

Checkpoint Science Scheme of Work

Biology – Year 3

Topic: Photosynthesis

Aims

That pupils should be able to:

- know about photosynthesis
- use a word equation for the process
- know about the transport of water and minerals in flowering plants

Links

Checkpoint curriculum – Bp 2, Bp 3

IGCSE Biology Section II 6.2.1, IGCSE Co-ordinated Sciences B 4, IGCSE Combined Sciences Biology Topic Two

Words

photosynthesis, chlorophyll

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
describe the effect of light (or lack of) on growing plants.	Students should set up some quickly germinating seeds in advance, e.g. cress, and leave them in the dark to observe the effects. Some should be set up in the light as a comparison. Link the equation with transfer of energy along the food chain. Sun → producer → consumer.	$\text{carbon + water} \xrightarrow{\text{light}} \text{sugar + oxygen}$ dioxide Sugars are converted to starch.
show how light is needed to make starch	Leaves can have sections covered with foil excluding the light and left for at least 24 hours. Students can test for starch using iodine after softening the leaf and removing chlorophyll.	Ethanol must not be used when any naked flames are present.
provide evidence that only green parts of plants make starch	A variegated leaf can be tested showing that chlorophyll is needed to make starch.	Ethanol must not be used when any naked flames are present.
know that the green parts of cells are called chloroplasts.	Students should compare pond weed and onion skin cells under the microscope if not already seen. Chloroplasts are identified.	

know that carbon dioxide can enter and oxygen escape through stoma	Leaf-peel techniques can be used to see stoma, possibly showing differences on upper and lower surfaces. Suitable leaves include Tradescantia, Impatiens and beans.	
explain how to measure rates of photosynthesis	Rate of production of oxygen by counting bubbles is found for pond weed, or the gas can be collected. The effect of changing the temperature might be investigated.	
know that nutrients in the form of mineral ions are taken in by roots.	Duckweed is grown in shallow dishes containing solutions with certain minerals omitted to observe the effects. A control should be included. Water should be prevented from leaving the containers by an oil film.	A summary can be provided for this topic in the form of a diagram of a plant showing the intake and output of items by arrows and including the transport routes of xylem and phloem.

Topic: Seeds

Aims

That pupils should be able to:

- understand sexual reproduction in flowering plants including
- pollination
- fertilisation
- seed formation
- dispersal

Links

Checkpoint curriculum – Bp 4

IGCSE Biology Section III 1.2.1, IGCSE Co-ordinated Sciences B 12, IGCSE Combined Sciences Biology Topic Four

Words

pollination, fertilisation, dispersal

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
explain the role of seeds/embryos in life cycles.	Students can research a life cycle of a plant or animal and display on a hoop of paper e.g. frog, melon, butterfly, maize.	
identify the positions and functions of the reproductive parts of plants.	A diagram of a flower can be coloured to distinguish the male and female reproductive parts. The number of ovules in the ovary can be counted.	Male – anther , filament, pollen Female – stigma, style, ovary, ovule
explain what is meant by pollination	Examples of wind and insect pollinated flowers should be studied (live, diagrams or photographs) and if possible a local flower showing the pollen and sticky stigma clearly.	Avoid pollen for students suffering from hay fever.
explain what is meant by fertilisation	Diagrams can show how the pollen causes a tube to grow down the style.	

observe the inside of a seed.	A seed such as a large bean can be bisected to identify the parts and a test done for starch. Some can be grown one way up, some another to compare the outcome. Fruits can be seen as the development of the ovary.	Seed structure does not have to be learned.
give reasons for the dispersal of seeds.	Students can compare the growth of plants which are crowded with those with plenty of space. The same amount of water, light and nutrients should be supplied to, for example, cress seeds.	
describe some methods of dispersal.	Examine a wide range of fruits and discuss methods of dispersal. Wind dispersal can be investigated by making a paper model (two or more wings and a weighted centre). By adjusting the wing size, total mass, shape etc students aim to make it stay in the air for the longest possible time, after dropping it from a certain height.	Have a competition.

Resources

<http://www.caosclub.org:80/freelessons/caosho34.html>

Topic: Food chains and webs

Aims

That pupils should be able to:

- explain energy flow, food chains and food webs using appropriate terminology
- explain the role of decomposers
- know about factors affecting the size of populations

Links

Checkpoint curriculum – Be 2, Be 3

IGCSE Biology Section IV 1, 2, 4, IGCSE Co-ordinated Sciences B 16, IGCSE Combined Sciences Biology Topic Five

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
write simple food chains	Using pictures of animals feeding (local / well known species where possible), students can suggest food chains. They can compare worldwide examples to group animals / plants within trophic levels to show similarities. Leaf litter / plant debris can be sorted for small animals which can be placed in a jar for observation before being returned unharmed.	Links should show arrows pointing to the consumer. Provide charts for identification.
give examples of how primary consumers and predators affect farmers and gardeners.	Examples can be used of organisms which are pests in many parts of the world, e.g. aphids, slugs, mice and of solutions, pesticides or predators. Students can gather information from farmers or gardeners, etc of from other resources about pests and their effect on crop yields.	
understand that energy is passed along a food chain originating with the Sun and that some is lost at each stage.	Students can list their diet for a day and then write relevant food-energy chains, using the Sun as a starting point. They should consider in what ways energy is lost.	

know that most food chains are interlinked as food-webs.	An example of a food web, preferably of local species, should be shown so students can identify food chains within it. A local habitat, such as a pond, tree, area of grassland, can be studied for students to write food webs. They should be able to predict the effect of increase / decrease of population of one species.	
role of decomposers	Students can observe the breakdown of bread (or fruit) as moulds are allowed to grow on it in a sealed container. A list of ways of preventing and / or encouraging decay (composting) can be drawn up. Items thrown away can be divided into biodegradable and non- biodegradable.	Containers must remain sealed.
factors affecting population	Students can count seeds of a plant like poppy, grass etc, or estimate numbers in frog spawn, fish eggs etc and be able to suggest reasons why only a small percentage survive.	
human population	Students may study graphs of the global population over time and consider reasons for, and disadvantages of, the rate of increase.	

Resources

<http://www.naturegrid.org.uk:80/pondexplorer/pondexplorer.html>

<http://www.uen.org/utahlink/pond/virtpond2.cgi>

Topic: Adaptation and selection

Aims

That pupils should be able to:

- explain adaptations of living things to their habitat
- know that genetic material is carried in the nucleus of the cell
- use keys to identify plants and animals

Links

Checkpoint curriculum – Bv 2, Be 1

IGCSE Biology Section I, Section III 3, IGCSE Co-ordinated Sciences B 14, B 16, IGCSE Combined Sciences Biology Topics Four and Five

Words

Selection, genetic, material

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
describe adaptations for the seasons.	Students should choose(from a list) an animal and a plant and research and report on one or more changes which occur though the year in response to hot, cold, rainy or dry conditions.	
describe adaptations for habitats.	A choice chamber used for wood lice / maggots etc will show preference for dark, damp conditions. Students can choose a characteristic of an animal e.g. shape, skeleton etc, and illustrate the way in which it is suited to its habitat, underground, in water, in trees etc.	Ensure wood lice etc are returned to their habitat unharmed.
describe adaptations for survival.	Picture cards of bird beaks, plant shapes, animal eyes etc, can be matched to “owners”. Students can write the function (obtaining food, producing offspring) on linking tape. It can be made as a game with the cards face down and picked up in pairs.	
show how populations can change with time.	Plot a population / time graph. Start with chosen values of two species e.g. fox and rabbit or lion and antelope. Suggest on the graph what happens when the population of rabbits / antelopes	The graph shows a repeating curve for each of predator and prey, the line for the prey has higher peaks and reaches its highest point before that for the predator.

	increases.	
give examples of inherited characteristics.	Students can list three ways in which an animal is identical to its parents and three ways in which it may be different.	A simple knowledge of genetic materials being located in the nucleus of most cells and being joined with other genes during fertilization is all that is required.
write and use simple keys.	Collecting leaves or seeds can provide samples for building a key but students will need to have worked with a provided key first. They can make keys to identify class members and discuss whether it will work next week or next year.	Bring out the point that some questions are less useful than others, e.g. length or mass, depth of colour etc.

Resources

<http://www.pics4learning.com/pics/lessons/lesson/Adaptation.html>

Topic: Human influences on the environment

Aims

That pupils should be able to:

- know about human influences on ecosystems
- know that selective breeding can lead to new varieties

Links

Checkpoint curriculum – Be 4, Bv 4

IGCSE Biology Section III 3.6 Section IV 5, IGCSE Co-ordinated Sciences B 15, B 17, IGCSE Combined Sciences Biology Topic Five

Words

ecosystem, selective, breeding

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
suggest the needs of an increasing human population.	Students discuss the needs of an increasing population and display e.g. as a topic web. They could compare those of two differing populations such as people in desert areas and those in major cities.	The list may include fresh air, living space, water, food, mineral resources.
understand the problems of obtaining enough fresh air.	Students in cities can test for air born particles by leaving a white tissue on the outside of a building for a few days and comparing with a clean one. A waxy or oily fuel can be burned and the fumes collected on cotton wool or similar.	Pollutants include carbon dioxide (global warming), nitrogen and sulphur oxides (acid rain), smoke (smog). This should be a demonstration as the fumes can be unpleasant. Safety precautions should be taken s appropriate and a fume cupboard used if necessary. Solutions include use of catalytic converters and renewable energy resources.
describe the problems of obtaining enough living space.	The effects of deforestation can be seen through diagrams showing how water washes soil away when tree roots are removed. A visit to a building site enables students to	Solutions include introduction of conservation schemes. Observation from a distance only.

	suggest what species might have been affected by destruction of habitat.	
describe the problems of obtaining enough clean water.	Where appropriate, fieldwork at a stream site can be undertaken. Indicator species found can show the relative cleanliness of the water.	Pollutants include chemical output which may be poisonous or sewage which can carry cholera, typhoid, poliomyelitis etc. Solutions include sewage treatment by bacteria.
understand that there are problems associated with intensive farming.	Students can study the effect of the presence of nitrates and phosphates on the growth of plant weeds.	Fertilisers wash off farmland into rivers and encourage the growth of algae, reducing available light for oxygenating plants. Pesticides may be poisonous. Solutions include greater use of organic farming methods and encouraging diets low in meat.
understand the problems of limited resources.	Students can research the mining of a named mineral or fossil fuel and report back.	Man-made alternatives can cause pollution; most plastics are not biodegradable or easily recyclable.
understand the principles of selective breeding.	Ask students to write an account of a flower grower trying to achieve a flower of a certain colour, or similarly for a vegetable with a desirable property.	

Resources

<http://eduref.org>