Chapter 5: Classification

5.1 Classification organises our world

Student worksheet answers (pages 80–81)

Classification history

1 Draw a classification key that shows how Aristotle classified living things.

Student responses will vary in the appearance and structure of the classification key, but the key should include:

• the two major groups ‘plants’ and ‘animals’

• then movement (swim, fly, walk).

Some other examples of how Aristotle may have classified animals (e.g. number of legs, body covering, size, etc.), could also be included.

2 Name two animals that would fit into the following groups:

a Walking

Student responses will vary because there are numerous possibilities

b Flying

Student responses will vary because there are numerous possibilities

c Swimming

Student responses will vary because there are numerous possibilities

3 In which of Aristotle’s groups would a duck belong? Provide evidence to support your opinion.

The duck would probably be in the ‘fly’ group because of its wings; however, it may also be in the ‘swim’ or ‘walk’ group.

4 According to Aristotle, both bats and birds would be classified into the ‘flying’ group. Suggest a reason why these two animals should not be classified in the same group.

Student responses will vary, but could refer to the mouth (teeth v. beak), body covering (skin v. feathers), ear shape, eye location, hands and feet.

The current system of classification was suggested by Carl Linnaeus in the 18th century. It suggests a series of groups that become increasingly smaller.

5 Why did Linnaeus make changes to the classification system?

Linnaeus found the descriptions were too long and decided that the classification system needed to be simpler.

6 What changes did Linnaeus make?

Linnaeus changed the descriptions to single words and reduced the number of classification groups to seven.

7 What animals do you think these three classifications from Linnaeus’s classification system refer to?

a Quadrupedia:

quad = four (quadrant, quad-bike etc.); pedia (pedal) = feet; so, animals with four legs

b Aves:

birds (aviary)

c Amphibia:

amphibians

EXTEND YOUR UNDERSTANDING

8 New species are discovered every year. Some of these are ancient species that are classified using fossil evidence, but other species are alive today. Research three new species that have been discovered this year. Find a picture of the species and write a two- or three-line description about each.

Student responses will vary depending on the depth of research and the choice of species. The following website has examples and pictures of 10 new species: <http://www.discovery.com/dscovrd/wildlife/top-10-new-species-of-2015-rule-breaking-frog/>

5.2 Living organisms have characteristics in common

Student worksheet answers (pages 82–83)

Living or non-living?

1 All living things share eight key features. Complete the mnemonic (memory trick) below to outline the meaning of each feature. The first one has been done for you.

|  |  |
| --- | --- |
| **M** | Movement: Living things can MOVE by themselves |
| **R** | Reproduce: living things make new individuals that look like themselves |
| **N** | Nutrition: living things require nutrients to survive. |
| **G** | Grow: living things grow as they get older |
| **R** | Respond: living things respond to stimuli around them. |
| **E** | Exchange: living things exchange gases with their environment. |
| **W** | Wastes: living things produce wastes |
| **W** | Water: living things require water to survive |

2 Classify the following as living or non-living.

a a cat

living

b a drop of water

non-living

c an ant

living

d mould

living

e salt

non-living

g bacteria

living

h grass

living

i computer

non-living

3 Light a candle and observe the candle flame. Describe how it carries out each of the eight key features.

|  |  |
| --- | --- |
| **M** | Movement: The flame flickers and moves |
| **R** | • Reproduction: flames reproduce by sparks and matches. |
| **N** | • Nutrition: flames consume wax as they burn. |
| **G** | • Growth: flames can grow as more wax is available. Flames are bigger on bigger candles than on small candles. |
| **R** | • Respond: flames respond to blowing on them, adding more oxygen, or pouring water onto the candle top. |
| **E** | • Exchange: flames consume oxygen gas and produce carbon dioxide gas. These gases are exchanged with each other. |
| **W** | • Waste: candle flames produce carbon dioxide, soot and water vapour as products which they cannot use. |
| **W** | • Water: flames respond badly to water. Flames are extinguished by water. |

4 Based on your responses to the question above, decide whether you think a flame is living or non-living. Explain why.

Even though a flame has many of the features of living things, it is not living. Flames cannot reproduce on their own, and they do not use the wax as nutrition to grow a bigger flame but burn it all into waste

EXTEND YOUR UNDERSTANDING

4 A recently-discovered species of *Loricifera* is missing an important characteristic that most animals and plants on Earth share. Use the Internet to find the answers to these questions:

• What are *Loricifera*?

*Loricifera* are a type of microscopic animal that lives in the sediment (mud and sand) on the ocean floor. Most *Loricifer*a live more than 3 kilometres below the surface.

• What is different about L*oricifera* compared with other animals?

A few different types of *Loricifera* are different to other animals on Earth because they can survive in environments that have no oxygen. These environments are referred to as ‘anoxic’ by scientists, measing ‘no oxygen’.

• How do *Loricifera* survive without this characteristic?

*Loricifera* are able to survive in anoxic environments because they have organelles (tiny organs inside their cells) that can generate energy without the need for oxygen.

5.3 Classification keys are visual tools

Student worksheet answers (pages 84–85)

Who am I?

1 Why do scientists use dichotomous keys?

Scientists use dichotomous keys to make simple ‘yes’ and ‘no’ decisions at each branch to assist with classification of organisms.

2 Why is it important to classify things?

It is important to classify things to organise organisms with similar characteristics into particular groups.

3 Name five characteristics that would help to classify the people in your class

Student responses will vary but could include, hair colour, eye colour, gender, skin colour etc.

4 On the next page is a dichotomous key for students in a Science class at *Stickman Secondary College.*

a Use the dichotomous key provided to identify the students in this class at *Stickman Secondary College* on the next page.

A Mina

B Mag

C Pierre

D Hana

E Robert

F John

G Joshua

G Molly

I Cheng

J An

K Ally

L George

b Draw in the missing students.

M Sara: No skirt, no pants, shoes, no hair

N Fatima: Skirt, no shoes, hair no spikes

O Mohammad: No skirt, pants, shoes, hair, spikes

P Fred: No skirt, pants, shoes, hair, no spikes

Q Juan: No skirt, no pants, shoes, hair, spikes

R Isla: Skirt, shoes, no hair

EXTEND YOUR UNDERSTANDING

5 Use the Internet to find out the difference between bugs, beetles and insects. Summarise your findings in the table below.

|  |  |  |
| --- | --- | --- |
| **Bugs** | **Beetles** | **Insects** |
| Bugs have a mouth shaped like a straw that they use to suck juices from plants. Their wings are thickened and coloured near where they are attached to the insect's body. | Beetles have chewing mouthparts, and their forewings (the ones in front) have evolved over many generations to become hard, leathery coverings (called elytra) that protect the hindwings (the ones at the back). The hindwings of beetles are made from clear membranes that fold under the elytra when the beetle is not flying. | Insects belong to the Phylum Arthropoda because they are invertebrates and have legs with joints.  Bugs and beetles are types of insects. |

5.4 The classification system continues to change

Student worksheet answers (pages 86–87)

Classification using seven levels

1 Identify which level of classification contains the most number of organisms.

Kingdom level

2 Identify which level contains the least number of organisms.

Species level

3 Which two species in the table above would be most similar? Explain why.

The human and the snow leopard would be the most closely related because they are the only two species in the same class as each other.

4 Which organism listed in the table above is most different to all the other organisms?

The honey bee is the most different to all other organisms in the table since it is classified in a different phylum to the others.

Early classification methods used the outside appearance of organisms to help classify them into groups. Modern techniques compare the genetic material (DNA) for similarities and differences. Organisms that have similar DNA are placed in the same group, while those with very different DNA are placed in different groups.

5 The two moles above look very similar. Describe three physical characteristics the moles have in common.

The physical characteristics the moles have in common are body size, tail shape, the shape of the hind leg, body covering (fur), eye location and size.

6 The DNA of these two moles is very different. Would you classify the moles in the same group or in different groups? Provide evidence to support your decision.

Student responses may vary depending on the level of classification; for example, the genus of the moles would probably be the same, although they would belong to different species because of genetic (DNA) variations.

EXTEND YOUR UNDERSTANDING

7 Find out three other species from the same Genus as humans.

Other species in the same genus as humans include *Homo erectus*, *Homo ergaster*, *Homo floresiensis*, *Homo habilis*, *Homo naledi* and *Homo neanderthalensis*.

5.5 All organisms can be divided into five Kingdoms

Student worksheet answers (pages 88–89)

Kingdoms of life

1 List the five main kingdoms.

Animalia, Plantae, Fungi, Monera, Protista

2 Identify which of the kingdoms has the smallest number of known species.

Kingdom Plantae

3 Identify which of the kingdoms consists of unicellular organisms.

Monera and Protista

4 Explain how the members of the Kingdom Plantae differ from all other life forms.

Members of the plant kingdom are autotrophic (meaning they make their own food from sunlight).

5 Which of the kingdoms would be the most successful type of life form on Earth? Explain, giving reasons.

Members of the animal kingdom could be considered the most successful life forms on Earth because they make up the largest group of organisms on Earth – almost 10 to 1 time larger than the next biggest kingdom (Fungi).

EXTEND YOUR UNDERSTANDING

Bacteria (Kingdom Monera) are the smallest living organisms on Earth. They are so small that a microscope is needed to see them. Despite this, they are not all the same: they come in all shapes and sizes. Each type of bacteria causes different diseases, so it is important that medical scientists are able to correctly identify them.

6 A doctor sent a sample of bacteria found in a sore throat to the laboratory for testing. The scientist used a microscope to look at the sample and found cocci. Draw a picture of what the scientist saw down the microscope.

Students answers will vary, but picture should include spherical bacteria, which look similar to the image of cocci on the worksheet.

7 Why was it important that the scientist identified the type of bacteria for the doctor?

It was important that the type of bacteria was identified so that the correct medication or other forms of treatment could be used to treat the bacterial infection.

There are two main types of spherical-shaped bacteria that could cause a throat infection, *Staphylococci* and *Streptococci*. Scientists must use a special stain called a Gram stain to tell these two stains apart. *Staphylococci* stain a purple colour with this stain and are called Gram positive; *Streptococci* do not stain purple and are called Gram negative.

8 Why do scientists sometimes need to stain bacteria cells?

Bacteria cells would be stained so the particular type of bacteria could be identified in order to correctly treat the infection.

9 *Staphylococci aureus* (also known as Golden Staph) is often resistant to many bacterial treatments like antibiotics. Why would it be important for hospitals to correctly identify these cells?

Student responses will vary, but could include the use of specific antibiotics to treat the infection and needing to isolate the patient to reduce cross-contamination.

10 How are these cells different to cells in the Kingdom Animalia?

These cells are less complex than the cells in Kingdom Animalia.

5.6 Animals that have no skeleton are called invertebrates

Student worksheet answers (pages 90–91)

Butterfly or moth?

1 What is an exoskeleton?

An exoskeleton is an external skeleton.

2 Both butterflies and moths are classified as insects. How can you tell the difference between insects and spiders?

Student responses will vary, but could include the number of legs as the main distinguishing feature.

3 Use the information provided above to draw the life cycle of a butterfly or a moth.

The life cycle (according to the information) is caterpillar larva, pupa, moth (cocoon) or butterfly (chrysalis).

4 Suggest a reason why a moth might have dull-coloured wings.

Student responses may vary, but camouflage could be a common response.

5 Use the characteristics listed above to draw a butterfly and a moth. Label the similarities and differences between them.

Similarities: number of legs, exoskeleton, wings

Differences: antenna shape, wing structure, posture, forelegs, active times, colouration, pupa covering

EXTEND YOUR UNDERSTANDING

6 Research a butterfly or moth that lives in your area.

• What characteristics could you use to identify it?

• Where does it live in your area?

• What is its life cycle?

• Does it migrate? If so, where to?

Student responses will vary depending on their location.

5.7 Vertebrates can be organised into five Classes

Student worksheet answers (pages 92–93)

Classifying vertebrates

1 Using your student book, list the five classes of vertebrates.

Class Mammailia, Class Aves, Class Reptilia, Class Amphibia, Class Pisces

2 Decide whether each of the following statements is true or false.

a A kingdom is a bigger group than a phylum.

True

b All animals in Class Aves lay eggs.

True

c A cat is a endotherm.

False

d Turtles belong to Class Amphibia.

False

e A frog is an example of a reptile.

False

3 Describe what determines whether an animal is a vertebrate or an invertebrate.

Vertebrates have a spine or a backbone. Invertebrates do not.

4 What are the three subgroups of Class Mammalia? What is the feature used to separate these subgroups?

Monotremes, marsupials, placentals. The main feature used to separate mammals into subgroups is how their young develop.

5 Complete the table below.

|  | **Fish**  **(Class Pisces)** | **Amphibians**  **(Class Amphibia)** | **Reptiles**  **(Class Reptilia)** | **Birds**  **(Class Aves)** | **Mammals**  **(Class Mammalia)** |
| --- | --- | --- | --- | --- | --- |
| Internal skeleton? | Ectotherm | Ectotherm | Ectotherm | Endotherm | Endotherm |
| Ectotherm or endotherm? | Wet scales | Moist skin | Dry scales | Feathers | Hair or fur |
| Body covering? | Usually birth from eggs, but some live births (from womb) | Birth from eggs | Birth from eggs | Birth from eggs | Usually live birth (from womb), but some from eggs |
| Birth from egg or womb? | Ectotherm | Ectotherm | Ectotherm | Endotherm | Endotherm |

6 Complete the list of features for the vertebrate classes.

a Mammals = Internal skeleton, endotherm, hair/fur, birth from womb (usually)

b Birds = internal skeleton, endotherm, feathers, birth from eggs

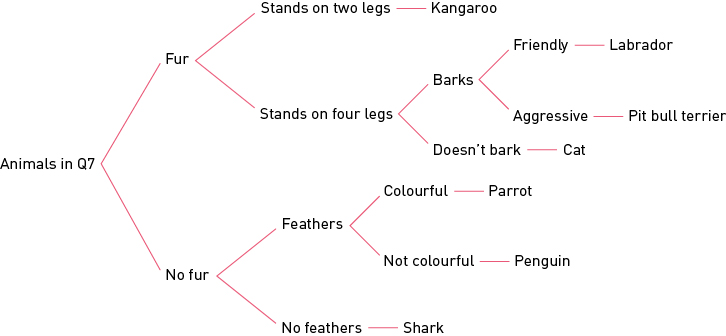
c Reptiles = Internal skeleton, ectotherm, dry scales, birth from eggs

d Fish = internal skeleton, ectotherm, wet scales, birth from eggs

e Amphibians = Internal skeleton, ectotherm, moist skin, birth from eggs

EXTEND YOUR UNDERSTANDING

7 Construct ONE dichotomous key to classify ALL of the following animals:



5.8 Plants can be classified according to their characteristics

Student worksheet answers (pages 94–95)

Plants from the dinosaur age

1 Pine trees belong to a group of plants called conifers. What are the characteristics that can be used to identify these plants?

Characteristics that can be used to identify these plants include: forms seeds in cones, no true flowers (produce cones instead) and needle-like leaves.

2 One of the distinguishing characteristics of the Wollemi pine tree is its bark, which was once described as looking like it was ‘covered in Coco Pops’. Can you use more scientific terms to describe what this might look like?

Student responses will vary, but an example could be a rough vascular cambrian, or a rough external covering or a rough outer layer.

3 The Wollemi pine has large seeds that have been described as ‘wings’. How might these seeds be spread into new areas?

The ‘wings’ would allow the seeds to glide with the wind to spread into different areas.

4 How might the Brachiosaurus (the dinosaur shown in the picture on the previous page) help with the dispersal of the Wollemi pine seeds? (Look at what the Brachiosaurus is doing.)

The Brachiosaurus would consume the seeds contained in the cone and then defecate in a different location.

5 What might the Brachiosaurus provide to help the Wollemi pine seeds grow? (Think about what we add to plants to give them nutrients to help them grow).

The Brachiosaurus faeces (manure) would provide fertiliser for the seeds.

6 Why is it important for seeds to move away from the parent tree before growing?

The parent tree is much larger than a seed or seedling. In order for the new seedling to grow, it needs space, water and nutrition.

7 To revise some of the terms used in this section, write the definition of the following words:

a spore

Spores are produced by plants such as ferns. Spores are much smaller than seeds and contain only half the genetic material

b vascular tissue

Vascular tissue is the system of tubes in a plant that transports water from the roots to the leaves.

c pollination

Pollination is the transfer of pollen from one plant to another to allow fertilisation to occur.

d monocots

Monocots are plants with seeds that contain a single embryonic leaf.

e dicots

Dicots are plants with seeds that contain two embryonic leaves.

EXTEND YOUR UNDERSTANDING

8 Use the Internet to research the discovery of the Wollemi pine. What made it such an exciting discovery?

Student responses will vary, but should include mention of the following points:

• The Wollemi pine was discovered by a park ranger in the Wollemi National Park (about 200 kilometres from Sydney) in 1994.

• The discovery of a Wollemi pine in the wild was exciting because this species of tree had only ever been identified through fossil specimens that are millions of years old. It was thought to be extinct before it was discovered in 1994.

• Today, there are fewer than 100 mature Wollemi pines in the wild and they are protected by law.

5.9 Science as a human endeavour: The first Australian scientists classified their environment

Student worksheet answers (pages 96–97)

Aboriginal medicines

1 When testing a plant for the first time, early scientists did not put it in their mouth. Instead, they would rub a small amount on their skin. Suggest one reason why they tested plants in this way.

If the plant was poisonous and it was put in the mouth first, the poison would be quickly absorbed into the bloodstream and could cause illness or death. If a reaction occurs on the skin, the poison can be washed off and the reaction would hopefully be localised.

2 Why might scientists prefer to use the scientific names for the plants rather than their traditional (or common) names?

The scientific names are a universal language. So, no matter which country a scientist is from, they can identify plants using a scientific name rather than trying to work out the traditional (or common) names, which can vary from place to place.

3 Suggest two advantages and two disadvantages of traditional medicines.

Student responses will vary, but could include the following:

Advantages: hundreds if not thousands of years of use, readily available in nature

Disadvantages: potential side effects, may not be available during certain seasons

EXTEND YOUR UNDERSTANDING

4 Research one plant found in your state that was used by Indigenous Australians for food or medicine.

Student responses will vary.