Science@School Book 5B

# Life cycles

# Activity worksheets

Peter Riley

# Teacher's sheet: comprehension

See **pages 4 and 5** of *Life cycles*

## Answers

1. **(a) The single adult and the pair should be coloured in.**

   **(b) X = eggs.**

   **(c) Y = nymph.**

2. **Sprouting of seed.**

3. **Hatch from eggs, birth of young.**

4. **Plants may be attacked by disease, trampled by animals, or have their shoots eaten. Animals may die from disease or may be eaten by other animals. Plants and animals may also die from drought and other natural disasters.**

5. **Reproduction, or breeding.**

6. **The adults die soon after breeding.**

## Complementary work

(a) Let the children use secondary sources to find out about the life cycle of an earthworm, snail or slug, fish, turtle and a common bird. They could also find out about the life cycle of a mould, or mushroom, which would prepare them for work on microbes.

## Teaching notes

There are stages in the life of every living thing. First, there is the stage when the living thing comes into being. For plants this is usually when a seed germinates. In animals that lay eggs, it takes place when the egg hatches. For animals that give birth, it is the moment the baby is born. Although living things were present before, in embryo form, for life cycle purposes birth is considered the first stage of a life cycle.

The following stages of the life cycle are related to growth. In the case of plants, where growth usually involves simply getting larger, there may be no more stages until the production of reproductive organs. In the case of animals, such as mammals, there may be other stages, such as when the eyes open, or when the young are weaned. In frogs, there can be many stages, such as the gill stage, or the stage at which the back legs grow.

A major stage in all life cycles is the reproductive stage. Plants undergo a period of pollination and fruit formation, followed by the dispersal of fruits.

On page 4 of the pupil's book, the life cycle of the conifer is presented to give contrast to the life cycle of flowering plants which feature in future units. The organs of reproduction in the conifer are cones. There are male cones, which release pollen, and female cones, which receive it. Fertilisation inside the female cones results in the production of seeds.

In the insect life cycle, there is a complete change of form from early to later stages in the life cycle. Locusts and cockroaches share the style of life cycle shown by the grasshopper. The nymph has a very different form from the adult grasshopper. Nymphs grow by moulting. Several moults take place as the young insect grows up. Some adult parts emerge after each moult. This type of gradual development in insects is called incomplete metamorphosis.

# Teacher's sheet: activity

Based on **pages 4 and 5** of *Life cycles*

## Introducing the activity

(a) Begin by looking, with the children, at the diagram of the grasshopper life cycle on page 5 of the pupil's book. Turn to page 18 of the pupil's book and read, with the children, the section on how insects grow by moulting.

## Using the sheet

(b) Give out the sheet, let the children fill in their names and form, then go through tasks 1 and 2 (see note (i)).

(c) Let the children try tasks 1 and 2.

(d) Go through task 3, then let the children try it (see note (ii)).

(e) Go through task 4 (see note (iii)).

(f) Go through task 5, then let the children try it (see note (iv)).

## Completing the activity

(g) The children can compare their tables, subtractions and descriptions of the pattern of growth.

(h) The children could use secondary sources to find out more about the life of the locust.

## Conclusion

The nymph grew 3mm after its first moult. The nymph grew 7mm after its second moult. The nymph grew 4mm after its third moult. The nymph grew 9mm after its fourth moult. As the nymph moulted, it tended to grow by a larger amount each time. The exception to this was after the third moult when it grew by only 4mm.

## Teaching notes

(i) Some children may still need help with tables. There should be two columns. The left hand column is headed 'Nymph stage' and is numbered 1 to 5. The second column is headed 'Length (mm)' (see example below).

(ii) Some children may need to be reminded that they have to make subtractions.

(iii) The children should look at how much the nymph grew at each stage. You can ask them to look for a pattern in the way the nymph grows, and to look for any result that does not fit the pattern.

(iv) Tell the children they need to make accurate measurements, using a ruler.

| Nymph stage | Length (mm) |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |


# Teacher's sheet: comprehension

See **pages 6 and 7** of *Life cycles*

## Answers

1. **X = shoot. It finds light and air.**
2. **Y = root. It finds water.**
3. **Dormant.**
4. **Germination.**
5. **From food stored in the seed.**
6. **(a) It is used up.**

   **(b) It grows a stem with leaves, and the leaves use a green-coloured chemical to trap energy from sunlight.**

## Complementary work

(a) The children can weigh a group of beans that are dry, and then leave them to soak overnight. They can then weigh the soaked beans and calculate how much water they have taken up.

(b) The beans can be sowed in many different positions, and the children can predict which way the roots and shoots will grow. As the seeds germinate and turn into seedlings, the children can check their predictions.

## Teaching notes

Each seed grows from an ovule in the ovary. During pollination a pollen tube attaches itself to the ovule and the male sex cell enters the ovule so that fertilisation can take place. A tiny hole, called a micropyle (meaning 'little gate'), develops at the place where the pollen tube enters the ovule. The male sex cell passes through this hole and into the ovule. After fertilisation, the ovule grows into a seed or seeds.

When the seed germinates, it takes in water through the micropyle. The water is used to dissolve food (sugars) in the seed's food store. The dissolved sugars can then be easily transported to the tiny plant. The food is used to provide energy and materials so the plant can grow. As the plant has a store of food, but also needs water to transport it, the plant grows a root first to help it find more water.

There is enough food in the seed to allow the plant to grow a root and a shoot. The depth of the seed in the soil is critical. If it is sown too deep, the seedling will use up all its food store before the shoot can sprout leaves above the ground which make food by using sunlight.


# Teacher's sheet: activity

Based on **pages 6 and 7** of *Life cycles*

## Introducing the activity

(a) Ask the children how plants reproduce and look for an answer about producing seeds. Show the children some large seeds, such as broad beans, and ask how they can become plants. Look for an answer about sprouting and introduce the word germination (see note (i)).

## Using the sheet

(b) Give out the sheet, let the children fill in their names and form, then go through task 1 and let the children try it (see note (ii)).

(c) Go through tasks 2 to 4, then let the children try them (see note (iii)).

(d) Let the children try task 5 (see note (iv)).

(e) Let the children try task 6 (see note (v)).

## Completing the activity

(g) Let the children present an account of their investigation to the rest of the class so they may compare their work.

(h) When the investigations are complete, draw together the results to show the conditions that are needed for germination.

## Conclusion

Water and warmth are needed for germination. Seeds will germinate in both dark and light. Seeds will germinate in other substances (for example, cotton wool or sand) besides soil.

## Teaching notes

(i) The children may have come across germination before. They may need to know that they can also use it as a verb.

(ii) You may want to hold up a broad bean and ask the children what it needs to become a plant. Make sure the children do not call out but write their answers on the sheet. You may like to check that the children have included light, water, warmth and soil in their lists.

(iii) You may ask the children to think about how they would make their investigation while they are choosing. It may help them to choose.

(iv) Make sure they have picked one of the following: the effect of warmth, water, light or soil. They should also show how they plan to make a fair test by using the same number of seeds for each part of the investigation and keeping all conditions the same except for the one being investigated.

(v) In addition to describing the results, look for ways in which the children have evaluated their investigation and whether they have included suggestions for how they could improve it.


# Teacher's sheet: comprehension

See **pages 8 and 9** of *Life cycles*

## Answers

1. **(a) A = stamen; B = stigma; C = ovary; D = petal.**

   **(b) A, stamen.**

2. **By insects and the wind.**

3. **A sugary liquid that insects drink.**

4. **Pollination.**

5. **When the base of the flower swells. (Some children may also have found the answer from the word list on page 2, which is: 'The joining of male and female sex cells to create a complete set of instructions for a new life'.)**

6. **Petals may fall off, centre may change colour, fruit forms and seeds develop.**

## Complementary work

(a) If there are no children in your class who are allergic to pollen you could let the children look at some pollen under a microscope. Tap the yellow, swollen end of the stamen (called the anther) on a microscope slide and look for a yellow powder. Put this on the microscope and focus to show the spiky pollen. The spikes help the pollen grip the hairs on insect bodies. When using a microscope, never use the mirror to collect light from the Sun.

(b) In early spring, let the children look at catkins and tap them to release pollen. In summer, show the children wind pollinated grass plants with their stamens sticking out. Place some of this pollen on a microscope slide to show that it is smaller than pollen carried by insects and also lacks spikes.

## Teaching notes

Insect pollinated flowers have strong stamens that can stand up to insects brushing past them on their way to find nectar. The stamen is divided into two parts. The swollen tip is called the anther. This is the part where the pollen is made. The stalk which supports the anther is called the filament.

In many flowers, the ovary is a bottle-shaped structure. It contains egg-shaped structures called ovules which hold the female sex cells. When the pollen lands on the stigma, each grain grows a tube down through the stigma. Between the stigma and the ovary is a stalk which may be long or short. It is called the style. The pollen tubes grow through the style and enter the ovary where they reach the ovules. Inside each pollen grain is a male reproductive cell. It travels down the pollen tube and enters the ovule. Here, it joins with a female reproductive cell in the process of fertilisation. After fertilisation, the ovule becomes a seed and the ovary becomes the fruit. The purpose of the seed is to grow into the next generation of the species. The purpose of the fruit is to disperse the seed so that it stands a better chance of growing to maturity.

# Teacher's sheet: activity

Based on **pages 8 and 9** of *Life cycles*

## Introducing the activity

(a) You may wish to begin by showing the children a daisy and a dandelion. Tell them that although we think of them as individual flowers, each one is really a group of flowers on one stalk. You could pull individual florets off a dandelion to illustrate the point. Tell the children that they are going to look at the structure of different flowers (see note (i)).

## Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through task 1 and let the children try it (see note (ii)).

(c) Go through task 2, then let the children try it (see note ((iii)).

(d) Let the children try task 3.

## Completing the activity

(e) If the children have been examining the same kinds of flowers they can compare their results. They may find that different flowers of the same kind have different numbers of parts. If the children have each been examining different kinds of flowers, they can present their results to the rest of the class.

(f) You may wish to extend the activity by grouping the flowers according to their colour. You may also wish to compare the shapes of the petals of the various flowers that the children have examined.

## Conclusion

Each kind of plant has a distinctive flower. The flowers may vary in the number of parts they have.

## Teaching notes

**This practical is for the more able children only.**

(i) Daisies, dandelions, sunflowers and many garden plants have 'flowers' which are really made up of a group of flowers on one stalk. It is important for children to know this at the outset so they do not attempt to examine flowers which are really flower heads.

(ii) For simplicity, the ovary and stigmas are described separately. In fact, together with the style they form a unit called a carpel. Some secondary sources may refer to this.

(iii) Let the children start with a flower, such as the wallflower, which is large and shows the structures clearly. If you wish the children to look at the flowers of weeds, such as the shepherd's purse, let them use magnifying glasses.

Some flowering plants, such as daffodils, do not have sepals but instead emerge from a protective sheath of green tissue.


# Teacher's sheet: comprehension

See **pages 10 and 11** of *Life cycles*

## Answers

1. **(a) The two seedlings should be drawn as described.**

   **(b) The four seedlings should be drawn as described.**

   **(c) Seeds that spread out can get the most from the soil and light and so develop strong roots and leaves.**

2. **Dispersed.**

3. **They are brightly coloured and tasty to eat.**

4. **Because they have a tough coat.**

5. **By growing hooks on their surfaces which can attach themselves to fur or feathers.**

## Complementary work

(a) The children can examine parachute fruits with a magnifying glass and see how far they go when they are given a gentle blow. Some of the hairs of the parachute could be removed, and the seed blown again to see how the hairs help the seed move.

(b) The children could visit alder trees in the winter time. Alders grow near water. They are unusual in that they are flowering plants, but they produce their seeds in cones. In winter the cones open and the seeds fall out. Each seed is a tiny nut with two hollow wings. The wings help the seed to move through the air and float on water so it can be dispersed in two ways.

## Teaching notes

There are three kinds of fruits – false fruits, succulent fruits and dry fruits. A false fruit has a fleshy part made from the top of the flower stalk, or receptacle. It grows up around the ovary. Apples and pears are false fruits. Succulent fruits are true fruits. Some succulent fruits (called drupes) contain a single seed enclosed in a woody case called a stone. This is surrounded by juicy flesh. The plum and the peach are examples of drupes. Some succulent fruits (called berries) do not have a stone, but have many seeds. The orange and the tomato are examples of berries.

Dry fruits are also called true fruits. Some dry fruits split open when they are ripe. The lupin and poppy are examples of this kind of fruit. Other dry fruits do not split open. Some dry fruits, such as the acorn and hazel, are called nuts. Buttercup fruits are dry fruits. They form a knobbly cluster at the centre of the flower. Cereal grains are also dry fruits.

The poppy is also an example of a wind-dispersed fruit, although it does not have a wing or a parachute. The top of the fruit opens as the fruit swings about in the wind. As it swings it releases seeds like pepper from a pepper pot.

Some dry fruits split open as they mature. The force generated by the splitting fruit spits out the seeds. These fruits are sometimes called explosive fruits. The lupin and the balsam are examples of explosive fruits.

# Teacher's sheet: activity

Based on **pages 10 and 11** of *Life cycles*

## Introducing the activity

(a) Ask the children if they have seen any fruits spin as they leave a plant. Look for answers about the spinning fruits of the sycamore or the lime. Tell the children that spinning helps to keep the fruit in the air and increase its chances of being blown away by the wind. Tell the children that scientists sometimes make models when they are making investigations and in this activity they are going to make model winged fruits which may spin.

## Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through tasks 1 to 5 (see note (i)).

(c) Let the children perform tasks 1 to 5.

(d) Go through task 6, then let the children try it (see note (ii)).

(e) Go through task 7, then let the children try it. (see note (iii)).

(f) Let the children try tasks 8 and 9.

## Completing the activity

(g) Let the children present their results to the class, perhaps with demonstrations of good and poor spinners.

## Conclusion

The model prepared from the sheet is a good spinner but its wings need to be twisted a little. Some models with smaller wings and bodies did not spin as well. Some models with longer wings and bodies did not spin as well.

## Teaching notes

(i) This is a very simple spinner which does not need a paperclip weight. The children need to take care when they are twisting up the body so that they do not tear the paper around the wings. It is important to twist the wings as the diagram shows. Later in the activity you could ask children to see if flat wings work better – they don't.

(ii) The children should express their answer as for half the time, a quarter of the time, and so on. The model may only spin in the last half or quarter of its flight and the children should make a note to this effect.

(iii) You may feel the need to stress the importance of repeating investigations. The children could record their observations in a table (see example below), adding additional rows for task 8.

| Wing length (cm) | Trial | Length of spin |
|---|---|---|
| 3 | 1 | |
| 3 | 2 | |
| 3 | 3 | |

# Teacher's sheet: comprehension

See **pages 12 and 13** of *Life cycles*

## Answers

1. **The plant flowers and pollen is transferred by insects.**
2. **The poppy is fertilised, the seed pod grows and the seeds are dispersed by wind.**
3. **Germination.**
4. **A perennial plant.**
5. **Squirrels and birds.**
6. **It may be eaten by deer and caterpillars.**

## Complementary work

(a) The children can use secondary sources to find out how daffodils survive from year to year.

## Teaching notes

Some plants have life cycles which only last a few weeks. They are called ephemerals. Weed plants, such as the shepherd's purse, are ephemerals.

Many plants are annuals. They complete their life cycle in one year and the seed is left behind to begin its life cycle in the following year.

A few plants are biennials. They take two years to complete their life cycle. In the first year the plant produces leaves and stores its food in part of its body such as the root. This body part then survives through the winter. In the following year the food stored in the root is used to produce leaves and flowers. The plant then sets seed and dies. The carrot, parsnip and beet are examples of biennials.

Many plants are perennials. They have a life cycle that lasts for many years. Some perennials have shoots that die back in the autumn, and they survive underground as bulbs, corms (a short, thick stem, similar to a bulb) or tubers which all contain food stores. Each year they use the stored food to grow new shoots. The grass plant is a perennial which does not die back completely and stays in leaf all year round. Trees are perennials which keep their food stores above ground in the wood in their trunks and branches.


# Teacher's sheet: activity

Based on **pages 12 and 13** of *Life cycles*

## Introducing the activity

(a) Remind the children of the dangers a plant faces as it tries to complete its life cycle. Ask the children what happens when a plant gets cut to pieces, and look for an answer about it being killed. Present the children with a dandelion plant which has a long tap root. Tell them that the plant stores food in its root and they are going to find out what happens when a root is cut up and buried.

## Using the sheet

(b) Give out the sheet, let the children fill in their names and form. Go through task 1, then let the children try it.

(c) Go through task 2, then let the children try it.

(d) Let the children try task 3 (see note (i)).

(e) Go through task 4 and let the children try it.

(f) Let the children try tasks 5 and 6 (see note (ii)).

(g) Let the children perform tasks 7 and 8, as appropriate.

(h) Let the children try task 9.

## Completing the activity

(i) Let the children compare their conclusions.

## Conclusion

If a dandelion root is cut up, the pieces are capable of growing into new plants.

## Teaching notes

(i) You may let the children do this for themselves if they are mature enough and the correct level of supervision can be given.

(ii) Look for the children predicting that the root will grow a new shoot because it has a store of food it can use. Some children may say that the root may grow into new plants because the dandelion is a difficult weed to remove from a garden.


# Teacher's sheet: comprehension

See **pages 14 and 15** of *Life cycles*

## Answers

1. **(a) A = sperm; B = egg.**

   **(b) Male – sperm; female – egg.**

2. **Nucleus.**

3. **Chromosomes.**

4. **Genes.**

5. **The sperm swims to the egg. The nucleus of the sperm fuses with the nucleus of the egg. The genes from each parent combine to form a complete set of instructions.**

6. **The fertilised egg divides to produce cells and eventually a baby.**

## Complementary work

(a) The children can look at photographs of embryos taken with an ultrasound scanner and see if they can identify parts of the body.

## Teaching notes

DNA stands for deoxyribonucleic acid. DNA forms long strands which contain lines of chemicals that form messages or instructions for the cell. DNA forms the chromosomes, which are found in the centre of the cell, called the nucleus. Copies are made of the instructions on the chromosomes and these are taken outside the nucleus to structures in the cell called ribosomes. These structures 'read' the instructions and assemble chemicals, such as proteins, which are used to build up parts of the body. In the introductory activity to the unit this action was greatly simplified, but it shows the children the link between DNA and body structure and function.

When a cell divides it makes copies of the chromosomes so that the two daughter cells get the same instructions. All the cells in the body have the same set of instructions. Each cell only uses certain instructions. Those in the skin, for example, only use instructions which make them into skin cells.

Everyone has their own individual set of DNA. This is why DNA can be used as a kind of fingerprint to identify people.

# Teacher's sheet: activity

Based on **pages 14 and 15** of *Life cycles*

## Introducing the activity

(a) Tell the children that the baby develops inside its mother in a structure called the womb (see note (i)). You may add that the baby gets its food from its mother's blood and uses the food to grow. Remind the children that they may have a growth chart in their home on a wall which they use to measure their own growth and now they are going to look at some data which records the growth of a baby in the womb.

## Using the sheet

(b) Give the children the sheet, let them write their names and form on it, then go through task 1 with them.

(c) Let the children carry out task 1.

(d) Go through task 2, then let the children try it (see note (ii)).

(e) Go through task 3.

(f) Let the children try task 3.

## Completing the activity

(g) Let the children compare their answers.

(h) If some children have a record of their growth on a chart at home ask them to bring the charts in. You may wish them to convert the data on their charts into line graphs if each height has a date. The children could then extract data from their graphs to reinforce the skills they have acquired in answering questions (iii) to (v).

## Conclusion

(i) 4cm.

(ii) 28cm.

(iii) 13cm

(iv) 24cm

(v) 40cm.

## Teaching notes

(i) Some children may think that the baby develops in the stomach and they will need guidance on where it actually forms.

(ii) You may have to show them how to plot the graph and how to find the answers to question 3 if they have not done work of this kind before.

# 7 Teacher's sheet: comprehension

See **pages 16 and 17** of *Life cycles*

## Answers

1. **The heights in column 2 should be arranged downwards as 113, 129, 152. The weights in column 3 should be arranged downwards as 20, 32, 54.**
2. **The head grows taller.**
3. **(a) 10 or 11 years old, (b) 13 to 15 years old.**
4. **You grow tall then fill out.**
5. **They get longer compared to their width.**
6. **A person in their twenties is at their tallest and strongest. A person in their sixties is getting shorter, as the bones shrink and the muscles become less powerful.**

## Complementary work

(a) If any children have young pets such as puppies, kittens, or guinea pigs, they may like to weigh them at home regularly and provide data on their growth for the class to use in plotting graphs.

(b) The children could use secondary sources to find out how a tree trunk grows thicker.

## Teaching notes

As children grow at different rates, this topic needs treating with sensitivity. It is important to stress that variation is natural.

There are four types of growth:

1. Some living things grow to a certain body size, or stop growing when they reach a certain age. Among plants, annuals have this type of growth. Mammals and birds are examples of animals with this type of growth.

2. Some living things continue growing throughout their lives and may become very large. Trees, bushes, coral, fish and reptiles are examples of living things with this type of growth.

3. Some animals grow in stages. Insects and crustaceans (such as crabs and lobsters) grow in this way.

4. In some living things, one part grows at a different rate, or at a different time, to other parts. For example, when a plant is mature, its flowers grow faster than its leaves. In humans, the reproductive organs grow rapidly in the early teens.

# Teacher's sheet: activity

Based on **pages 16 and 17** of *Life cycles*

## Introducing the activity

(a) Ask the children if any of them have measured their own growth. Look for answers that some children have used a growth chart on their bedroom wall (see note (i)). Tell the children they are going to study the growth of a boy and a girl from age 9 to 16 (see note (ii)).

## Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through task 1 with the children.

(c) Go through task 2 with the children, then let them try it (see note (iii)).

(d) Go through task 3 with the children, then let them try it (see note (iv)).

(e) Go through tasks 4 and 5, then let the children try them (see note (v)).

## Completing the lesson

(f) Let the children compare their answers to tasks 4 and 5.

## Conclusion

Both children were growing at nearly the same rate between ages nine and 10. Between the age of 10 and 11, Belinda had grown to the same height as Arthur, and continued to grow taller than him for about three years. During Arthur's thirteenth year, he grew to the same height as Belinda, and from that time onwards he continued to grow taller than Belinda. Belinda only grew a small amount after age 13, while Arthur grew by a large amount.

## Teaching notes

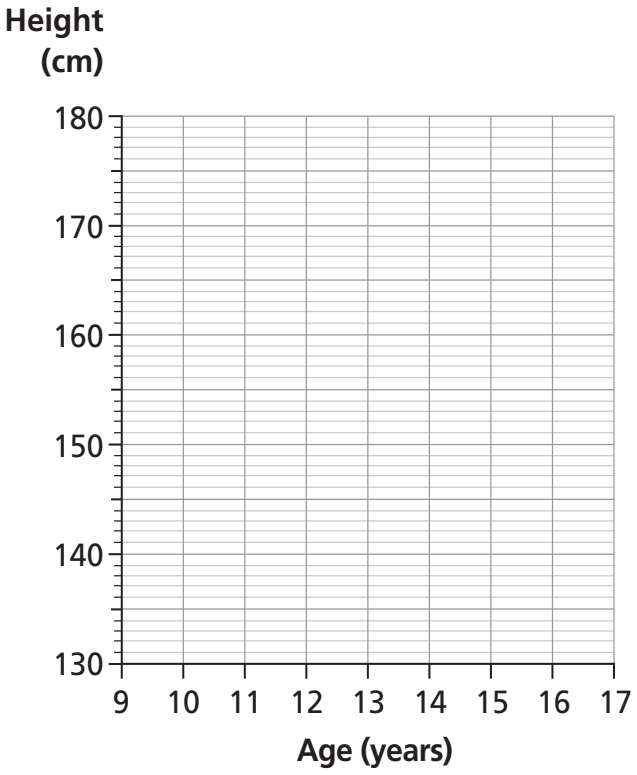
(i) If any children have kept a record of their changes in height ask them to bring in their data and talk about how frequently they were measured and how they were measured (against a wall, with a tape measure, etc).

(ii) The children are made-up but their heights follow the average trend of growth of people at this time in their life. It is important to stress that there is a great deal of variation in height among the people in a class and that this is natural. Also, different people have growth spurts at different times, and this is natural too.

(iii) The X axis could start at 130cm and the Y axis at 9 years (see example below).

(iv) Some children have difficulty adding a second line to a graph and may need help. Make sure that the two lines are different colours.

(v) Some children may have difficulty reading information from a graph and may need help.




# Teacher's sheet: comprehension

See **pages 18 and 19** of *Life cycles*

## Answers

1. **A = egg; B = larva; C = pupa; D = adult.**
2. **As a caterpillar.**
3. **They have a hard outer skin that does not stretch.**
4. **It gets rid of (sheds) its old skin.**
5. **To stretch its new skin before it hardens.**
6. **Lets its wings dry for a few minutes.**

## Complementary work

(a) The children could keep a colony of stick insects. The common stick insect feeds mainly on privet, roses and blackberry leaves. The eggs can be told apart from the droppings because they look like little barrels with a light coloured top.

When the eggs hatch, the children could carefully measure the lengths of the nymphs. They could measure their lengths every week as they grow. If a binocular microscope is available, the children could use it to look at the skins after they are shed.

(b) The children could look under nasturtium leaves in a garden for the eggs and larvae of the small, white butterfly. They could make regular observations on the growth of the caterpillars.

## Teaching notes

It may be useful to think of insects in terms of their evolution. The first insects had a life cycle, similar to the grasshopper, in which the young hatched from the egg and were similar in body to the adults, but without wings and reproductive organs. This is called incomplete metamorphosis. This type of immature insect is called a nymph. They grow by moulting their skin (which is also their skeleton). With each moult they grow some adult organs. On the last moult they receive their reproductive organs and full wings. Examples of insects with this 'primitive' life cycle are cockroaches, grasshoppers and locusts. Aquatic insects such as the dragonfly and may fly also have young in the form of nymphs.

In complete metamorphosis, the insect changes its form completely between the larva stage and the adult stage of life. These more 'modern' insects have a life cycle like that of the butterfly. Other insects with this type of life cycle include beetles, moths and flies. In these insects the larva eats a lot to store energy, then builds a cocoon and, inside the cocoon, changes into the adult form. Adults generally reproduce and then die shortly after.

The greenfly, or aphid, grows by incomplete metamorphosis, but the greenfly has taken it a stage further. The eggs hatch inside the female greenfly and the nymphs feed on the mother's body.

The stick insect also grows by incomplete metamorphosis. In some kinds of stick insects, the females can produce fertile eggs without mating, and males are rare. The common stick insect kept in classrooms is an example of this kind.

Children must not examine hairy caterpillars as some of them are poisonous.

# 8 Teacher's sheet: activity

Based on **pages 18 and 19** of *Life cycles*

## Introducing the activity

(a) Tell the children they are going to study maggots and flies but are not going to touch either of them.

## Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through task 1 (see note (i)).

(c) Let the children try task 1.

(d) Go through task 2 with the children and then let them try it.

(e) Go through task 3 with the children and let them try it (see note (ii)).

## Completing the activity

(f) The children could make a display of their models. They could use secondary sources to find out about the other two stages in the life cycle of the fly and make models of them. All four models could then be arranged in a life cycle.

## Conclusion

A maggot has a body made up of eleven segments. It has a pointed head end and a wider back end. It does not have any legs or wings (see note (iii)). When a maggot changes into an adult fly its body forms a head, a thorax and an abdomen. On the head are a pair of large eyes and a pair of antennae. On the underside of the thorax are three pairs of long legs. On the top of the thorax are a pair of wings (see note (iv)).

## Teaching notes

(i) The models that are made will not be natural size. Choose a size to fit the ability of the children.

(ii) You may like to use the word feeler instead of antennae. In the fly the antennae are only short and not used for feeling the way, as are the antennae of some other insects, such as cockroaches.

(iii) The maggot is wedge-shaped. This shape helps it burrow into its food. The maggot does not have eyes, but instead has a light sensitive patch which it uses to sample light by swinging its head to and fro.

(iv) Some children may notice from photographs that the abdomen is divided into parts called segments which look a little like the segments in a maggot. The thorax is divided into three segments, but they are more difficult to see. A pair of legs is attached to each segment and the wings are attached to the middle segment. The head is made of a number of segments which have been fused together.

# 9 Teacher's sheet: comprehension

See **pages 20 and 21** of *Life cycles*

## Answers

1. **The stage 3 tadpole should have four limbs and a long tail. The stage 4 tadpole should have four limbs and a shorter tail.**
2. **Frog spawn.**
3. **(a) 10 days; (ii) about three months; (c) four years.**
4. **Algae.**
5. **The back legs grow first.**
6. **It does not have fins like a fish. The fins help the fish control its movements.**

## Complementary work

(a) The children could use secondary sources to find out about toads, newts and salamanders.

## Teaching notes

The frog belongs to a group of animals called Amphibia. Other members of this group are toads, newts, salamanders and some snake-like creatures, called caecilians, which live in the soil on the floors of tropical rainforests.

It is easy to tell the difference between frog and toad spawn. Frogs lay their spawn in clumps and toads lay their spawn as long threads. Newts lay single eggs on a leaf, and wrap the leaf around it for protection.

The jelly in the spawn protects the developing tadpoles by making it difficult for predators to eat the spawn. Should the spawn temporarily come to rest on land, the jelly keeps the developing tadpoles moist.

Some amphibians, such as the midwife toad, keep their eggs with them until they hatch. In the case of the midwife toad, the eggs are kept on the male's back until they hatch.

Tree frogs are a common animal in tropical rainforests, even though there are no pools or lakes nearby for breeding. Some rainforest plants which grow high on the branches of the trees have leaves which form in a container-shape and hold water. The tree frogs lay their eggs in this water and the tadpoles develop there.

# Teacher's sheet: activity

Based on **pages 20 and 21** of *Life cycles*

## Introducing the activity

(a) Show the children some frog spawn. Tell them that only a small amount has been collected and that in the next few weeks they are going to study the development of the tadpoles, then return them to the wild (see note (i)).

## Using the sheet

(b) Give out the sheet and let the children write their names and form, then go through task 1 and let the children try it (see note (ii).

(c) Let the children try tasks 2 to 5 at appropriate times (see note (iii)).

(d) Go through task 6, then let the children try it (see note (iv)).

(e) Go through task 7, then let the children try it (see note (v)).

## Completing the activity

(f) If the children have been studying separate tanks of tadpoles as groups, each group could report their findings to the whole class. If they have been using the same tank, they could make a display of their work (see note (vi)).

## Conclusion

You can see a tadpole developing inside the frog spawn. When the tadpole hatches it has suckers to hold it in place and grows gills on the outside of its body. By the time the tadpole is a week old it has a well-developed tail and a spiral intestine on its underside. (This is used for digesting its food.) By three weeks of age the tadpole has lost its suckers and the gills on the outside of the body.

## Teaching notes

(i) You may like to use this activity in connection with the next unit – 'Avoiding extinction'. You could use it to introduce the next unit, or as an example of helping to improve the chances of tadpoles reaching maturity by keeping them away from predators at an early stage in their life cycle.

At first the tadpoles will eat their jelly, then feed on algae growing on water plants. When the legs begin to develop they need to be offered a small piece of meat. This should be removed when the tadpoles are not feeding and replaced with a fresh piece.

(ii) The children will need to use magnifying glasses in all their observations. The frog spawn needs to be quite fresh, so the eggs appear as black dots.

(iii) The children should see the spawn becoming comma shaped, or even see the tadpoles inside the jelly.

(iv) They could make a chart in the form of a calendar. It will need to cover the next eight or nine weeks.

(v) The children should write about the development of the legs. They may also describe the change in head shape. If they can measure the length of the tadpoles, they can record this, too.

(vi) The children should use secondary sources to check their observations on how a frog develops. Briefly, the hind legs grow at about 8 weeks, the front left leg at 10 to 11 weeks and the front right leg at 12 weeks.

# Teacher's sheet: comprehension

See **pages 22 and 23** of *Life cycles*

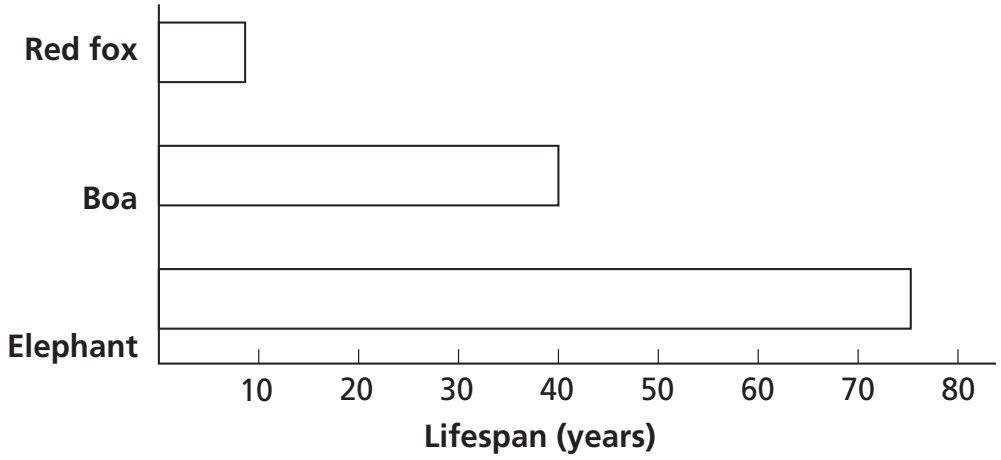
## Answers

1. **The lengths of the bars should be accurate (see example below).**
2. **Lack of food, lack of water, eaten by animals, accident, attacked by disease.**
3. **Extinct.**
4. **Animals that need large territories or eat only a small range of foods.**
5. **(a) They were collections of animals to amuse curious people; (b) They save animals from extinction and educate people about the importance of animals.**
6. **A large area of land set aside for wildlife. In these areas large animals do not compete with people and so can thrive.**

## Complementary work

(a) The children can use secondary sources to find out about the success rates of zoos in avoiding the extinction of various species.

(b) The children can use secondary sources to find out about wilderness areas in other continents.




## Teaching notes

It is important to make it clear that a species, or kind of living thing, exists as populations. This is the total number of individuals of the species in a given area.

The size of a population depends on the birth and death rates of the population, on the size of the area it has to live in, and on the availability of food. If the birth rate exceeds the death rate the population grows. If the two rates are the same the population stays the same, but if the death rate exceeds the birth rate, the size of the population falls. There are many species on the planet which have populations that are falling.

Living things which cannot breed quickly enough to replace the dead members of the population will face extinction.

Living things which need large territories to move around in are at risk now more than in the past. Some animals need large territories to find enough food or to mate, but much of the territory may be taken over by people.

If the territory is split up, individuals in each part may not be able to meet and breed.

In a larger population, the genes which make up the species are widely spread. In every species there are combinations of genes which produce defects which may cause an individual to die early. In a large population these genes are so widely spread that they rarely meet. As a population shrinks there is a greater chance of the genes combining to produce defects, and further increasing the death rate.


# Teacher's sheet: activity

Based on **pages 22 and 23** of *Life cycles*

## Introducing the activity

(a) Tell the children they are going to make a study on the plight of the pando. This is an imaginary animal, but its name is based on two very real animals which are threatened with extinction. Ask the children to name them. Look for panda and rhino in the answer (see note (i)).

## Using the sheet

(b) Give out the sheet and let the children fill in their names and form then go through task 1.

(c) Let the children try task 1 (see note (ii)).

(d) Go through task 2 then let the children try it.

## Completing the activity

(e) If the children have worked on their own, let them compare their results.

(f) Tell the children that the plight of the pando is not really fiction. There are thousands of animals and plants in danger of extinction at this moment, and for some it will be their final year of existence.

(g) Ask the children if they would like to become involved in a conservation exercise and organise a class group to set it up (see note (iii)).

## Conclusion

(i) The size of the pando population after one year fell to 90.

(ii) The size of the pando population in the following year fell to 75.

(iii) The pando will be extinct in three years.

(iv) 45 pandos will be in zoos at the end of five years.

(v) 155 pandos will be in the national park in five years.

(vi) The world population of pandos will be 200 after five years.

## Teaching notes

(i) There are several species of rhino and all are at risk of extinction. Some rhinos, such as the Java rhino (about 70 individuals) which live in rainforests, may become extinct while the children finish their education.

(ii) You may have to go through each exercise in task 1 with the children and stop and check their calculations at each stage.

(iii) The children may wish to sponsor a species at a zoo, help conserve a local area or become involved in a fundraising activity for conservation in another part of the world.