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Shikha Gupta
Shikha Nautiyal

SCIENCE OLYMPIAD

National Science Olympiad

4

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A SUCCESS PACKAGE FOR ASPIRANTS OF SCIENCE OLYMPIAD

NATIONAL SCIENCE OLYMPIAD

Exploring the World of Science

Class 4

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Publisher's Note

V&S Publishers, after the grand success of a number of Academic and General books, is pleased to bring out a series of *Science Olympiad books* under *The Gen X series – generating Xcellence in generation X* – which has been designed to focus the problems faced by students. In all books the concepts have been explained clearly through various examples, illustrations and diagrams wherever required. Each book has been developed to meet specific needs of students who aspire to get distinctions in the field of science and want to become Olympiad champs at national level.

To go through the exams successfully, the students need to do thorough study of topics covered in the *Olympiad syllabus and the topics covered in the school syllabus as well*. The Olympiads not only tests subjective knowledge but Reasoning skills of the students also. So students are required to comprehend the depth of concepts. The Olympiads check efficiency of candidates in problem solving. These exams are conducted in different stages at regional, national, and international levels. At each stage of the exam, the candidate should be fully prepared to go through the exam. Therefore, this test requires careful attention towards comprehension of concepts, thorough practice, and application of rules.

While other books in market focus selectively on questions or theory; V&S Science Olympiad books are rather comprehensive. Each book has been divided into five sections namely *Science, Logical Reasoning, Achievers section, Subjective section, and Model Papers.* The theory has been explained through solved examples. To enhance problem solving skills of candidates, *Multiple Choice Questions (MCQs)* with detailed solutions are given at the end of each chapter. Two *Mock Test Papers* have been included to understand the pattern of exam. A CD containing Study Chart for systematic preparation, Tips & Tricks to crack Science Olympiad, Pattern of exam, and links of Previous Years Papers is accompanied with this book. The books are also useful for various other competitive exams such as NTSE, NSTSE, and SLSTSE as well.

We wish you all success in the Olympiad and a very bright future in the field of science.

All the best

Contents

Section 1: Science

Section 2: Logical Reasoning

Section 3: Achievers Section

Section 4: Subjective Section

Section 5: Model Papers

Section 1 : Science

Living and Non-Living Things

Learning milestones:

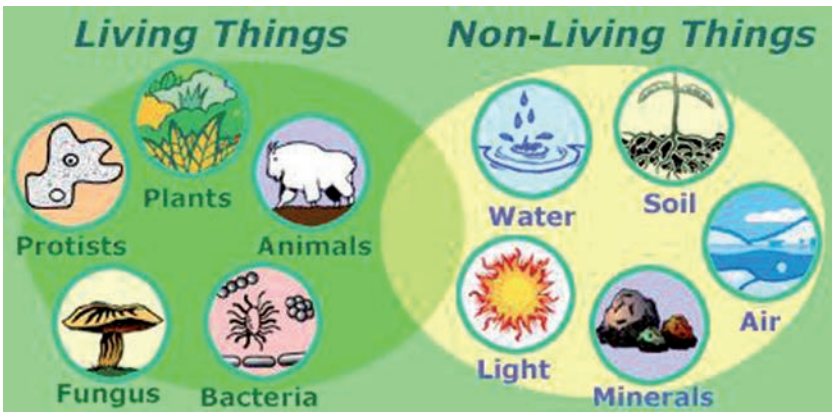
- ❒ Living and non-living things
- ❒ Plants and animals
- ❒ Habitat and adaptation
- ❒ Adaptation in animals
- ❒ Adaptation in plants

Living and Non-Living Things

We see many things around us. Some things have life in them. They are called **living things**. Some things do not have life in them. They are called **non-living things**.

Characteristics of a living thing are:

- ♦ it feeds e.g. a horse eats grass
- ♦ it moves e.g. a cat moves its body
- ♦ it grows e.g. a foal grows into an adult horse
- ♦ it senses e.g. sees, smells, tastes, hears, and feels
- ♦ it produces waste e.g. a horse passes urine and faeces
- ♦ it breathes e.g. breathes air through its nose
- ♦ it reproduces.



What are some of the shared characteristics of living and non-living things?
Living and non-living things are made up of matter, and have weight and mass.

Plants and Animals

Plants and animals are both living things but they are different from each other. The fundamental difference between plants and animals is in the way they obtain food. Plants cannot move around. Therefore, they have to prepare food with easily available materials. Hence, we say that plants are those living things that can produce their own food with the help of air, sunlight, soil, and water.

Animals can move around and obtain their food. Hence, animals are termed as those living things that are dependent for food on other living things, such as plants and other animals.

Churn up Your Mind

Think of a few differences between human beings and animals.

Habitat and Adaptation

The natural environment in which plants and animals live is called their **habitat**. It is very difficult for the plant/animal to survive in a different habitat. For e.g., a camel will not be able to survive in water because its body is adapted to a desert habitat. In nature, living things adapt or change themselves to suit their surroundings for survival. This is known as **adaptation**.

Climatic conditions, such as temperature, rainfall, sunlight duration, and altitude, make a difference in the adaptation required to survive in the natural conditions.

Adaptation in Animals According to Habitat

Animals live in different habitats – they live in oceans, on mountains, plains, and valleys, and even in the snow. Their different features and habits help them survive in these conditions. Adaptations help animals get food, keep safe, and reproduce and protect themselves from harsh climatic conditions.

Animals can be grouped depending on the habitat they live in:

Terrestrial Animals

Animals that live on land are called **terrestrial animals**. The features of terrestrial animals are as follows:

- They have strong legs to walk around.
- They can run fast.
- Terrestrial animals that live in the desert, such as camels, can convert fat stored in their humps into water.
- Desert animals also have very thick skin to prevent loss of water by evaporation.
- Most of the desert animals avoid being out in the sun during the day. Many desert mammals, reptiles, and amphibians live in burrows to escape the intense desert heat. They come out during the night when the temperatures are low.
- Desert animals like reptiles have minimized loss of water by excreting urine in the form of insoluble uric acid. This ensures very little wastage of water.

Do you know?

A camel's feet are padded so that it can walk comfortably over hot sand.

- Terrestrial animals that live in cold areas have fur on their bodies to protect them from the cold.
- The body shape and size of many cold climate mammals is well adapted to the cold climate. They are round and bulky with short legs, ears, and tail. These features help to conserve heat.
- Penguins have a thick layer of densely packed feathers to reduce heat loss. Their flippers and legs are also adapted to reduce heat loss.

Did you notice that some land animals are not seen in winter season? For e.g., lizards and snakes. They show very little activity during winter months. This is called **hibernation**. These animals eat a lot of food before the winter season and store it in their bodies to use it during their hibernation.

- Snakes do not have legs so they have scales on their bodies to help them crawl on land.

Aquatic Animals

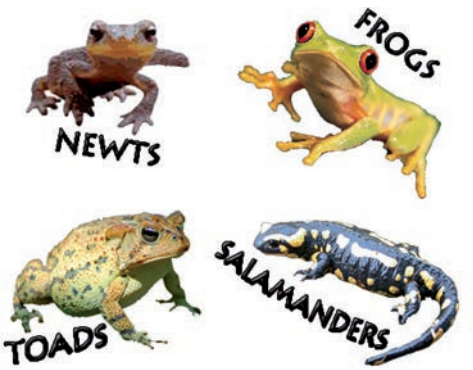
Animals that live in water are called **aquatic animals**. They have the following features:

- Streamlined body (pointed at both ends) that reduces friction when the animal moves through the water.
- Smooth, almost hairless body helps aquatic mammals move through the water with little friction.
- Webbed feet in ducks, formed from thin skin between the toes, work like paddles for swimming.
- Flattened tail that serves as an oar.
- Fins of fish help to swim, steer, and maintain balance. A whale has flippers for swimming.
- Long legs and necks of wading birds, such as cranes, keep their bodies out of the water. The long neck helps the birds to reach the water, or below it, for food.
- Blubber, a thick layer of fat or oil stored between the skin and muscles of the whale, provides insulation.
- Eyes positioned on top of the head allow animals to hide in the water and still detect predators or prey above the water.
- Transparent eyelids cover the eyes of animals swimming underwater.
- Nostrils positioned near the top of the head allow animals to come to the surface to breathe in air. Nostrils close when the animal goes underwater, as in the case of whales and dolphins.
- Some fish have a swim bladder, which is filled with air to help maintain buoyancy.
- Fish and aquatic invertebrates, such as prawns, have gills for respiration.

Amphibians

Animals that live on land as well as in water are called **amphibians**. Frogs, newts, toads, and salamanders are examples of amphibians.

- They are adapted to breathe through the skin when in water and through the lungs when on land.
- They can swim in water and move on land.



Arboreal Animals

Animals that live on land but spend most of their time on trees are called **arboreals**.

- They may walk or run on land or glide in the air for a short while to land on the tree or ground. Flying squirrel, flying lizard, tree frogs, lemurs, and monkeys belong to this group.
- Monkeys have long tails and long arms to swing from branch to branch.
- Some arboreal animals have claws to support them while climbing.
- Some have spines or plates so that they do not slip.

Aerial Animals

Aerial animals include animals that are able to fly in the air. True aerial animals are birds and bats. These animals exhibit adaptations to balance themselves and stay in the air, soaring or flying. These adaptations include:

- Streamlined body to steer through the air.
- Forelimbs are modified into wings to help them to fly.
- Birds have wings that are covered with feathers, which trap air to keep the body warm and help the bird to fly. Bats have an extension of the skin between the fingers of the forelimb, which help them to fly.
- Bones are hollow to make them light.
- Very strong flight muscles are attached from the body to the wings.

Do you know?

Bats are the only mammals that have wings to fly.

Adaptation in Animals According to Feeding Habits

Different animals have different feeding habits. They can be divided into the following groups according to what they eat:

Herbivores

Animals that eat plants are called **herbivores**. They include animals like buffaloes, cows, deer, and horses.

- They have sharp cutting teeth in the front and flat grinding teeth at the back.

Carnivores

Animals that eat the flesh of other animals are called **carnivores**. Lions, tigers, foxes, and eagles are examples of carnivorous animals.

- They have sharp teeth or beaks to cut through the flesh.
- They have very strong legs since they have to run fast to catch their prey.

Omnivores

Animals that eat both plants and animals are called **omnivores**. Examples include bears, crows, cockroaches, and humans.

Parasites

Parasites are animals that live on or inside the body of other animals to obtain food. Some examples are fleas, lice, and bugs.

- Parasites have suckers to help them suck food from another body.
- Liver flukes, tapeworm, and roundworm live in our body and other animals to suck blood, which is their food.

Adaptation in Animals for Protection

Animals have the unique ability to adapt themselves for protection from predators and for survival in harsh conditions.

- Small fishes move in groups to protect themselves against the big fishes.
- A whale's huge size is intimidating to other sea creatures.
- Deer and gazelles protect themselves from predators by running fast.
- Camouflage is a technique used by some animals like chameleons, whereby they change the colour or pattern of their skin to match their surroundings.
- A polar bear's white coat helps it to blend in with the snow.
- A stick insect, when immobile, looks like a lifeless twig.

Adaptation in Plants

Plants are found almost everywhere on the earth – in the plains, hills, deserts, sea, and so on. They have special features that allow them to survive in their natural surroundings. This ability to adjust to their surroundings is called **adaptation**. Plants differ from each other depending on the surroundings where they grow. Let us read about them:

Terrestrial Plants

Plants that grow on land are called **terrestrial plants**. There are different types of terrestrial plants, depending on the place they grow in. The word terrestrial means living on land.

Plants in Hilly Areas

- Trees that grow in hilly areas are usually tall, straight, and have a conical shape. This enables the snow to slide off easily.
- These trees do not produce flowers. They have cones with seeds inside them; hence, they are called **coniferous trees** also.
- These trees are evergreen and have needle-like leaves with a waxy coating. This prevents them from getting damaged from the snow. The leaves have few stomata; hence, they do not lose much water.
- Oak, fir, cedar, and pine are some examples of such trees.

Plants in the Plains

- Trees found in the plains have many branches with flat, thin, broad, and light-weight leaves. This enables them to capture a lot of sunlight that is required to make food.
- The leaves have many stomata that help to keep the trees cool by evaporation of water vapour from the surface of the leaves.
- Most trees shed their leaves in autumn.
- Neem, Ashok, peepal, mango, and sal are examples of such trees.

Plants in Deserts

Desert regions are very dry with little rainfall. Plants that are found in deserts can survive with little water. Babool, keekar, and date palms are some examples.

Cactus plants are common in deserts and have the following features:

- The leaves are transformed into thorns or spines to reduce water loss.
- The stem is green and fleshy, and carries out photosynthesis for the plant.

- The stem is spongy and fleshy as it has water stored in it.
- The roots spread out wide or go deep into the ground to absorb water.

Plants in Areas with Heavy Rainfall

Plants that grow in areas with heavy rainfall are evergreen. Rubber, pepper, cashewnut, sugarcane, and cotton are examples of such plants.

Plants in Swampy or Marshy Areas

- The soil is very sticky and clayey in marshy areas.
- The roots of the plants grow above the soil because air cannot reach the roots in the sticky soil. Plants give out breathing roots to absorb air. Trees that grow in marshy areas are called **mangroves**.
- Kendelia and cariops are examples of plants found in marshy areas.

Aquatic Plants

Aquatic plants live in water and are of three kinds:

Floating Plants

- These plants are spongy and light, enabling them to float on water.
- The stems are reduced and roots are not well developed.
- The leaves have a waxy coating, preventing water from blocking the stomata.
- Duckweed, water hyacinth, and water lettuce are examples of such plants.

Fixed Plants

- The stems are thin, long, and hollow and reach the surface of the water.
- The roots of the plants are fixed to the bottom of the pond.
- The leaves are big and broad with stomata on the upper surface. Leaves have a waxy coating, preventing them from rotting.
- Lotus and water lily are examples of such plants.

Underwater Plants

- Underwater plants are so called because they grow and remain under water.
- The leaves are thin and narrow with no stomata. They absorb carbon dioxide from the water and release oxygen into the water from their surface.
- The plants are fixed to the soil with the help of their roots.
- Hydrilla and tape grass are examples of such plants.

Insectivorous Plants

Insectivorous plants like sundew, Venus flytrap, and pitcher plant have green leaves that make food for them. They are carnivorous as they grow in places where they do not get all the minerals they need from the soil. Hence, they trap insects. The leaves of a Venus flytrap plant are like boxes with hinges. The edges have long hair; when an insect touches the hair, the leaf snaps shut and the insect is trapped and digested by the plant.

Venus Fly Trap

The leaves of pitcher plants are in the shape of a pitcher with a lid. Once the insect is trapped, the lid of the pitcher closes and the insect is digested by the fluid present inside the pitcher.

Non-green Plants

Some plants like mushrooms, moulds, and toadstools are non-green as they do not have chlorophyll. Non-green plants are also called saprophytic plants as they obtain food from dead and decaying plants and animals.

Plants of the Grass Family

Bamboo, rice, and wheat are examples of the grass family. They grow in a vast area as they require neither too dry nor too wet conditions.

They are useful to us in several ways:

- They are a source of staple food. Rice, wheat, and maize are some food cereals we eat. Bamboo grass is used to make baskets, mats, brooms, etc.
- Dried grasses are used as packing material.
- Paper is made from bamboo and sugarcane plant.
- Some grasses have medicinal value.

Test Your Skills

1. Fill up with suitable words:

   Animals move in a variety of ways. Birds use wings to _____. Fish and dolphins _____ in the ocean. Humans can _____ and _____ on their legs. Legs have _____ so they can bend and swing. Movement is powered by _____. All living things _____. Young animals grow until they reach _____ size.

2. How is the suckerfish benefitted by attaching itself to the shark's body? What type of association is it?

Multiple Choice Questions

1. **Aerial animals are animals that spend most of their time:**
   A. In water
   B. In the air
   C. On land
   D. Underground

2. **Camouflage is a kind of adaptation in which an organism deceives others by changing its colour to merge with its surroundings. Which colour will suit a chameleon to hide from its enemies in the forest?**
   A. Red
   B. Green
   C. Blue
   D. Brown

3. **Snake is a:**
   A. Parasite
   B. Producer
   C. Herbivore
   D. Carnivore

4. **Find the mismatched pair according to animals and their habitats:**
   A. Terrestrial – land
   B. Arboreal – air
   C. Aquatic – water
   D. Amphibian – both land and water

5. **The feet of frogs and ducks are webbed. This adaptation helps them to:**
   A. Hold branches tightly
   B. Swim faster in water
   C. Fly in the air
   D. Eat insects and grab things

6. **Which of the following can live on both water and land?**
   A. Frog
   B. Fish
   C. Bird
   D. Dog

7. **A student identifies the following characteristics in an animal:**
   1. Strong claws and broad hip girdles
   2. Spines to prevent slipping
   3. Ability to climb trees

   Which is the best-suited title for this animal?
   A. Terrestrial animal
   B. Aquatic animal
   C. Amphibian
   D. Arboreal animal

8. **In aerial animals:**
   A. Limbs are modified as gills
   B. Limbs are modified as spines
   C. Limbs are modified as wings
   D. Limbs are modified as tails

9. **Tigers and leopards have stripes on their bodies. This adaptation helps them to:**
   A. Keep their bodies cool
   B. Keep their bodies hot
   C. Merge with their surroundings
   D. Look beautiful

10. **The scaly skin of snakes:**
   A. Protects them from drying
   B. Scares human beings
   C. Makes them beautiful
   D. Helps them to crawl

11. **The adaptation mechanism of the chameleon is to:**
   A. Hibernate during winter
   B. Change its colours to merge with its surroundings
   C. Develop scaly skin on its body to maintain moisture
   D. Migrate to long distances during winter

12. **An animal is taken to the polar region. Which of the following adaptive characteristics will help it to survive in its new environment?**
   A. Growth of thick and less hairy skin
   B. Sharp beaks and strong claws
   C. Growth of thick fur on its skin
   D. Light-weight wings to fly

13. **Which of the following hibernate?**
   A. Human beings
   B. Pitcher plants
   C. Frogs
   D. Crows

14. **How can fishes survive inside water?**
   A. Water contains carbon dioxide in dissolved form
   B. Feed on smaller organisms containing oxygen
   C. Water contains oxygen in dissolved form
   D. Fish do not require air for respiration

15. Mice, dogs, and tigers have:

A. Fur and four legs
B. Scales and fins
C. Feathers and wings
D. Wings and beak

16. The polar bear is adapted to live in the:

A. Cold mountains
B. Arctic region
C. Antartic region
D. Snow

17. Camels are adapted to living for many days without

A. Air and sunlight
B. Water and food
C. Air and rest
D. Air and sunlight

18. Which of these is adapted to swim?

A. Penguin
B. Snake
C. Sparrow
D. Dog

19. Which of these is adapted to live in the desert?

A. Tortoise
B. Snake
C. Elephant
D. Tiger

20. Bear is a:

A. Carnivore
B. Herbivore
C. Omnivorous
D. None of the above

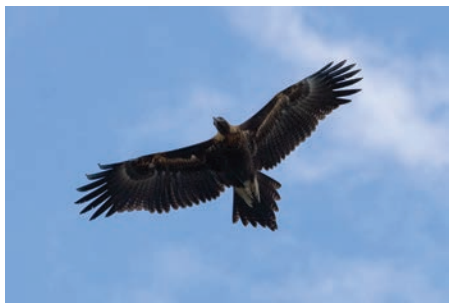
21. The type of tree shown in the given picture grows in _____ regions.

A. Marsh
B. Mountain
C. Plain
D. Desert

22. These plants can trap, dissolve, and digest invertebrates and, in rare cases, small mammals, reptiles, and amphibians.

A. Carnivores, insectivorous
B. Insectivorous, herbivores
C. Primary producers
D. Secondary producers

23. Look at the picture below and find out the type of animal it is.



A. Amphibian
B. Arboreal
C. Aerial
D. Air

24. Which of the following sentences is correct regarding a grassland community?

A. Without the grass population, only the antelope population will be affected but not the lion population.
B. The grass population is much lesser than the antelope population in order to support the energy needs of the antelope population.
C. The source of energy for all the populations in the grassland community comes directly or indirectly from the sun.
D. There will be more lions than antelopes in the grassland community because energy is passed from the antelope population.