

How to find the name of an organism?

- To find the scientific name of an organism, a key is used to identify unknown organisms.

Using Dichotomous Key

- A dichotomous key is a device that can be used to easily identify an unknown organism.
- The word dichotomous comes from two Greek words that together mean, "divided in two parts".
- A dichotomous key consists of a series of two part statements that describe characteristic of organisms.
- At each step of a dichotomous key the user is presented with two choices.
- Each choice refers to a feature of the animal or plant being studied.
- As the user makes a choice about a particular characteristic of an organism they are led to a new branch of the key.
- Eventually the user will be led to the name of the organism that they are trying to identify.

Below are five arthropods found in a beech forest.

Key:

1. Wings present go to 2
Wings absent go to 3
2. Abdomen thin when joins thorax *Apanteles* sp
Abdomen same thickness as thorax *Tenthredo* sp
3. More than 10 legs *Lithobius* sp
Less than 10 legs go to 4
4. Short fat body *Pergamasus* sp
Long thin body *Agriotes* sp

Use the above key to identify the scientific name of arthropods A - E.

A: _____

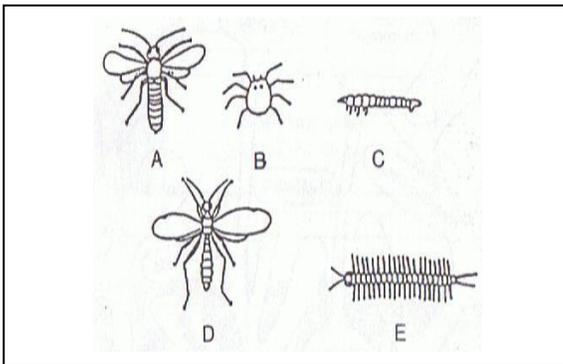
B: _____

C: _____

D: _____

E: _____

Example: Classifying Arthropods



Important biological terms and their meaning!!

Species - group of organisms that can interbreed freely and can produce a fertile offspring.

Biodiversity - refers to the variation of living things that inhabits a particular area. This includes variation amongst different species and also the variation amongst members of the same species.

Importance of Biodiversity

- The diversity of life enriches the quality of our lives in ways that are not easy to quantify.
- Biodiversity is intrinsically valuable and is important for our emotional, psychological, and spiritual well-being.
- Some consider that it is an important human responsibility to be stewards for the rest of the world's living organisms.
- Diversity breeds diversity. Having a diverse array of living organisms allows other organisms to take advantage of the resources provided.
For example, trees provide habitat and nutrients for birds, insects, other plants and animals, fungi, and microbes.
- Humans have always depended on the Earth's biodiversity for food, shelter, and health. Biological resources that provide goods for human use include:
 - i) **food**—species that are hunted, fished, and gathered, as well as those cultivated for agriculture, forestry, and aquaculture.
 - ii) **shelter and warmth**—timber and other forest products and fibers such as wool and cotton.
 - iii) **medicines**—both traditional medicines and those synthesized from biological resources and processes.

Environment - the sum total of all the biotic (living) and abiotic (non-living) factors surrounding an organism.

Habitat - refers to the place where an organism lives.

Biotic factors - the living part of the environment e.g predators, parasites, competitors and food supply.

Abiotic factors - refers to the non-living (physical) part of the environment e.g temperature, light intensity, water salinity, wind speed and soil pH.

UNIT 2: ADAPTIVE FEATURES

Learning Outcome

At the end of this unit, students should be able to:

- Identify an adaptation as a characteristic that enables an organism to survive better in its habitat.
- Describe four types of adaptation (structural, physiological, behavioural) and give examples.
- Describe the concepts implied in the terms: tolerance, acclimation, Gause's Principle, ecological niche and Liebig's Law.

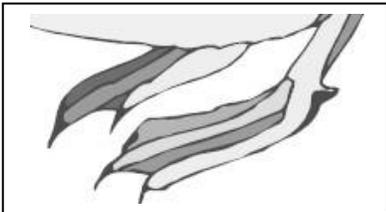
Adaptation: an inherited characteristic that enables an organism to survive and reproduce more effectively in its environment.

FOUR MAIN TYPES OF ADAPTATION

1. Structural (Morphological) Adaptation

- An inherited part of the body that enables and organism to survive.
- Many animals have developed specific parts of the body adapted to survival in a certain environment.
- Among them are webbed feet, sharp claws, whiskers, sharp teeth, large beaks, wings, and hooves.

Example 1: Webbed Feet



- In most aquatic animals, swimming is a must.
- To aid swimming, many animals have adapted and evolved with webbed feet.
- Webbed feet help animals propel themselves through the water with ease. This can help the animal swim faster to catch prey or escape a predator.
- Also, if an animal has to swim long distances, webbed feet can help it save energy so it can swim farther.

Example 2: Sharp teeth



- One of the most visible adaptations on many animals, sharp teeth help an animal eat meat.
 - Found primarily on meat-eating animals, or carnivores, sharp teeth are used mainly for the tearing and chewing of an animal's prey.
 - Rather than developing the dull teeth of plant-eaters, or herbivores, carnivores rely on their sharp teeth to allow them to eat and survive.
 - Sharp teeth can serve another purpose: **defense**.
 - In some animals, bearing a large set of sharp teeth can show power or fear.
- #### 2. Behavioural Adaptation
- Behavior adaptations include activities that help an animal survive.
 - Behavior adaptations can be learned or instinctive. (a behavior an animal is born with).
 - Social behavior - some animals live by themselves, while other live in groups.
 - Behavior for protection - An animal's behavior sometimes helps to protect the animal.
 - For instance the opossum plays dead. A rabbit freezes when it thinks it has been seen. Bears hibernate during winter and whales migrate to warm tropical waters during winter.
- #### 3. Physiological Adaptation
- This deals with internal chemistry or function of the body.
 - Anything to do with the body metabolism.
- Example:** the ability of an organism to tolerate temperature or a salty condition; the production of venom or poisons in the glands of scorpions and snakes, the secretion of enzymes for digestion.,etc.

BIOLOGICAL CONCEPTS

1. Tolerance

- *The ability of an organism to withstand any variation or changes in its environment.*
- When an environmental factor exceeds the tolerance limits of an organism, the organism suffers **physiological stress**.
- If the level of stress is too high, the organism will die.
- Between the tolerance limits of an organism lies the **optimum range** - *the range in which an organism functions at its best.*

Example: Temperature tolerance limit of humans

The optimum temperature range for humans is 20 - 30°C. Outside of this range, humans show signs of physiological stress as their body tries to cope with the adverse (opposing) temperatures.

Above 30°C the body begins to sweat rapidly. At even higher temperatures panting, breathlessness, coma and even death can occur.

Temperatures lower than 20°C causes shivering and goose bumps as the body tries to produce and conserve heat energy. At even lower temperatures blood circulation to the skin and then limbs will be stopped. Eventually, if the body's core temperature drops too much, a coma, then death will result.

2. **Acclimation:** *the change in the tolerance limit of an organism as conditions slowly changes e.g sheep and cattle develop fur in autumn.*

3. Gause's Principle (Competitive Exclusion Principle)

- Russian biologist A.F Gause observed that competition between species usually results in the suppression of one population until it disappears.
- Based on his observation, Gause formulated the principle that:

“No two species with similar needs for the same limiting resources can coexist in the same place”

- This means that if two species occupy the same habitat and have the same ecological niche (way of life) then they will not be able to both survive (co-exist) for long.
- This occurs because the two species will compete for the limiting resources.
- The species that will win will survive, and the one that loses in this competition will be disadvantaged and die.

4. **Ecological Niche:** *refers to the mode (way) of life of an organism.*

Example of mode of life

- (i) **Producer (autotrophs)** – organisms that cannot make their own food by photosynthesis e.g plants.
- (ii) **Consumers (heterotrophs)** – organisms that cannot make their own food but get it from other organisms.
- (iii) **Predators** – animals that attack and kill their prey.
- (iv) **Scavengers** – organisms that feed off animals already killed by predators, or animals that have died from disease or injury.
- (v) **Omnivores** – organisms that eat both plant and animal material.

5. Liebig's Law of the Minimum

“It states that growth is controlled not by the total of resources available, but by the scarcest resource (limiting factor).”

- This concept was originally applied to plant or crop growth, where it was found that increasing the amount of plentiful nutrients did not increase plant growth.
- Only by increasing the amount of the limiting nutrient (the one most scarce in relation to "need") was the growth of a plant or crop improved.
- Liebig's Law has been extended to biological populations (and is commonly used in ecosystem models).

Self-Check 3: ADAPTATION.

1. What are the four main types of adaptation?
2. Dengue fever is spread by the bite of an *Aedes* mosquito. The mosquito transmits the disease by biting an infected person, sucking up blood and then biting someone else. The mosquitoes live among humans and breed in discarded tyres, flower pots, old oil drums and water storage containers close to human dwellings.

A mosquito has an anti-clotting substance that prevents the blood from clotting in its mouthpart as it removes it from a human. What type of adaptation is this?

3. The ecological niche of an organism is:
 - a. The same as its habitat
 - b. Its position in a food chain
 - c. The species in the environment it will support.
 - d. The way it fits in the environment for survival.
4. Which of the following is an example of a structural adaptation?
 - a. A shark's tooth
 - b. A spider spinning a web
 - c. The ability of an animal to make digestive enzymes
 - d. The ability of a honeysuckle plant to produce nectar.