What is an adaptation?

1. Each organism has special features or characteristics that make it unique and different from the rest. This feature is known as an adaptation that enables it to survive comfortably and cope with the living conditions in its natural habitat.

2. For example, an Arctic fox has a thick coat of fur and a layer of fat under its skin. This adaptation enables the fox to survive in the icy region but not in a desert.

3. There are two types of adaptation. It may be structural or behavioural.

Type of adaptation	**Characteristics/Examples**
Structural	The shape or structure of an organism enables its - survival. For example: ·Penguins have flippers to help them swim in water. ·Money plant has clasping roots to climb up a support.
Behavioural	An organism behaves in a certain way in order to survive well. For example: ·Millipedes curl into balls when touched. ·The leaves of the mimosa plant close when touched.

Adaptations for Coping with Land Habitats

Coping with Temperature

Some organisms live in habitats with harsh weather conditions. Thus, they require certain adaptations to survive the conditions.

Organism	Habitat	Structural adaptation
Polar bear	Arctic cold regions	Has thick fur and a layer of insulating fat under the skin to keep it warm. Has a layer of air close to its skin to prevent heat loss to the surrounding.
Musk ox, arctic fox, snow shoe rabbit	Arctic cold regions	Have thick fur and a layer of fat under their skin to keep themselves warm.
Snowy owl, ptarmigan	Arctic cold regions	Have thick feathers to keep themselves warm.
Fennec fox	Desert climates	Has huge ears enabling blood that is pumped through the larger exposed surface of the ears to lose heat more quickly.
		Behavioural adaptation
Bear, squirrel	Arctic cold regions	·They hibernate to slow down life processes such as respiration in order to survive the long cold winter periods.

Coping with Light conditions

Organism	Structural Adaptation
Owl, bat	·Have eyes with special eye cells that are sensitive to small amounts of light, enabling the animal to see well in the dark.
Rose, rattan, bougainvillea	Have hooks on their stem to help them climb a support to reach for sunlight.
Cucumber, bitter gourd, water melon	·Have tendrils to help them climb up supports for more sunlight.
Morning glory	·Has weak, twining stems for climbing up supports.
Money plant	·Has clasping roots for climbing up supports.

Organism	*Behavioural adaptation*
Owl,bat	Nocturnal behaviour (active in the night, rest in the day) allows these animals to adapt to the light conditions of their surroundings.

Coping with Availability of Water Sources

Some organisms that live in places with less water need to be adapted to receive more water or reduce water loss.

Organism	**Structural adaptation**
Cactus	Has enlarged stems to store water, few stomata and waxy cells to reduce water loss. Has needle-like leaves to reduce water loss through transpiration. Has hairy leaves to reduce water loss by evaporation
Organism	*Behavioural adaptation*
Camel	·Drinks a lot of water.
Cactus	·Have long roots that grow deep into the ground to tap water.

Coping with Movement within Different Land Habitats

Animals need to move around to look for food, escape from danger or find mates. Animals have different adaptations for moving about in their habitat.

Organism	**Structural adaptation**
Polar bear	Has stiff hairs at the bottom of its feet to allow the animal to walk on ice without slipping.
Camel	Has large, padded feet to enable the animal to walk on fine sand without sinking.
Monkey, orang utan	Has long limbs to swing from branch to branch.
Monkey	Has a long tail to help it balance as itself as it climbs on trees. Some monkeys (howler, spider) use their tail for grasping tree branches.

Adaptations for Coping with Aquatic Habitats

Adaptation for Movement in Water

Animals that live in water need certain features to help them move about.

Structural adaptation	Function	Examples
Streamlined body shape	·To reduce water resistance and swim through water more easily	Shark, barracuda, guppy, swordtail
Webbed-feet	·For paddling in water	Seagull, frog, duck
Flippers	·To move around in water as well as to get on land	Seal, turtle, penguin, dolphin
Oar-like legs	·To propel forward in water	Water boatman, common water bug
Storing oil in liver	·To stay buoyant inwater	Cod, shark
Powerful tail fin	·To propel the animal forward in water	Dolphin, fish, whale
A thick layer of blubber under the skin	·To stay buoyant in water	Seal, whale

Adaptation for Breathing

Animals need to breathe in oxygen in order to survive, Aquatic animals have different structural and behavioural adaptations to breathe in dissolved oxygen (found in the water) or atmospheric oxygen (from the surrounding atmosphere).

Structural adaptation	Function	Examples
Gills	·To absorb dissolved oxygen in the water when water flows past them.	Dragonfly nymph, Fish, prawn, tadpole,
Blowhole (found on top of the animal's head)	·To enable the animal to breathe in atmospheric oxygen while the rest of its body is under water.	Whale, dolphin, seal, sealion, walrus (aquatic mammals)

Breathing tube	·To breathe in atmospheric oxygen.	Water scorpion, water stick insect, mosquito pupa and larva
Gill chambers	·To store water so that the animal can absorb dissolved oxygen from the water while on land.	Crab, hermit crab, mudskipper
Moist skin	·To breathe in dissolved oxygen in the water	Frog, toad, tubifex worm
Behavioural adaptation	***Function***	***Examples***
Trap air bubbles	·To breathe in water	Water boatman, backswimmer, water spider, great diving beetle

Adaptations for Getting Enough Light

Aquatic plants have structural-adaptations to obtain sufficient light energy to carry out photosynthesis. Plants that live at different parts of the pond have different adaptations.

(a) Floating plants have adaptations to keep them afloat in order to carry out photosynthesis.

Floating plant	**Adaptation**
Water hyacinth	Has hollow, swollen leaf stalks that are filled with air and hanging roots that have air spaces.
Duckweed	·Has small and light waxy leaves.
Water lettuce, water moss fern	·Has hairy leaves that prevent water from collecting on them so that the leaves stay afloat.

(b) Fully-submerged plants have adaptations to help them float near the water surface in order to receive enough sunlight so that they are able to carry out photosynthesis.

Fully-submerged plants	Adaptation
Hydrilla, Elodea, Cabomba	·Has tiny air spaces in between their leaves and stems.

(c) Partially submerged plants are rooted to the bottom of the pond but have their leaves above the water surface so that they can trap more light for photosynthesis.

Partially-submerged plants	Adaptation
Water Lily	Has large, thin and flat leaves that float on the water surface.
Water Lotus	Leaves are very wide and disc shaped. This allows them to float on water and absorb large amount of sunlight. The stem and leaf surfaces of the water lotus are coated with a wax which allows water to roll off it easily.

Adaptations for Obtaining Food

Animals need to be adapted for getting and eating the food that they need.

Organism	Structural adaptation
Eagle, falcon, hawk, owl	·Have talons or sharp claws to grip prey tightly and keen eyesight to stop prey from a distance.
Tiger	·Has stripes that enable it to camouflage itself and blend into the surrounding and remain unseen by the unsuspecting prey
Snow owl	·Has white feathers to camouflage with the white snow and remain unseen by its prey.
Chameleon	·Can change colour to blend into the surroundings.
Stonefish	·Camouflages itself by looking like a stone.
Anglerfish	Has a stalk growing out of its head that can glow to attract prey.

Venus flytrap, pitcher plant	·Have structures to trap insects, digest them and absorb the nutrients.
Organism	***Behavioural adaptation***
Lion	Hunt in groups to increase chances of bringing its prey down.

Adaptations for eating food

Organism	**Structural adaptation**
Eagle	·Has a hooked beak for tearing flesh.
Hummingbird	·Has a long,tubular beak to draw nectar from flowers.
Parrot	·Has a curved beak for cracking hard seeds and nuts.
Wolf,tiger (carnivores)	·Have fangs or sharp incisors to tear flesh of prey.
Deer,sheep (herbivores)	·Have small teeth to cut and grind grass.
Butterfly	·Has a coiled straw-like mouth for reaching into flowers to feed on nectar.

Adaptations for Escaping from Predators

Animals need to be adapted to escape from predators.

Organism	**Structural adaptation**
Chameleon, grasshopper	Have camouflaged body colours that blend into the surrounding so as to hide from predators.
Leaf insect, stick insect	Have camouflaged body shapes that imitate the surrounding to remain unseen by predators.
Snail, tortoise	·Have shells to protect themselves from danger.
Lizard	·Has a detachable tail to distract its enemies and escape from danger.
Puffer fish, frilled lizard	·Have structures to help them appear larger.
Porcupine	Has modified hairs called quills that are raised to threaten predators.
Bee, wasp, poisonous frog	Have warning colours or brightly-coloured patterns on their bodies to warn predators that they can sting, are poisonous or taste bad.
Viceroy butterfly	Looks like the Monarch butterfly that tastes bad to prevent predators from eating it.
Organism	***Behavioural adaptation***
Mole	·Hides and burrow holes in the ground to escape from being noticed.
Snail, tortoise	·Hides inside a hard shell when attacked.
Millipede	·Curls into a tiny ball when touched to protect itself.
Deer, antelope, zebra, buffalo	·Live in groups for a better chance of survival.

Adaptations for Reproduction

Animals have structural and behavioural adaptations to attract and find a mate.

Animal	**Adaptations**
Peacock, Bird of paradise	( ) Male birds have beautiful / brightly-coloured feathers to attract the attention of female birds. ( ) The male birds displays their feathers and perform a mating dance to attract the female birds.
Female moth	( ) Releases a substance that can be detected by male moths from a few kilometres away.

Plants also have structural adaptations for reproduction.

(a) Flowers have large, brightly-coloured petals, sweet scent and nectar to attract insects or birds to help them pollinate their flowers.

(b) Fruits have special structures on them to help disperse their seeds as far away from the parent plant as possible. This prevents overcrowding and ensures that the young plants need not compete for sunlight, water, space and nutrients.

Dispersal method	**Plant**	**Structural Adaptation**
By wind	Shorea, angsana	·Have wing-like structures to stay in air for a longer time.
	Lalang, vernonia	·Have parachute of hairs to stay in air for a longer time
By water	Coconut, pong pong	·Have fibrous husks to trap air, enabling the fruit to float on water.
By animals	Chilli, guava, tomato	·Have small, hard, indigestible seeds that are passed out in the animals' droppings unharmed.
	Mimosa, lovegrass	·Have stiff hairs or hooks that cling onto the fur of passing animals.
	Mango, rambutan	·Fleshy and juicy to attract animals to eat them.
By splitting	Balsam, rubber	·Fruits split open when ripe to scatter their seeds as far away as possible from the parent plant.