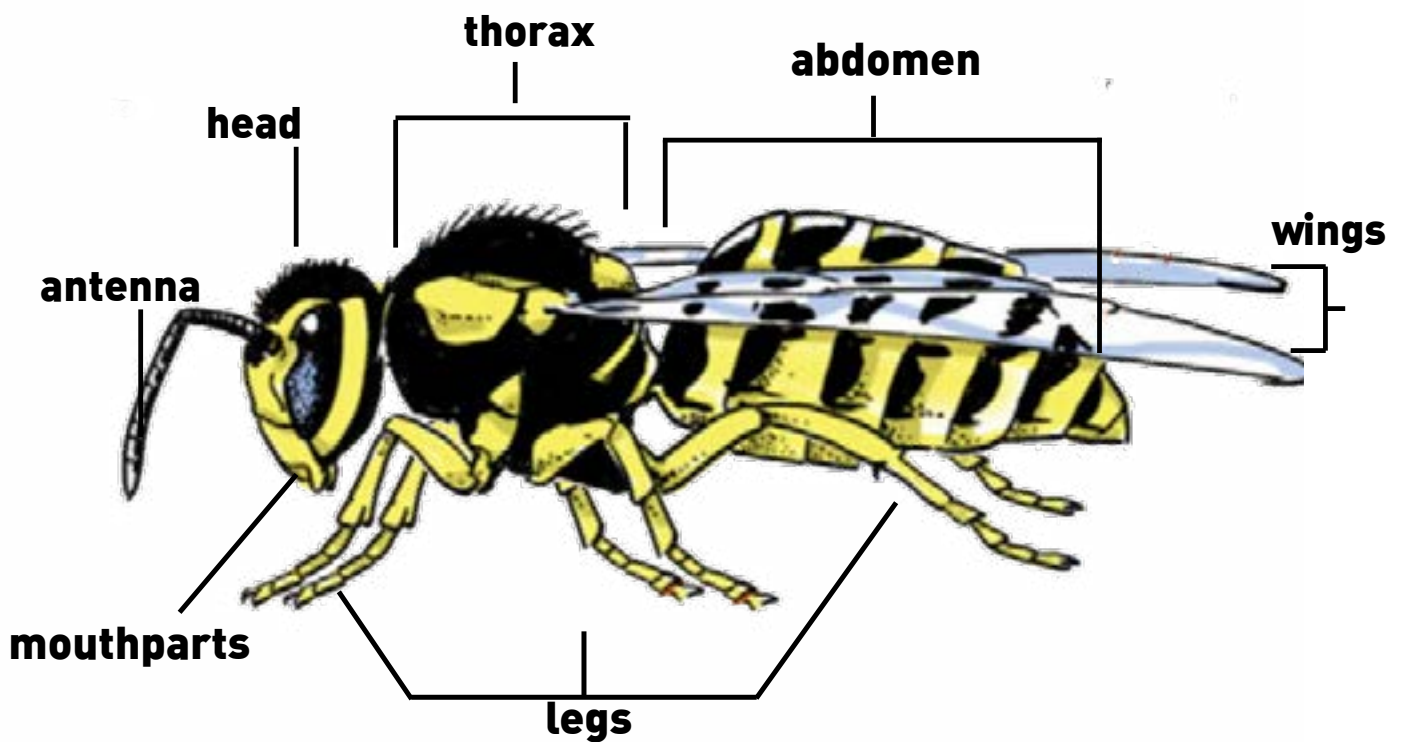
2. How many legs does it have? _____

3. Does a bee have hair? _____

Answer Key

Fly with a Bee

Study the diagram. Then answer the questions.



1. How many main body parts does a bee have? Three
2. How many legs does it have? Six
3. Does a bee have hair? Yes

Name _____

Date _____

Designer Flowers

1. What is your favorite colour? _____

2. What is your favourite shape? _____

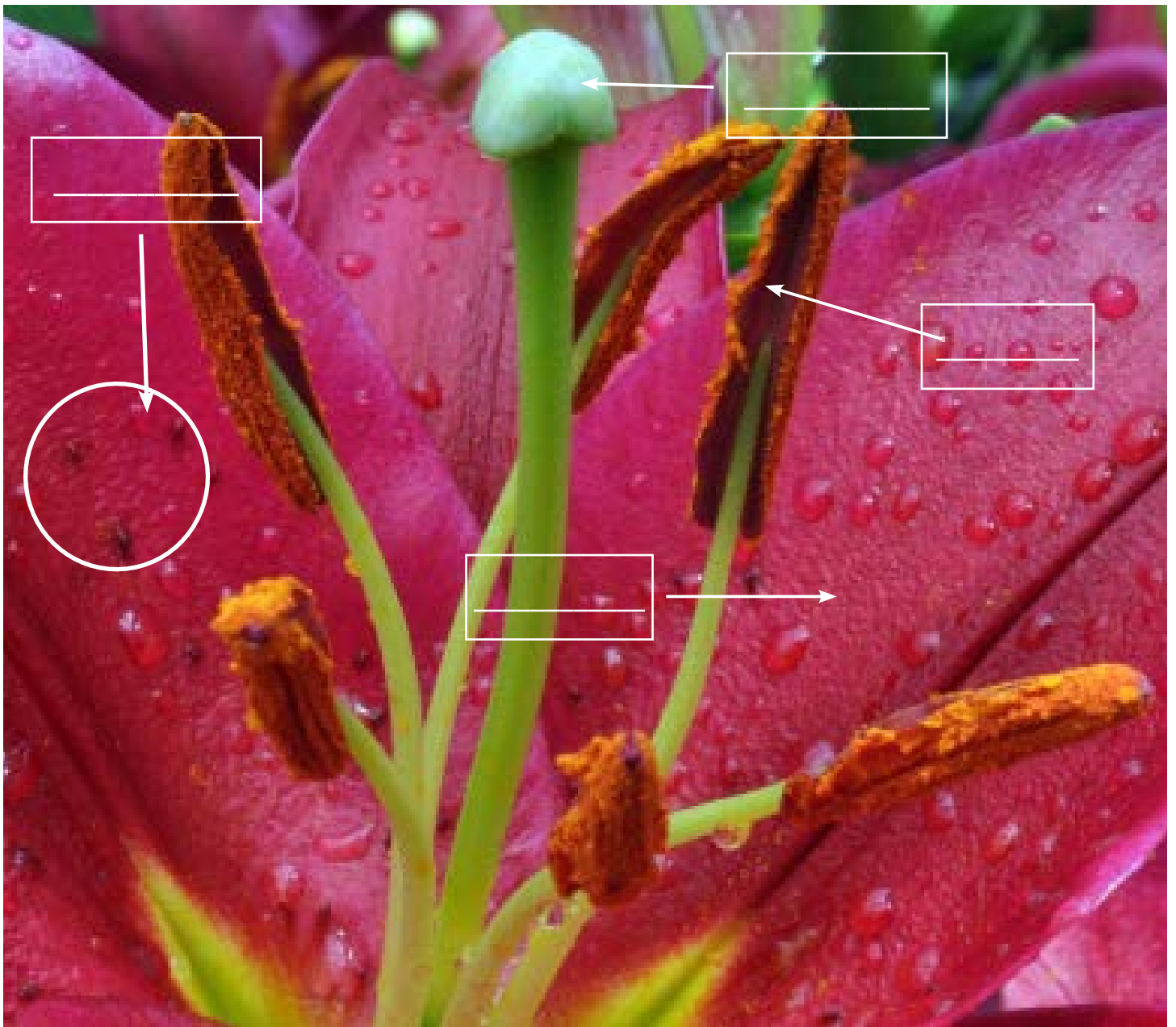
3. What are your favorite smells? _____

Use your answers to draw a flower that would attract your attention if you were a pollinator.

A large, empty rectangular box with a thin black border, intended for drawing a flower based on the student's answers to the questions above.

What is in a Flower?

Label each part of the flower. Check your work by looking at the diagram on page 17 of your issue of *Engage* magazine.



HONEY HUNTERS: Level 3

Comprehension Check

After reading 'Honey Hunters', answer the questions.

1. In what country do the Gurung live? _____

2. When people move from one place to another, they _____

3. For how long do the honey hunters have to walk to reach the honeybees? _____

4. Why is honey important to the Gurung? _____

5. Explain what pollinators do. _____

6. List four pollinators. _____

7. What do bees do to protect their honey? _____

8. How are the Gurung changing? _____

9. What is pollen? _____

Answer Key

HONEY HUNTERS: Level 3 Comprehension Check

After reading 'Honey Hunters', answer the questions.

1. In what country do the Gurung live? Nepal
2. When people move from one place to another, they migrate
3. For how long do the honey hunters have to walk to reach the honeybees? 3 hours
4. Why is honey important to the Gurung? The Gurung eat some of the honey and they sell the rest.
5. Explain what pollinators do. They pollinate flowers to help them reproduce.
6. List four pollinators. Bees, butterflies, other insects and the wind.
7. What do bees do to protect their honey? They sting the honey hunters.
8. How are the Gurung changing? Some are moving away from their villages to cities and abandoning their old traditions.
9. What is pollen? a powder that forms on a flower's anther

HONEY HUNTERS: Level 4 Comprehension Check

After reading 'Honey Hunters', answer the questions.

1. What is a tradition? _____

2. Explain what happens when a person migrates. _____

3. Why are traditions important? _____

4. What does the honey hunter on the ladder do? _____

5. Explain what pollinators do. _____

6. Why is pollination important? _____

7. What is harming bees? _____

8. How are the Gurung changing? _____

9. Why is honey hunting dangerous? _____

10. List the three R's. _____

Answer Key

HONEY HUNTERS: Level 4 Comprehension Check

After reading 'Honey Hunters', answer the questions.

1. What is a tradition? A tradition is a custom or belief passed on from one generation to the next.

2. Explain what happens when a person migrates. When a person moves from one place to another.
For example, a person migrates if she moves from Pune to Delhi.

3. Why are traditions important? Traditions help people feel connected to their culture or family.
They help people know how to act.

4. What does the honey hunter on the ladder do? He uses a tango to cut honeycombs off the cliff.
He lowers the honeycombs to the ground.

5. Explain what pollinators do. Pollinators move pollen from the male part of a flower to the
female part of the flower.

6. Why is pollination important? Pollination helps plants reproduce.

7. What is harming bees? Pesticides and destruction of habitat are harming bees.

8. How are the Gurung changing? Some are moving away from their villages to cities and
abandoning their old traditions.

9. Why is honey hunting dangerous? Bees can sting honey hunters. Smoke can make it difficult to
breathe and cause eye problems. A honey hunter could fall from the cliffs.

10. List the three R's. Recycle, reduce, reuse.

CRAZY CRITTERS

Learning Outcomes

Level 3 students will learn that animals have traits that help them survive in their natural habitats. **Level 4 students** will learn that adaptations are traits that help animals survive in their natural habitats.

Before Reading

BUILD BACKGROUND

Before reading 'Crazy Critters', tell students: The animal in the photo on pages 24-25 is a sea slug, or nudibranch. It lives in the ocean. Ask students: How might this nudibranch's wild colours help it live in the ocean. Write student responses on the board. Tell students that this nudibranch lives in a colourful coral reef. Its colours and leafy body parts help it blend in with the rest of the coral reef. This helps the nudibranch hide from predators.

Explain to students that some organisms have body parts and colours that helps them to blend into their natural habitats. A good example of this is a tiger's colour and stripes. They help it blend into the forest environment in which it lives. This is called camouflage.

After students finishing this discussion, explain that all organisms inherit traits that help them survive. These traits are called adaptations. Tell students that even humans have adaptations. Ask students to list some adaptations people have. They can include two hands, eight fingers, two thumbs, elbows, a brain, hair, eyes, and nearly all body parts. Explain that these are all physical adaptations.

Explain that body parts are physical adaptations. How an organism acts is a behavioural adaptation. Having two legs is an example of a behavioural adaptation. Walking and running in an upright position are examples of behavioural adaptations.

Adaptations allow organisms to do things that other organisms cannot do. To show this, have students place a pencil on their desks. Then ask them to pick up the pencil without using their thumbs. Some students may be able to pick up their pencils; some will not



be able to. Then ask them to pick up their pencils using their thumbs. They should also be able to pick up their pencils when using their thumbs. An opposable thumb is a physical adaptation. It allows humans to do many things. Other primates have thumbs, but not all have opposable thumbs. Primates that swing from trees do not. They have thumbs that they can use to catch branches, so they do not fall.

Ask students to draw an animal that they are familiar with. Then have them label the animal's physical and behavioural adaptations. Ask select students to talk about their animals and the adaptations they labeled.

Build Word Power

For **all students**, write the following words on the board. Then read aloud one of the definitions. Ask which word it defines and then write it next to the correct word. Repeat this for each word.

species: the largest classification of living things in which two members can reproduce

abdomen: a body part that contains its digestive organs

arachnid: an animal with eight legs and two body parts

fish: a cold-blooded vertebrate with gills and a body covered with scales that lives in water

For **Level 4 Students**, add these words:

prey: an animal hunted and eaten by a predator

adaptation: a behavior or physical trait that helps a living organism survive in its habitat

habitat: the place where an organism lives

predator: an animal that hunts and eats other animals

warning colours: bright colours that warn predators that prey is poisonous

venom: a kind of poison

amphibian: a cold-blooded vertebrate that does not have scales and lives part of its life in water and part on land

rodent: a kind of mammal, such as mice, rats, porcupines, and squirrels

herbivore: an animal that eats plants

nocturnal: an animal that is active at night

After discussing the definitions, have students add the words to their science notebook.

For **all students**, circle the word **adaptation** and then ask students to circle the adaptations they find in the “Crazy Critters” article.

Ready to Read

Have students turn to pages 24-25 of *Engage Magazine*.

Pages 12-13

Direct students’ attention to the photo and tell them that a nudibranch is a soft animal that does not have a shell for protection. Ask them to describe the adaptations that it has for protection. (*Its colour and leafy body parts help it blend in with its surroundings.*)

Pages 26-27

After students read page 26, ask: What animal is on the page 26? (*peacock spider*) Does the photo show a male or female peacock spider? (male) How can you tell? (*Only the male has a colourful tail.*)

After students read page 27, ask: Is a goblin shark a predator, prey, or both? (*It is a predator.*) What are some of a goblin shark’s prey? (*crabs, sting rays, and squid*) What is the difference between a physical and a behavioural adaptation? (*A physical adaptation is a body part. A behavioural adaptation is the way an organism acts.*)

Pages 28-29

After students finish reading page 28, ask them to look at the photo of the purple frog and then compare the frog’s physical adaptations to adaptations that a human has (*Answers will vary, but students could mention that humans have two legs, the frog has four legs; humans have two eyes and so does the frog. They could also compare size, shape, colour, etc.*)

After students read page 29, ask them to describe the difference between flying and gliding. (*an animal that flies powers its movement through the sky. So, a bat or a bird flaps its wings to fly. A gliding squirrel leaps and then falls. It controls its fall by spreading out flaps of skin. It cannot flap its arms to fly, like a bird or a bat.*)

Pages 30-31

After students finish reading pages 30-31, ask them if they can identify any physical or behavioural adaptations that each animal shown has. (*Answers will vary.*) Ask students to pick two animals and then explain if each animal can survive in the other’s habitat. For example, could the dolphin survive in the frog’s habitat, and could the frog survive in the dolphin’s habitat? Have them discuss the adaptations that would allow them to or not to survive in the others habitat.

sciQ

Share this amazing fact:

Point out the photo of the centipede on page 31. Tell students that the root word in centipede means 100. Then tell students that centipedes never have an even number of pairs of legs. Ask: Could a centipede have 100 legs? (*No, because a centipede would have to have 50 pairs of legs to have 100 legs. Fifty is an even number.*)

After Reading

EXTENSION ACTIVITIES

- 1 Tell students to invent an animal and a habitat. Have them draw the animal in its habitat and then label the animals adaptations.
- 2 Have students pick and then research an animal. Then have students write a paragraph describing the animal's adaptations. Have them discuss how the adaptations help them animal survive in its natural habitat.
- 3 Ask students to think about the most important human adaptation. Then have them write a position paper explaining why the adaptation they chose is the most important human adaptation.

Video Hub

Watch these exciting videos.

Watch a peacock spider: <https://www.youtube.com/watch?v=eGS4JdewROU>

Swim with a diver who encounters a goblin shark: https://www.youtube.com/watch?v=eh_HUIJkRzU

Watch a flying squirrel in action. It is not a giant Indian flying squirrel, but shows similar behaviour: <https://www.youtube.com/watch?v=1-FHzf4xnWw>

Pollinators: https://www.ted.com/talks/louie_schwartzberg_the_hidden_beauty_of_pollination

Leap with another kind of flying squirrel: <https://www.youtube.com/watch?v=1-FHzf4xnWw>

Answer Key

Wild Spider Adaptations

Write about the peacock spiders adaptations.



A peacock spider has eight legs and two main body parts. It also has a fan. The fan is very colourful. It uses its fan to attract a mate. It also drums its legs on the ground and dances to attract a mate. Dancing and drumming are behavioural adaptations. Its fan, two main body parts and eight legs are physical adaptations.

CRAZY CRITTERS: Level 3

Comprehension Check

After reading 'Crazy Critters', answer the questions.

1. What is the definition of species? _____

2. How large is a peacock spider? _____

3. How does a peacock spider attract a mate? _____

4. How does a goblin shark capture prey? _____

5. What is a predator? _____

6. What are warning colours? _____

7. Do flying squirrels fly? _____

8. List some animals that are rodents. _____

9. What is a nocturnal animal? _____

10. How far can the Indian giant flying squirrel glide? _____

Answer Key

CRAZY CRITTERS: Level 3 Comprehension Check

After reading 'Crazy Critters', answer the questions.

1. What is the definition of species? A species is the largest classification of living things in which two members can reproduce.
2. How large is a peacock spider? A peacock spider is 3-5 millimetres.
3. How does a peacock spider attract a mate? It shows its fan, dances, and drums its legs.
4. How does a goblin shark capture prey? It pushes out its snout.
5. What is a predator? A predator is an animal that hunts and eats prey.
6. What are warning colours? Warning colours are bright colours that warn predators that prey is toxic or poisonous.
7. Do flying squirrels fly? No, a flying squirrel does not fly. It glides. It cannot flap its arms to fly.
8. List some animals that are rodents. Some examples of rodents include squirrels, mice, rats and porcupines.
9. What is a nocturnal animal? A nocturnal animal is an animal active at night.
10. How far can the Indian giant flying squirrel glide? It can glide for 90 metres.

CRAZY CRITTERS: Level 4

Comprehension Check

After reading 'Crazy Critters', answer the questions.

1. What is an arachnid? _____

2. How big is a peacock spider? _____

3. What does a peacock spider do to attract a mate? _____

4. What adaptation allows the slow goblin shark to capture faster prey? _____

5. What is the difference between a predator and prey? _____

6. How do the bright colours on a peacock spider differ from those on a fluorescent purple frog? _____

7. What is the difference between how a bird and a flying squirrel moves through the sky? _____

8. Are rodents arachnids? _____

9. What kinds of animals are active at night? _____

10. Which animal is the craziest critter in the story? _____

Answer Key

CRAZY CRITTERS: Level 4 Comprehension Check

After reading 'Crazy Critters', answer the questions.

1. What is an arachnid? An arachnid is an animal with eight legs and two body parts.
2. How big is a peacock spider? A peacock spider is 3-5 millimetres.
3. What does a peacock spider do to attract a mate? It shows its fan, dances, and drums its legs.
4. What adaptation allows the slow goblin shark to capture faster prey? It can push out its snout.
5. What is the difference between a predator and prey? A predator hunts and eats prey.
6. How do the bright colours on a peacock spider differ from those on a fluorescent purple frog? A peacock spider uses its colours to attract a mate. A fluorescent purple frog uses its colours to warn away predators.
7. What is the difference between how a bird and a flying squirrel moves through the sky? A bird powers its flight by flapping its wings. A flying squirrel controls its fall by spreading flaps of skin. It does not fly; it glides.
8. Are rodents arachnids? No. An arachnid has two main body parts and eight legs. A rodent has only four legs, so it cannot be an arachnid.
9. What kinds of animals are active at night? Nocturnal animals are active at night.
10. Which animal is the craziest critter in the story? Explain why. Answers will vary.