PLANT REPRODUCTION
Teaching notes

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Teaching notes.

First of all let me explain the main reason why we start classifying things. Classification is the process of grouping things together on the basis of the features they have in common. It is a way of summarising what we know. Anything can be classified (furniture, vehicles, emotions) but here we are referring to biological organisms and specifically plants.

The study of plant classification is known as taxonomy (“taxon” means group) and specialised botanists called “taxonomists” do it.

The system of classifying or naming living things may seem very “scientific”. But in fact, the system involves much human judgment and there is dispute and uncertainty about it. It is a system in constant flux as new information is discovered.

Children may have never thought about the key to living things, but all living things are put into different groups. Living things are placed into different groups because it makes them easier to organise and easier to study. There are over 1,4 million kinds of known living things. With so many living things we have to show pupils why it is important to develop a system to classify them.

There are many different features scientists use to classify organisms. Living things may be classified based on their outward appearance, structure inside their body, ancestral relationship, genetic characteristics and behavior.

Many times scientists develop keys to help other people identify a living thing. A type of key called “dichotomous key” allows the person using it to make decisions on the features a living thing has. The choices in the key start broadly and get more specific. Eventually, the decision is narrowed down to the name of a living thing or group to which a living thing belongs.

When children have a practical application for classification, the information has value and will be remembered by them. It also helps to give them a chance to develop their own system of classification.

There are millions of different kinds of living things. It is very difficult to think about all these things separately, so scientists put them into groups. All the living things in a group are similar in some way.
Lesson 1 Introduction How to classify

Students classify living things according to similarities and differences through guided and independent activities. They place objects into groups according to their characteristics and then make a collage of living things classified into groups based on their criteria.

Go outside and look around (power point: How to classify. Slides 1 to 7).

Activity 1 Living and non-living things

In this activity we are going to compare and classify a set of pictures. The teacher puts pupils into groups of three. He/She explains that he/she will give each group a set of pictures. He/She also will suggest helping each other to organize the pictures according to physical structures and characteristics, so they can work together within their groups.

To grade the pictures pupils have to put them into groups that are closely related; and then divide the groups into smaller ones that are related too. Sorting into groups based on their traits, is the meaning of - Classifying .

When they finish students can complete the chart on their worksheet.

Let's classify things:
Car, telephone cabin, house, stones, milk cartoons, flowers, cow, tree, horse, fern, grass, a lamp. These can be some of the pictures given.

<table>
<thead>
<tr>
<th>Never been Alive</th>
<th>Alive</th>
</tr>
</thead>
<tbody>
<tr>
<td>..................................................</td>
<td>..................................................</td>
</tr>
<tr>
<td>..................................................</td>
<td>..................................................</td>
</tr>
<tr>
<td>..................................................</td>
<td>..................................................</td>
</tr>
</tbody>
</table>

To check the activity the teacher can ask some questions like:

- Why have you placed these animals or plants together?
- Is there another way you could have grouped them?
- Can you group them by their characteristics?
Lesson 1

Activity 2 - Sorting game.

Teacher puts pupils groups of three. Each group has a set of cards, as the model below. Children need to understand why living things are classified. They should also understand that a classification system is devised by people and can change. They have to ask and answer some questions to guess which the animal one of their classmates has chosen. They only possible answer is: yes or no. Turn over the animals which do not fit the answer ‘yes’.

- Choose a creature and try to work out which one has your classmate picked.

<table>
<thead>
<tr>
<th>Lizard</th>
<th>Goldfish</th>
<th>Owl</th>
<th>Rabbit</th>
<th>Snail</th>
<th>Spider</th>
<th>Butterfly</th>
<th>Crab</th>
</tr>
</thead>
</table>

Questions:
- Is it a mammal?  Does it have legs?
- Is it a vertebrate? Does it have fur?
- Is it carnivorous? Does it eat animals?
- Is it a reptile? Does it have a backbone?
- Is it warm blooded? Does it have wings?
- Can it fly? Does it have gills?
- Can it live under water? Does it have fins?

Activity 3 - How can you classify these animals? (fig 1)

Complete the animal chart using the characteristics given: dog, horse, bird, snake, crocodile, sardine, butterfly, whale, golden eagle, alligator, donkey, penguin, and hake.

Children can check their answers using slides 8, 9, and 10 from the power point. They start classifying a well known animal kingdom.
Activity 4 - THE KEY TO LIVING THINGS.

In this activity children will learn how to use a dichotomous key. They start by looking at one of the living things at the bottom. To classify these living things, in pairs, children will work their way down the dichotomous key given. They have to do this by reading the first question on the key and answering it. Then they should follow the line that connects the question to their answer. They do this until they reach until the end of the lines, where they will write the name of that living thing in the empty box. After they have completed keying out all the living things below, they can make their own drawings and give them to other students to key out.
Activity 3 - How can you classify these animals? (fig 1)
DICHOTOMOUS KEY

Does the living thing have a backbone?

Yes | No

Does the living thing have fur?

Yes | No

Does the living thing have feathers?

Yes | No

Do you need a microscope to see the living thing?

Yes | No

Does the living thing have fins?

Yes | No

Does the living thing have scales?

Yes | No

Does the living thing lay its eggs in water?

Yes | No

Is the living thing green and has leaves?

Yes | No

Does the living thing look wormlike?

Yes | No

Is the living thing not green and lives on a once living thing?

Yes | No
THE KEY TO LIVING THINGS

Does the living thing have a backbone?
Yes | No
--- | ---

Does the living thing have fur?
Yes | No
--- | ---
FOX

Do you need a microscope to see the living thing?
Yes | No
--- | ---
BACTERIA

Does the living thing have an exoskeleton?
Yes | No
--- | ---
CRICKET

Does the living thing have fins?
Yes | No
--- | ---
FISH

Does the living thing have scales?
Yes | No
--- | ---
SNAKE

Does the living thing lay its eggs in water?
Yes | No
--- | ---
DAISIES

Is the living thing green and has leaves?
Yes | No
--- | ---
MUSHROOM

Is the living thing not green and lives on a once living thing?
Yes | No
--- | ---
MUSHROOM
Lesson 2
Activity 1 - Living things - what they need and what they can do.

Application (fig 2)
Choose a plant, then write its name on the dotted line in the box in the table.
Choose an animal and write its name on the dotted line in the middle of the box.
Choose an object that has never been alive and write its name on the dotted line in the last box.

Synthesis
Look at your plant and answer each of the questions. If the plant has the characteristics in the list, write YES in the box.
If the plant does not have the characteristics, write NO in the box. Then repeat this for the animal and for the object you chose.

(fig 2)

<table>
<thead>
<tr>
<th>Characteristics (Living things need to do all these things)</th>
<th>A plant</th>
<th>An animal</th>
<th>An object that has never been alive.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Does it show any movement?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R Does it need air or oxygen?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S Does it react to what is happening in its surroundings?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G Can it grow larger?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R Can it make more living things like itself?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E Can it get rid of waste from itself?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N Does it need food for energy?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First children have to answer the questions for M,G,R and N, in the rows with white background. Later on, the teacher may also ask them to do the other ones.
Activity 2
Application
Show children some pictures specimens of animals and plants e.g. bee, spider, worm, mealworm, snail, dog, horse, bird, snake, crocodile, butterfly, whale, grass, ivy, holly, cherry tree, daffodil, oak tree, human and ask which word describes this living thing

Analysis
Ask children to group the living things into similar groups and give their reasons for doing so.

Synthesis
Produce a skeleton Mind map of living things groups on a poster.

Evaluation
Selected children present their poster to rest of class.

Activity 3
To bring order to this daunting task, botanists have developed a scientific classification system to group similar plants together. They make notes of details about plant anatomy (especially that of flowers, fruit, seeds and leaves). They use these characteristics to divide plants into categories.

Application
Working in pairs, pupils have to read the text carefully. After that they have to complete the plant kingdom classification (fig 3)

Plants are the key to life on Earth. Without them many other living organisms would soon disappear. This is because higher life forms depend on plants, either directly or indirectly, for their food. Most plants, however, are able to make their own food using sunlight. All plants fall into two basic categories. Flowering plants produce true flowers. The non-flowering plants include “primitive” plants, such as algae, mosses, ferns. Horsetails, and liverworts, and the “gymnosperms” a group of plants which includes the conifers. There are about 250,000 species of flowering plant in the world today, and they grow everywhere from snowy mountain falls away to arid desert.
Activity 4 – Sort it out – game with cards.

This activity is based on the card game "Happy families". There are 24 cards in the pack, made up of six sets of four cards. While playing the game, children have opportunities to:

• Practice sorting objects into groups.
• Learn that there is more than one way of sorting objects into a group.
• Appreciate that it helps to have names for objects when trying to sort them.

Preparation for the game

We will need one pack of cards for each group in the class. The master sheet (figure 4) shows the complete set of cards. (do not show the master sheet to the children until they have attempted to sort their own pack of cards into groups).

Playing the game

This game is best played with three or four players, but can be played with two. There are several stages as they progress through the game.

1. Give each group a pack of 24 cards. Ask them to spread the cards out (face upwards) and then sort them into groups in whatever way they like. Give them several minutes to discuss this. Then the children report back to the rest of the class saying how they have sorted their cards and their justification for doing so.
   • They should find lots of different ways of sorting cards into groups. As they do this, we should make the point that most objects, including living things, can be sorted in different ways. After that the person who devised the game of "Sort it!" actually divided the cards into six sets of four cards.

2. Ask the children if they can sort the cards into six sets of four cards. Again, let them discuss how they decided to group their cards.

3. The "master sheet" (fig 4) shows how the six sets of cards can be grouped into families, using certain characters. If the children have not grouped their cards in this way, we can then show them the master sheet. We can discuss with them the characters that were used to put the cards into the "families" shown on the master sheet.
Sort it! Master sheet for the six family cards  (fig.4)  http://www-saps.plantsci.cam.ac.uk/docs/p4pp/g&c/g&cD.pdf
DISCOVERY If a child finishes early, he/she. Students will read an article about a scientist that made contributions to the information in this standard. A number of literacy strategies are suggested that could be used to assist students to understand the reading.

Copies of the reading below. Other materials depending on the strategy chosen. They can also use some of these web pages to look for some relevant information. 
http://www.nhm.ac.uk/nature-online/science-of-natural-history/biographies/linnaeus/index.html
http://encyclopedia.kids.net.au/page/ca/Carolus_Linnaeus

Procedures:

Strategy 1
1. A group of students can create a 3-column list where as they read they write down what they know about Linnaeus, what they learned and what his discoveries were. K-W-L
2. Ask students to volunteer to share their work.

Strategy 2
1. Give to another group of students different colour highlighter markers and have them highlight the education Linnaeus received in one colour, his work experiences in another and his contributions to science in another.
2. Students can compare their work by looking at the colour patterns.

Strategy 3
A third group of students can create a timeline of Linnaeus life. Give them a piece of paper or adding machine tape to make it on.

Strategy 4
Some other students can write sentences about the most impressive thing about Linnaeus and the thing they liked least.
Carl Linnaeus was born on the 23rd of May 1707 at Råshult, in the parish of Stenbrohult, where his father was vicar, in Småland, Sweden. Young Carl Linnaeus loved to spend his days out in the countryside, which in pre-industrial Sweden was rife with fresh air and wildlife. He avoided the schoolroom to such a degree that his father despaired he would ever amount to anything. However, the local doctor, Johan Rothman, saw more in the boy’s interest in nature, and encouraged him to study medicine, which then included botany.

Linnaeus attended the University of Lund, where he studied medicine for a year before moving on to the larger University at Uppsala. Like so many students, past and present, he lived in poverty while pursuing his education, and like so many, he persevered and became an outstanding student. Soon Doctor Olaf Doctor Celsius, botanist and priest, happened upon young Linnaeus in the University’s botanical garden, and was taken with his knowledge and interest in plants. Soon Dr. Celsius offered Linnaeus lodging, and mentored him in his studies. In return, Linnaeus tutored the professor’s son, and soon realised one of his greatest talents, that of teaching.

The University also recognised Linnaeus’ talent for teaching and promoted him to the position of Assistant to the Professor of Botany, an assignment with many responsibilities and an almost non-existent income. Before he completed his degree, the Academy of Science elected him to go on an exploration of Lapland and record any new plants he found there. So on Friday, the 12th of May, 1732 he set out alone from Uppsala and trekked hundreds of miles through northern forests and across the tundra, mapping the land and seeking new plants.

Although the term ‘ethnobotany’ was not coined until 1895 by John W. Harshberger, Professor Paul Alan Cox, Director of the National Botanic Gardens in Hawai’i and Florida, has proposed that ‘Linnaeus in His Lapland Dress’, a copy, made by Eleonora Lindstrom-Hennig in 1907, of Hollander’s adaptation of Martin Hoffman’s original 1737 portrait. Linnaeus was the first to practice this relatively new science. On his first expedition Linnaeus not only took detailed notes of the plants he found, but also
of the indigenous people he met, and the way in which they used the plants for food and medicine. He travelled light and lived with the people he met, ate the same food, and even adopted their clothing, much as many modern ethnobotanists do.

He returned with over one hundred dried and pressed specimens that were new to science. He so liked his Saami clothes from Lapland, complete with talismans and Shaman’s drum, that he had the artist Hoffman paint his portrait. In fact, most portraits from Linnaeus’ youth picture him in his favourite garb, and it is likely that he used these clothes for his many plant hunting expeditions, having learned early that the foppish attire of the period was both a hindrance and a hazard in the wilds.

In this portrait he holds a sprig of Linnaea borealis in his right hand, a flower he admired so much he asked a friend to name it after him. He felt it would be immodest to name it himself. The Twin-flower, as it is commonly known in English, is remarkable in that it is pan-arctic, growing in the northern regions of Asia, North America and Europe.

It was during this time that he began to develop his system of classification, as the existing methods were proving inadequate for naming all the new species recorded each year.

On one of his many expeditions, Linnaeus visited Dalarna and the copper mine in the town of Falun. Here he met Sara Elisabeth, the daughter of the local doctor Johan Moraeus and proposed to her a fortnight later. In his youth Moraeus had taken his MD in Holland and now he insisted that his future son-in-law should do the same.

So, in 1735 Linnaeus went to the University of Harderwijk in the Netherlands, where he finished his medical degree, published his first treatise on classification, Systema Naturae, and then enrolled at the University of Leiden for further studies. For three years Linnaeus remained in the Netherlands, where he corresponded and met with many or Europe’s greatest botanists and continued to refine his system of classification. During this time he became the curator of a private botanical garden, Hartecamp, just outside Harlem. He visited the garden’s wealthy owner in England in
1736, and met many of Europe’s great thinkers. In 1738 he returned to Sweden to practice medicine and lecture on a variety of subjects and continue his own studies.

Soon after his return he married the young woman he had proposed to three years earlier. According to one biography, ‘She turned almost overnight into a dragon’ and that ‘He was to regard her with respect and terror for the rest of his life’. Nonetheless he had five children with her, four daughters and one son, Carl von Linné Jr.

In 1741 he was awarded a professorship at Uppsala University, where he once again embraced his natural vocation of teaching. He also oversaw the restoration of the university’s botanical garden, where he quite naturally organized the plants by his own system of classification. His popularity as a teacher at the university was unprecedented, with student ranks eventually swelling from five hundred to fifteen hundred undergraduate students during his tenure.

Many of Linnaeus’ students went on to travel the world, seeking out new plants and returning their discoveries to their former professor for inclusion in his ever increasing classification lists. Linnaeus also corresponded with students of botany throughout Europe and beyond, one of whom was a young Joseph Banks. One of Linnaeus’s star pupils, Daniel Solander, would later join Banks in one of the greatest botanical expeditions in history.

Although Linnaeus continued to practice medicine, eventually being appointed physician to the Swedish royal family, his teaching and plant studies remained the focus of his life. He was ennobled in 1757, and given the suitably grand sounding name of Carl von Linné. He died of a massive stroke in January of 1778. During his life, Linnaeus had published over 170 scientific works and had influenced the world of botany for centuries to come.

Erasmus Darwin, grandfather of Charles Darwin, translated many of Linnaeus’s published works into English, making them accessible to many more people.

The Linnaen Society
LIVING THINGS - PLANT KINGDOM

LIVING THINGS
- Bacteria
- Fungi
- Plants
- Protist
- Animals

Non-seed plants
- Algae
- Mosses & Liverworts
- Ferns

Seed Plants
- Conifers (Gymnosperms)
- Flowering (Angiosperms)

Invertebrates
- Animals without bones

Vertebrates
- Animals with bones

HUGUET FITE, Janet
CEIP Antoni Roig
Lesson 3

Activity 1

Before viewing the “Parts of a flower” power point, it is important, for us as teachers, to discover what the students know - or think they know - about the topic, before actually starting this significant part of the unit. Therefore, after prompting discussion with the pre-viewing questions, we are going to lead the class to create an “Everything We Think We Know About…” list.

To make their list we can stimulate and focus their thinking by raising some questions like the following: - Do all plants reproduce in the same way?

- Can a flower really be the secret of world domination?

so that their list will better reflect the key ideas. Power point “Parts of a Flower” slide one.

“Everything We Think We Know about ….” List is on the board and the teacher writes the children’s previous knowledge on it.
Activity 2

After that children are continuing to watch the power point. They have to be familiar with the new vocabulary and also understand and recognize the functions.

Power point 2 “Parts of a flower”. Slides from 2 to 10. When they have seen the power point we are going to give them a picture or a drawing of a flower in order to make groups (rose, lily, daisy, poppy, gladiolus, dandelion, crocus, snowdrop, tulip, daffodil). Each child has to go around the classroom looking for another child who has the same flower, so they are going to join together.

They have to ask questions to guess who has got the same flower. When they are in their pairs or threes, give them a set of vocabulary words and their definitions, so they have to match them. Read carefully the functions and match them with the names of the parts of a plant. Using the following patterns.

I think it is the ..........  
I think this is the ..........

<table>
<thead>
<tr>
<th>Ovule</th>
<th>Male reproductive organ that contains pollen grains.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calyx</td>
<td>Consists of all the petals, which serve to attract pollinators through colour and scent.</td>
</tr>
<tr>
<td>Corolla</td>
<td>Receives the pollen from the anther.</td>
</tr>
<tr>
<td>Filament</td>
<td>Consists of all the sepals, which protect the flower before it opens</td>
</tr>
<tr>
<td>Anther</td>
<td>Female reproductive organ of flowers.</td>
</tr>
<tr>
<td>Stigma</td>
<td>Where the ovules are.</td>
</tr>
<tr>
<td>Style</td>
<td>A stalk that supports the anther.</td>
</tr>
<tr>
<td>Ovary</td>
<td>Pollen moves from a flower to another flower, from the anther of one flower to the stigma of another.</td>
</tr>
<tr>
<td>Stamen</td>
<td>Where the pollen is produced.</td>
</tr>
<tr>
<td>Pollination</td>
<td>Bottle-shaped organ that contains ovules.</td>
</tr>
</tbody>
</table>
Activity 1

Do the worksheet individually and then compare your answers with your partner.

Get started:

Why do many flowers have bright coloured petals?

___________________________________________________

___________________________________________________

1. True or false? Tick the correct answer.

<table>
<thead>
<tr>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Flowers have bright coloured petals so that humans will pick them.</td>
<td></td>
</tr>
<tr>
<td>b. The sepals were closed to make a case around the flower when it has a bud,</td>
<td></td>
</tr>
<tr>
<td>c. Trees never have flowers.</td>
<td></td>
</tr>
</tbody>
</table>

2. Anne has taken a tulip flower to pieces and stuck the different parts on a piece of card.
a. Help Anne to label each part of the flower with its proper name.

b. The flower has male and female parts. Put a letter (M) besides the Male parts and a letter (F) besides the Female parts.

c. Match the parts of the flower to the function (what it is that they do for the flower) by writing the number in the lines before each sentence.

|-----------|---------|----------|----------|

a. _____ holds the pollen
b. _____ where the pollen enters the female part of the flower.
c. _____ the stick that holds the anthers in the air.
d. _____ where the ovules are stored.

**Activity 2**
Say this Rhyme:

Roses are red,
Violets are blue,
Everything is colourful
Just like YOU.

**Activity 3**

**TOP TIP** Make a set of cards with the name of the plant part on one side and write the function on the other side. Use them to test yourself and soon you’ll be an expert.
Activity 5: A simple flower dissection

Procedure:
1. Divide the class in pairs. They need an A3 card sheet, a ruler, and a scalpel.
2. Give a gladiolus flower, a lily or a tulip flower to each pair.
3. In Figure 1, draw your flower. Note the colour and flower position. Label the sepals and petals.
4. Using your scalpel, very CAREFULLY, make a vertical incision to open your flower.
5. Pin the petals and ovary to keep it open.
6. In Figure 2, draw your flower pinned open. Be sure to label: Sepals, Anther, Stamen, Filament, Stigma, Style, Ovary, & Pistil
7. Using your ruler, measure the length of the Pistil (stigma, style, & ovary) in mm. Record in Table 1.
8. Measure the length of the Filament only (mm). Record in Table 1. Repeat for all 3.
9. Measure the length of the Anther only (mm). Record in Table 1. Repeat for all
10. The anthers may be releasing pollen. Look for a powdery residue.
11. Look inside the ovary. See if you can find the ovules. When fertilized, these will become seeds.
12. Record the lengths of the pistil and filament on the class stem and leaf Figure 3.
13. Calculate data, answer the questions.
Data

Figure 1: Drawing of the flower given.

Color __________ Position ________ Label: Sepals and Petals

Figure 2: Flower Pinned Open.
Label: Sepals, Anther, Stamen, Filament, Stigma, Style, Ovary, & Pistil

Table 1: Table of Anther, Filament and Pistil Lengths in mm.

<table>
<thead>
<tr>
<th>Flower part</th>
<th># 1</th>
<th># 2</th>
<th># 3</th>
<th>Average (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pistil</td>
<td></td>
<td>none</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Anther</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filament</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Double Stem and Leaf of Pistil and Average Stamen (anther + filament) Length.

Table 2: Summary Data Table of Pistil and Stamen Lengths.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Max</th>
<th>Min</th>
<th>Range</th>
<th>sum</th>
<th>Mean</th>
<th>med</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pistil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stamen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analysis:

1. Name the female parts of your flower.
2. Name the male parts of your flower.
3. In your flower, which was longer?
4. According to our class data table, which had the longest length?
5. Was your flower a complete or an incomplete flower?
6. Was your flower releasing pollen? How could you tell?
7. Why would having a longer pistil or stamen be an advantage in pollination?
8. Draw the leaf of the gladiolus, the lily or the tulip. Note the margin and vein pattern, the spotted markings.

Conclusion:

Write 2 or 3 sentences on what you learned.

A3 card sheet

1. Drawing of the flower given Label: Sepals and Petals
2. Flower Pinned Open. Label: Sepals, Anther, Stamen, Filament, Stigma, Style, Ovary, & Pistil
3. Pistil
4. Stamen

Conclusion:
   a.
   b.
   c.
Extension activity

Using the data from each lab group in your class, create a line graph of length in mm (y-axis) versus flower position (x-axis). Using 3 lines, Record the average lengths of the anthers, pistils, and stamens. Do you notice any trends?

1. Write a suitable question for each answer:
   a. ____________________________________________________________
   ___________________________?
   It consists of stigma, style and ovary.
   b. ____________________________________________________________
   ___________________________?
   The pollen lands on the tip of the female organ in the flower and then starts to grow inside until it reaches the egg equivalent.
   c. ____________________________________________________________
   ___________________________?
   Algae, mosses and ferns are the main plant group that don't have flowers and therefore can't make seeds. Instead they produce spores.
   d. ____________________________________________________________
   ___________________________?
   Pollination happens first.
   e. ____________________________________________________________
   ___________________________?
   The petals die and fall off.
LABEL THE PARTS OF THE FLOWER (it can be used for evaluating)

Read the definitions then label the diagram below.

- **Anther** - the anther is the tip of a flower’s stamen (the male reproductive organs of the plant) - it contains the pollen.

- **Filament** - the filament is the part of the flower that holds the anther (and part of the stamen, the male reproductive organs of the plant).

- **Ovary** - the ovary is a female reproductive organ in plants that produces ovules. It is at the base of the pistil.

- **Petal** - a petal is one of the leafy structures that comprise a flower. Petals are often brightly-coloured and have many different shapes.

- **Sepal** - the sepals are small leaves located directly under a flower - they are the outermost part of a flower.

- **Stem** (also called the peduncle) - the stem supports the plant.

- **Stigma** - the stigma is uppermost part of the pistil, the female reproductive tissue of a flower. The stigma receives the male pollen grains during fertilization, when they travel through the style to the ovary.

- **Style** - the style is part of the pistil, the female reproductive tissue of a flower. The style is a long tube on top of the ovary, and below the stigma.

Plants produce seeds when pollen grains are carried from the flowers of one plant to another.
PLANT REPRODUCTION
POLINATION & FERTILISATION

Lesson 6

Activity 1 Listen to the song and guess the order of the lines and also the verses.

Divide the class in four groups. Give to each group the stripe lines of a verse, a copy of one of the verses to each group. They have to think what could be the correct order of each line of the verse of the pollination song they have. Then with the whole group class they are going to discuss and argue what can be the order of the four verses.
After they get a conclusion they can listen to the song. While they listen the verse they have ordered, pupils stand up and sing their verse.

Pollination song How do plants pollinate? To the tune of: “This land is your land”.
www.mbgnet.net/bioplants/pollination.html

Verse 1
What does a plant need
To make a new seed?
Three things give flowers
Reproductive powers,
The sticky pollen.
The slender stamen,
And pistils, make the flower whole.

Verse 2
What gets the pollen going
To keep new plants growing?
Different kinds of birds do,
Or the wind that's blowing.
Butterflies and bees,
Carry pollen they need.
That's what makes pollination work.

Verse 3
If a flower's not scented,
Or brightly colored,
and the flowers are smaller
in clusters tighter
With stamens longer
The signs are stronger
This plant spreads pollen on the wind.

Verse 4
When brightly coloured flowers
Have a sweet perfume
And a sugary nectar
Then chances are good
That birds and insects active
Find the plants attractive
And they'll spread the pollen as they go.
After the pollination song, pupils can discuss the order of the life-cycle and then they should go on doing activities two and three individually.

Activity 2

Plant life cycle. What happens first and how does it go on?

☐ germination

☐ pollination

☐ seed produce

☐ fertilisation

Activity 3

Circle the correct words to complete each sentence.

a. Some plants are pollinated by insects/cats/slugs and other plants are pollinated by the Sun/wind/snow.

b. Plants that are pollinated by the wind have rubbery/feathery "flowers", like grasses. This is so the wind can blow through and collect the pollen/nectar.

c. Most seeds need dry/moist conditions to germinate.

d. Plants that are germinated/pollinated by insects are often dull/brightly colours, and are scented. This attracts insects.

e. Some seeds, such as cleavers are spread by beetles/animals when their tiny hooks catch on fur.

f. Some seeds, such as raspberry seeds, are found inside juicy flesh. This is so that flies/birds/snails will eat them and spread the seeds.
Lesson 7 - Pollination Power point

The teacher explains that they are going to watch the “pollination” power point. Before watching the ppt, students read aloud the sentences in the boxes. Make sure they understand the meaning and the idea of each label. They have to number them according to the correct order of the pollination process.

Activity 1
Add each of the following labels to the correct corresponding image at the “Pollination and fertilization” power point.

______ Pollination is the carrying of pollen from the stamens (male part of the flower) to the stigma (on the female part of the flower).

On the stigma the pollen grain grows a pollen tube down the style into the ovary.

______ Fertilisation takes place when the pollen tube and the ovule come together.
After fertilisation the ovule develops into a seed.

Wind-pollinated flowers, like the male Hazel flowers shown here, are often small, and borne in long dangly catkins. These are blown about by the wind, releasing large amounts of pollen.

Here a hazel catkin shows the large amount of pollen shaken out of it as it moves. Pollen being blown around in the wind may not find a stigma and will be wasted.

______ Wind-pollinated plants produce a lot of pollen and this increases the chance of success.

In June and July, it is often the grasses, releasing very large amounts of pollen, which cause problems for hay fever sufferers.

Feathery stigma which sweeps pollen from the air.
Stamens with long dangling stalks.

Insects visit flowers to find food, e.g. nectar.
In the Butterfly-orchid nectar is stored in a long tube (the spur) which is part of the petal.
Many insects feed on pollen.
This bee is collecting pollen in its pollen basket to feed to its larvae.

As an insect moves from flower to flower, pollen stuck to its body has a good chance of landing on a stigma.

How Foxglove flowers are adapted to their pollinating insects.
The Foxglove flower is just the right size for a bumblebee to fit inside.
Bee going into the Foxglove.

As the bee squeezes into the Foxglove flower its back brushes against the stamens and stigma.
Smaller insects can’t enter the flower because of the long hairs at the entrance.

The Evening Primrose is pollinated by moths flying in the evening.
The luminous yellow petals are easily seen in the dusk.
Sticky chains of pollen cling to the visiting moths.

Broom is designed to be pollinated by heavy insects like bees. The male and female parts are all tightly packed into the keel.
When a heavy insect lands on the wings, they are pushed downwards and the bee hits the keel, which then explodes!

The stamens, style and stigma which round the insect both collecting and covering it with pollen.

Most insect-pollinated flowers are large and brightly coloured so that insects can easily find them.
If they are small they may be grouped together to look like a large flower as in this Dandelion.

Many insects do not see red well, so it would not be a good colour to use to attract them.

Can you think why not many British wild flowers are red?
After watching the "Pollination" power point, students share their answers in small groups and discuss if they agree or they do not.

**Lesson 7**

**Activity 2 and 3**
The teacher asks pupils to do these activities on their own. They have to decide how each plant is pollinated and on exercise three, complete the text filling the gaps with the given words. Then he/she corrects the activities with the whole class. He/she encourages one pupil to ask another "How is .......... pollinated by? another student is persuaded to answer “ ...... is pollinated by ......". The teacher asks to the big group class if they agree with this answer or they do not and why.

**Lesson 7**

**Activity 4 Dandelion Life-cycle mobile.**
The teacher gives a handout with the Dandelion Life-cycle. First pupils are going to order it orally, as a group class and then individually they are doing their own mobile.
Make a mobile of the life-cycle of the Dandelion. Cut along the lines. Glue each picture on to card with the matching sentence on the back. Cut out. Use cotton thread to join up the mobile in the correct order.
**Material needed:** scissors, glue, card, cotton thread, colouring pencils.

**Lesson 8**

**Activity 1 - Plants and their adaptations for pollination.**
To carry out this activity each pupil has to brought to the class three wild plants (these can be from the local area).
Pupils have to identify their plants and think about their adaptations for pollination.

**Activity 2 and 3 - Seed dispersal**
Investigate different methods of seed dispersal. Evaluate why each model is useful to the plant.
Looking at the investigation model given by how long it takes some seeds to fall, students have to investigate and evaluate how far some seeds land away from the parent plant.
Activity 4 - Finding out about how fruits and seeds are dispersed.

**Fruit, Seeds and their Dispersal.**

**Blackberry** (a juicy fruit) This is a collection of individual fruits, each with a seed in the centre. It is juicy, shiny and brightly coloured to attract animals, particularly birds. The fruit is eaten but as a hard coat protects the seed it passes through the digestive system and is deposited in the animal's faeces.

**Horse-chestnut or conker** (a takeaway) The shiny brown seeds are enclosed in a prickly case formed from the ovary wall. When ripe, this splits to release the seeds. The seeds are a good food source for small mammals; some are carried away and buried as a winter food store. These often get forgotten so will have a chance to grow.

**Cleavers** (a hitch-hiker) Pairs of small round fruits, the leaves and stems are all covered in hooked bristles. The bristles cling to animals' fur so seeds get carried away. Long pieces of stem, with many fruits, may be seen trailing from animals' coats.

**Sycamore** (wind dispersal) After fertilisation each of the two carpels develops a wing on one side. As the fruit ripens, the two carpels separate and the off-centre wings make it spin helping to keep it in the air.
Activity 5 - Adaptations of plants for seed dispersal.

Explore different types of seeds and encourage kids to grow something of their own at home or in the classroom.
Some seeds have special adaptations for dispersal. Looking at some pictures, the students, in pairs, have to accommodate them in the table. They have to plan, discuss and give reasons about how the fruits have been adapted for seed dispersal.

Extension activity: Insect pollination

This activity can be used as an evaluation worksheet.
The Life-cycle of a flowering plant (*Brassica*)
Lesson 9

Before growing a geranium from cuttings, pupils can watch a video that shows some of the asexual reproduction methods studied. They can also see how a gardener plants some plantlets by fragmentation.

Activity 1

Watch the Asexual Reproduction Video and complete the text choosing the correct word in brackets:

http://www.blinkx.com/video/plant-reproduction-asexual-reproduction-britannica-com/-8ufFe2t1M0sw_VjBJoUQ

After winter has thawed the first flowers of early __________ (spring / summer) appear. But these plants have not grown from seeds, they have reproduced from ____________ (rhizomes / bulbs).

Bulbs enable plants to reproduce asexually. That is ____________ (with/without) producing gametes. Bulbs are known as perennating organs. They allow plants to survive in __________ (favourable/adverse) conditions and then to grow quickly when the time is right.

The swollen rhizomes of irises have a similar function, but asexual reproduction does not rely solely on perennating organs.

This Liverwort can reproduce asexually and be a gemae. Gemae are small discs of green tissue that grow inside special caps. When mature, they break off from the parent plant often due to the action of rain drops. They scattered away from the parent plant and will eventually grow into a new gametophyte plants.

Plants like this bryophyllum can also reproduce asexually. Miniature plantlets develop at the edges of its leaves, in time these will drop off and develop into independent plants.

Mature strawberry plants are able to establish new plantlets on the end of long ____________ (rhizomes / runners).

Gardeners are able to cultivate plants asexually of via ____________ (cuttings/corns). This is possible because of stems cells like these are able to trigger the formation of root cells and will start to grow roots.

The ability of many plants to reproduce asexually helps commercial growers, because it’s quicker and more reliable than growing plants from seeds. It also ensures growers that quality is consistent.

Asexual reproduction is all about exploiting a good niche. In such circumstances the value of sexual reproduction, with its results and diversity may actually weaken the dominance of an established group. But, in a changing environment ____________ (uniformity / diversity) means survival.
Activity 2 – Growing geraniums (*pelargoniums*) from cuttings.

There are two basic types of reproduction of living organisms. One type, sexual reproduction, requires the union of male and female sex cells, or gametes (sperm and eggs) in the formation of a new organism. The second type is asexual reproduction in which there is no union of sex cells. In this project, pupils will study one kind of asexual reproduction by examining the ability of plants to reproduce by vegetative propagation. They will also discover some methods and special plant organs by which plants can reproduce asexually.

Geraniums (*pelargoniums*) are easy plants to keep and grow in the classroom. They are easy to grow from cuttings taken from a mature plant. Three or four large mature plants can provide cuttings for 20 or 25 children, which they can then plant and grow. It could be usually recommended that cuttings are taken in late summer but they can be taken early in the spring term.

Cuttings taken in early spring should be in flower by July and are still likely to be in flower at the beginning of the autumn term.

The most important factors when growing plants from cuttings are:

- To prevent cuttings dying from lack of water due to water loss through the leaves (transpiration).
- To ensure the developing roots are in a well-aerated medium. This allows them to have plenty oxygen and also prevents them getting too wet and then rotting.

**Aim:**
To produce a new plant by cutting or fragmentation.

**Materials:**

- A small plastic pot (7 cm diameter) There must be some holes in the bottom of the pots to drain freely.
- Two plastic dishes.
- A polythene bag, large enough to enclose the pot (transparent) or half of a 1.5 liter lemonade bottle.
- A 50:50 mixture of peat-free compost and horticultural sand.
- Plant labels.
- Healthy mature geranium plants from which to take the cuttings.
**Preparing the pots**

1. Label your pot and fill it with the soil mix, pressing down gently. (Remember the soil needs to have plenty of air in it).
2. Place the pot in a dish of water until the surface becomes moist and then leave the pot to drain while the cutting is being taken by the teacher.

**Planting the cutting**

1. Push your cutting gently into the soil to just below the lowest leaf and firm it in by gently pressing on the soil around it.
2. Cover the cutting with a transparent cover. Half a lemonade bottle is ideal. A polythene bag can be used, but it should be arranged so it is not touching the cutting.
3. Place your cutting in a warm light place, preferably not in full sun. After one week, water your pot by standing it in a dish of water. Repeat after about 10 days by which time the cutting should have rooted and new leaves should have started to develop.

**As an alternative:**

**To Watch the roots develop**

If children want to observe the roots as they grow, you have to place the cutting into a test tube. Add water so that the bottom 2cm of the shoot is in the water. You will be able to observe the roots developing over 2–3 weeks.
Activity 1 - QUIZ

In this activity the teacher says that they are going to play a “pub game” known as QUIZ. The teacher is going to split the class group. There would be three teams. Each team has a set of A, B, C and D cards, to answer the teacher’s questions. Before starting the Quiz each group can read and talk about the content of the questions.

The team who gets the highest score will win

Listen to the questions carefully and show the ACBD cards that your group thinks is the most suitable answer to the questions.

QUESTION 1
Which are the female parts of a flower?
    A. Stigma, style and stamen.  
    B. Style, stigma and ovary.  x
    C. Stigma, sepals and style.  
    D. Ovary, anther, stamen.

QUESTION 2
How do plants attract insects?
    A. By having brightly coloured petals.  
    B. By having scented flowers.
    C. By having sweet, sugary nectar.  
    D. All of the above.  x

QUESTION 3
Dandelion seeds have fluffy parachutes........
    A. That are carried by the wind.  x
    B. That are pollinated by insects.
    C. That are dispersed by water.  
    D. Self dispersal by pepper pot.

QUESTION 4
When pollen joins with the egg is this......?
    A. Fertilization.
    B. Germination.  
    C. Pollination.  x
    D. Seed dispersal.
PLANT REPRODUCTION
ASEXUAL REPRODUCTION

QUESTION 5
Which of the following are seeds?
A. Cabbage, celery, lettuce.
B. Pea, bean, peanut.      X
C. Lemon, cucumber, bean.
D. Tomato, pea, pear.

QUESTION 6
How are seeds from grass dispersed?
A. Spread by insects.
B. Blown by the wind.     X
C. Carried by water.
D. By exploding mechanisms in the fruit.

QUESTION 7
Wind-pollinated flowers have:
A. Abundant pollen on dangling stamens.
B. An absence of bright colours or exotic flower shapes.
C. Large feathery stigmas.
D. All of the above.      x

QUESTION 8
Which part of the flower turns into a seed?
A. The anther.
B. Stigma at the top of the style.
C. Ovules in the ovary.      x
D. Pollen grains.

QUESTION 9
Which is the correct order of occurrence in seed formation?
A. Flower formation, pollination, fertilisation, seed formation.      x
B. Flower formation, fertilisation, pollination, seed formation.
C. Flower formation, pollination, seed formation, fertilisation.
D. Pollination, flower formation, fertilisation, seed formation.

QUESTION 10
Which of the following is NOT considered to be an example of asexual reproduction?
A. Strawberry plants growing from runners.
B. Artificial insemination of cattle.     x
C. Geranium cuttings.
D. Cloning of Dolly the sheep.
PLANT REPRODUCTION
ASEXUAL REPRODUCTION

QUESTION 11
Which of these plants requires water to reproduce?

A. Daisy.
B. Moss.  x
C. Pine Tree
D. All do

QUESTION 12
Which words describe the basic structure of vascular plants?

A. Artery, vein, haemoglobin.
B. Roots, stems, leaves.  x
C. Bacteria, Fungi, Algae.
D. None of the above.
Extension activity

Organise the class into four groups. Two groups are going to look for the advantages and disadvantages of sexual reproduction (A, B) and the other two groups look for the disadvantages and advantages of asexual reproduction (C,D). They can use some web pages to search for information.

Discuss the advantages and disadvantages associated with each form of reproduction and write your ideas down. After that, get pupils involved in new groups (A,C) and (B,D) to share their knowledge.

Pupils have to be able to communicate the facts they know to the others.

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