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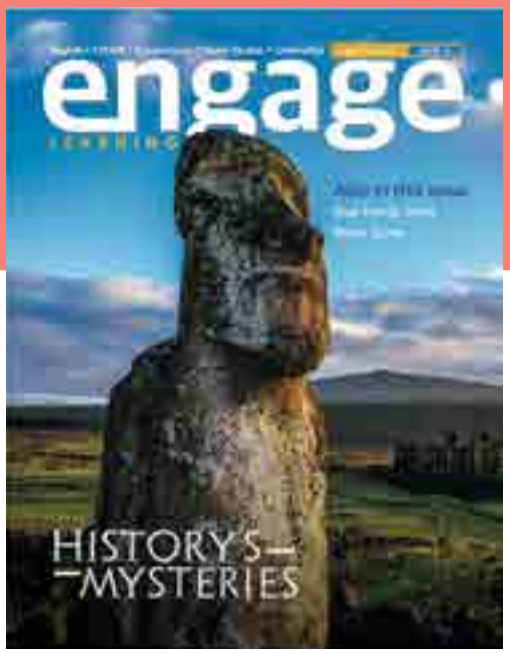

TEACHING GUIDE

VOL 2 / ISSUE 6 / LEVELS 3 & 4

AGES 9-13 YEARS

Dear Educator,

We have had an amazing year engaging your students. We have traveled the world and met some of India's greatest scientists. They showed students how what they are learning in school relates to what real-life scientists do. Along the way, students have developed their math, reading and writing skills.

This is your last issue of the school year, but do not worry. We are already hard at work developing stories for next year. We always pick a general theme for each year. This coming year, we are concentrating on new technologies. In the first issue, students will learn how real-life CSI works and solves mysteries. Then students will see how nanotechnology, the world's smallest machines, are changing lives. We will fly drones into erupting volcanoes and the deepest caves. And we will learn how coding is improving farming and AI is solving seemingly impossible questions. Of course, we will also cover all the kinds of stories you expect from **engage** magazine.

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CONTENTS

MEET THESE OUTCOMES

SOCIAL STUDIES

- Students locate the various artefacts/structures from the story on a world map.
- Students compare the three artefacts and analyse the reasons they exist.

SCIENCE

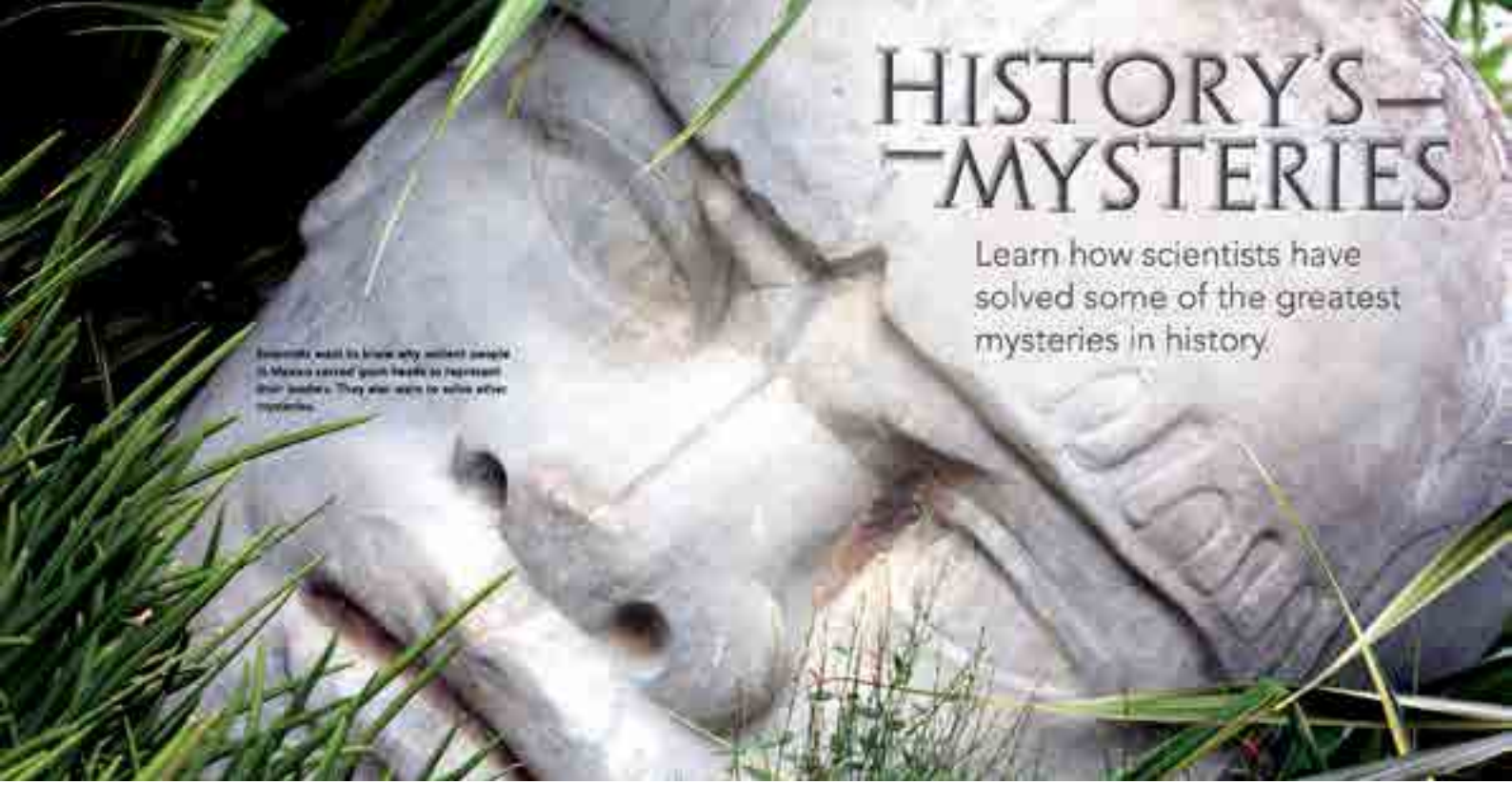
- Students classify animals based on their physical characteristics.
- Students create food chains with the red panda.
- Students discuss reasons for why species become endangered or extinct.
- Students learn what the skeletal system is, list the functions of the skeletal system and explain how to take care of their bones.
- Students identify vertebrate and invertebrate animals and give reasons for their selection.

LANGUAGE ARTS

- Students create a nonfiction "story".
- Students understand the meanings of science vocabulary words.
- Students find answers to given factual questions from the text.

MATH

- Students solve word problems involving more than one step.
- Students learn about symmetry and draw a symmetrical skeleton.



SOCIAL STUDIES OBJECTIVES

- Students locate the various artefacts/structures from the story on a world map.
- Students compare the three artefacts and analyse the reasons they exist.

LANGUAGE ARTS OBJECTIVE

- Students create a nonfiction "story".

CURRICULUM CONNECTIONS

In this story, students learn about different artefacts from Easter Island (Rapa Nui), China and Pompeii that give us insights about what the culture and history of those places may have been. Students locate these places on a world map and describe the artefacts while reading about them. They compare the reasons for constructing the statues, figures and sculptures mentioned in the story and understand what these artefacts represent.

In language arts, students write a paragraph on "A Way of Life in the 20th Century".

BUILD BACKGROUND

1. Ask students to share information they may have about old monuments/structures/statues in their own town or city. Ask them to discuss the following points with a partner:
   a. Think of a famous monument/statue/structure in your city.
   b. Why was it constructed?
   c. Who built it and what does it represent?
   d. What materials have been used in its construction?
   e. Who looks after it?
2. Ask students to turn to pages 2-3 of their copies of **engage** magazine. Project the same pages using the digital flipbook. Read the title of the story and ask students to study the image given. Discuss what the image shows and ask students what they think this story is about and what mysteries might they learn about. Take a few responses.
3. Ask students to look at the images from pages 4-9 in their copies of **engage** magazine. Ask them the following questions. Answers may vary for all the questions. Accept all answers, encouraging a discussion.
   a. Have you seen these kinds of structures before? If so, where?
   b. How old do you think these structures are?
   c. Who do you think made them and why?
   d. Why do you think the author calls them 'history's mysteries'?
   e. What questions come to your mind after seeing them?

READY TO READ

1. Students read the "Moai Mystery" story on page 5 from their copies of **engage** magazine. Divide Level 4 students into pairs and direct them to take turns reading the story aloud. For Level 3 students, model the reading first using the digital flipbook as students follow along in their own copies of the magazine Once you have finished modelling, give students time to read the same story again in pairs. For both levels, go over the key words students may have difficulty reading before they start reading. Ensure you stress the pronunciation and meanings of these words:

   Level 3: canoes, carved, moai, ancestors, individuals, slavery, collapsed, ecological, disaster

   Level 4: canoes, forged, archaeologists, ancestors, deforested, Rapanui, habitat, collapsed, ecological
2. Once students have finished reading, ask them to write the information about the statues in their notebooks in the format given below. We have provided the responses for "Moai Mystery" for your reference.

Key Points	Information
Location where the statues are found	Rapa Nui island
What are the statues called?	Moai
Size of the statues	4 metres high
Material used to make the statues	The statues are carved in rock.
What do they represent?	Rapanui's ancestors or important chiefs
Two questions you have about this history's mystery.	• Who were the Rapanui and where did they come from? • How did they make the statues without any technological advancement? • Responses may vary.

3. Repeat the reading process for "Military Mystery" and "Mountain of Mystery" on pages 6-9. After students finish reading, they complete the same information about the two sections in their notebooks. Walk around and help students read and find the relevant information. After students have written the information, discuss the answers with the whole class.

Key Points	Military Mystery	Mountain Mystery
Location where the structures are found	China	Pompeii, Italy
What are the structures called?	warriors (Level 3) terracotta warriors (Level 4)	NA
Size of the structures	life-size statues (Level 4)	size of humans
Material used to make the structures	clay	plaster of Paris
What do they represent?	An army to protect the emperor in his afterlife.	preserved living bodies; showing a way of life in Pompeii
Two questions you have about this history's mystery.	• Why did they make so many statues? • How much time would it have taken to build all these statues? • Responses may vary.	• What is plaster of Paris? • Why couldn't the people escape to a safe place? • Responses may vary.

EXTENSION ACTIVITIES

ACTIVITY 1
MAP IT!

Objective:

- **Students locate the various artefacts/ structures from the story on a world map.**

You Need:

- copies of the worksheet "History's Mysteries World Map" given on page 12 of this Teaching Guide – one per pair
- crayons
- sticky notes

To Do:

1. Ask students to refer to the information written in their notebooks during "Ready to Read," specifically the locations of all the three mysteries. Tell them the new names of two of the places and show them where these sites exist on a map.

Old Name of the Place	New Name of the Place	Continent
Rapa Nui	Easter Island	Chile, South America. It can be found in the south Pacific ocean.
China	China	Asia
Pompeii, Italy	doesn't exist today	Europe

2. Project a picture of the world map and distribute copies of the worksheet. Ask students to identify and write the names of the three continents and colour the countries each with a different colour in their individual maps.
3. Using the maps given on page 8 of this teaching guide as a reference, show students the specific locations of the sites on the projected map. Students mark these on their own maps by drawing a star at the specific location and writing the name of the structure next to the star. Alternatively, you can use Google Earth Live in class to show them the location.
4. Distribute three sticky notes to each child. Instruct them to stick one next to each location on their map and write the name of the structure and two interesting facts about it from their copies of **engage** magazine.


BRAZIL
EASTER ISLAND


RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
XI'AN
IRAN
INDIA


SWEDEN
FINLAND
BELARUS
POLAND
GERMANY
UKRAINE
KAZAKHSTAN
SPAIN
POMPEII
TURKEY
SYRIA
IRAQ
IRAN
ALGERIA
LIBYA

ACTIVITY 2
COMPARE AND CONTRAST

Objective:

- **Students compare the three artefacts and analyse the reasons they exist.**

You Need:

- copies of the worksheet "Compare and Contrast" given on page 13 of this Teaching Guide – one per student

To Do:

1. Divide students into pairs and assign each pair with any one of history's mysteries.
2. Distribute copies of the worksheet to each student. Ask them to find the relevant information about their assigned structure with their partners and fill in the table individually.
3. After students have completed the assignment, combine three pairs of students, each with a different mystery, and have them share their information with each other so that every student has a complete worksheet. We have provided a completed table for your reference.

	Moai Mystery	Military Mystery	Mountain Mystery
How old are the artefacts?	They are around 1,000 years old.	They are around 2,000 years old.	The statues are 100 years old.
Number of structures	887	Around 7,000	Around 1,200
Reason for their construction	They represented Rapanui's ancestors. They were important chiefs or ancestors of the families that moved to the island. They were placed inwards to watch over and protect the Rapanuis.	They were made to protect the emperor's tomb. (Level 3) They were made to protect the ancient emperor in the afterlife. (Level 4)	A tragedy struck on 24th August 79 C.E. on Pompeii. A volcano erupted due to which gas and lava erupted from it. Gas and heat killed all the living things. Ash covered the bodies and made moulds around them.. An archaeologist came up with a way to find out what the remains under the pile of ash looked like.
How were they constructed?	They were carved from giant rocks.	They were made from clay. Heads, legs and bodies were made in separate moulds. Each piece was then assembled. Facial expressions and hair were made with clay.	The ash formed a mould around dead human bodies. Plaster of Paris was poured into these moulds. These bodies decomposed and left a hollow shape of plaster of Paris cast into the shape of human bodies.
Special features	On the back of each statue, there is canoe-shape carved in.	All the soldiers looked different.	These figures show what the people looked like, what they wore, ate and used during their time.

ACTIVITY 3
MYSTERIES OF 2019

Objective:

- **Students create a nonfiction "story."**

You Need:

- copies of the worksheet "A Way of Life" given on page 14 of this Teaching Guide – one per pair

To Do:

1. Ask students to turn to page 9 of their copies of **engage** magazine. Ask them to re-read the section "The End of Pompeii". After reading, discuss the various facts presented in the story related to the lifestyle, food and health of the people who lived in Pompeii around the 1st century and ask students to draw some conclusions based on the evidence. The table below is given for your reference.

Topic	Evidence	Possible Conclusions
Lifestyle	The walls of the houses were decorated with murals and graffiti. People used coins, jewels and pottery. (Level 4 only)	Appearances mattered (since houses were decorated and jewellery was worn). People may have been rich. People had trade (since they had money).
Food	Bread was in the oven. A variety of food was found in the drainage system like sea urchins, meat of giraffe and flamingo.	They had specialised cooking techniques like baking. They were not vegetarian. They hunted or traded for meat.
	They ate lot of fruits and grains. (Level 4 only)	They may have had agriculture.
Health	People lived until an old age. Most people did not have cavities in their teeth.	People had a healthy life style.

2. Present the following hypothetical scenario to students: A major tragedy has wiped out our present civilisation, but many artefacts relating to our way of life have been preserved. 2,000 years from now, a new civilisation finds these artefacts from 2019.
3. Ask students to discuss with their partners what possible artefacts might this new civilisation find; what conclusions might they reach about our lifestyle, food, health and technological advancements; and what kind of a story might they write about us.
4. In groups of three, ask students to brainstorm and list as much evidence and as many conclusions as they can think of using a table like the one shown below.

Topic	Evidence	Possible Conclusions
Lifestyle		
Food		
Health		
Technology		

5. Ask students to write a paragraph on "A Way of Life in the 20th Century". Provide copies of the worksheet to Level 3 students; they can use the scaffold provided to write the outline of the story and then write the final story in their notebooks.

COMPREHENSION CHECK

ANSWER THE FOLLOWING QUESTIONS IN 1-2 SENTENCES (USE YOUR OWN WORDS):

1. What do you think an archaeologist does?

_____

_____

2. Why do you think it is important to study history's mysteries?

_____

_____

_____

SELECT THE CORRECT STRUCTURE THAT MATCHES THE INFORMATION IN EACH STATEMENT AND WRITE ITS NAME IN THE BLANK:

moai statues	**terracotta army**	**preserved bodies**

1. They were carved from rock and were made to protect the islanders.

   _____

2. They were buried when a volcano erupted.

   _____

3. These statues can be found in Rapa Nui, now called Easter Island.

   _____

4. These were built to protect the emperor, after he died, in his afterlife.

   _____

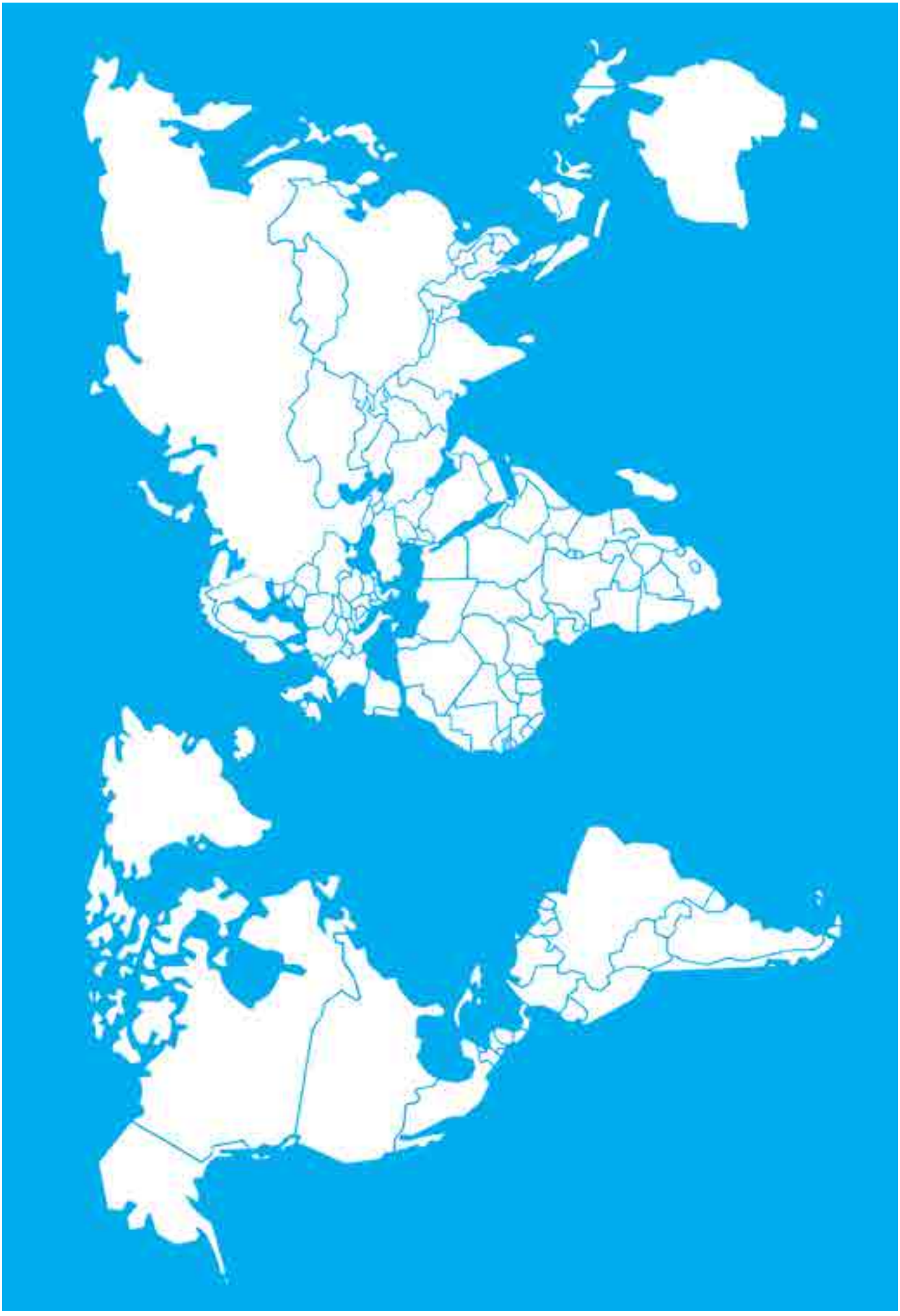
5. These represent the lifestyle, health and food of the people in Pompeii.

   _____

6. These can be found in China.

   _____

History's Mysteries World Map



Compare and Contrast

	Moai Mystery	Military Mystery	Mountain Mystery
How old are the artefacts?			
Number of structures			
Reason for their construction			
How were they constructed?			
Special features			

A Way of Life

Date: Jan 21st 4019

We know that the tragedy destroyed _____ in 2019 but it preserved _____.

Last week, archaeologists in India discovered (some evidence related to our lifestyle) _____

_____

_____

suggesting that people in the 20th century _____

_____.

They also found (some evidence about food) _____

_____.

Based on this evidence, we believe that the people in India ate _____

_____.

What surprised our team was when they found (some evidence related to technological advancement) _____

_____.

It was surprising because _____

_____.

Overall, we can say that people's way of life in the 20th century was _____

_____ and _____

_____

(a concluding paragraph).

SCIENCE OBJECTIVES

- Students classify animals based on their physical characteristics.
- Students create food chains with the red panda.
- Students discuss reasons for why species become endangered or extinct.

MATH OBJECTIVE

- Students solve word problems involving more than one step.

CURRICULUM CONNECTIONS

This story introduces students to the red panda. They learn about its physical features, habitat and food and mating habits. They create a food chain for the red panda. They also understand the reasons why it is endangered.

BUILD BACKGROUND

1. Ask students to turn to pages 12-13 of their copies of **engage** magazine. Project the same pages using the digital flipbook. Ask them to describe the animal they see. Take a few responses. They can describe the animal's colour, size, physical features, its similarity to other animals they may know about, etc.
2. Read the headline of the story. Tell students that in this story, they will learn about the red panda.
3. Ask students the following questions:
   a. What are the basic needs of all living things? (*food, water, shelter, safety*)
   b. What needs may be difficult for animals to meet? (*food, water, shelter*)
   c. What will happen to animals if they don't get the things they need to survive? (*They will start dying.*)
4. Write the words "extinct", "endangered" and "threatened" and their definitions on the board. Discuss what each term means. Let students copy the definitions into their notebooks:
   a. Extinct – Species that no longer exist.
   b. Endangered – Species that are in serious danger of extinction and whose population is very low.
   c. Threatened – Species that may become endangered in the future if necessary steps are not taken to prevent their population from decreasing.
5. Read the information given on page 13 and ask students who they think a conservationist is. Explain that conservationists are people who are worried about endangered and threatened species and try to raise awareness about how we can protect them. This story tells us why conservationists are worried about the red panda. Ask students if they could guess some of the reasons why the red panda might be endangered.
6. Project page 15 using the digital flipbook and ask student volunteers to read the information provided from their own copies of **engage** magazine. Guide students through the reading when they struggle with certain words

READY TO READ

1. In pairs, ask students to list three questions that they have about the red panda. Give them 5 minutes to brainstorm. Take at least 1-2 questions from each pair and list them on the board.
2. Hand out a copy of the "Red Panda FAQ Sheet" given on page 26 of this Teaching Guide to every student. Explain that a FAQ sheet answers the most frequently asked questions that we can anticipate about a topic, in this case about the red panda. Go over the sheet and read the questions out loud once so that students understand what information to look for.
3. For Level 4, ask students to read pages 16 and 19 in pairs. For Level 3, project the same pages and read them to the class while your students follow along in their copies of the magazine.
4. In pairs, students find the answers to the questions on the FAQ sheet and fill in the answers.
5. After students have completed filling the sheet, discuss the answers with them.
6. In pairs, students read the information on page 15 again. They discuss the advantages of the red panda's fur colour, claws and tail.

EXTENSION ACTIVITIES

ACTIVITY 1
CHARACTER TRAITS

Objective:

- **Students classify animals based on their physical characteristics.**

You Need:

- copies of the worksheet "Classification of Animals" given on page 28 of this Teaching Guide – one per student
- YouTube video: https://www.youtube.com/watch?v=mRidGna-V4E&t=6s

To Do:

1. Project the images given on page 27 of this Teaching Guide. Ask students what differences they notice between the three animals' skin. (*The body of the red panda is covered with fur; the skin of the frog appears moist; the cobra has scales on its body.*) Tell students that the bodies of different animals could be covered with feathers, hair, fur or scales.
2. Draw the following table on the board, leaving the topmost row blank. Brainstorm with the whole class and fill in each column with at least three examples. We have provided some examples for your reference below. Tell students that here we have sorted or 'classified' animals based on their physical features, specifically body covering. After the table is complete, ask students if they can guess the category of animals in each column. Write each category in the top row. (*From L-R: mammals, fish, reptiles, amphibians, birds*)

Animals with fur on their bodies	**Animals with scales on their bodies that breathe through gills**	**Other animals with scales on their bodies that breathe through lungs**	**Animals with moist skin**	**Animals with feathers on their bodies**
cat gorilla fox	goldfish clownfish sharks (*they have very small scales*)	lizard snake crocodile	frog salamander newt	crow pigeon parrot

3. Ask students what we mean by 'classification' and why we need to classify animals. Take a few responses. Tell students that biologists classify all known living things into different categories. When they find a new living thing, they have to figure out a class or group to assign it to. Explain that there are millions of species of organisms. It would be nearly impossible to keep track of and study them if they were not organised into groups. Scientists use precise criteria based on characteristics to put living organisms into specific groups.
4. Ask students what kinds of criteria we could use to classify animals. Animals can be classified on the basis of:
   a. habitat
   b. food
   c. physical characteristics
   d. ways of giving birth
5. Distribute the worksheet "Classification of Animals".
6. Tell students that you will now show them a video on classification. You will pause the video several times as they watch. Each time you pause the video, you will discuss a questions with the class and students will complete the relevant section/s of the worksheet. A completed worksheet has been provided below.
7. Begin the video. Pause the video at the following intervals and discuss the animal characteristics. Ask students to fill in the worksheet for the relevant category of animals as they watch the video.
   a. 1:51 min
   b. 3:01 min
   c. 3:52 min
   d. 4:46 min
   e. 5:28 min
   f. 6:10 min
8. Ask students to justify why the red panda is a mammal. They can write the reasons in their notebooks (*its body is covered with fur; it gives birth to babies; their ears stick out*).

Time	Category	Characteristics	Examples
1:51	Invertebrates	They don't have a backbone. On land, most invertebrates are small. In the water, they could be big.	octopus, squid, jellyfish, insect, starfish, lobster
1:51	Vertebrates	They have a backbone.	fish, bird
3:01	Fish	They live in water. They have gills for respiration and their bodies are covered with scales. They have fins. They are cold-blooded. They lay eggs.	goldfish, anglerfish, shark

Time	Category	Characteristics	Examples
3:52	Amphibians	They live in water and on land. They have smooth, moist skin. They lay eggs in water. Their eggs are covered with jelly. They are cold-blooded. Their young look different from the adults.	frog, toad, newt, salamander
4:46	Reptiles	They have dry and scaly skin. They lay eggs out of water. The eggs have protective layers. They breathe through lungs. They are cold-blooded.	turtle, lizard, snake, crocodile
5:28	Birds	They have wings and two legs. Their bodies are covered with feathers. They are warm-blooded. Their eggs are covered by a shell.	duck, peacock, pigeon, crow
6:10	Mammals	They breathe through lungs. Their bodies are covered with hair or fur. They are warm-blooded. They give birth to babies. They have ears that stick out.	human, lion tiger, monkey

ACTIVITY 2
FOOD CHAIN

Objective:

- **Students create food chains with the red panda.**

You Need:

- long strips of chart paper (30 cm (l) x 8 cm (w)) – two per group of 3 students

To Do:

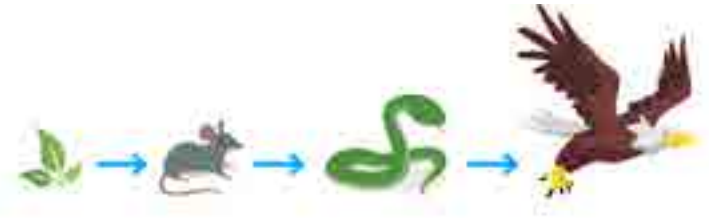
1. Remind students that they have learnt about food chains in the story on sharks in Issue 2.
2. Ask them to turn to page 19 eat of their copies of **engage** magazine and find out what red pandas eat. Next, turn to page 16 and ask students to read the section "Panda Problems". Discuss the following with them after they have finished reading.
   a. Food habits: bamboo leaves, bamboo shoots, fruits and flowers
   b. Natural predators / other hunters: Inform students that red pandas are naturally hunted by leopards, and are caught or killed by hunting dogs and humans.
3. Explain to students that animals need living (plants and animals) as well as nonliving things (sun, water, air, soil) for survival. Write down the roles of the following living and nonliving things on the board and ask students to copy them into their notebooks.
   a. Plants – They make food used by other living things.
   b. Sun – It provides the energy needed by plants to make food.
   c. Water – All living things need water to survive.
   d. Animals – Some animals eat other animals for energy.
   e. Air – All living things need oxygen to breathe.
   f. Soil – Plants need soil to grow.
4. Explain that all living things need food. Some animals eat plants e.g. cow, deer, red panda. Some animals eat other animals e.g., some humans eat chicken, frogs eat insects, big fish eat small fish, etc. All animals eat food as they need energy. The sun provides solar energy to plants to make their own food. When animals eat plants, this energy gets transferred to animals.
5. Draw the following food chain on the board. Explain to students that grass converts solar energy from the sun into food (chemical energy). When deer eat grass, this energy gets transferred from the grass to the deer. When a tiger eats a deer, it gets energy from the deer. This is called a food chain.

   Sun → Grass → Deer → Tiger

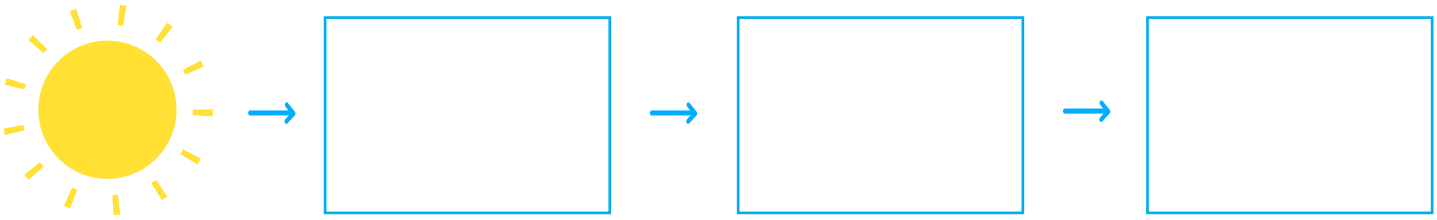
   Note for the teacher:

   For Level 3, you don't need to explain the energy transfer. You can simply explain who eats what/whom.

6. Students write the following information about food chains in their notebook.
   a. A food chain shows how each living thing gets its food. It shows who is eating what/whom. The arrow means "is eaten by".
   b. Each plant or animal in this sequence is food for the next one in the chain.
   c. The direction of the arrow shows how energy moves in the chain. Living things need energy to grow and move.



   d. Revise the following terms with the class: producers, primary and secondary consumers, herbivores, carnivores, predators, prey
7. Give one more example of a food chain. Discuss the primary consumer, secondary consumer, predator and prey in the food chain given below.
8. Divide students into groups of 3. Give each group two long strips of chart paper. Ask students to make two different food chains in the following format.



Sun Producer Consumer 1 Consumer 2

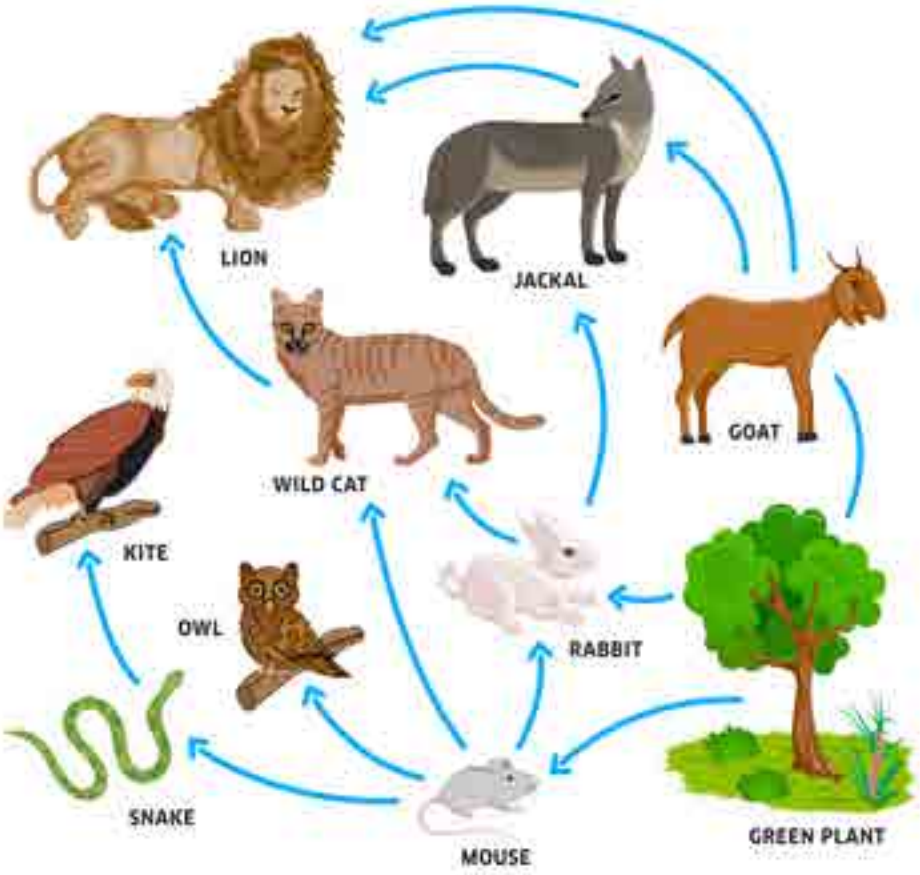
Both food chains should be related to red pandas. Students can refer to the previous discussion on the kinds of food the panda eats and who eats the panda as its food. Ask students to explain the food chains which they have made and which of these occurs naturally (*the one with the leopard as the predator*).

1. Project the Food Web given on page 22 of this Teaching Guide. Ask students the following questions:
   a. Which animals depend on the green plant for their food? (*goat, rabbit, mouse*)
   b. Which animals eat goat for their food? (*jackal, lion*)
   c. How many food chains can you make from this image? (*several; some examples given alongside*)

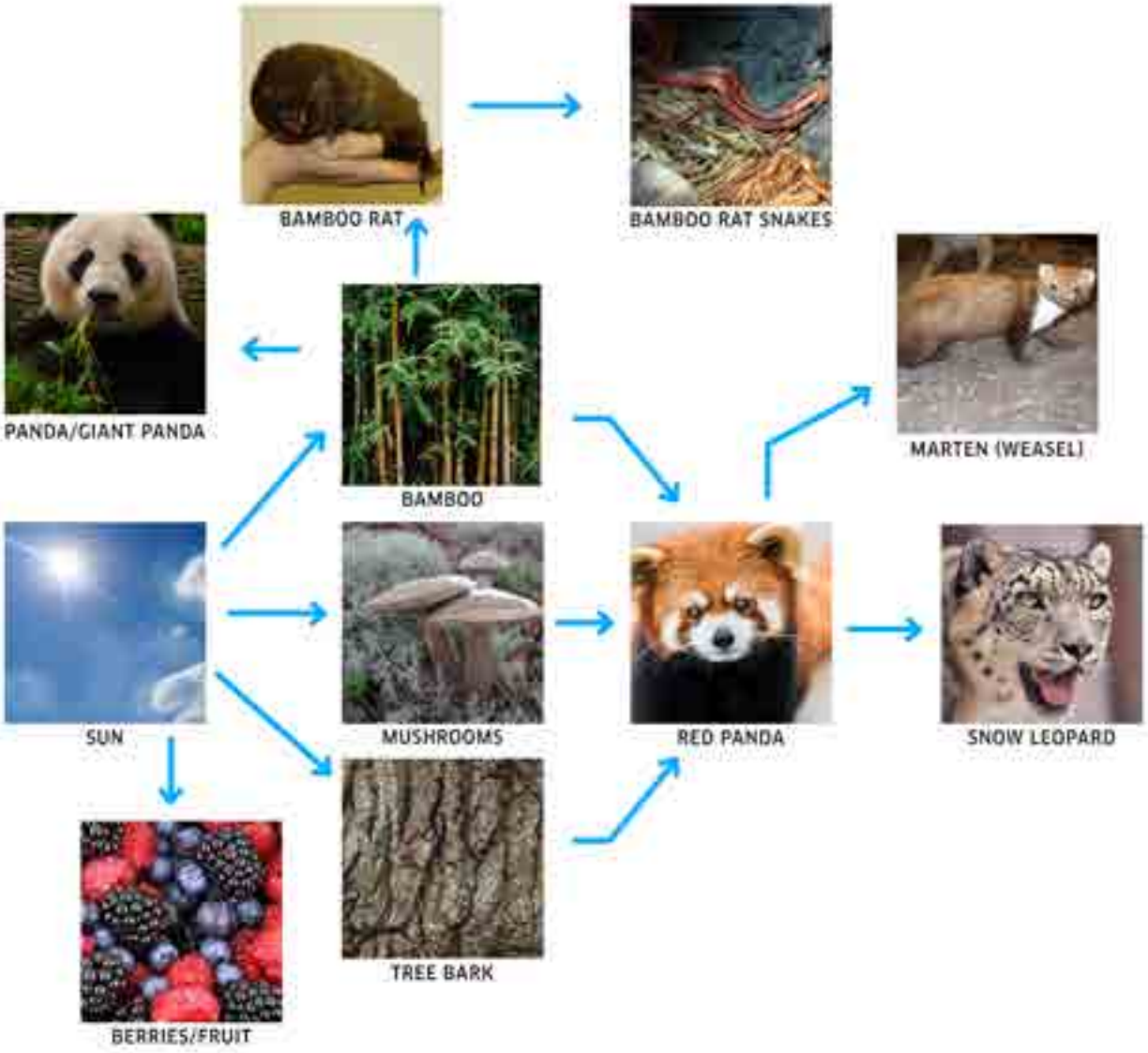
i. plant → goat → lion
ii. plant → goat → jackal → lion
iii. plant → rabbit → wild cat → lion
iv. plant → mouse → wild cat → lion
v. plant → mouse → owl
vi. plant → mouse → snake → eagle

2. Explain to students that many animals have common foods, so different food chains can be linked with each other, forming a food web. Food webs are more complex than food chains. They consist of many food chains that are interconnected.
3. Project the Red Panda Food Web given on page 22 of this Teaching Guide. Ask students to create two or three different food chains with the red panda, in their notebooks.

Food Web



Red Panda Food Web



ACTIVITY 3
RED ALERT SPECIES

Objective:

- **Students discuss reasons for why species become endangered or extinct.**

You Need:

- YouTube video: https://www.youtube.com/watch?v=lKvex-0x0fA

To Do:

1. Begin the lesson by telling students that living things survive in their habitats because their basic needs are met. In pairs, ask students to make a list of things that we all need to live. (*water, air, food, shelter*)
2. Ask students:
   a. What would happen if you don't get what you need to survive? (*You will not be able to live.*)
   b. What are the needs of plants and animals? (*air, water, shelter, space*)
   c. What could happen to plants and animals if they don't get the things they need? (*They will be in danger and could die.*)
   d. What would happen if many plants and animals start dying slowly? (*Very few animals and plants will remain on Earth. This will affect the food web. Some animals may not have plants to eat and they may die. Other animals that eat animals will also get affected.*)
3. Revise the definitions of the terms "extinct" and "endangered" discussed during "Build Background".
4. Show the video to the entire class. After watching the video, discuss the following questions with the class:
   a. What are some examples of extinct animals? (*dodo, Tasmanian wolf*)
   b. Do you know of other animals that have become extinct? (*Answers may vary; dinosaurs, western black rhinoceros*)
   c. Can you name a few animals that are endangered? (*Answers may vary – red panda, giant panda, gorilla, tiger, some species of giraffes, sea turtle, orangutan, Sumatran elephant*)
   d. What are some of the reasons that animals become endangered? (*loss of habitat from deforestation; hunting for animal parts; polluted air and water resources*)
5. Ask students to read all the information on page 16. Students may read individually or in pairs.
6. Discuss the following question with the class after they have finished reading. After the discussion, students answer the question in their notebooks: What are some of the reasons leading to the red panda becoming an endangered species? (*habitat destruction; captured by humans for their fur and meat or as house pets; accidental death through traps set for other creatures; attacked by hunting dogs*)

ACTIVITY 4
OPERATIONAL CHOICE

Objective:

- **Students solve word problems involving more than one step.**

You Need:

- copies of the worksheet "Word Problems" given on page 29 of this Teaching Guide – one per student

To Do:

1. The assumption in this activity is that students know basic operations and can apply them to solve sums, and they know how to work with percentages. This set of word problems are complex and students need to think critically to determine which operation to use in solving the problem. A particular problem may even have multiple steps.
2. Hand out a copy of the worksheet to each student.
3. Students solve the problems in pairs but every student needs to complete his or her own worksheet. Since this is a problem-solving task, students can draw, discuss and use any method they wish to arrive at the answer. They can show their work on the other side of the worksheet.
4. When all students are done, combine two pairs and have them compare their solutions.
5. Collect the worksheets and check them. The answers are given here for your reference.

Problem No.	1	2	3	4
Answers	1.5 kg/day 10.5 kg/week	9,900 pandas in 2016 67% (66.89%)	38.8 inches	29 females

COMPREHENSION CHECK

ANSWER THE FOLLOWING QUESTIONS:

1. In which countries are red pandas found?

_____

2. What do red pandas eat and who hunts red pandas?

_____

_____

3. Why is the red panda classified as a mammal?

_____

_____

WRITE T (TRUE) OR F (FALSE) NEXT TO EACH STATEMENT:

1. The red pandas live their entire lives in large families. _____

2. Baby pandas stay with their mother until they are a year old. _____

3. Red pandas can “talk” to each other. _____

4. Red panda populations have been increasing. _____

5. A red panda uses its tail to maintain balance. _____

Red Panda FAQ Sheet

Q1. Where does the red panda live?

_____

_____

Q2. What does the red panda eat?

_____

Q3. Why is the red panda classified as a mammal?

_____

_____

Q4. What are baby red pandas called? _____

Q5. How do pandas care for their young ones?

_____

_____

_____

Q6. Till what age can red pandas live? _____

Q7. How much do red pandas weigh? _____

Q8. What does the red panda look like? (Use all the images in the magazine to write your description.)

_____

_____

_____

_____

Q9. Why has the red panda been declared endangered?

_____

_____

_____

What is Different?

Classification of Animals

Category	Characteristics	Examples
Invertebrates		
Vertebrates		
Fish		
Amphibians		
Reptiles		
Birds		
Mammals		

Word Problems

Solve the following problems using the right operation/s: addition, subtraction, division or multiplication

1. Red pandas need to eat food that weighs about 30% of their body weight every day. If an adult red panda weighs 5 kg, how much food should it eat every day? How much food should it eat in a week?

2. There were about 14,800 red pandas in 2001. About 4,900 pandas were lost between 2001 and 2016. How many red pandas were left in 2016? What percentage of the original red panda population from 2001 was left in 2016?

3. An adult red panda seen by a scientist has a body length of 44 cm and its tail is 53 cm long. If 1 cm = 0.4 inches, what is the total length of this panda in inches?

4. In a given ecosystem, there are 44 red pandas, of which 24 are males. Half the female red pandas give birth to three babies each that year. Of all the babies born, 30% are female. How many total female red pandas will be in that ecosystem?

SCIENCE OBJECTIVES

- Students learn what the skeletal system is, list the functions of the skeletal system and explain how to take care of their bones.
- Students identify vertebrate and invertebrate animals and give reasons for their selection.

LANGUAGE ARTS OBJECTIVES

- Students understand the meanings of science vocabulary words.
- Students find answers to given factual questions from the text.

MATH OBJECTIVE

- Students learn about symmetry and draw a symmetrical skeleton.

CURRICULUM CONNECTIONS

In this story, students learn about the functions of the skeleton. They understand the difference between vertebrate and invertebrate animals.

In language arts, they practise reading comprehension by finding answers from the text, based on given clues. They also understand the meanings of the given vocabulary words.

In math, they learn about symmetry and make a skeleton.

BUILD BACKGROUND

1. Introduce a KWL chart to students (see the table below). Ask students to draw the chart in their notebooks. Explain each column to the class

What do you **k**now about the topic?	What do you **w**ant to know?	What did you **l**earn?

2. Ask students to turn to pages 22-23 of their copies of **engage** magazine and look at the title, caption and the picture. Ask students to think about what they know about bones and the skeletal system. Students think individually for 1 minute and fill in the first column of the KWL chart in their notebooks.
3. Next, ask students to think about questions that come to their minds about bones. What do they want to know? What are they curious about? Remind students that questions can begin with what, why, where, when and how. Instruct them to scan through the images and section titles of all the pages 24-29 of their copies of **engage** magazine and note down any three questions they have in the "W" column of the KWL chart.
4. Draw a similar KWL chart on the board. Fill in the first two columns by taking a few responses from students about what they know and what do they want to know. The last column stays blank for now.

READY TO READ

1. Students read "The Bone Zone" story on pages 22-29 in their copies of engage magazine. Divide Level 4 students into pairs and direct them to take turns reading the story aloud. For Level 3 students, model the reading first using the digital flipbook, as students follow along in their own copies of the magazine. Once you have finished modelling, give students time to read the same story again, in pairs. For both levels, go over the key words students may have difficulty reading before they start reading. Ensure you stress the pronunciation and meanings of these words:

   Level 3: skeletal system, cartilage, marrow, hardening, arthropods, mollusks, annelids, coelenterates, phalanges, sacrum, carpals, humerus, cranium, sternum, clavicle

   Level 4: wiggle, bend, flexible, hardening, marrow, scratch, twisting, sprained, severed, fragments, platelets, minerals, sedentary, vertebrates, arthropods, mollusks, annelids, coelenterates, phalanges, sacrum, carpals, humerus, cranium, sternum, clavicle
2. After students have finished reading, ask them to think about 1-2 new things they learnt about the topic. Take a few responses from different students and fill in the last "L" column of the KWL chart on the board. Ask students to copy the information into their notebooks.
3. Distribute the crossword puzzle given on page 45 of this Teaching Guide. Ask students to read all the clues given in the puzzle and to find the answers from the text. They can discuss the answers with a partner if they wish and complete the crossword.
4. After they complete the worksheet ask students to share their answers. Write the correct answers on the board. Ask students to read the sentences which provide the answers. Answers are given below for your reference:

Number	Answers
1	coelenterates
2	joint
3	carbohydrates
4	marrow
5	elbow
6	calcium
7	arthropods
8	cartilage
9	earthworm
10	shoulder

EXTENSION ACTIVITIES

ACTIVITY 1
FRAYER'S MODEL

Objective:

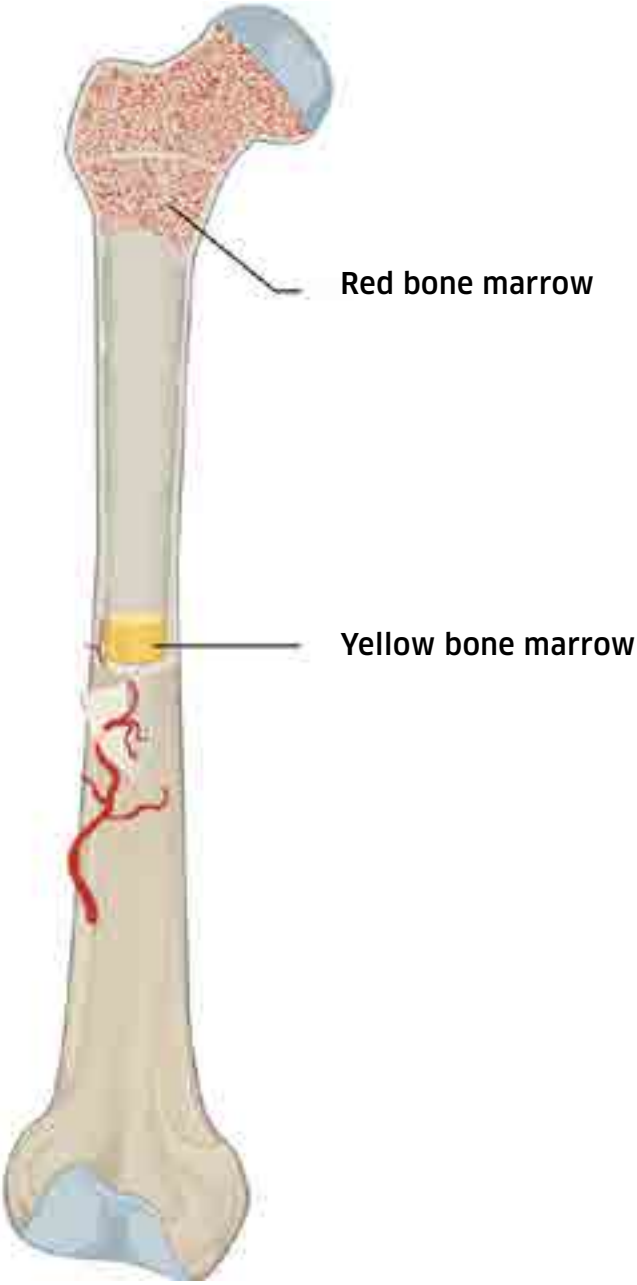
- **Students understand the meanings of science vocabulary words.**

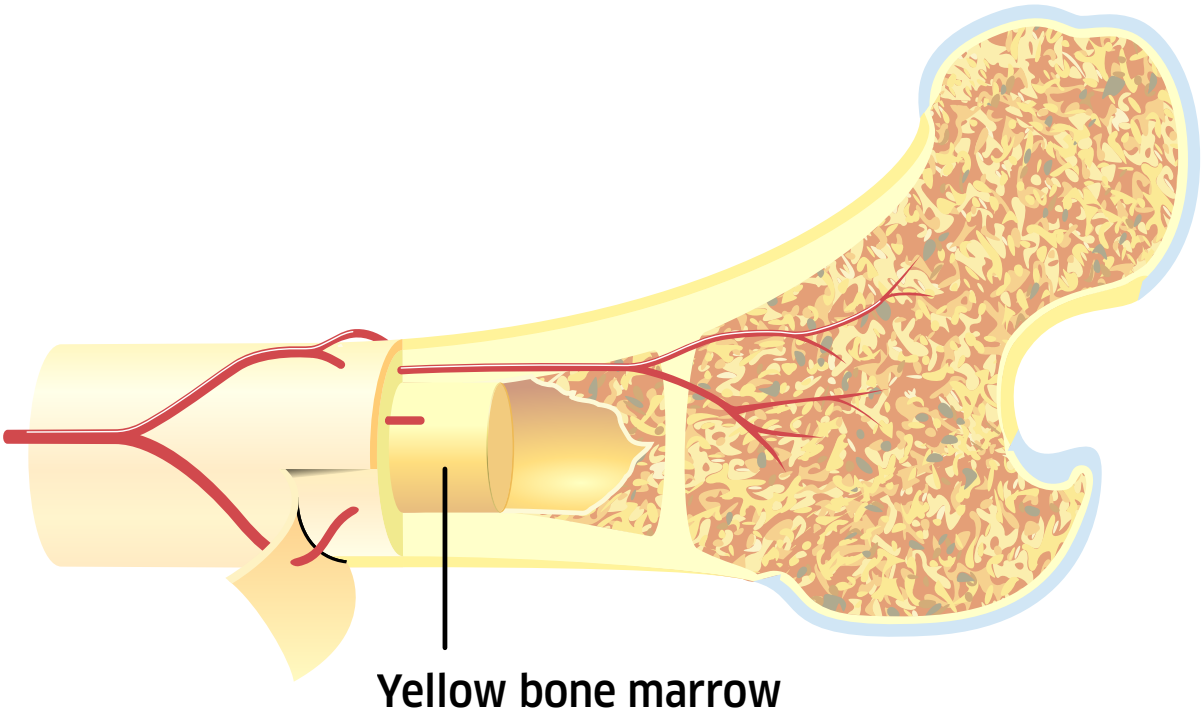
To Do:

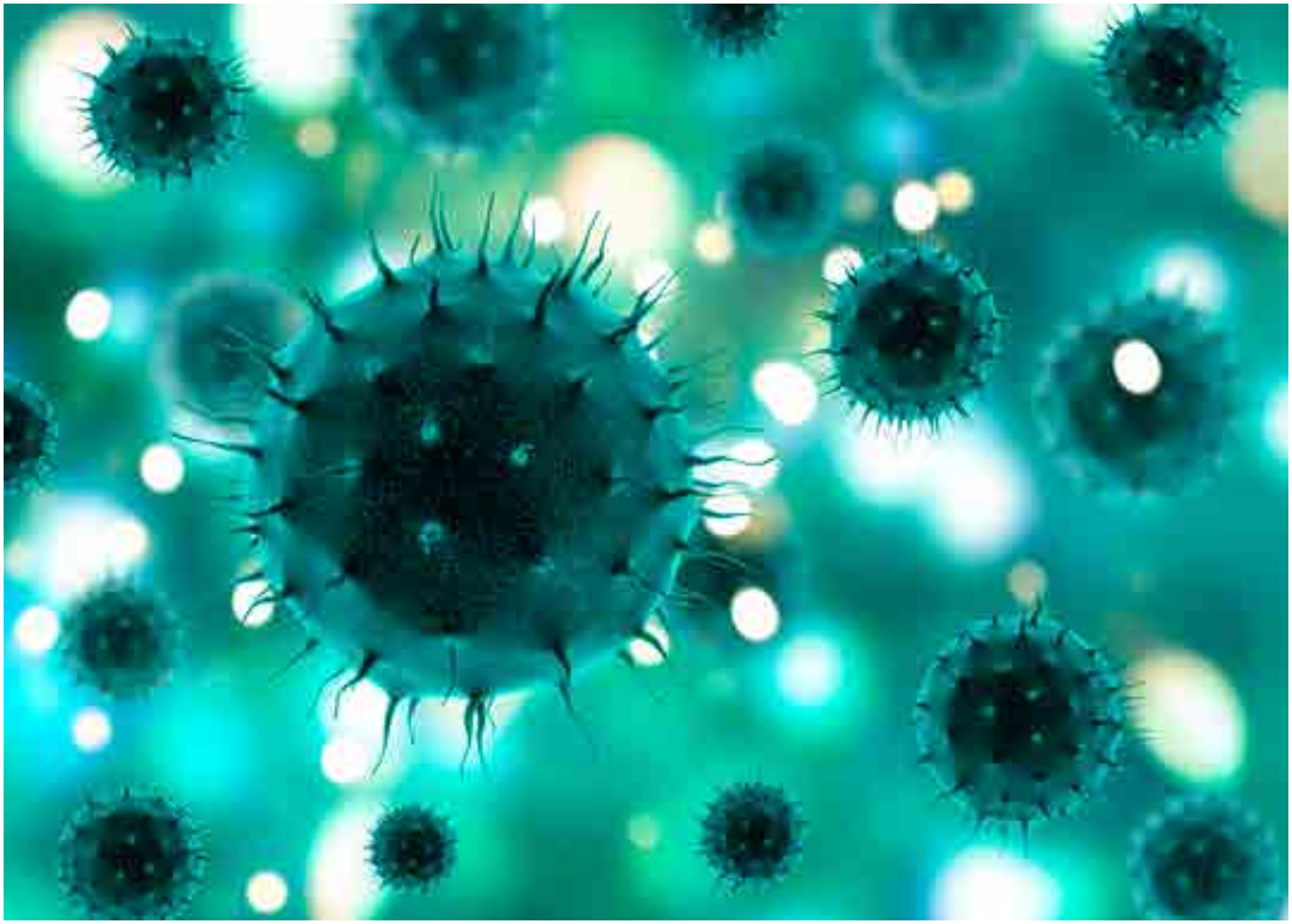
1. Ask students to find the following words from pages 24-29 in their copies of **engage** magazine and write them in their notebooks.
   a. ball-and-socket joints
   b. hinge joint
   c. marrow
   d. germs
   e. vertebrates
   f. invertebrates
   g. arthropods
   h. molluscs
   i. annelids
   j. coelenterates
   k. blood cells
2. Project the pictures given on pages 22-23 and 27 of **engage** magazine and explain ball-and-socket and hinge joints. Ask students to read the information on page 25.
3. Project the pictures of bones given on page 34 of this Teaching Guide and explain the structure of bones. Ask students to show you where the bone marrow is located.
4. Project the picture of blood cells given on page 35 of this Teaching Guide and ask students to identify red blood cells and white blood cells.
5. Project the pictures of viruses and bacteria given on page 36 of this Teaching Guide and explain to students that these are different kinds of germs that are microscopic.
6. Project page 25 and help students read the information on that page using their copies of **engage** magazine.
7. Project the picture of invertebrates given on page 29 of **engage** magazine. Ask students to describe the different invertebrates.
8. Draw a "Frayer's Model" on the board, as shown on page 37 of this Teaching Guide. Explain how to fill in each section. Ask students to create a Frayer's Model template for each of the words listed in their notebooks (in point 1) and fill it in.
9. The table below has been given for your reference

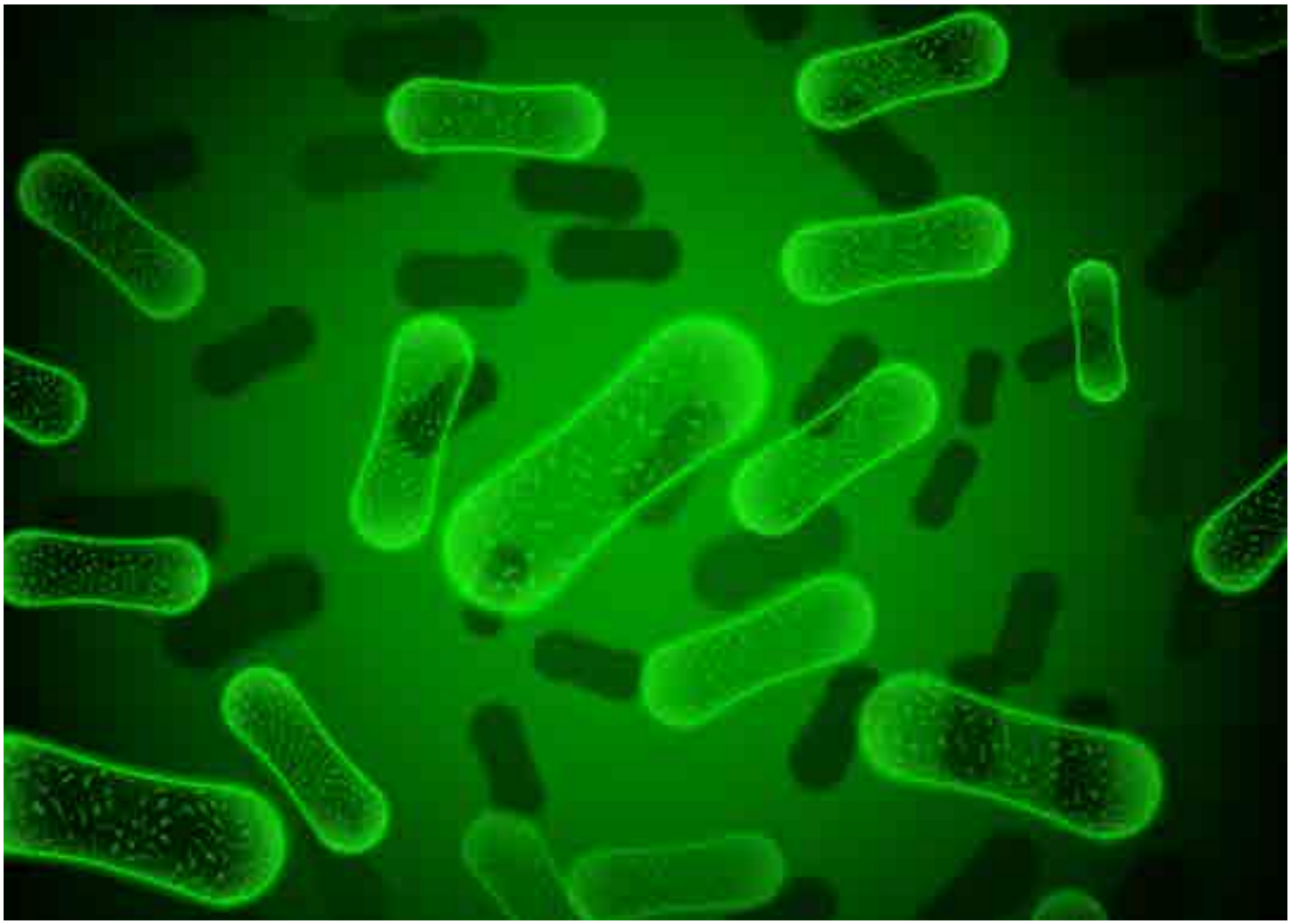
Words	Definition	Characteristics	Examples	Non-examples
ball-and-socket joint	A joint where a ball-shaped end of a bone fits into a bowl shape of another bone.	Allows bones to swing in a circular motion.	shoulder, hip	elbow, knee
hinge joint	A hinge joint is joint between two bones where bones can move along one axis.	Bones can move back and forth like a door. The bone can only bend in one direction.	elbow, knee	shoulder, hip
marrow	It is a soft and gooey substance filled inside the hollow cavity of bones.	It helps the body make blood cells. It stores fat.	red bone marrow, yellow bone marrow	red blood cells,white blood cells, anything that is not bone marrow

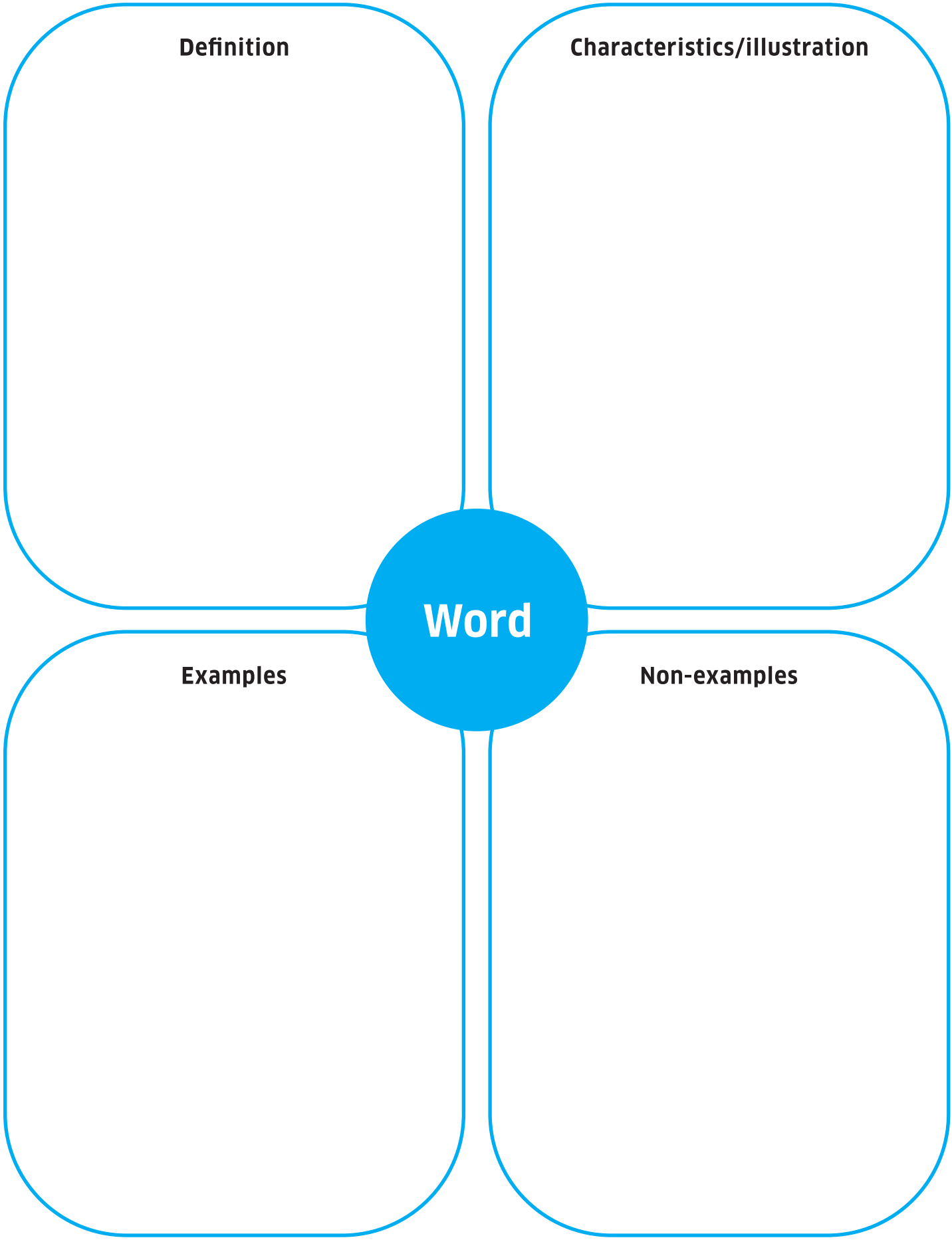
Words	Definition	Characteristics	Examples	Non-examples
germs	Tiny microscopic organisms that can cause diseases.	They invade our body like terrorists.	bacteria, virus	insects
vertebrates	A group of animals that have bones.	They breathe through lungs or gills.	reptiles, mammals	arthropods
invertebrates	A group of animals that don't have bones.	They use gills, trachea or breathe directly through their cell membrane.	insects, sponges, jelly fish	mammals
blood cells	Cells present in our blood that help carry oxygen and fight invaders.	Red blood cells carry oxygen to other parts of body. White blood cells protect the body from germs. Both are produced in the bone marrow.	red blood cells, white blood cells, platelets	nerve cells, plasma
arthropods	Animals with segmented bodies and a hard exoskeleton.	Students can draw a picture.	lobster, spider	octopus
mollusks	Animals with soft skin and a hard shell.	Students can draw a picture.	octopus, clam	ant, spider
annelids	Soft animals usually shaped like tubes.	Students can draw a picture.	earthworm, leech	squid
coelenterates	Type of invertebrates that live in water.	Their bodies have a single opening, surrounded by tentacles.	coral, jellyfish	squid


Red bone marrow
Yellow bone marrow


Yellow bone marrow






Definition
Characteristics/illustration
Word
Examples
Non-examples

ACTIVITY 2
SKELETON DETAILS

Objective:

- **Students learn what the skeletal system is, list its functions and explain how to take care of their bones.**

To Do:

1. In pairs, ask students to discuss why bones are important parts of their bodies. Ask the following guiding questions to generate a discussion:
   a. Which part of the body gives it shape and support? (*bones*)
   b. Which bones protect the heart and lungs? (*ribs*)
   c. Which part of the body produces blood cells? (*bones*)
   d. What do we call the gooey substance in bones? (*bone marrow*)
   e. What is the function of the bone marrow? (*It produces red and white blood cells.*)
   f. What are some of the actions we can perform because of our bones? (*stand, chew, bend, run, write*)
   g. How does the skeletal system provide a framework for the body? (*It gives the body its basic shape and structure.*)
   h. Which internal organs are protected by the following bones? Project page 27 of **engage** magazine using the digital flipbook and point to the cranium, ribs, pelvis and vertebral column. (*brain, lungs/heart, reproductive organs, spine*)
   i. How can we take care of our bones? (*Project page 26 of **engage** magazine and read the section on "Caring for Bones" and "Eat Right".*)
2. Ask students to list the functions of the skeletal system in their notebooks:
   a. Bones provide shape and support to the body.
   b. Bone marrow present inside bones stores fat and produces red and white blood cells and platelets.
   c. Joints in our skeleton allow us to bend and move.
   d. Bones protect internal organs like the heart, lungs, brain, etc.

ACTIVITY 3
SYMMETRY

Objective:

- **Students learn about symmetry and draw a symmetrical skeleton.**

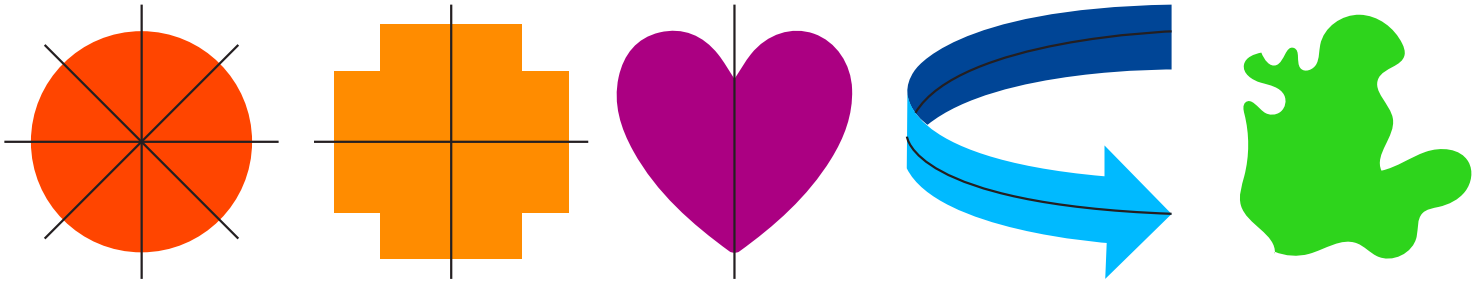
You Need:

- A4-size white sheets of paper
- black construction paper
- scissors
- glue
- pencils
- erasers

To Do:

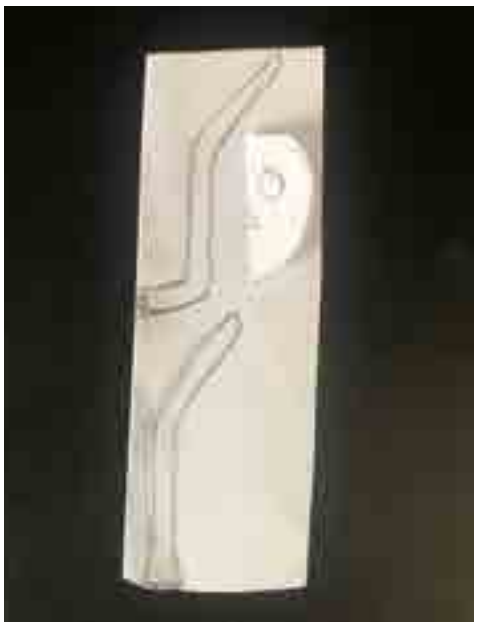
1. Discuss with students the meaning of half.
2. Draw the following pictures on the board and ask students to draw a line in a way that divides each picture into two equal parts that are mirror images of each other.

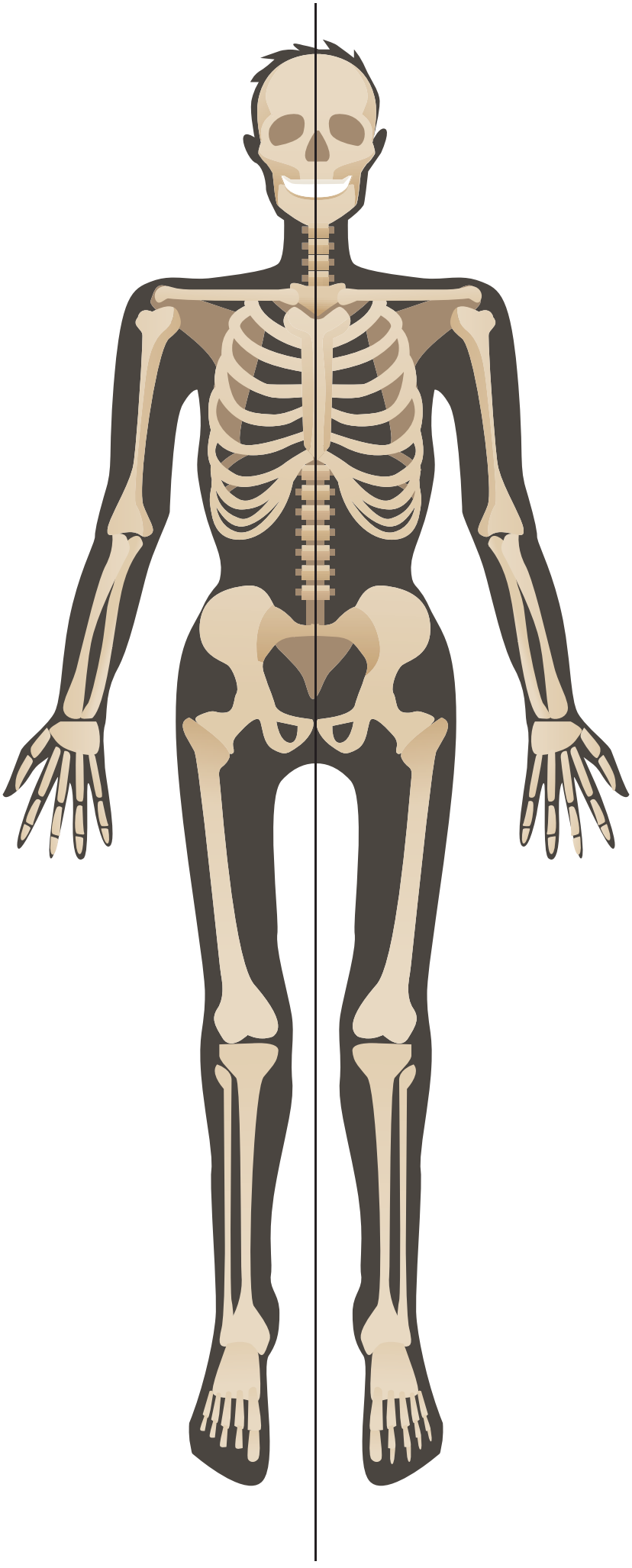
3. Ask students:
   a. Which shapes can be divided into two equal halves and which cannot? (*The last picture cannot be divided into two equal halves.*)
   b. Where can you draw a line to divide the picture into matching halves? (*Ask students to come to the board and show you.*)
   c. Can we draw more than one line to divide any of the pictures into two halves? (*Yes, the first two.*)
4. Explain that if an object can be divided into two matching halves that mirror each other, then the object is symmetrical. Lines which divide an object into two matching halves are called lines of symmetry. If you fold a picture on the line of symmetry, then each side will match up. An object can have more than one line of symmetry.
5. Show the line of symmetry in the above pictures.



ASYMMETRICAL

6. Distribute A4-size sheets of paper to all students. Ask them to draw one symmetrical and one asymmetrical figure, and to show the line/s of symmetry.
7. Next, on a different sheet of paper, ask students to draw a vertical line through the centre of the page from top to bottom. Ask them to draw a symmetrical figure such that either side of the line has a mirror image of what is on the other side. Ask students to fold the paper to see if both parts of the symmetrical figure match when the paper is folded.
8. Project the picture of a skeleton given on page 40 of this Teaching Guide. Ask students whether the skeleton is symmetrical or not. Where will they draw a line of symmetry to divide the picture into two exact parts? Both parts should be mirror images of each other.
9. A skeleton can be divided into two exact halves (mirror images). If we draw a vertical line that goes through the middle of the skeleton, then each side of the skeleton is a mirror image of the other side. So, the skeleton is a symmetrical figure.
10. Ask students to create a symmetrical skeleton in a fun way. Divide them into groups of 3. Distribute white A4-size sheets of paper, black construction paper and scissors. Ask students to fold the white paper in half along the vertical midline and write their names as shown in the image below. The name should fit across the paper in landscape orientation. Ask them to cut around their names as shown in the example images. The fold in the paper should remain intact.
11. When students open the fold, it will look like a skeleton of an unknown creature. On another folded sheet of paper, they draw and cut out half a head, arms and legs as shown. On opening the fold, they will get a symmetrical head, arms and legs.
12. Ask students to glue the main body, head, arms and legs on black construction paper as shown. They should get a perfectly symmetrical “skeleton”. Ask them to draw the line of symmetry and colour the two sides in two different shades. Ask them to name their skeleton.





ACTIVITY 4
VERTEBRATES AND INVERTEBRATES

Objective:

- **Students identify vertebrate and invertebrate animals and give reasons for their selection.**

You Need:

- pictures of animals
- copies of the worksheet "Vertebrate or Invertebrate" given on page 46 of this Teaching Guide – one per student

To Do:

1. Project the given pictures of animals given on page 43 of this Teaching Guide. Ask students to find similarities between them. Explain that they all are vertebrates and have a vertebral column in their bodies.

   Ask students to turn to page 31 of their copies of **engage** magazine and discuss the common characteristics of these skeletal systems. The common characteristics are as follows:

   a. They all have a vertebral column which protects their spinal cord.

   b. The vertebral column gives a framework to the body so their bodies have a fixed shape.

   c. These animals are strong and can move fast.

   d. They have well defined closed circulatory, respiratory and nervous systems which are protected by a skeletal system. (Note: this information is not in the story but can be given as additional information to Level 4 students.)

   e. They have a well-defined brain which is protected inside the cranium.

   f. Their body is symmetrical.

   g. Groups of vertebrates are mammals, fish, reptiles, birds and amphibians.

2. Project the pictures given on page 29 of **engage** magazine. Ask students to find the similarities between these animals. Explain that they are all invertebrates and they don't have a vertebral column in their bodies. Ask students to read the information given on page 29 and discuss the common characteristics of invertebrates (some information may be new and should be provided by the teacher):

   a. They don't have a vertebral column.

   b. Most of invertebrates are small in size.

   c. They move slowly.

   d. Their bodies can be asymmetrical.

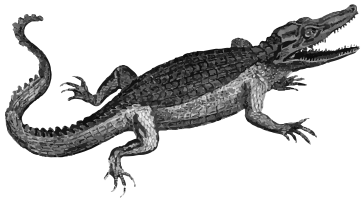
   e. They squirm, wiggle, run, walk, swim and fly.

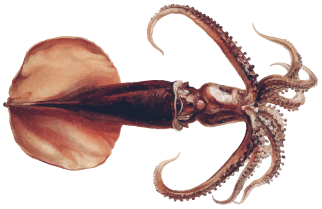
   f. Their bodies may be covered with an exoskeleton or a hard shell.

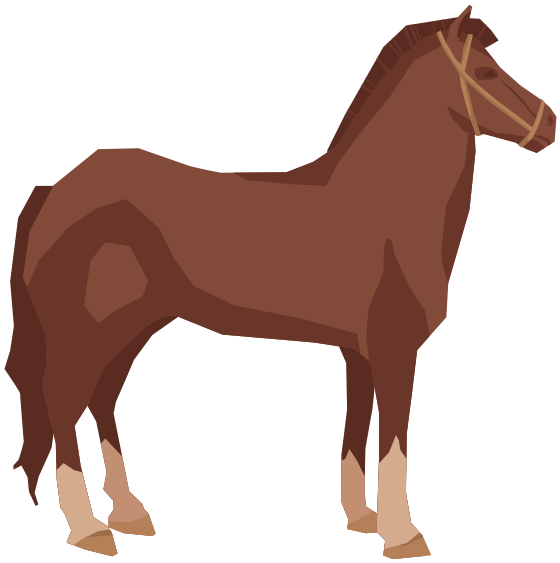
   g. They are soft animals.

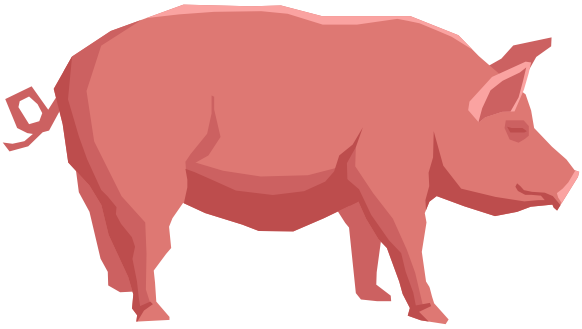
   h. Groups of invertebrates are arthropods, mollusks, annelids and coelenterates.

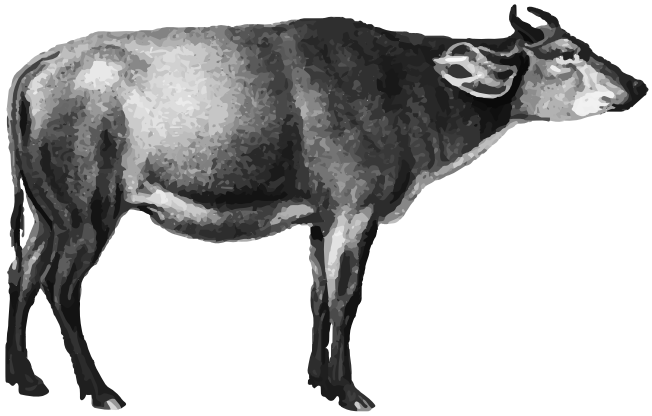
3. Distribute the worksheet "Vertebrate or Invertebrate" and ask students to identify if the animals are vertebrates or invertebrates. Ask them to give reasons why they belong to the selected group. The table below is for your reference.

Name and picture of the animal	Vertebrate or invertebrate?	Give reasons why you think the animal is a vertebrate or an invertebrate.
 Fish	vertebrate	It has a vertebral column. It breathes through gills. Its brain is protected by the cranium.
 Crocodile	vertebrate	It has vertebral column. It breathes through lungs. Its brain is protected by the cranium.

Name and picture of the animal	Vertebrate or invertebrate?	Give reasons why you think the animal is a vertebrate or an invertebrate.
 Lobster	invertebrate	It doesn't have a vertebral column. It has an exoskeleton.
 Squid	invertebrate	It doesn't have a vertebral column. It is very soft but has a hard shell.
 Pigeon	vertebrate	It has a vertebral column. It breathes through lungs. It is symmetrical.
 Coral	invertebrate	It doesn't have a vertebral column.
 Clam	invertebrate	It doesn't have a vertebrate column. It has a hard shell and is soft inside.







COMPREHENSION CHECK

WRITE THE FUNCTIONS OF THE FOLLOWING:

	Functions
red blood cells	
cranium	
ribs	
vertebral column	
bone marrow	
white blood cells	

ANSWER THE FOLLOWING QUESTIONS:

1. Name two different types of joints. Give examples of each.

_____

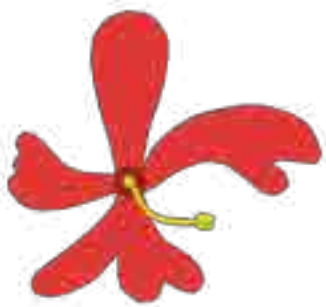
_____

2. Why is it important to include calcium in your diet?

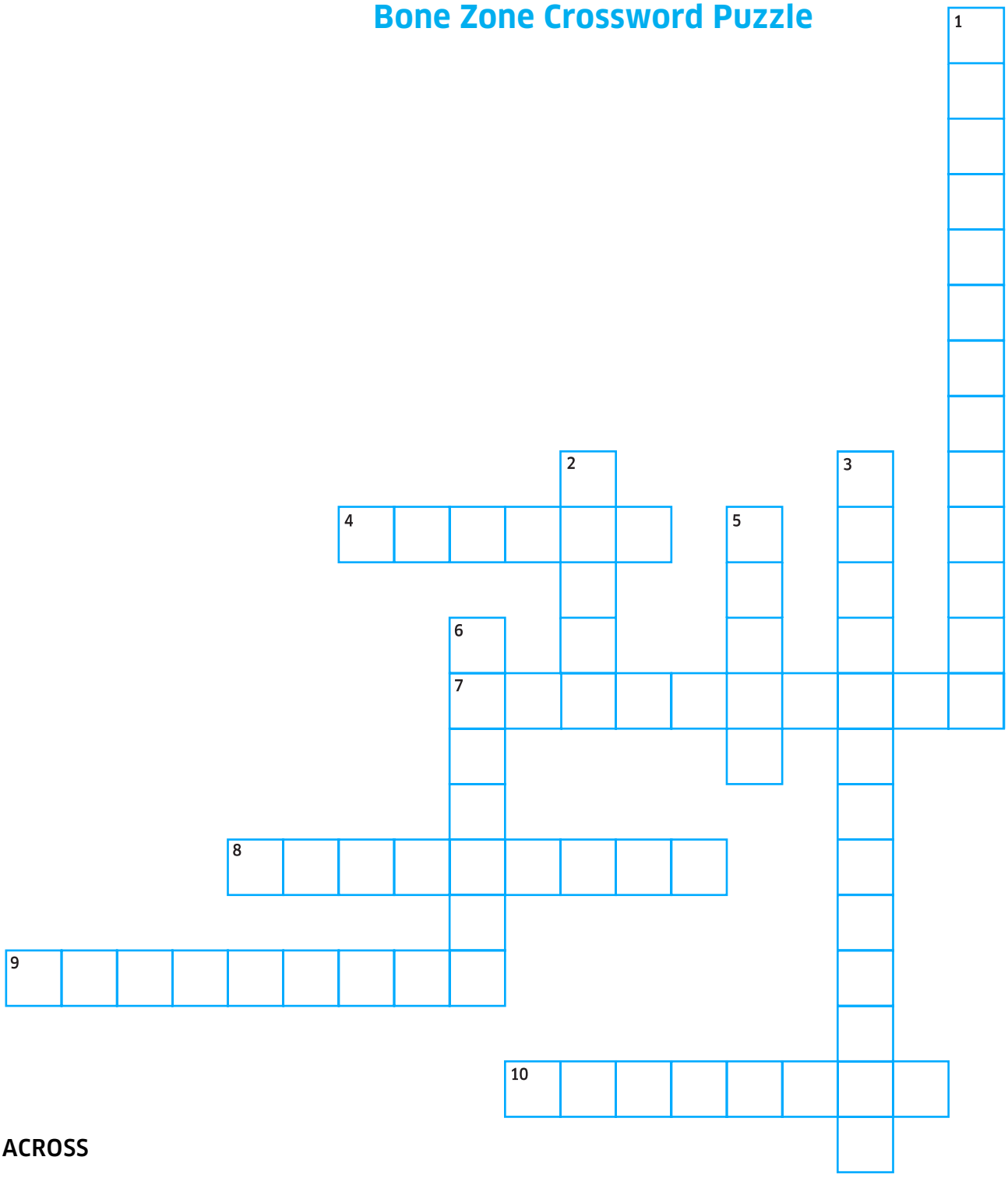
_____

_____

IDENTIFY WHICH OF THE FOLLOWING FIGURES ARE SYMMETRICAL AND DRAW A LINE OF SYMMETRY THROUGH THEM:



Bone Zone Crossword Puzzle



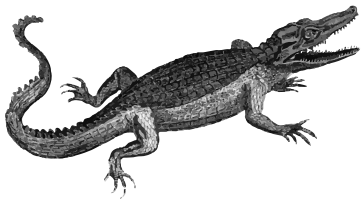
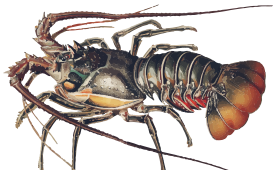
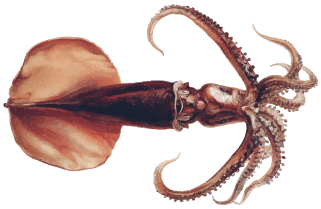
ACROSS

4. A soft and gooey substance filled inside the bone is called _____.
7. _____ is the group of animals with segmented bodies and a hard exoskeleton.
8. Soft and flexible bone is made from _____.
9. _____ is an example of annelids.
10. An example of a ball and socket joint is _____.

DOWN

1. Jellyfish is an example of _____.
2. The place where two bones meet is called a _____.
3. _____ turns into sugar in our bodies.
5. _____ is an example of a hinge joint.
6. _____ is required to make bones strong.

Vertebrate or Invertebrate?

Name and picture of the animal	Vertebrate or invertebrate?	Give reasons why you think the animal is a vertebrate or an invertebrate.
 Fish		
 Crocodile		
 Lobster		
 Squid		
 Pigeon		
 Coral		
 Clam		