

# TEACHING GUIDE



For ages  
10 to 13 years

Dear Educator,

Welcome to the third issue of **engage** magazine. We continue to make changes making each issue better than the last one. For example, in this issue, you will find a QR Code integrated into each of the three articles. Download a free QR Reader on your smartphone. Hold the phone over the code and it will automatically show a video related to the article. This extends the learning and allows students to integrate information from videos with their reading. It will help you teach 21st-century learning skills.

You will also see a change in this Teaching Guide. We now include a section that directly tells you how each article relates to your curriculum. This will help you apply the articles to what you are already teaching. You can use each article to introduce, review or teach content. You can also use each article to teach nonfiction reading strategies. These are also called out in this guide. Finally, you will note a curriculum connection has been added to each article in the magazine itself.

The three articles in this issue teach physical science, life science and Earth science. In '*Sky Lights*', students read about how the sun interacts with Earth's atmosphere to form auroras, rainbows and other sky lights. In '*Meet the Mola Mola*', students meet a marine biologist who studies the mola, a unique fish. While reading about the mola, students also learn about an ocean food web. In '*Fantastic Fossil Finds*', students learn about some of the amazing stories fossils tell.

We hope you enjoy teaching this issue.

## TABLE OF CONTENTS

Pages 2–12: Sky Lights

Pages 13–20: Meet the Mola Mola

Pages 21–25: Fossil Finds

## MEET THESE OUTCOMES

### Language Arts

- Students will learn to ask questions about texts they read.
- Students will understand how to preview a nonfiction article.
- Students will integrate information from text and a graphic element.
- Students will use a graphic organizer to improve comprehension.

### Physical Science

- Students will understand how energy from the sun can cause lights in the sky.

### Life Science

- Students will understand that organisms depend on their physical environment and on each other.
- Students will understand that a food web shows energy flow in an ecosystem.

### Earth Science

- Students will understand that data can be represented in a graphical format.
- Students will identify that patterns in rock formations and fossils can show how ecosystems have changed over time.

### Citizenship

- Students will learn that they can make positive changes by properly disposing of plastic items.

# SKY LIGHTS

## PHYSICAL SCIENCE STANDARDS

Students will understand how energy from the sun can cause lights in the day and night sky.

## LANGUAGE ARTS STANDARDS

Students will learn to ask questions about texts they read.



## CURRICULUM CONNECTION

This article is about how energy from the sun can form lights in Earth's sky. Remind **Level 3** students that Earth's atmosphere is made of different kinds of gases, such as oxygen, nitrogen, hydrogen, and helium. Also remind them that dust, water vapour and ice are in the atmosphere. Also remind students that the sun is the main energy source in the solar system. The moon does not make its own light. Rather, it reflects light from the sun. You may want to write the word 'reflect' or 'reflection' on the board. Then remind students what it means in the context of light. Remind students that light bounces off some objects, like mirrors. This is called 'reflection'.

Remind **Level 4** students that visible light is only one kind of energy released by the sun. Ultraviolet and infrared radiation are also forms of energy given off by the sun. Visible light is made of seven colours – red, orange, yellow, green, blue, indigo, and violet. They can use a prism to divide sunlight into these colours. Write the word 'refraction' on the board. Ask students what refraction means. Explain that refraction is the bending of light. You can demonstrate refraction by pouring water into a clear glass. The water should fill at least half the glass. Then place a pencil in the glass. The pencil will look bent. The water bends or refracts light. Pull the pencil out of the water to show students that it is not actually bent.

## BEFORE READING

### **BUILD BACKGROUND**

Write the word 'atmosphere' on the board and ask students to quickly say the first thing that comes to their minds when they think of the word 'atmosphere'. (*Possible answers: sky, stars, sun, moon, clouds, rainbow, blue, dark etc.*) Write their responses on the board as they speak.

Direct students' attention to the word 'sky'. Explain that the atmosphere makes up Earth's sky.

Then discuss how the sky changes from day to night. Focus on the colours students can observe in the day and night sky.

Let students know that they will read about colours in the sky and how they change in the story 'Sky Lights'.

## READY TO READ

- ➔ Hand out copies of engage magazine and have students turn to the story 'Sky Lights'.
- ➔ Have students preview the text and write down questions they would like answered as they read. Explain that good readers ask questions and then go back to see if the text answers their questions.
- ➔ Conduct a shared reading session where the students read in pairs.
- ➔ Discuss the questions and ask students whether their questions have been answered after conducting the 'After Reading Extension Activities'.

## **AFTER READING: EXTENSION ACTIVITIES**

### **SCIENCE CONNECTION**

#### **SESSION FOCUS: ELECTRONS, PROTONS AND NEUTRONS**

- Break a piece of chalk in two and then break each piece again. Ask students how many times they think you could break the chalk until you reach the smallest particle of chalk.
- Pound the piece of chalk into powder and ask students whether they think that a grain of chalk is the smallest or most fundamental building block of the chalk.
- **Share:** Even though the grain of chalk is very small, it is still made up of atoms. Individual atoms come together to form chalk. Atoms are too small to see and we cannot break chalk into individual atoms. These atoms come together to make molecules. The molecule that forms chalk is called calcium carbonate. Its chemical symbol is  $\text{CaCO}_3$ . It is made of one atom of calcium, one atom of carbon and three atoms of oxygen. It is the smallest piece of chalk. The atom is the most basic unit of matter.
- Continue by explaining that atoms are not the smallest particles of matter. Atoms are made up of even smaller particles. They are called protons, neutrons and electrons. An atom is the smallest unit of a particular kind of material. For example, if you try to divide a calcium atom into smaller pieces, it splits into its subatomic particles and you no longer have calcium.
- Draw a diagram on the board illustrating the basic structure of an atom and the location of each sub-particle. The protons and neutrons make up the centre of the atom, or nucleus. Electrons go around the nucleus. Use an oxygen atom as an example. It has eight protons and eight neutrons in its nucleus. It has eight electrons going around its nucleus.
- **Explain:** At the centre of every atom is a nucleus containing protons and neutrons. All atoms of the same element have the same number of protons.
- Share that protons have a positive electrical charge and electrons a negative electrical charge. Neutrons have no charge. Electrons circulate in a cloud around the nucleus.

- Read out the following sentence from the *Sky Lights* story: 'In solids, liquids, and gases, electrons whip around the nucleus. But in plasmas, electrons spring away from the nucleus for a short period of time.'
- Ask students to visualise what a plasma would look like. Ask a student to come to the board and ask him or her to change the diagram you made to show oxygen plasma.
- Show students the video **Just How Small is an Atom?** <https://www.youtube.com/watch?v=yQP4UJhNn0I>

### **SCIENCE CONNECTION**

#### **SESSION FOCUS: WHAT IS PLASMA?**

- Draw a table on the board with four columns. Write 'solids', 'liquids', 'gases,' and 'plasmas' at the top of each column. Each state of matter is a header for a column. Explain to students that there are four states of matter. They may be familiar with the first three, so you will need to tell them that there is a fourth state, plasma. Ask students to take turns coming to the board and writing a characteristic of each state of matter.
- Show students the following videos: (*Please preview the clips prior to showing them to your students.*)  
**What is Plasma? Chemistry for All** <https://www.youtube.com/watch?v=94tReSbyPYc>  
**Solid, Liquid, Gas ...and Plasma?** <https://www.youtube.com/watch?v=tJplytSR-ww>  
**What is Plasma?** <https://www.youtube.com/watch?v=2osF6l6-zWg>
- After viewing, ask students to share their understanding of plasma.
- Re-read the section on 'Auroras' in the story and ask students to write and explain in their own words how are aurora forms. Direct them to include a discussion of the differences between a gas and a plasma.

## SCIENCE & STEM CONNECTION

(Level 4)

Explain to students that they may not be as familiar with plasmas as they are with the other states of matter, but plasmas are very common. For example, lightning is a plasma. A neon sign is a plasma. A plasma ball is also a plasma. Plasma is also used in a plasma TV. Explain to students that plasmas do not last long since they involve electrons jumping away from an atom and then returning. Remind students that all the states of matter can change with conditions. For example, they can change a solid into a liquid by adding heat energy.

## SCIENCE & LANGUAGE ARTS CONNECTION

### SESSION FOCUS: ABOUT AURORAS

- Show the video <http://video.nationalgeographic.com/video/short-film-showcase/time-lapse-a-hypnotic-look-at-voyageurs-national-park?source=relatedvideo>
- The video is a time lapse presentation of auroras. A time lapse video is a technique of showing a very slow process at high speed. Auroras are usually visible over long periods of time. Here the filmmakers have condensed it into a time span of about two minutes.
- Ask the students to read the story 'Auroras' one more time and discuss the following questions with the class:
  1. What is an aurora?
  2. Where are they formed?
  3. From where do they originate?
  4. What are the four states of matter?
  5. How are they different from each other?
  6. What is matter made of?
  7. What comprises the nucleus in an atom?
  8. How are electrons placed differently in plasma?
  9. How is plasma formed?
  10. How is a tubelight similar to an aurora?
- **Summarise:** The sun is the main source of light in our solar system. The sun is a star that makes energy. It fuses hydrogen atoms into helium atoms, releasing huge amounts of energy. Storms and explosions ripple across the sun's surface. These release electrically charged particles into space. Some of these particles collide with Earth's

atmosphere, forming auroras. The charged particles interact with gas atoms in Earth's atmosphere, stripping electrons away from those atoms. Different gases form different coloured auroras.

- Students will solve the BLM: **Skylights (Aurora) Comprehension Check.**

## LANGUAGE ARTS CONNECTION

### SESSION FOCUS: CHAIN POEM USING CONDITIONAL CLAUSES

1. Point to the following sentences in the story, and write them on the board:

*"If you live far from the poles, you may never see an aurora."*

*"If you add energy in the form of heat, the solid melts to form a liquid."*
2. Explain that these sentences are examples of conditional sentences. Conditional sentences contain two clauses. The first clause begins with the word 'if' and sets up the condition on which the second clause depends. The second clause can take place only if the condition in the first clause is met.

Explain to students that the word 'if' signals a conditional sentence, even if it is not at the beginning of a sentence, but not all conditional sentences contain 'if'. Here are some examples of conditional sentences: If water reaches 0°, it will freeze; when water reaches 0°, it freezes; water freezes if it reaches 0°. Two of the three sentences contain the word 'if' and, hence, are easily spotted as conditional sentences. The third does not, but it sets up a specific condition that must be met.

Ask a student to come to the board and circle the condition set up in the first sentence (*If you live far from the poles...*). Then have a second student come to the board and underline the dependent clause that can happen only if the condition in the first clause is met (*you may never see an aurora*). Repeat using the second sentence. Then explain to students that conditional clauses are important tools they can use in their own writing.
3. Ask students to describe situations they may be aware of using conditional sentences. For example, you might ask students to describe one aspect of their day at school using a conditional sentence. Invite students to present examples of conditional sentences that do not include the word 'if'.

4. **State:** A chain poem is where one action leads to another.

5. Write the following sentences on the board:

- I go to school.
- I learn about science.
- I learn what causes natural phenomena.

6. **Explain:** These sentences can be combined to make a chain poem:

If go to school,  
I learn about science.  
If learn what causes natural phenomena,  
I know how things work.  
If I know how things work, etc

7. Ask students to write a new poem to explain the formation of rainbows or auroras. Explain that they have to write chain poems, where one action is the consequence of the previous one while also being the reason for the next one. After students finish writing their chain poems, select some students to read aloud their poems. Then remind students that their chain poems are examples of conditional sentences.

## LANGUAGE ARTS CONNECTION

### SESSION FOCUS : POETRY APPRECIATION – LEVEL 4

- Distribute copies of the poem given on this webpage <https://hellopoetry.com/poem/726374/rainbow/> in the classroom. The poem deals with the rainbow scarf that the Sema Naga community uses. The significance of the scarf is also given.
- Ask students the following questions to generate some discussion in the class before the poem:
  - Do you have a specific dress/outfit that you cherish?
  - Are there special costumes that we wear for special occasions?
- What are the special wedding outfits that people in your respective communities wear?  
**Share with students:** Rainbows are not visible every day. It is a special occurrence. Thus, the rainbow scarf is draped only on special occasions. People take extra care of it. The poem is an example of how a scientific concept like a rainbow can become a part of popular culture and literature.

- Now ask the class to read the poem.
- Discuss the meaning of the poem using the following questions:
  - What is the poem about?
  - What form of respect is the poem addressing?
  - How does the poet ask people to respect the rainbow scarf?
- Talk to them about the value of respecting everything in the world around us. The clothes that we wear, the food we eat, the air we breathe, the earth we live on are all essentials. The more we take care of our surroundings and our possessions, the better will we be able to sustain Earth.

## SCIENCE CONNECTION

### SESSION FOCUS: REFLECTION AND REFRACTION FORMS A RAINBOW

- Ask students to share what they know about light and write their responses on the board. For example, you can include:

Light is a form of energy.  
Light travels in a straight line.  
There are natural and artificial sources of light.
- Write the words 'translucent, transparent and opaque' on the board and ask students to explain the differences between them.
- *Ask students:* Which materials are capable of reflecting light? What is reflection? (*When light bounces off a surface, like a mirror.*) What is refraction? (*The bending of light.*)
- Discuss rainbows with students: What colours make up a rainbow? (*red, orange, yellow, green, blue, indigo, and violet*) Do all rainbows have the same colours? (*yes*) Are the colours always in the same order? (*yes*) What order are they in? (*red, orange, yellow, green, blue, indigo, and violet*)
- Show students the videos:  
**How Do Rainbows Form?** <https://www.youtube.com/watch?v=5cVX3eq6NUQ>  
**The Science of Rainbows** <https://www.youtube.com/watch?v=5pYnC-ONdXQ>  
They show how rainbows are formed. They also explain why rainbows are optical illusions.
- Ask students to re-read the rainbows section of the story.

- Discuss the following questions with the class:
  - What specific conditions do you need for a rainbow to be visible?
  - What role do the raindrops play in the creation of a rainbow?
  - What is the visible spectrum of light?
- **Share with the students:** When it rains, light passes through raindrops before it reaches your eyes. The light is refracted and you see the different colours as a rainbow.
- While a rainbow can only form during a storm, other colours can also form in the sky. These do not have to form during storms. They form when sunlight or moonlight passes through ice crystals. Show this video to students: **This is not a rainbow** <https://www.youtube.com/watch?v=gVad-hJOC9k>  
The video explains how other sky lights form. These lights are called halos, sundogs, and pillars. One is called the green flash.
- Students will solve the BLM: **Skylights – Rainbow Comprehension Check and Creative Writing**

## SCIENCE CONNECTION

### SESSION FOCUS: COLOURS IN A RAINBOW

**Share:** A rainbow forms when water droplets refract and reflect sunlight. The pattern of colours is always in the same order: red, orange, yellow, green, blue, indigo and violet. Red is always on the outside and violet on the inside. Conduct the following activity to see a model of a rainbow.

#### ACTIVITY: Make Your Own Rainbow

Conduct one or more of the following activities with students so they can see the colours that make up a rainbow. By conducting two or three of these activities, students will be able to see that the order in which the colours appear never changes.

#### 1) Bubbles

Mix together soapy solution using soap and water. Stir them together to make lots of bubbles. When light passes through the bubbles, you can see a rainbow-like image. In the bubbles. This is an easy way to make a rainbow, but it can be difficult to discern all seven colours.

#### 2) Prism

Students can use a prism to make a rainbow. Shine a white light through a prism and hold a white sheet

of paper on the other side. The prism splits the light into seven colours, which are projected on the paper. This activity allows a group of students to see the 'rainbow'.

#### 3) Mirror and Water

Use the activity included in the magazine by placing a mirror in a pan of water. This activity produces a clear rainbow-like image that a group of students can see. It also does not require any specialized equipment, such as a prism.

After conducting one or all of these activities, invite students to draw the rainbow-like images that they observed. Have them label the different colours that they see. Explain to students that their eyes may not discriminate between blue, indigo and violet. Instead of the three colours, they may see only one or two. Different people see slightly different colours.

## STEM CONNECTION

### SESSION FOCUS: HOW OBJECTS INTERACT WITH LIGHT

In this session students will explore how light interacts with different objects in the classroom.

- Divide the class into small groups. Then tell them to draw a large cross on a sheet of paper to divide the sheet into four evenly sized squares. Use these four labels to label the four squares: Absorbs Light, Transmits Light, Reflects Light, Refracts Light.

<b>Absorbs Light</b>	<b>Transmits Light</b>
<b>Reflects Light</b>	<b>Refracts Light</b>

- Explain to students that they are going on a Light Scavenger Hunt. Have the students look through the classroom and place the objects they find in the appropriate square. For example, the window would be placed under Transmits Light and a book would be placed under Absorbs Light. After students finish, have each group share their lists. Track the number of objects they find for each category.

## LANGUAGE ARTS CONNECTION (Level 4)

### SESSION FOCUS: WRITING

In this writing activity, students will research and write about the cultural perspective of rainbows.

- Divide the class into groups.
- Explain to students that many cultures have traditional stories about rainbows, including the ancient Greeks, Romans, Hindus, Chinese, the Norse and others. Assign each group one culture and have them research the importance of the rainbow as a symbol in that culture. Ask each group to summarize their research in a paragraph. Have each group present their summary paragraphs. Then ask students to compare and contrast how each culture viewed these arches of colour.

## LANGUAGE ARTS CONNECTION (Level 3)

### SESSION FOCUS: SIMILES

In this activity, students will use the colours of the rainbow to develop similes.

#### You need:

- a sheet of paper for each student.
- sketch pens of the colours of the rainbow

#### To do:

1. Explain that a simile is a way of making a comparison. It is also a good way to make writing more colourful and interesting. For example, students can use similes to help readers visualize what is being described. Give them these examples: She is as brave as a lion. That candy is as sweet as honey. The surface is as smooth as butter.
2. Hand out the sheets of paper and have the students draw a simile on each side of the sheet.

Then invite the students to show their drawings to the class and ask the class to guess the simile it depicts. For example, a student could use an orange pen to draw a sunset. The students would guess as orange as a sunset. Another student could use a yellow pen to draw a house. Students would guess: the house is as yellow as a lemon. Students will have fun guessing at which iconic item each colour represents. You might list them as students take turns guessing.

### SESSION FOCUS: QUESTIONS

After students have finished reading, revisit the questions they asked before they read 'Sky Lights'. Ask students if the article answered their questions. Ask them how they could find the answers to the remaining questions, if any.

### VIDEO HUB

**Colour Wheel** <https://www.youtube.com/watch?v=lil4coOz7QA&t=16s>

**The Science and Beauty of Auroras** <https://www.youtube.com/watch?v=ZVTbolyobcE>

**Fantastic Aurora** <https://www.youtube.com/watch?v=N5utQxtma2U>

**Rainbows in the Sky** <https://www.youtube.com/watch?v=xyQjdF2EvLw>

**LEVEL 4**

# SKY LIGHTS (AURORAS): Comprehension Check

1. Why does the author feel that the aurora he saw was a magical sight?

---

---

---

2. What does the author mean by the phrase 'seething ball of plasma'?

---

---

---

3. What is a nucleus? What particles does it contain?

---

---

---

4. How are plasmas different from gases?

---

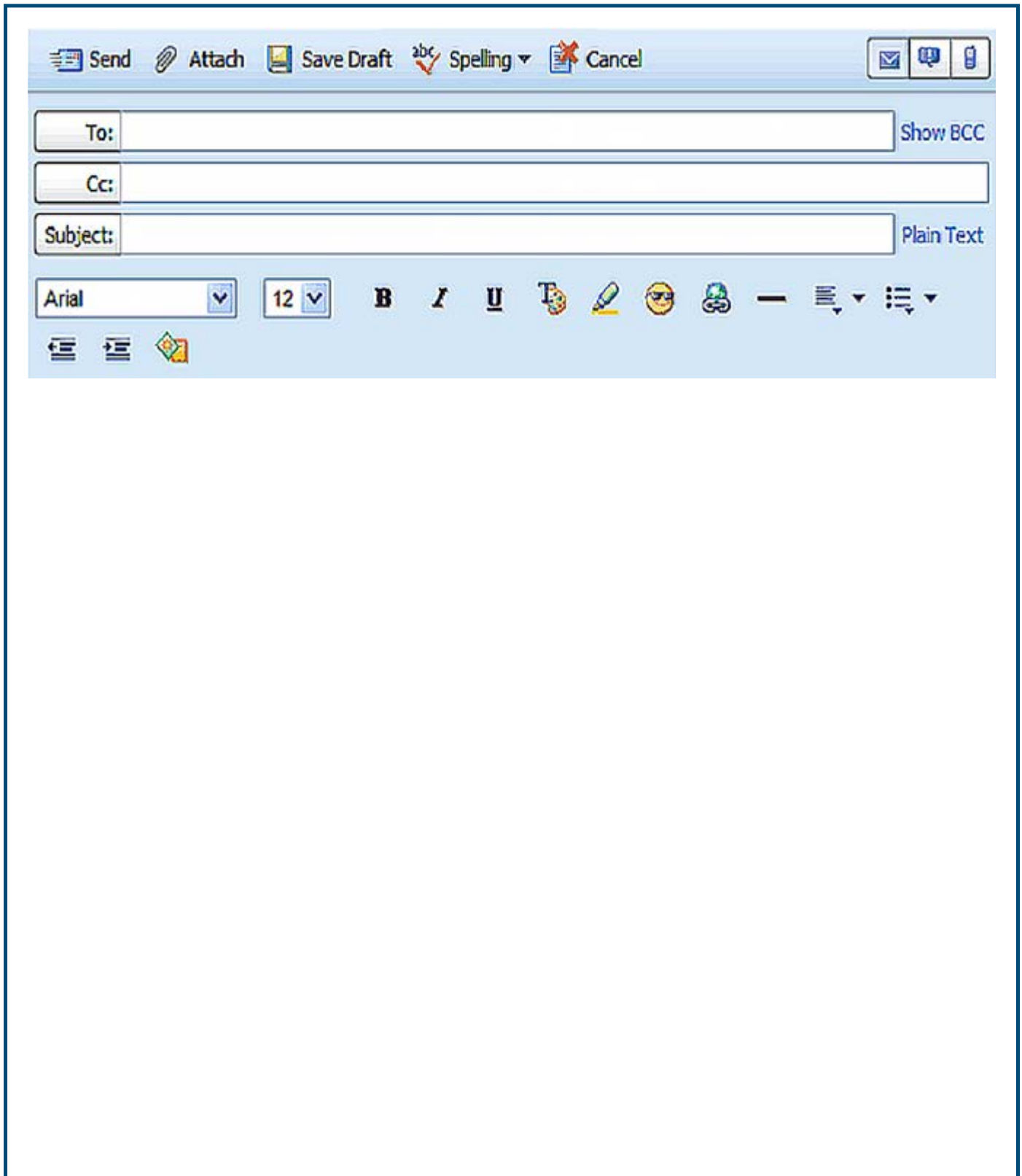
---

---



# SKY LIGHTS: Email Writing

Write an email to your teacher that explains how adding energy changes a solid into a liquid, gas, and plasma.



The image shows a screenshot of an email composition window. At the top, there is a toolbar with buttons for Send, Attach, Save Draft, Spelling, and Cancel. Below the toolbar are three input fields: To: (with a Show BCC link), Cc:, and Subject: (with a Plain Text link). Below the input fields is a rich text toolbar with options for font face (Arial), font size (12), bold (B), italic (I), underline (U), text color, background color, emoji, link, unlink, text color, and list creation. The main body of the email is a large empty text area.

**LEVEL 3**

**SKY LIGHTS (AURORAS): Comprehension Check**

1. What causes an aurora?

---

---

---

2. What is a solar wind?

---

---

---

3. What is the magnetosphere?

---

---

---

4. Complete the following table. Give an example for each type of matter.

Types of Matter			

**LEVEL 4**

# SKY LIGHTS (RAINBOWS): Comprehension Check

1. What causes a rainbow?

---

---

2. Define refraction.

---

---

3. What colours make up a rainbow?

---

---

4. Which colour is always on the outside of a rainbow?

---

---

5. At what times of the day would you expect to see a rainbow?

---

---

6. Explain how a rainbow forms.

---

---

7. When might you see the green flash?

---

---

**LEVEL 3**

**SKY LIGHTS (RAINBOWS): Comprehension Check**

1. When are rainbows usually seen?

---

---

---

2. Explain how a rainbow forms.

---

---

---

3. List the seven colours that make up the visible spectrum.

---

---

---

4. Why does a rainbow look like an arch instead of a complete circle?

---

---

---

5. At which time of day would you see the green flash?

---

---

# MEET THE MOLA MOLA

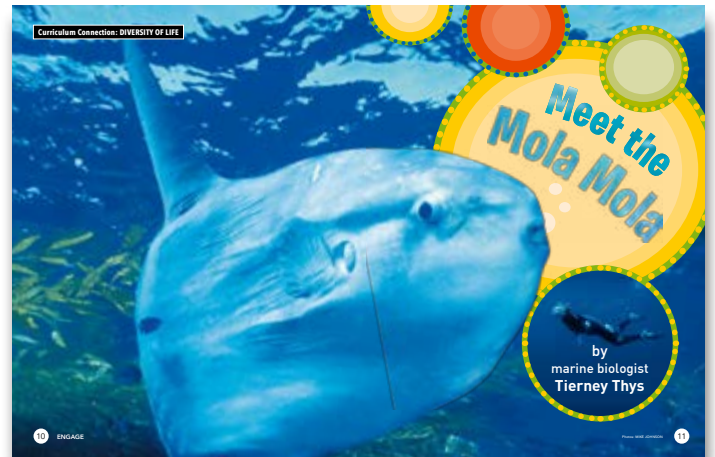
## LIFE SCIENCE STANDARDS

Students will understand that plants, animals and humans depend on their physical environment and on each other.

Students will understand that a food web shows how energy flows from the sun through various organisms.

## LANGUAGE ARTS STANDARDS

Students will understand how to preview a nonfiction article.



## CURRICULUM CONNECTION

This article is about the ocean sunfish, or mola mola. It is an odd-looking fish, but an important part of the ocean food web. Remind **Level 3** students that everything they do is connected to all living and non-living things on Earth. For example, explain that all organisms depend on one another for the transfer of energy. This is called the food web. A food web shows where each kind of organism gets its energy. Humans can disrupt the food web. One way that humans are disrupting ocean food webs is by throwing away plastics. Plastics can wind up in the ocean, where many sea creatures mistakenly eat them. Instead of eating nutritious prey, they fill up on plastics that can kill them.

Remind **Level 4** students that a food web is a diagram that shows how energy moves from organism to organism. All food webs begin with the sun. Plants take in sunlight and make their own food. Some animals get their energy by eating plants. Other animals get their energy by eating animals. And some animals get energy by eating both plants and animals. So, in essence, a food web mostly shows the relationships between predators and prey. Most animals are carnivores, meat eaters; herbivores, plant eaters; or scavengers, carnivores that eat dead animals.

## BEFORE READING BUILD BACKGROUND

Teachers can read up on the topic further using these links:

- <http://mentalfloss.com/article/64197/14-fascinating-facts-about-ocean-sunfish>
- <http://oceana.org/marine-life/ocean-fishes/ocean-sunfish>
- <https://www.britannica.com/animal/mola-fish-family>

Ask students the following questions:

1. What are some kinds of fish?
2. What other creatures live in the oceans?
3. What is the largest ocean animal?
4. Are all sea animals predators?
5. Are some sea animals herbivores?
6. Are humans part of the ocean food web?

## READY TO READ

- ➔ Hand out copies of engage magazine and have students turn to pages 2-3 and read the headline and deck. Then instruct them to read the subheads and captions that go with each photo. Previewing a nonfiction article will help students improve their comprehension by telling them what the story is about before they read the text. A headline, deck, subheads and captions should encapsulate an article's main and supporting ideas.
- ➔ Ask students to read the story alone or in pairs.
- ➔ After students finish reading discuss the following questions.
  1. Why does the author think she has superpowers?
  2. What type of superpowers do she have?
  3. What is a mola mola?
  4. Why was the author fascinated by the mola mola?

5. Why does the author call the sea a 3D environment?
6. Describe what the mola looks like.
7. What are parasites? How do they affect a mola?
8. Why does the author call the mola an unlikely fish?
9. Describe the mola's food web.

- Share with the students these interesting facts about the mola mola:
- It is called the sunfish because it floats in the sun.
  - It is the world's largest bony fish.
  - The word mola comes from the Latin word millstone.
  - A mola can dive very deep though they usually swim at surface level and are also seen sunbathing.

## AFTER READING: EXTENSION ACTIVITIES

### LANGUAGE ARTS CONNECTION

#### SESSION FOCUS: PREVIEWING

Ask students to think back to the previewing exercise and ask them if reading the headline, deck, subheads and captions helped them identify the article's main and supporting ideas. Ask students to identify the article's main idea. (*The mola is a unique fish that is important part of the ocean food web.*)

#### SESSION FOCUS: INFORMATION MAP – THE MOLA MOLA

- Ask students to refer to the story and draw an information map of the Mola Mola.
- Give each student a sheet of paper.
- Have them draw a mola in the centre of the sheet of paper and then write the key information about the mola around the drawing.

### SCIENCE CONNECTION

#### SESSION FOCUS: FOOD WEBS

- Ask the students to re-read pages 14-15, paying attention to the mola's food web.
- Discuss the following questions with the class:
  - What is a food web?
  - Why is a food web important?
  - What would happen if one of the creatures in the food web were to become extinct?

- Share with the students: All energy on Earth comes from the sun. This energy is transferred from one form to the other. A food web shows how energy is transferred by living creatures.
- Have students use the information from the article to draw the mola's food web. Explain to students that they should connect the organisms in the food web with arrows. The arrows should point in the direction in which energy is transferred.

#### ACTIVITY

This activity will help students visualize the mola's food web.

1. Before conducting the activity, hand out a sheet of paper to each student. Assign one item from the mola's food web to each student. Have the students draw that item and label it. Make sure that one student has the sun.
2. Give students a piece of string or thin rope. Explain that they are going to form the mola's food web. Have students stand in a large circle and explain that the string or rope represents the energy in the ocean environment.
3. Ask the student who represents the sun, to stand in the centre of the circle and hold the end of the string. Students representing plants should hold the other end. Have students hold their drawing high and join the food web in their turn. They can use the food web drawings to as a blueprint to tell them when it is their turn to join the food web.
4. Once the students have completed the food web, explain that the web is incomplete. For example, the sea birds and cleaner fish do not have predators listed in the story. However, predators and scavengers do eat them.

- Students answer the BLMs: **Mola Mola Comprehension Check** and **Creative writing**

### LANGUAGE ARTS CONNECTION

#### SESSION FOCUS: AURAL COMPREHENSION – The Author Speaks To You

- Get students to listen to the author of the story speak about the Mola Mola in this video: **Strange Sunfish and Hope for the Ocean** <https://www.youtube.com/watch?v=6jCuoohMARY>
- Ask them to write a short summary of the video.
- Then ask students to explain how the video extended their knowledge of the mola.

## LANGUAGE ARTS & CITIZENSHIP CONNECTION

### SESSION FOCUS: CONNECTING WITH TIERNEY THYS

- Show students the video **The Plastic Vagabond** <https://ed.ted.com/featured/hiGIPdFs>
- Explain that there are many schools that take part in projects to ensure reduction in the amount of use of plastic.
- Ask students to write a persuasive essay explaining reasons people should protect the ocean. Remind students that a persuasive essay never presents more than one side of an argument. Rather, it tries to convince the reader that one side of an argument is correct.

## CITIZENSHIP CONNECTION

### SESSION FOCUS: PLASTIC POLLUTION AWARENESS

- Show students the video: <http://www.plasticpollutioncoalition.org/>
- Ask students to research and arrive at actions they can take to downsize the use of plastic. For example, they can use cloth bags at the grocery store instead of plastic bags, and carry their own water bottle instead of purchasing disposable water bottles.
- Create a bulletin board in school educating the school community about the problem and display all the possible solutions and/or alternatives.
- The board can also outline ways the school can help and/or how students/faculty can help at home.
- Students can also work in smaller groups and present lessons to the other classes on how plastics impact wildlife and what they can do to lead positive change.

## MATH CONNECTION

### SESSION FOCUS: BECOMING PLASTIC WASTE WISE

- Ask students to think of all the types of plastic items they throw away on a daily basis.
- Record their responses on the chalkboard. For

example, plastic shopping bags, packets of chips, straws, water bottles, etc

- Tell students that for one week they will track the number of individual plastic items they throw away each day.
- Have students chart their data using the following format. At the end of the week, draw the table on the board and enter all the students data. Add up the number of plastic items.

DAY	DESCRIPTION/NAMES OF ITEMS	TOTAL NUMBER OF ITEMS

- Ask students to plot the results on a bar graph day-wise, and to analyse the results. Ask them to develop a plan for throwing away fewer plastic items. Repeat the process four weeks later to see if their plans were effective. Have them graph the results on the same graph and then compare the data.

## ENVIRONMENT MANAGEMENT CONNECTION

### SESSION FOCUS: CREATING A PLASTIC FREE WORLD

- Ask students to challenge themselves by going plastic-free for a day or a week.
- Encourage them to share ways in which they could avoid using plastic which they would normally throw away after use.
- After they complete the challenge ask them to share whether they found the challenge difficult and why. Ask them to describe the items they used to substitute for plastic.

## CITIZENSHIP CONNECTION

### SESSION FOCUS: THE LAST PLASTIC STRAW

- Show the following videos to the students :
  - **World's Most Polluted Island** <http://www.businessinsider.com/henderson-island-worlds-most-polluted-island-plastic-waste-south-pacific-ocean-2017-5?IR=T>
  - **Plastic Oceans** <http://www.abc.net.au/btn/story/s3591476.htm>
  - **5 Facts About Plastic Straws** <https://www.youtube.com/watch?v=e0Z11IDel4s>

- Share with students that the videos are about how plastic is polluting the world. The third link discusses how straws cause the worst form of plastic pollution. Straws are too small to be recycled and get dumped into the garbage. They finally end up in the ocean where they break down into smaller bits of plastic and are consumed as food by fish, whales and other animals.
- Discuss the following questions
  1. List the plastic items you use in daily life.
  2. Are there any items that you can avoid using?
  3. Do you recycle plastic items at home or at school?
  4. What can you do to keep plastic out of the ocean?
  5. How has plastic entered the food web? Why is it dangerous?
- Create an awareness drive in your school and your local area to dissuade people from using plastic straws, by creating attractive pamphlets/posters. Think of all the other avenues where you can reduce the use of plastic, especially straws.

## MATH CONNECTION

### **SESSION FOCUS: COMPARING THE HEIGHT AND WEIGHT OF THE MOLA MOLA**

**Note to the teacher:** *The story 'Meet the Mola Mola' has a number of references to numbers.*

- Share the following information about the mola:  
Size: 4 metres from face to tail and 3 metres measured from back to stomach.
- Let students compare their size to that of the mola.
- Mark 4 metres on the wall and have volunteers measure themselves against it.
- Ask them how large or small they are compared to the mola.
- **State:** A full-sized mola can weigh as much as 2,268 kgs.
- Ask students to compare their weight with the weight of a mola. For example, if a child weighs 20 kgs, the mola will weigh as much as 114 children put together.

## LANGUAGE ARTS CONNECTION

### **SESSION FOCUS: FIRST AND THIRD PERSON NARRATIVE - COMIC STRIP MAKING**

#### **You need:**

- A3 Size chart paper
- pencils
- sketch pens or crayons

#### **To Do:**

1. Ask students to read the first few lines of the text from 'Meet the Mola Mola': 'I have superpowers. I am a scientist. Scientists have skills and tools that allow us to explore places invisible to the naked eye. I study organisms that live in the ocean.'
2. Share with students:
  - The sentences begin with the letter 'I'. This means that someone is narrating personal experiences. This is called a first-person narrative. You use a first-person narrative when you relate personal experiences.
  - A first-person narrative is used to express personal viewpoints and opinions. It is also used to describe personal experiences, events, journeys and occasions.
  - A third-person narrative is written using the pronouns: he, she, they or it. Ask students to skim the three stories in the issue and ask them to identify whether they are first-person or third-person narratives. ('Sky Lights' and "meet the Mola Mola" are first-person narratives, while Fantastic Fossil Finds is a third-person narrative.)
3. Ask students to divide the A3 chart into two parts.
4. Use the first half to draw a cartoon of the author of 'Meet the Mola Mola' and her underwater encounters. Write this section using the first person.
5. Use the second half to draw a conversation between you and a friend. You are talking about the author's experiences with the mola. Write this using the third person.

#### **REFERENCE READING**

<http://oceanresearchproject.org/wp-content/uploads/2014/03/Plastic-Pollution-Lesson-Plan-1.pdf>

#### **VIDEO HUB**

- **Plastic Ocean** <http://www.abc.net.au/btn/story/s3591476.htm>
- **Seagulls help Sunfish – World's Weirdest** <https://www.youtube.com/watch?v=U60obmWODLQ>
- **Swim with the Giant Sunfish (Tierney Thys Ted Talk)** [https://www.ted.com/talks/tierney\\_thys\\_swims\\_with\\_the\\_giant\\_sunfish](https://www.ted.com/talks/tierney_thys_swims_with_the_giant_sunfish)



**LEVEL 4**

**MOLA MOLA: Comprehension Check**

**1. Why does the author like the ocean?**

---

---

**2. Why does the author call the mola the gentle giants of the sea?**

---

---

**3. How does the mola differ from other fish?**

---

---

**4. What other modern fish has the same ancestor as the mola?**

---

---

**5. What are parasites?**

---

---

**6. What animals prey on the mola?**

---

---

**7. How do humans threaten the mola?**

---

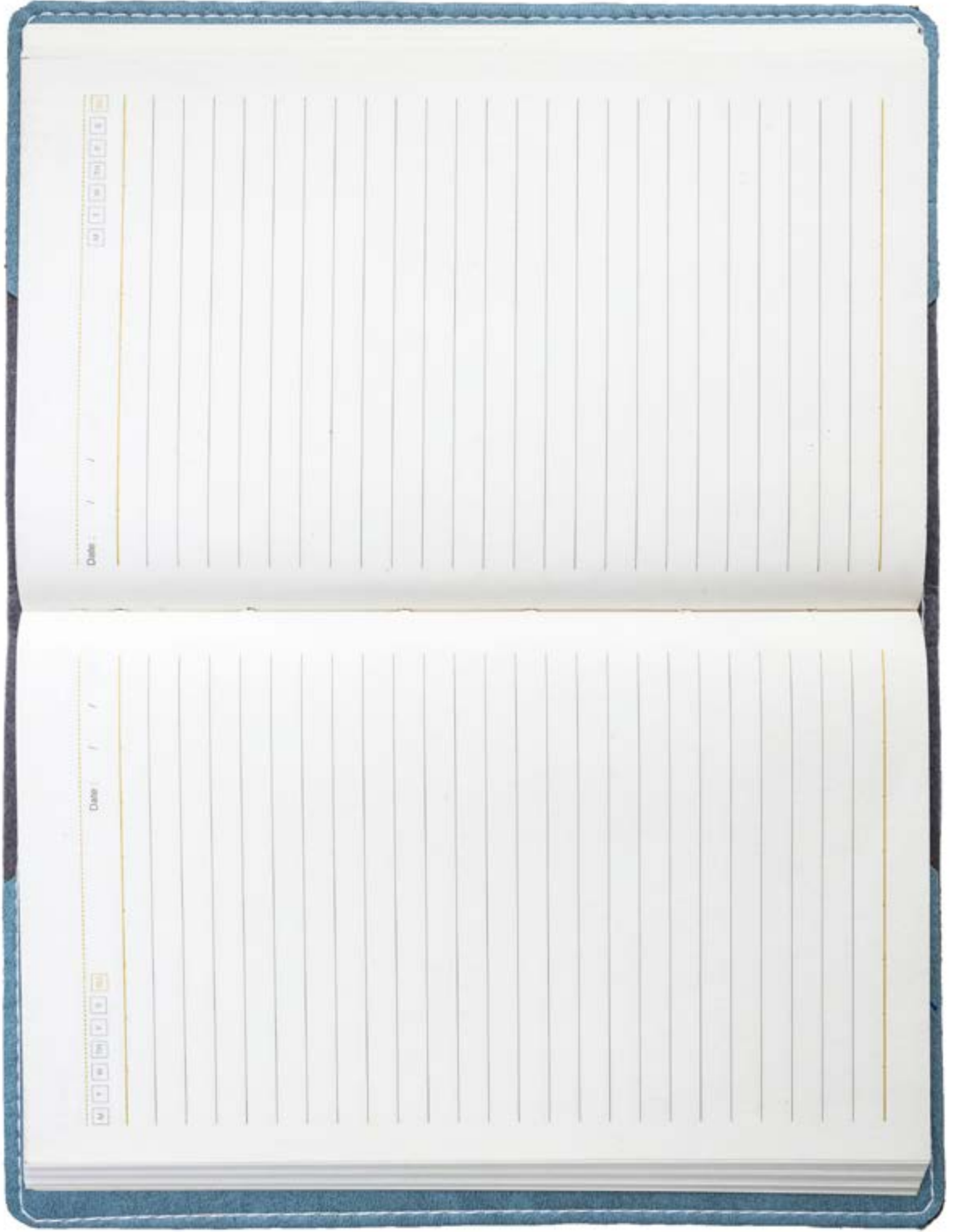
---

Name \_\_\_\_\_

Date \_\_\_\_\_

## Mola Mola: Diary Writing

Imagine that you are a mola. Write a diary entry in the first person explaining what a day is like for you.



**LEVEL 3**

**MOLA MOLA: Comprehension Check**

1. How much of Earth’s living space is in the ocean?

---

---

2. Why does the author call the mola the gentle giant of the sea?

---

---

3. What are the differences between bone and cartilage.

---

---

4. Describe how a mola gets rid of parasites.

---

---

5. Describe how the author tracks molas.

---

---

6. How is the ocean reacting to all the plastic that is being dumped in it?

---

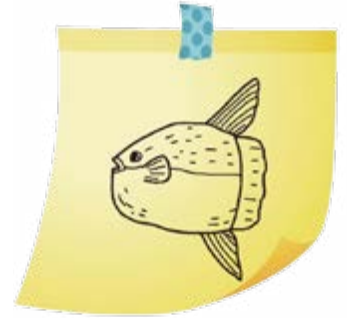
---

---

---

# Mola Mola: Creative Writing

Imagine that you could interview a mola. Write a story in the third person about a day in the mola's life.



# FOSSIL FINDS

## EARTH SCIENCE OUTCOMES

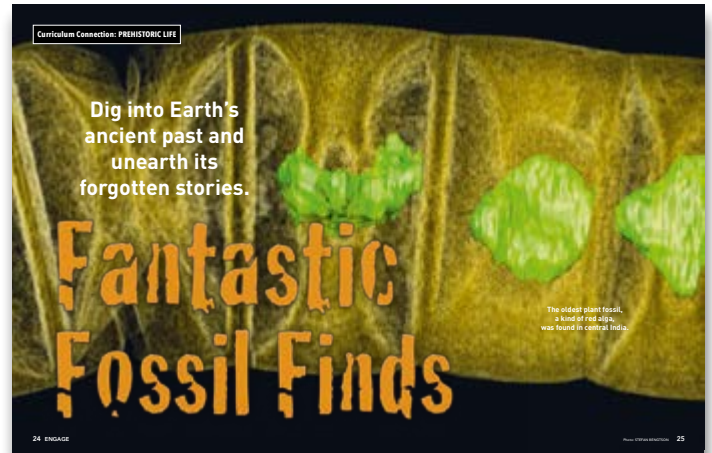
Students will understand that data can be represented in a graphical format. They will identify that patterns in rock formations and fossils can show how ecosystems have changed over time.

## LIFE SCIENCE OUTCOMES

Students will understand that scientists can interpret data from fossils to learn how plants and animals lived long ago. They will understand that plants and animals have external structures that function to support survival.

## LANGUAGE ARTS OUTCOMES

Students will integrate information from text and a graphic element. They will use a graphic organizer to improve comprehension.



## BEFORE READING BUILD BACKGROUND

Hand out copies of **engage** magazine.

Explain that history is the study of the past. Historians read written records to learn about people, plants and animals that lived long ago.

**Ask:** what kinds of records do palaeontologists use to learn about organisms that lived long ago. Guide the conversation to discuss fossils. Have students turn to page 26 of their magazine. At the bottom of the page, students will find a graphic that shows the five main types of fossils.

Have students read the graphic and then discuss the different kinds of fossils. Be sure to compare and contrast the different kinds of fossils. Point out that each fossil tells a story about the past. By studying many fossils, scientists learn a more complete story about the past.

## READY TO READ SMALL GROUP ACTIVITIES

Since guided reading involves small-group instruction, one of the problems teachers face is what to do with the groups who are not reading. Group activities will be provided here. We assume that you have three reading groups. We will refer to these groups as Group 1, Group 2 and Group 3. You can structure the groups so that each student is more or less on the same reading level or you could also mix up the reading levels. Both can be effective strategies.

## CURRICULUM CONNECTIONS

While reading 'Fantastic Fossil Finds', students will learn important life science and earth science concepts. They will also learn how to read a graphical representation of information and then integrate that information with text. The core of this story is that a variety of organisms inhabit Earth's ecosystems. These organisms have different physical features that help them survive. Students will learn that some organisms that are now extinct once lived on earth. They will learn that we know about these organisms from scientists who study their remains in the form of fossils. They will also learn about geologic time, and that the deeper that rocks are in the ground, the older they are. All of these concepts are essential to developing a basic understanding of both life science and earth science.

Teach this story in two parts over the course of several days. Begin by having students read the story 'Fantastic Fossil Finds' in guided reading groups or independently. This reading could be conducted by either the reading teacher or by the science teacher. Guided reading has the advantage in that you can check student comprehension as students read and reinforce important concepts. After students finish reading, use whole-class instruction to teach the science.

- Explain to all the three groups that they will be doing an activity after reading the story with you. The activity involves reading, drawing and writing. Ask them to look at the diagram on page 26 of the magazine which shows five fossil types.
- Tell the students in Group 1 to come up for the reading. In the meantime, ask the students in Groups 2 and 3 to draw other kinds of fossils that fit each of the five fossil categories. After they have finished drawing the fossils, have them meet together and explain how each drawing fits the categories outlined in the graphic.
- After Group 1 has finished reading the story with you, have them return to their seats. Tell them to draw other kinds of fossils that fit each of the five fossil categories. Group 2 will now be called up for the reading. And Group 3 will write a story about the fossils they drew. The story can be about the organism that made the fossil or about the how the fossil was formed or discovered. Students may have to do some research to write their stories, so make sure you have books or internet access available to them.
- After Group 2 has finished reading, have them return to their seats and call up Group 3 for the reading. Groups 1 and 2 will now do the writing activity. After all groups have finished reading, drawing and writing ask students to share their stories within their groups.
- With this activity, you will be able to encourage and assess nonfiction reading skills while developing background information about how fossils form.
- **Timing:** Reading the article should take about 45 minutes per group. If you have three reading groups, the total time will be 135 minutes. You should add another 45 minutes for sharing, so the total time will be 180 minutes.
- Have students turn to pages 26-27 and direct their attention to the artwork on page 27. Explain that the artwork is based on information that scientists learned by examining a fossil.
- Ask students to tell us what they see in the artwork. Then direct the students to look at the glossary of words on page 26. Have them read the words and their definitions. Quiz students to make sure they know what each word means. Then ask one student to read aloud the text in the first column. After the student has finished reading, ask all students in the group to use the graphic at the bottom of the page to identify the kind of fossil that is being discussed (*Replacement fossil*). Ask them to support their decision. (*The text says that minerals in sand replaced the material that made up the bones.*) Then ask another student to read the second column of text. After the student has finished reading, **ask:** why might a predator also scavenge for food? (*Hunting prey is dangerous. As the first part of the story shows, prey can fight back and may be more dangerous than they look. Just because an animal is a herbivore does not mean that it is defenceless. In fact, a herbivore can be deadly. So, a predator will eat a free meal whenever it can. A carcass is less dangerous than living prey.*) Use your QR Reader on your phone to show students the video of the velociraptor and protoceratops fighting. After watching the video discuss how it helps extend their learning. Ask students how combining the text, graphic, artwork and video improves their comprehension.
- Have students turn to pages 28-29. Direct their attention toward the graphic on page 29. Tell them that dinosaurs lived during the Triassic, Jurassic and Cretaceous periods. Ask them to use the graphic to tell us how long ago each period was and how long each period lasted. Then tell students that you will return to the graphic with the whole class. Then direct students' attention to the artwork in the left-hand column on page 28. Ask them to describe what they see. Then ask a student to read aloud all the text except 'A Swimming Dinosaur'. After reading, ask students to explain why Yi qi is different from other kinds of dinosaurs. Have them explain how Yi qi is like a bat and a bird. Then ask students to look at the photo under 'A Swimming Dinosaur'. Ask student to use the artwork to predict how this dinosaur lived. Then ask a student to read aloud the text. Discuss the dinosaur's unique features.
- Ask students to read pages 30-31 independently.

## GUIDED READING

- Ask students to turn to page 24 in their copies of the magazine.
- Ask a student to read aloud the text on pages 24-25. Then guide a discussion on what the story is about. Ask students what kinds of stories they would expect to learn from fossils. Help students understand that they have to get the information from the fossil and cannot just make up stories based on what they think might be cool.

## AFTER READING: INSTRUCTION

### EXTERNAL STRUCTURES (45 minutes)

Bring the whole class back together. Ask students to discuss what surprised them most about the dinosaurs they read about. Continue the discussion asking students to discuss the unique external structures each dinosaur had that helped them survive. Copy and hand out a web for each dinosaur by writing its name in the middle of a sheet of paper and then the external structures around the name. You will find a web that you can copy at the end of this lesson.

After students have written down the external parts on the web, have them write an explanation about how each structure helped the dinosaur survive.

### GEOLOGIC TIME (45 minutes)

- Explain to students that there are two main ways to tell time. Relative time and absolute time. Relative time is a non-numerical timeline. It simply states the order in which events occurred. Ask students to make a list of what they have done since waking that morning. To demonstrate this, you can write on the board what you have done.
- Then explain that absolute time associates numbers with the timeline. Have students write the time that they started each activity on their lists.
- Direct students' attention to a clock. Explain that a clock is a graphic representation of time. It helps to break up time into smaller, more easily understood units. Explain that they can use a clock to break up time into hours, half hours, quarter hours, minutes and seconds. They can add smaller units together to make larger units. A clock is a tool that helps them understand the passage of time.
- Explain to students that they can also create a linear timeline. A linear timeline shows important events over a period of years. Provide students with a sheet of paper each and have them draw a horizontal line across the middle of it. Have them then add evenly spaced tick marks across the line, one tick mark for each year they have been alive. Under each tick mark, they should write the year from birth to the present. Above the first tick mark, they should write 'Born'. Then they should add an important event in their lives for each tick mark.
- Have students turn to the 'Layers of Time' graphic on page 29 of their magazines. Explain that the graphic also shows the passage of time. Unlike a clock, it

shows the passage of billions of years. Like a clock, the graphic can be used to split time into smaller units. These are called eons, eras and periods. It shows two eons, Proterozoic and Archean; three eras, Palaeozoic, Mesozoic and Cenozoic; and 18 periods. Eons are the largest time periods, eras are smaller and periods are the smallest units of time on the graphic. Explain that the oldest events shown on the graphic are at the bottom of the graphic and youngest are at the top. This is what happens in nature. Sediments build up. Younger sediments fall on top of older sediments. Ask students to ignore the numbers and ask them to explain which periods happened before other periods. This would be a discussion of relative time. Then ask students to calculate how long each period lasted. Point out that the periods are not equal in length. They were divided according to significant changes shown in the fossil record.

## AFTER READING: EXTENSION ACTIVITIES:

The following activities will increase comprehension and help students explore different aspects presented in this lesson. Pick and choose the ones that work in your class. You may not have time to conduct all of them. You can also modify some of them and assign them as independent work or homework.

### **ACTIVITY: Make your own Trace Fossil** (45 minutes)

Follow the instructions given on this link so that students can create their own trace fossil. [https://www.mos.org/sites/dev-elvis.mos.org/files/docs/education/mos\\_dig-into-dinosaurs\\_make-your-own-fossil.pdf](https://www.mos.org/sites/dev-elvis.mos.org/files/docs/education/mos_dig-into-dinosaurs_make-your-own-fossil.pdf)

### **ACTIVITY: Geologic Time** (45 minutes)

Direct students to turn to page 21 and use the instructions there to build a geologic time scale. It will help them understand how sediments build up and fossils form, and the relative age of sediments and fossils.

### **ACTIVITY: External Structures** (20 minutes)

Show students drawings of dinosaurs or photos of dinosaur fossils. Ask students to identify external structures shown in each drawing or photo and explain how they think those structures helped the dinosaurs survive.

### **ACTIVITY: News Writing** (45 minutes)

Divide students into groups and assign one of the fossil finds from pages 24-29 to each group. Tell students that they are news teams. Their assignment

is to research the fossil find, write a 1-minute long news story and then film the news story. Students can divide their groups into subgroups. They will need researchers, writers, editors and at least one reporter. Use your mobile device to film each news report and then show the news reports on your interactive whiteboard or a screen. You can also just hold up your device so the class can see the video. If students are allowed to bring mobile devices to school, have them use their own devices.

**ACTIVITY: News Writing** (45 minutes)

- Using a computer and an interactive whiteboard or projector and screen, display the poem *Fossils* by Ogden Nash. You will find it at <http://www.powerpoetry.org/famous-poems/fossils>. The poem deals with an imaginary situation in which fossils come alive in a museum.
- Discuss the poem:
  1. Where does the action in the poem take place?
  2. What are the main characters in the poem?
  3. Why do you think one of the fossils says, 'It's fun to be extinct'?
  4. What do you think is a wassail? (A wassail refers to celebratory songs.)
  5. Though there are no musical instruments, the poet says there is a lot of music. What made the music?
- Point out the poem's rhyme scheme. It is composed of couplets. The last word of the lines of each couplet rhyme. Ask students to write a short poem about one or more dinosaurs from the story using the same rhyme scheme. Have them share their poems.

**ACTIVITY: Walk Like a Dinosaur** (10 minutes)

By conducting this kinetic activity with students, you will demonstrate how some dinosaurs, including T. rex and velociraptor walked. Explain to students that fossil footprints show that these two dinosaurs mainly walked on their toes. Have students stand up. Then have them stand on their toes. Tell them that velociraptor and T. rex had short, stubby arms. Ask them to hold out their arms, just like a T. rex. Then add that T. rex and velociraptor leaned forward when they walked and ask them to lean forward. Finally, invite them to take a step and see what happens. Students should feel off balance and will catch themselves as they step forward. Explain that students do not have a body part that the two dinosaurs had – a tail. The tail acted as a counterbalance that prevented them from toppling over as they walked. Scientists know that these dinosaurs carried their tails in the air and didn't drag them on the

ground, because they do not see tail marks along with fossil footprints. If these dinosaurs dragged their tails, their tails would have made long lines that would be part of the fossil record. Since tail marks are not found, dinosaurs must have carried their tails in the air.

**ACTIVITY: Comprehension Check** (30 minutes)

Print and hand out the comprehension check at the end of this lesson.

**REFERENCE READING**

<http://www.sciencekids.co.nz/sciencefacts/dinosaurs/fossilseggs.html>

<http://www.nationalgeographic.com/magazine/2017/06/dinosaur-nodosaur-fossil-discovery/>

<http://www.enchantedlearning.com/subjects/dinosaurs/dinofossils/First.shtml>

**MOVIE WATCH**

Jurassic Park

**VIDEO HUB**

**Dinosaurs Documentary** <https://www.youtube.com/watch?v=vuet3t9geXo>

**How the Dinosaurs Died** <https://www.youtube.com/watch?v=sEFjuNkY0yw>

**Dinosaur Fossil Park in India** <https://www.youtube.com/watch?v=8VA5jNiOdEo>

**School children in Netherlands driving a cycle bus to school** <https://www.youtube.com/watch?v=1ZwN7D1IUcw>

**Students Building Fuel Efficient Car** <https://www.youtube.com/watch?v=kg2SeglpQbo>

**Electric Car on Solar Energy** <https://www.youtube.com/watch?v=Hq5XJmBZcJk>



**LEVEL 3**

**FANTASTIC FOSSIL FINDS: Comprehension Check**

Draw a line to connect each photo with its correct label.  
Then briefly describe each fossil.



**Mould**

---

---

---



**Preserved Fossil**

---

---

---



**Carbon Film Fossil**

---

---

---



**Trace Fossil**

---

---

---



**Petrified Fossil**

---

---

---