

Lesson Plan 3

Adaptations

CRITICAL OUTCOMES

CO #3: Organise and manage oneself and one's activities responsibly and effectively.

CO #4: Collect, analyse, organise and critically evaluate information

LEARNING OUTCOMES

LO#2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Process Skills:

Observation and Recall

Comprehension and Understanding

ASSESSMENT STANDARDS

Recalling meaningful information when needed

Categorising information to reduce complexity and look for patterns

TEACHING THE LESSON

Review the adaptations background information found on page 20.

Discuss with learners:

Animals come in all different shapes, sizes and colours. These differences make each species or individual member of a species specially adapted for success in a different habitat or place within the habitat.

Use the following activity to begin a discussion with the learners on adaptations. To help students understand the great diversity of life forms found in nature, generate a list of species with the colours and shapes listed below. Ask students to come up with as many species as possible. Some examples are listed. Ask the learners why they think the animals have these adaptations try to draw a link to habitat.

Black (penguins, black wildebeest)

Green (plants, grasshoppers)

Striped (tiger, zebra)

Fur (mammals)

Short tail (hyena, wild dog)

Short legs (warthog)

No legs (snakes, whales)

Grey (elephant)

Spotted (cheetah, leopard, giraffe)

Wings (birds)

Gills (fish)

Long tail (cheetah, lion)

Long legs (giraffe, antelope)

What is an adaptation?

Animals are designed to survive in particular habitats. Just as we might try to guess where people of different cultures are from by observing the way they dress, talk and behave, we can tell a lot about an animal's habitat by observing its behaviours and appearance. Simply explained, an adaptation is a physical or behavioural characteristic that helps an animal survive in its habitat. Those best adapted to the conditions in which they live are more likely to survive and reproduce. For example, take a cheetah with solid black spots. The spots help to hide them in the shade of bushes and trees, making it harder for other predators, which are a threat to the survival of the cheetah, to see them.

Use the following lesson to teach learners the significance and benefit of adaptations using the cheetah and its adaptations.



BUILD-A-CHEETAH

Explore with your students the special body parts and adaptations cheetahs have that allow them to run so fast. Using supplies listed below and the adaptation fact sheets and diagrams, discuss with the students the various adaptations of the cheetah. Next to each of the supplies listed is the body part and adaptation it represents. Go through items one by one and explain why each is an important piece to include in the cheetah. You may want to put up a picture of the cheetah to help students visualise each part.

<u>SUPPLIES</u>	<u>BODY PART</u>	<u>ADAPTATION</u>
Paper aeroplane	Long thin body	Aerodynamic build
Running shoe / takkie	Semi-retractable claws	Traction for running
Long, medium, short sticks	Legs	Long legs for bigger stride
Piece of wire	Flexible spine	Increased stride length
Picture of cheetah	Body / skeleton	Thin and light
Long piece of string	Tail	Maintains balance
Paper heart	Strong, enlarged heart	For oxygen supply
Binoculars (two toilet rolls tied together can substitute)	Eyes	Vision of 5 km
Sunglasses	Tear marks on eyes	Protect eyes from sun's glare

Paper aeroplane:

Throw it into the air and watch it fly. The cheetah has a long thin body to create less resistance to wind while running, just as a paper aeroplane flies easily through the air. Now crumple the paper and throw it; it will not fly like the aeroplane. Animals that move quickly through the air like birds or through the water like fish are streamlined. Cheetahs' long, thin bodies help them to run so fast.

Running shoe/takkie:

What is this? Shoe

What type of shoe? Running shoe / takkie / sneaker

When do we wear these shoes? Running / sport / exercise

Why do we wear these shoes for these activities and not other shoes? Rough sole with grooves can slip easily with a smooth sole. The rough sole provides better grip decreasing the chances of slipping and falling.

Do you think it will aid a cheetah to have such an adaptation providing grip?

A cheetah's paw has two adaptations to grip the non-retractable claws, which can dig into the ground and the grooves on the pads which work similar to the treads on a car tyre.

Sticks:

Ask students which sticks they would use for a cheetah's legs. Long legs increase the stride of a cheetah allowing it to cover a greater distance in less time.

Wire:

Bend and straighten the wire to show how flexible it is. This represents the cheetah's spine. The cheetah has a very flexible spine, which allows the body to stretch out in a run. Together with the long legs, this gives the cheetah a stride of 8m (pace out 8m).



Picture of a cheetah:

Is the cheetah thin or fat? Cheetahs have light bones and do not carry a lot of muscles. The bigger and heavier you are the slower you are.

String:

The cheetah's tail acts like a rudder helping the cheetah turn while running and maintain balance. The cheetah uses its tail like we use the handlebars on a bicycle to steer.

Heart:

What is the function of your heart? Pump blood with oxygen to your muscles so that they can work

When you are running and active, would you need more to keep muscles working? Yes

Why do you get tired when active? Not enough oxygen getting to the muscles.

Do you think it will take a lot of oxygen to run at 120km/h? Yes

Therefore the cheetah has an enlarged heart to help it run that fast.

Binoculars:

If you are a buck are you going to live near to a cheetah or as far away as possible? Far away

What do we use to see things that are far away from us? Binoculars

Do you think that it would be an advantage to a cheetah to be able to see far? Yes, will be able to see where food is / other predators are?

Cheetahs' eyes work like a pair of binoculars allowing the cheetah to see very far 5 km. Using a landmark 5 km from the school that the learners all recognise to explain to them just how far 5km is. Cheetahs will be able to see a bird at that distance.

Sunglasses:

Due to its speed a cheetah has to hunt by day in order to clearly see where it is going. At its active times, early morning / late afternoon the sun is low on the horizon often resulting in the cheetah looking directly into the sun. When you look into the sun can you see clearly? Do you think this would be good for the cheetah while hunting and running fast? What do we use to protect our eyes from the sun? Sunglasses. What do you think are the cheetah's sunglasses? Tear marks

The colour black absorbs light so attracts the glare of the sun to below the eyes not directly into the eyes.

Using both of the following activities, you can assess the learners understanding of the lesson as well as their ability to access information from a variety of sources.



ACTIVITY 1 - cheetah crossword puzzle

Using the Cheetah Crossword Puzzle Worksheet found on the next page, ask the learners to fill it in using a pencil recalling what they have learnt in the lesson. Give them 10 minutes to do this. Then allow them to use the poster on adaptations to check and correct their answers.



ACTIVITY 2

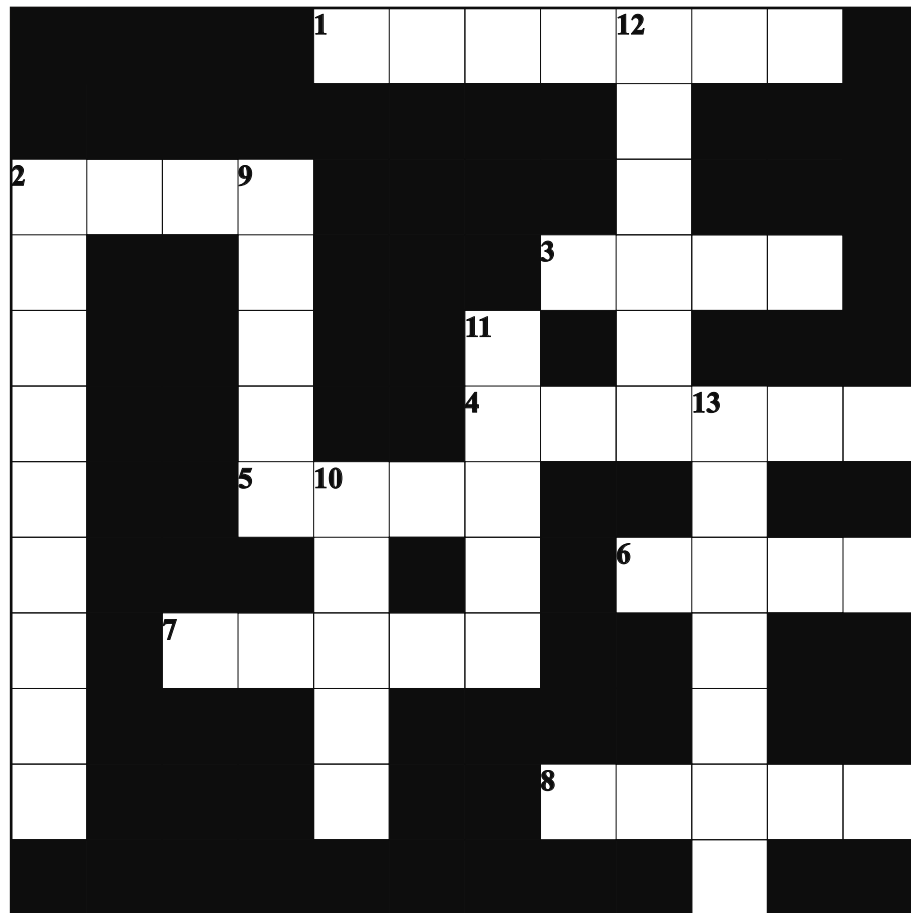
Using the paragraph and poster on the adaptations of a cheetah and what you have learnt from the previous activity fill in the blanks to show the relationships between structure, adaptation, and function on the Built for Speed worksheet on page 18.





WORKSHEET - cheetah crossword puzzle

Name: _____ Date: _____



Across:

- 1: The cheetah is the _____ animal on land.
- 2: The _____ helps the cheetah with balance and making sharp turns.
- 3: Its paws are adapted for _____.
- 4: The heart is enlarged to ensure more _____ gets to the muscles.
- 5: A cheetah is _____ while a leopard is fat.
- 6: The cheetah runs on the tips of its _____.
- 7: The cheetah has semi-retractable _____.
- 8: The cheetah's stride is 8 _____ at full speed.

Down:

- 2: The cheetah's _____ are its sunglasses.
- 9: The cheetah's skeleton is very _____.
- 10: The _____ and lungs are bigger than other cats.
- 11: The cheetah's hip _____ can turn.
- 12: It takes a lot of _____ for the cheetah to run so fast.
- 13: The cheetah has deep _____ on its pads.





ANSWER SHEET - cheetah crossword puzzle

Across

- 1 Fastest
- 2 Tail
- 3 Grip
- 4 Oxygen
- 5 Thin
- 6 Toes
- 7 Claws
- 8 Meters

Down

- 2 Tearmarks
- 9 Light
- 10 Heart
- 11 Bones
- 12 Energy
- 13 Grooves





ACTIVITY 2 - built for speed

Name: _____ Date: _____

Using the paragraph and diagram on the adaptations of a cheetah and what you have learnt from the previous activity fill in the blanks to show the relationships between structure, adaptation, and function.

STRUCTURE	ADAPTATION	FUNCTION
Tail		
Body		
Paws		
Spine		
Heart		

Adaptations of a Cheetah for Speed:

The cheetah is the fastest animal on land, with a maximum speed of 110 - 120 km per hour. Running is the cheetah's main form of defence, its speed allows it to hunt and escape from danger. The cheetah has many adaptations, which help it to run so fast. The cheetah has a very light skeleton and does not have a lot of muscles, allowing it to run fast as the heavier you are the slower you are. The cheetah's body is thin and streamlined. The leg bones are longer than other cats and cheetahs run on the tips of their toes giving them a bigger step. The cheetah's spine also can bend a lot more than other cats; this also allows them to increase the size of their steps by stretching their body out. Their hip bones can turn where they are attached to the rest of the skeleton, this allows them to stretch their hind legs out further. All these adaptations give the cheetah a stride of 8 meters while running at full speed. The cheetah's long, narrow tail helps him to keep his balance and steer around corners. The feet give them better grip on the ground to stop the cheetah from slipping while it is running. This grip is provided by grooves on the cushions of the feet as well as the claws which cannot be pulled into the paw completely (we say that they are semi-retractable). It takes a lot of energy for the cheetah to run that fast. It is the oxygen in our blood that provides that energy. The cheetah has a very big heart and lungs to make sure that they get enough oxygen to their muscles while running to keep up their energy.



ANSWER KEY - built for speed

STRUCTURE	ADAPTATION	FUNCTION
Tail	Long and narrow	Balance and steering
Body	Slender, long-legged, streamlined, light	Less wind resistance, and longer stride therefore increased speed
Paws	Semi-retractable claws Grooves in pad	Better traction for acceleration and faster movement
Spine	flexible	Increases the stride by allowing the body to stretch out further
Heart	enlarged	Increased oxygen supply to muscles



ASSESSMENT

Assessment Rubric for Activity 2: Built for Speed

1	2	3	4
Learner could not recall, understand information given, resulting in an incorrect table.	Learner could only partially fill in the table, showing some ability to recall the information and correctly categorise.	Learner could recall and understand information given in order to correctly fill in the table.	Learner exceeded expectations showing deeper understanding of information given.

Language links:

These two activities can be used to assess the following language outcomes

LEARNING OUTCOME	ASSESSMENT STANDARD
LO1: Listening	Listens for information in different kinds of texts
LO3: Reading and Viewing	Scans for specific details
	Understands and responds appropriately to information in texts
LO4: Writing	Converts information from one form into another
LO5: Thinking and Reasoning	Processes information from different sources



BACKGROUND - adaptations

The fastest animal on land, with a maximum speed of **110-120 km** per hour, the cheetah can accelerate from 0-80km in 3 seconds. Their top speed can only be maintained for between 400-500 meters resulting in a short burst of speed (20-30s) following which they then need to rest for about 30 min. Running is a cheetah's main form of defense, its speed allows it to hunt and escape from danger. Over generations the cheetah has evolved many adaptations to facilitate a specialization for speed.

Speed consists of the distance one covers in a certain time; therefore by increasing the distance covered one can increase ones speed. To this end, the cheetah is aerodynamic (**stream-lined**) for decreased resistance while running. The **leg bones are longer** in comparison to the other cats and they **run on their toes** giving them a longer stride. The cheetah also has a very **flexible backbone**, which allows it to stretch its body out further. The cheetah's **shoulder blades** are not connected to the collarbone thus allowing the shoulders to move freely and help increase the length of the forelegs while running. The **hip bones pivot** in their sockets allowing for greater length of the hind legs while running. All these adaptations result in a stride of 8m at full speed. The **lightened skeleton** and reduced muscles mass aids the cheetah in running faster by decreasing the weight carried (the larger you are the slower you are).

The **long tail** helps the cheetah to balance and helps the cheetah make sharp turns when running, stabilises the body and acts as a rudder. A cheetah's foot shows several modifications allowing for greater grip while running. The pads on the base of the foot bear **longitudinal ridges** the function of which is equivalent to tyre-treads. The cheetah has **semi-retractable claws**, which serve a function similar to cleats on a track shoe.

It takes a lot of energy to sustain the top speed of a cheetah and therefore the cheetah has several adaptations to allow more effective delivery of oxygen to the muscles. In comparison to the other large cats, the cheetah's **heart, lungs, nostrils and sinuses are enlarged** to increase oxygen supply to the muscles.

Adaptations for speed

