

BIODIVERSITY AND CLASSIFICATION

Overview

This unit emphasises classification not just for the sake of learning classification as part of Biology lessons but to develop the skills of observing, sorting, classifying/categorising, critically assessing, as well as organising and writing through simple exercises in classification. Hence the unit aims towards general modes of classification rather than emphasising on the evolutionary basis. The first task involves students in classifying objects that they find around them. In the following task, they use their comprehension skills to follow drawing instructions, observe the features in their own drawings and write in the table provided. They will draw their own classification tree in both the tasks, thus enabling them to further observe any object or animal and classify it.

Minimum time required: Minimum 2 sessions of 40 minutes

Type of learning unit: Indoor/Classroom

Introduction

India is one of the most biologically diverse countries of the world. It is home to many different types of organisms. To give an example more than 1300 species of birds alone are found in India, out of which 176 are found nowhere else in the world. The systematic study of such a huge amount of diversity makes it necessary to arrange them into groups based on similarities and differences in their characteristics. Such an arrangement serves multiple purposes; apart from making the study of biodiversity easier, it also ensures that newly found organisms are assigned to appropriate groups, at times making it even possible to predict some of their characteristics based on the groups they belong to. Classification is a concept not just limited to biology, but is part of every field of learning. In fact, it is such a fundamental concept that, it is a way in which we learn concepts! This learning unit aims to introduce students to the concept of classification and sets out the following objectives in that regard -

Learning objectives

Students will be able to

1. Get some sense of the biodiversity in the surrounding.
2. Explain the origin and need for classification.
3. Classify entities based on their features.

Outline of the activity

Task 1 (40 minutes)

In this task students will classify tools available in their geometry box based on their characteristics. An initial criteria for classification would be provided to the students. Using that as the base students would continue classifying each of these groups into subgroups wherever possible.

Task 2 (40 minutes)

In this task -

- Students would read the description of the given animals, and draw them using the basic shapes provided in the appendix.
- After creating their animal using the description, students would try and guess their animal from the list provided.
- In this manner students would complete drawing and identifying all the animals for which description is provided.

- Students would then proceed to fill in the information about the features of the drawn animals in biodiversity table.
- Biodiversity table consists features of three more animals whose image is given after description of the animals.
- Using the information in the table Students would classify the animals into different groups.
- To get the students started an initial division is provided to the students. Using that as the base students would continue classifying each of these groups into subgroups wherever possible.

Links to the curriculum

Class 8	Class 9	Class 10
Chapter 7: Conservation of Plants and Animals	Chapter 5: The Fundamental Unit of Life	Chapter 9: Heredity and Evolution
	Chapter 6: Tissues	
	Chapter 7: Diversity in Living Organisms	Chapter 15: Our Environment

Organizing objects into categories or themes is one of the basic human tendency such that these objects are related to each other in a meaningful way. Classifying helps us to find or recognize objects easily. The most popular example of classification is the clothes arranged in cupboard. You can check how clothes are separated in your home. They might be separated based on their use in different weathers, by ownership, and based on its utility like daily wear, special occasions or uniforms.

To classify objects, one must examine them carefully to find the differences and similarities between them. Ideally, every object should be placed in only one category and selecting the most appropriate category is very important. To organize objects within a category more, you can make sub categories if the objects can be classified further.

Q.1. Can you think of any place (than clothes separated in cupboard) where you use classification?

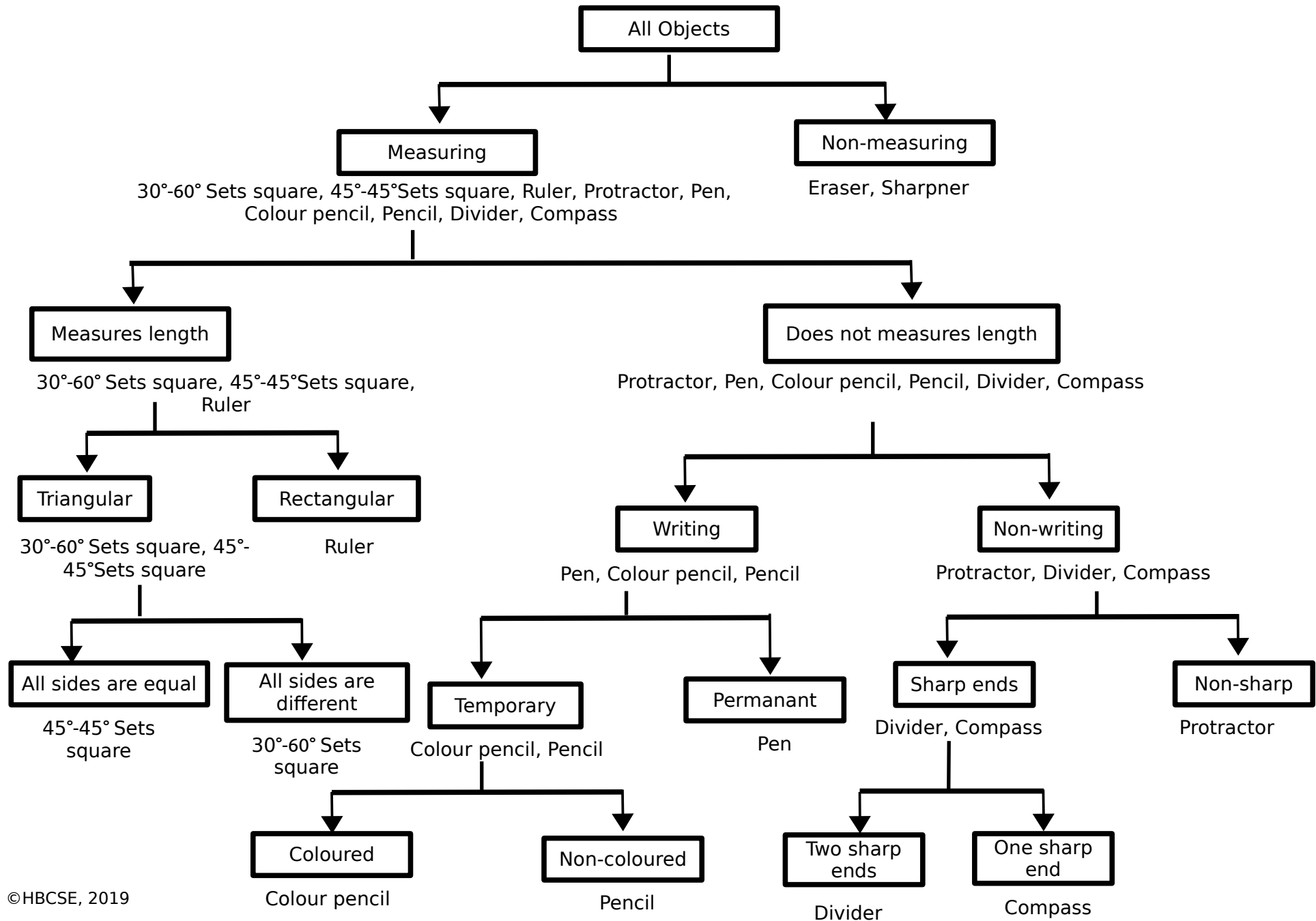
In the task below, we will classify objects we commonly found in our geometry boxes. Complete the classification tree by sorting the objects and writing below whichever category they belong to.

Task 1:

Requirement -

- | | |
|---------------------------|-------------------|
| 1. Ruler | 7. Pen |
| 2. Protractor | 8. Eraser |
| 3. Sets square (45-45-90) | 9. Sharpner |
| 4. Sets square (30-60-90) | 10. Pencil |
| 5. Divider | 11. Colour pencil |
| 6. Compass | |

Classification Tree: A classification tree is a model with a tree-like structure. It labels, records, and assigns variables to discrete classes.



Q.2. Do you think you can use any other criteria (than measuring or non measuring) for starting the classification? Try making such a classification tree in your notebook.
Do you think this classification tree is more useful than the previous one? Why?

The students will come up with various classification tree using different criteria. Some of them might get overlapping criteria where the object of a one criteria can be situated in other as well (Refer alternative classification of geometry box tools at page 13). In such cases the teacher can prompt discussion by asking, if we want to create a common or standard classification tree for geometry box objects how do we decide which one is better?

Biodiversity comes from two words, biology and diversity. Biological diversity means variety of living organisms found on earth. Different types of organisms are found living on land, air and water. Each of these organisms shows variation in the shape, size, color and various body functions. Each organism, whether big or small, plays an important role in various life processes occurring on earth. This diversity has evolved over millions of years since life first originated on earth.

Task 2:

Leena, a class 9 student, got hand lens on her 14th birthday as a gift from her parents. She goes around holding it against objects, in awe of the magnified view it provides. Once she was walking in a garden with her hand-lens and stumbles upon the sight of things moving in the soil. She collected some soil in a cup and brought it back home.

After reaching home, she started observing the soil sample carefully using a hand lens. She was surprised to see so many small animals in it. Most of them were alive. She decided to draw the shapes of these animals to understand their basic body structures. For this, she chose some basic shapes like triangles, squares, rectangles, ovals etc. to draw.

Let us help Leena to complete her work. For animals, she has written outlined basic body shapes she was able to observe. We will recreate those organisms using the basic shapes given below by following the body description given by her. When you finish drawing, guess the name of the animal. In the last page, a Biodiversity Table is given. Looking at your drawings and description, fill the blank boxes with appropriate answers in that table.

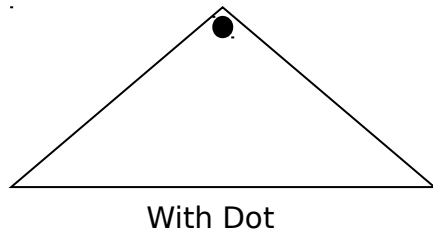
| The features of living organisms are tabulated in a biodiversity table .

Requirements:

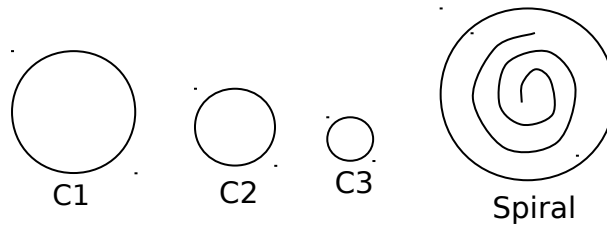
- 1) Printouts of sheets - 'Shapes for reconstructing animals' to each group
- 2) Blank paper sheet (for students to draw the shapes)
- 3) Pen / Pencil

SHAPES FOR RECONSTRUCTING ANIMALS

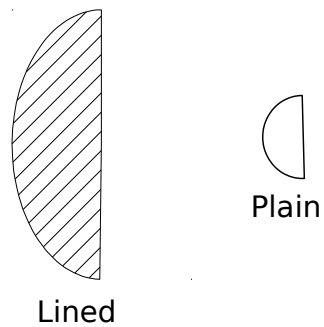
Triangle



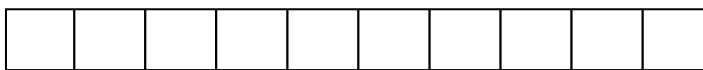
Circles



Semicircle



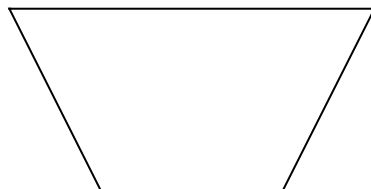
Rectangles



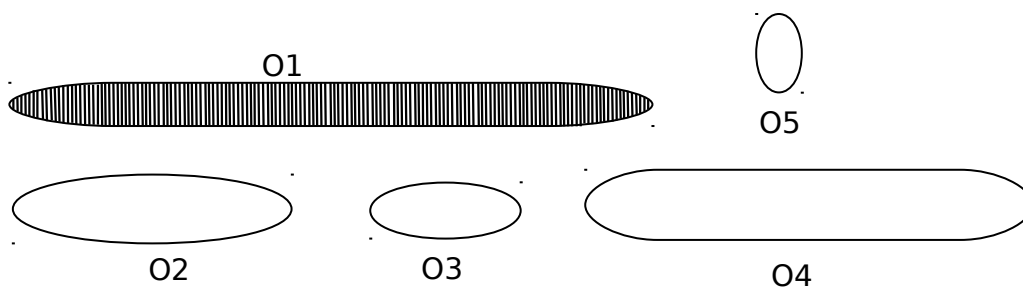
LR

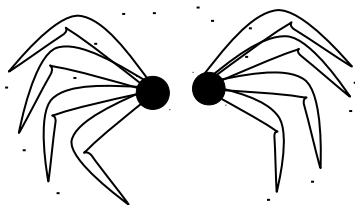


Trapezium

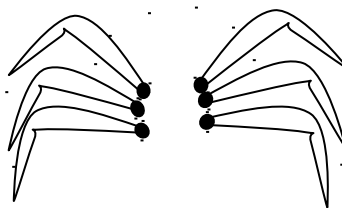


Ovals

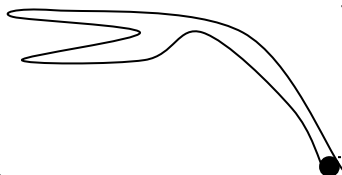


L - shaped legs

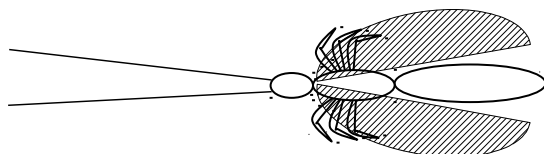
Joint



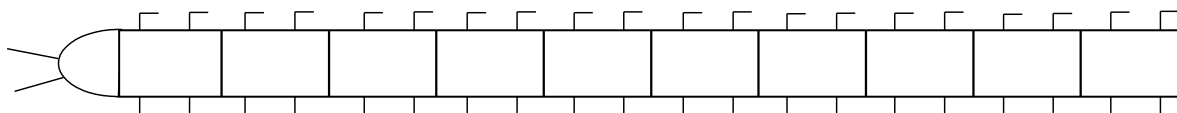
Separate

Branching structures**DESCRIPTIONS OF ANIMALS****1. Cockroach**

- Attach three ovals (O2, O3 and O5) on the high (or at the sharpest bends) curvature side in increasing order of size.
- Label the smallest oval shape as head (anterior end).
- Draw the separate L-shapes on either sides of the middle oval.
- Draw two straight long lines from head to represent antennae.
- Draw two lined semi circles along the middle near the junction of anterior and middle oval and last oval attaching one end.

**2. Millipede**

- Use a plain semi-circle without dots.
- Draw a rectangle (LR) joined to the flat side of the semi-circle making sure the size of the shorter side of rectangle and semi-circle is same.
- Label semi-circle as head (anterior end) and the other end as tail (posterior end).
- Each of smaller rectangles in LR represent a segment.
- Draw 2 small L shapes on either side for each segment to represent legs.
- Draw two short lines from the head.

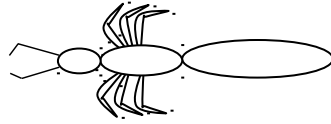
**3. Earthworm**

- Draw a long oval (O1).
- Label one end of the oval as head (anterior end) and the other as tail (posterior end).
- Draw a filled rectangle overlapping the body closer to the head making sure the width of rectangle and oval is same.



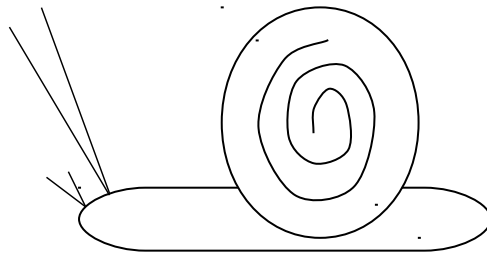
4. Ant

- Attach three ovals (O2, O3 and O5) on the sharp curvature side in increasing order of size.
- Label the smallest oval shape as head (anterior end).
- Draw separate L-shapes on either side of middle oval.
- Draw two short lines from head (L shaped lines) to represent antennae.



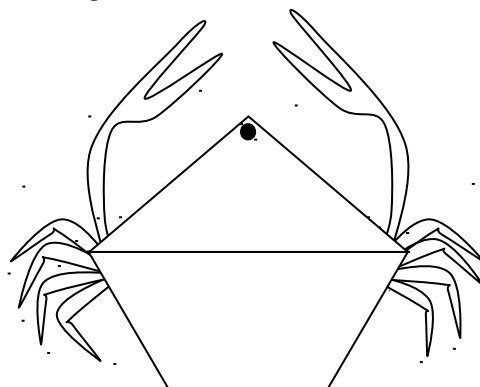
5. Snail

- Draw a medium flattened oval (O4) horizontally.
- Label one of the curved ends as the head (anterior end) and other as the tail.
- Draw the spiral circle on top of the oval slightly towards the posterior end.
- Draw two short lines on the head.
- Draw two longer lines behind the short lines.



6. Crab

- Draw a trapezium with lower side shorter than the upper side (as shown in the figure).
- Draw a triangle with dot using the longer side of trapezium as base.
- Mark the dotted end as mouth.
- Draw joint L shapes on either side of the trapezium.
- Then draw two branching structures one on each side of the triangle.



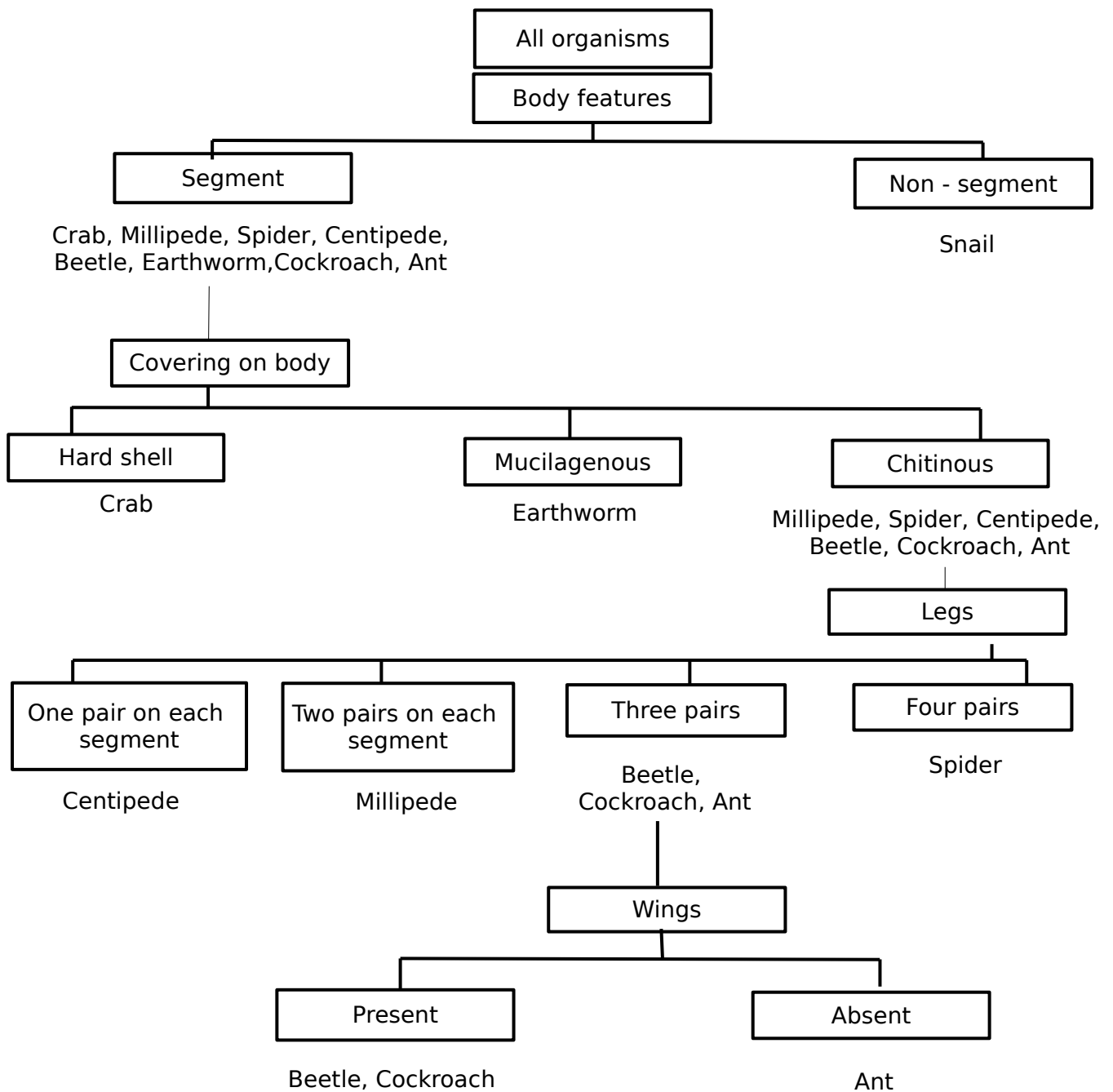
BIODIVERSITY TABLE							
No.	Animals	Body Division	Description of body parts	Antennae present or absent	Body features	Wings	Legs
1	Crab	2 parts	Cephalothorax* and abdomen	One pair of antennae present	Segmented	Absent	Five pairs
2	Millipede	2 parts	Head and trunk	One pair of antennae present	Segmented	Absent	Two pairs on every segment
3	Cockroach	3 parts	Head, thorax and abdomen	One pair of long antennae present	Segmented	Present	Three pairs
4	Ant	3 parts	Head, thorax and abdomen	One pair of antennae present	Segmented	Absent	Three pairs
5	Snail	3 parts	Head, visceral mass and foot.	Two pairs of antennae present	Not segmented	Absent	Muscular mass called foot present
6	Earthworm	1 part	Body not divided.	Antennae absent	Segmented	Absent	Absent
7	Spider	2 parts	Cephalothorax and abdomen	Antennae absent	Segmented	Absent	Four pairs
8	Centipede	2 parts	Head and trunk	One pair of antennae present	Segmented	Absent	One pair on every segment
9	Beetle	3 parts	Head, thorax and abdomen	One pair of antennae present	Segmented	Present	Three pairs

[Ref: Invertebrate Zoology - Jordan and Verma]

***cephalpthorax - A body part (in some organisms) where head and thorax are fused together.**

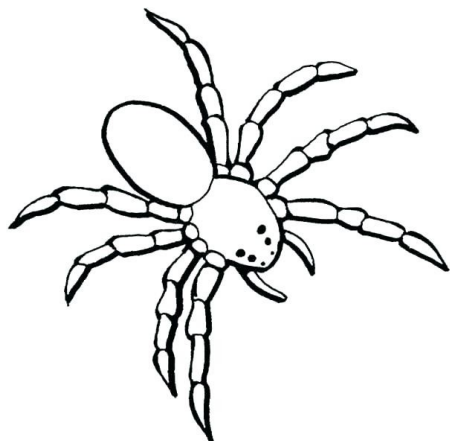
Task 3:

Using the biodiversity table, classify the animals you recreated in Task 2 in your note books. You can start with the “Body Features” criteria first. You can also start the classification tree with a different criteria given in the table.

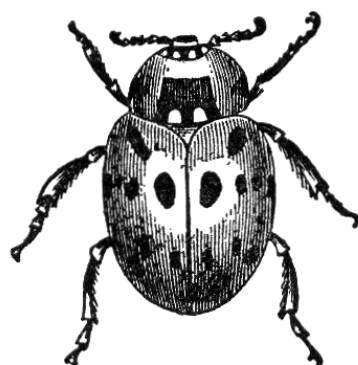


Classify the organisms given below with the help of features given in biodiversity chart in your classification tree.

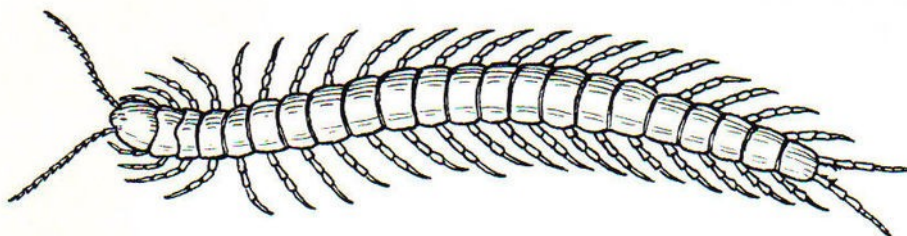
1. Spider



2. Beetle



3. Centipede



Q.3. Did you have to make another branch to classify this three organisms? Did these organisms fit easily in the classification tree?

Reading:

What you have done is very similar to how Bates and Wallace or another naturalists in 1800s studied animals, plants or insects and classified them.

In the year 1848, Henry Bates and Alfred Wallace from England, started their expedition to the Amazon forest at South America. After 3 years, Wallace returned back to England but Bates continued his exploration. After 11 years in South America, Bates conservatively estimated that he had collected 14,712 animal species (primarily insects) and more than 8,000 of these were new to science. In early 1863, Bates published a book in two parts on his travels in South America - The Naturalist on the River Amazon. This second book was one of the finest scientific travel books of the nineteenth century.

Q.4. Do you think it would have been easy for other explorers to cross check whether an animal species found by them at Amazon was already reported by Bates?

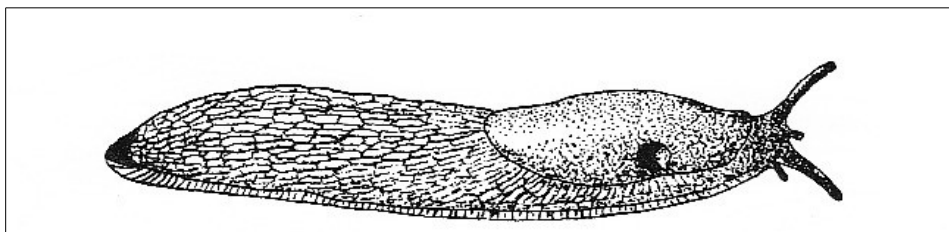
Q.5. If you see an animal you have never seen before how will you check if it is really 'new' to science? And how will you go about studying?

Q.6. Why do you think we need classification?

Additional organisms:

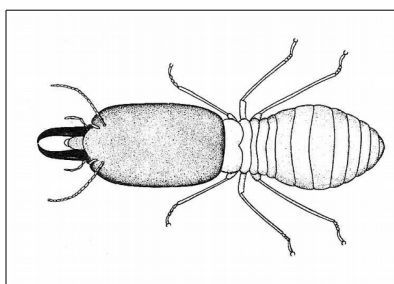
Teachers can give these 3 additional organisms once students complete their classification chart. Most features of these organisms are already given in the biodiversity table. Missing features can be added by looking at the images.

1. Land slug

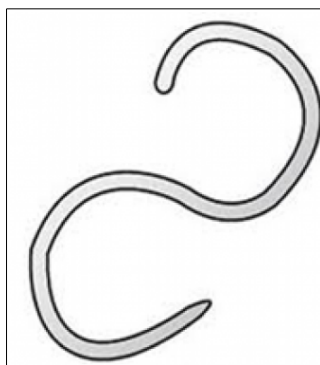


(Source: <https://huntingforsnails.wordpress.com/2014/01/19/18-rm-rp-t-1955-51v/>)

2. Termite



(Source: <http://www.biology-resources.com/drawing-termite-soldier.html>)



3. Roundworm

(Source: <http://www.hopeanimalhospital.org/educational-topics/intestinal-parasites.html>)

Extended activity:

1. Collect soil samples and observe the presence of different types of organisms in them. Collect soil sample from places where there is a greater chance of finding any organisms like underneath rocks or stones in a slightly damp place.
2. One can prepare a similar activity on classification using leaves collected from garden or leafy vegetables collected from kitchen or market.

References:

- 1) Quillin K., Thomas S. (2015). Drawing-to-Learn: A Framework for Using Drawings to

Promote Model-Based Reasoning in Biology. CBE-Life Sciences Education Vol. 14, 1-16.

- 2) Verma P. S., Jordan E. L. Invertebrate Zoology. S. Chand publisher, New Delhi.
- 3) Tree of life web project: <http://tolweb.org/tree/>

Further Reading:

- 1) Gendron P. (2017). The Classification & Evolution of Caminalcules. The American Biology Teacher, Vol. 62, No. 8 (Oct., 2000), pp. 570-576.
- 2) The Great Indian Nature Trail with Uncle Bikky - Author and illustrator: Rohan Chakravarty and Essays by Bijal Vachharajani (Available with WWF - India: <https://shop.wwfindia.org/books/the-great-indian-nature-trail-with-uncle-bikky.html>)

