

AN ACTIVE AUSTRALIAN SCIENCE 7 CURRICULUM MODULE

AUS BS7 SU STRAND MODULE 1: CLASSIFICATION OF LIVING THINGS

STUDENT'S NAME:

TUTORIAL:

TEACHER'S NAME:

DATE:

AUS Biological Sciences 7: Science Understanding Strand Module 1: Key Conceptual Understandings

- Students understand that the structure of an organism refers to the nature and arrangement of its body parts.
- Students understand that living things have a particular structure or body organisation and particular ways of behaving and functioning by which they may be distinguished.
- Students understand that classification is the process of sorting objects into groups based upon likeness between them, i.e., upon those characteristics that they have in common.
- Students classify some familiar animals into different groups on the basis of both structural and functional characteristics using a dichotomous schematic chart provided to them by their teacher.
- Students apply a classification scheme to sort some familiar plants into different groups on the basis of characteristics such as method of nutrition, structural features, and the way they reproduce.
- Students classify, by referring to a dichotomous schematic chart, some familiar animals into different classes of vertebrates on the basis of type of fertilization and development of zygote.

An Introduction to Classification

1. A science fiction show on ABC3 is [Dex Hamilton](#), Alien Entomologist. What do **entomologists** do?

[1 mark]

There are about one million [species of insects](#) living on earth.

2. How do biologists define the scientific word **species**?

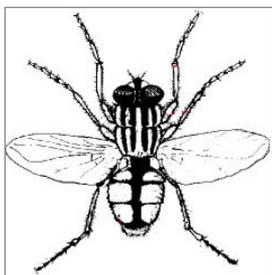
[2 marks]

- Science Concept: A **species** is a grouping of organisms that in nature are capable of interbreeding to produce fertile offspring. Members of two different species usually do not mate successfully in nature to produce fertile offspring. For example, horses can mate in nature with donkeys, but their offspring called mules are infertile, i.e. they are unable to reproduce.

An **entomologist** is a scientist who studies insects. As there are about one million species of insects living on earth; entomologists make their study of them easier by **classifying** them into groups. An entomologist can classify insects into groups by studying their **structure**.

- Science Concept: **Classification** is the process of sorting objects into groups based upon likeness between them, i.e., upon those characteristics that they have in common.
- Science concept: The **structure** of a living thing refers to the nature and arrangement of its body parts.

Now carefully study the structure of a fly, a bee, and a spider as shown in the images given directly below.



House Fly



Honey Bee



Red-Back Spider

3. Can you now complete Table 1, given below, which compares the body parts of a house fly, a honey bee and a red-back spider?

TABLE 1: Comparing the Body Parts of Flies, Bees, and Spiders

	House Fly	Honey Bee	Red-back Spider
Number of Body Parts			
Number of Wings			
Number of Legs			

[9 marks]

4. In what **three** structural ways is the body of a spider **different from** the body of a fly or a bee?

[3 marks]

The Science of Taxonomy

- Science concept: **Taxonomy** is the science of classifying living things.
- Science concept: Biologists refer to an individual living thing as an **organism**.

A simple classification system divides living things into **seven** major levels. Table 2 gives the classification of a house fly, a honey bee, and a red-back spider.

TABLE 2: A Simplified Classification System

Level of Classification	House Fly	Honey Bee	Red-Back Spider
Kingdom	Animalia	Animalia	Animalia
Phylum	Arthropoda	Arthropoda	Arthropoda
Class	Insecta	Insecta	Arachnida
Order	Diptera	Hymenoptera	Araneae
Family	Muscidae	Apidae	Theridiidae
Genus	<i>Musca</i>	<i>Apis</i>	<i>Latrodectus</i>
Species	<i>Musca domestica</i>	<i>Apis mellifera</i>	<i>Latrodectus hasselti</i>

5. How many organisms are shown in Table 2?

[1 mark]

Taxonomists group living things into categories called **kingdoms**. However, since taxonomists cannot agree on [a single way to classify organisms](#); there exists a small number of competing classification schemes, each having a different number of kingdoms.

A **taxonomist** is a biologist who specializes in the classification of living things into groups on the basis of their structure, [evolutionary history](#), and behaviour. Most modern taxonomists support five (5) kingdoms of living things. Recently, however, a [three \(3\) domain classification system](#), consisting of **bacteria**, **archaea**, and **eukaryota**, has been proposed mainly by the microbiologists. In the 3 – domain system, organisms are primarily classified according to molecular sequences in their [ribosomal RNA](#).

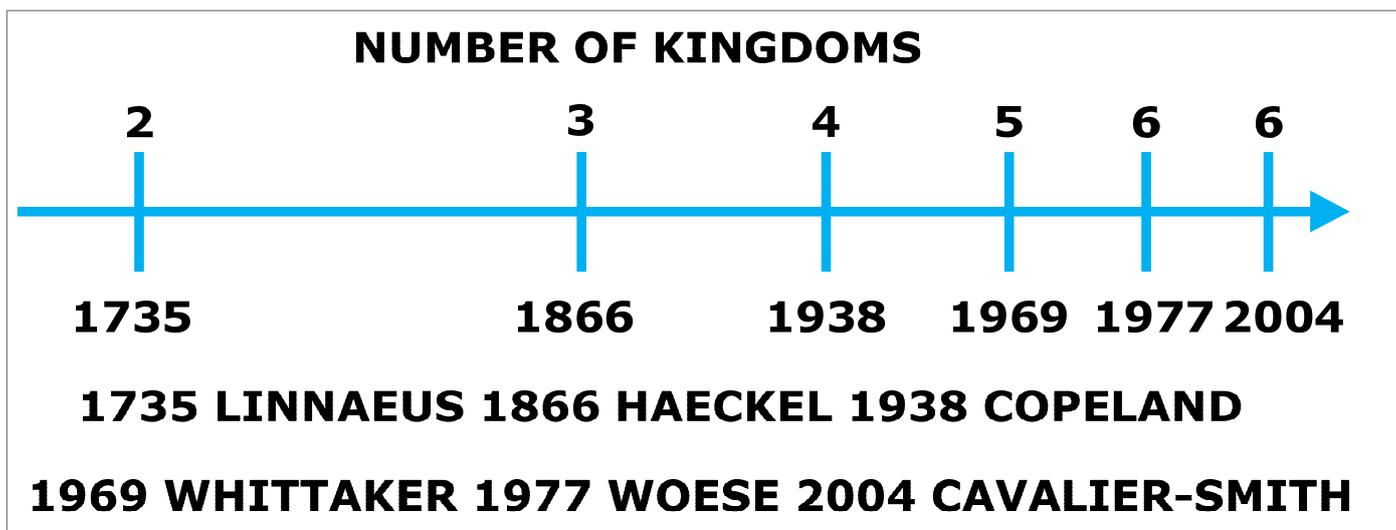
- Science Concept: The [five \(5\) kingdoms of living things](#) include the Monera, the Protista, the Fungi, the Plantae, and the Animalia. Fungi such as mushrooms were once classified as plants. Biology textbooks now show Fungi as a separate kingdom. Do you know why?
6. Can you identify and list two features of fungi, which allow them to be classified into their own kingdom separate from plants?

[2 marks]

The tentative Nature of Scientific Knowledge

Science has a way of determining the ‘correctness’ of its explanations. An initial explanation is referred to as a **model**, or **hypothesis**. Any new model is tentative or changeable. A new model/hypothesis is always tested experimentally by collecting more and more data. If new data contradict the existing model, then the model must be modified, or even discarded, and a new one developed. If a model is tested a number of times and continues to explain all the new data, then the model may be scientifically ‘correct’. But, we still can’t know if it is ‘correct’; because there is always a possibility that new data may arise in the future and require that we modify our current scientific model. To distinguish a new model from a well-tested model, we call a new model a **hypothesis**, and a well-tested model a **theory**.

A [timeline](#) for the number of kingdoms used, from about 1735 to present day, in **schemes of classification** of living things well illustrates the tentative nature of scientific models, in this case, models of classification.



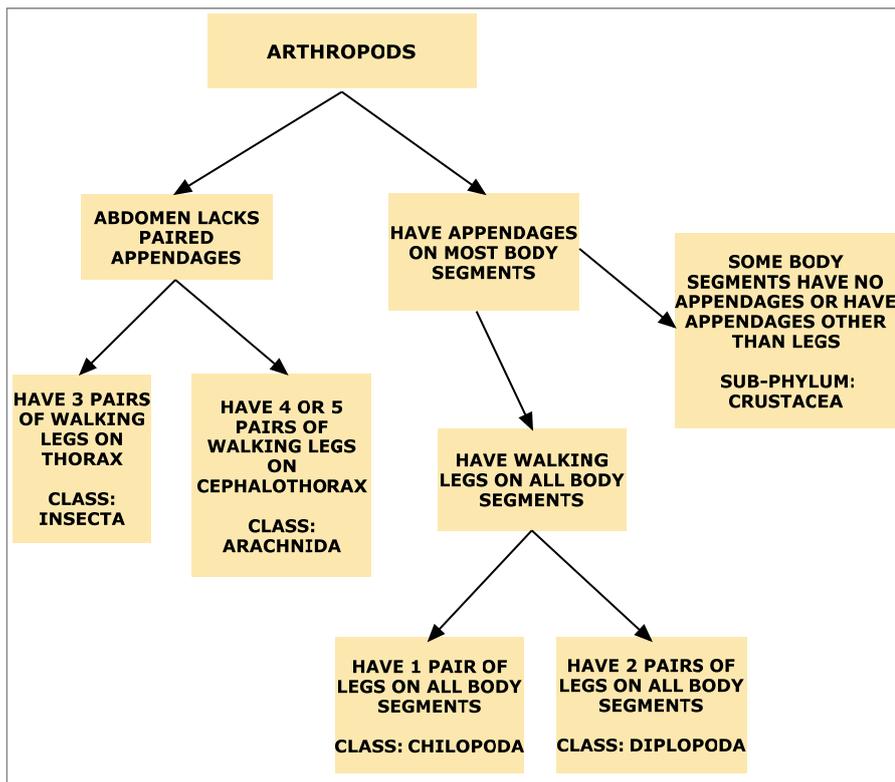
Forward Reference: In the Chemical Sciences Sub Strand at Year Levels 9 and 10, you will make a study of the evolution of atomic models, from the time of Dalton (1803) to Schrödinger (1926). In your study, you will ‘see’ how new atomic models replaced the older atomic models, so as to explain new observations that could not be explained by using the older models.

A Study of the Arthropods

You already know that a house fly, a honey bee and a red-back spider are arthropods. In your study of arthropods, you will need to be able to use a [dichotomous key](#) to identify other unfamiliar arthropods.

- Science concept: All **Arthropods** have these six characteristics: (1) An Exoskeleton, (2) Segmented bodies, (3) Jointed appendages, (4) Bilateral symmetry, (5) Dorsal blood vessel, and (6) Ventral nerve cord.
- Science concept: Most adult **insects** have these features: (1) A body divided into three parts (head, thorax and abdomen), (2) Three pairs of legs, (3) Usually one pair of antennae and a pair of compound eyes, and (4) Usually two pairs of wings, except for flies, which have one pair.
- Science concept: **Arachnids** have these features: (1) A body divided into only two parts (cephalothorax and an abdomen), (2) Four pairs of legs attached to the cephalothorax, and (3) Two other sets of jointed appendages.

A simplified Key for Identifying Arthropods



Centipedes and Millipedes

Centipedes and millipedes are both arthropods. Centipedes are carnivores, whereas millipedes are herbivores. Unfortunately millipedes are sometimes mistaken for centipedes.



Centipede



Millipede

7. In relation to their number of legs, what is one obvious difference between millipedes and centipedes?

[2 marks]

8. To what class of arthropods do centipedes belong?

[1 mark]

9. To what class of arthropods do millipedes belong?

[1 mark]

A scorpion is an arthropod.

10. Would you classify a scorpion as an **insect** or as an **arachnid**? You must give **two** reasons that support your classification choice.



Scorpion

[3 marks]

Arthropod Exoskeletons

- Science Concept: An **exoskeleton** is the hard outer structure, such as the shell on an insect or crustacean, which provides protection and support for the organism.

All arthropods have an exoskeleton. The exoskeleton acts as an external skeleton and provides the animal with structural support and protection. As the exoskeleton is rigid it must be jointed to allow the arthropod to move, as it acts as a framework to which the animal's muscles are attached.

11. What would be one **advantage** of an exoskeleton to a terrestrial arthropod living in a **dry** environment?

[1 mark]

12. How is an exoskeleton **disadvantageous** to a **growing** arthropod? In your answer, you must give at least **two** disadvantages.

[2 marks]

The Sub-Phylum: Vertebrata

Science Concept: All **Vertebrates** have these features: (1) Bilateral symmetry, (2) Two pairs of jointed appendages, (3) A well-developed internal skeleton, (4) A highly developed brain enclosed by skull, and a nerve cord enclosed by vertebrae, (5) Well-developed sense organs (eyes, ears, nostrils) located on the head, (6) A respiratory system, including either gills or lungs, and (7) A closed circulatory system with a ventral heart and a dorsal artery.

Taxonomy is the science of classifying living things. A simplified classification system divides living things into **eight** major levels as shown in Table 3 given below, with a human, a bonobo and a chimpanzee given as examples.

TABLE 3: A Simplified Classification System

Level of Classification	Human	Bonobo	Chimpanzee
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata
Subphylum	Vertebrata	Vertebrata	Vertebrata
Class	Mammalia	Mammalia	Mammalia
Order	Primates	Primates	Primates
Family	Hominidae	Hominidae	Hominidae
Genus	<i>Homo</i>	<i>Pan</i>	<i>Pan</i>
Species	<i>Homo sapiens</i>	<i>Pan paniscus</i>	<i>Pan troglodytes</i>

13. Which pair of animals is more closely related a human and a bonobo, or a bonobo and a chimpanzee? You must explain your answer by referring to selected information from Table 3.

[2 marks]

14. Which two animals are more closely related those that belong to the **same family and genus**, or those than only belong to the **same family**? In answering Question 14, you must refer back to your answer to Question 13.

[2 marks]

The seven classes of **vertebrates**, shown in Table 4, given below, are distinguished from each other by their skeletal systems, general environmental adaptations, and reproductive systems.

TABLE 4: The Vertebrate Classes

Phylum	Chordata						
Subphylum	Vertebrata						
Class	Agnatha	Chondrichthyes	Osteichthyes	Amphibia	Reptilia	Aves	Mammalia
	Jawless fish	Cartilaginous fish, e.g., sharks	Bony fish e.g., snapper	Amphibians e.g., frogs	Reptiles e.g., snakes	Birds	Mammals

- Science concept: **Chordates**, at least during their development, share these features: (1) Notochord: A firm, flexible rod of specialized cells, which becomes the skeleton in the **vertebrates**, (2) Dorsal nerve cord: A hollow tube above the notochord, which becomes the spinal column and brain in the vertebrates, (3) Pharyngeal pouches: Outside pockets in the pharynx, which is part of the digestive tract between the mouth and the esophagus. Pharyngeal pouches become gill chambers and gills in aquatic chordates, and jaws, inner ear, and tonsils in terrestrial chordates, and (4) a post-anal tail: A tail located posterior to the anus.

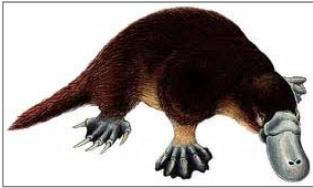
15. Why must all **amphibians** return to water to reproduce?

[2 marks]

16. The eggs of reptiles, birds and mammals are fertilized within the reproductive tract of the adult females. How is the **development** of the human embryo **different from** that of a bird embryo inside the bird egg? You must describe at least **two** differences in your answer to this Question.

[4 marks]

17. The eggs of reptiles, birds and mammals are fertilized within the reproductive tract of the adult females. The adult female, duck-billed platypus lays eggs. Is a duck-billed platypus a **reptile**, or is it a **mammal**? You must give at least **two** reasons for your choice.

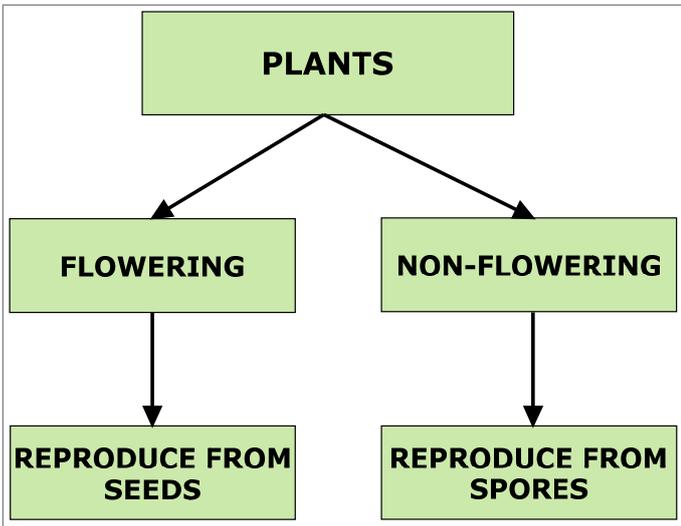


Platypus

[3 marks]

Classification of Plants

- Science concept: Most biologists now subdivide living things into five (5) major kingdoms including the Monera, the Protista, the Fungi, the Plantae, and the Animalia.



Science concept: Plants can be classified according to their method of **reproduction**. Some plants reproduce from **seeds**. Others reproduce from **spores**.

Science concept: A **seed** is a ripened plant ovule containing an embryo.

Science concept: A **plant spore** is a small, usually single-celled reproductive body capable of growing into a new plant.

18. Mosses, ferns and mushrooms all reproduce from spores. Mosses and ferns are plants. Mushrooms are a fungus. What **four** major features of mushrooms allow them to be classified as **fungi** and not as plants?



Mushrooms

[4 marks]

Key Concepts 

What new science ideas have you now learned about the **classification of living things** by studying this AUS BS7 SU Strand Module 1? List your newly learned key Science Concepts, as dot-points, in the textbox given below.

A Self-Check Summative Assessment Table

Now complete this assessment table by adding the 'self-check' mark achieved for your answer to each focus question. Your teacher will provide his/her 'model' answer to each question, via 'whole of class' discussion.

Total Mark Possible = 45	Mark Achieved =	Percent (%) Score Achieved =
---------------------------------	-----------------	------------------------------