N5 Biology LE 1 Ecosystems LEARNING OUTCOMES

	_+*	by the end of each lesson you should know (including meanings of **key words**)
Ecosystem components		☐ I can state that **a species** is a group of organisms which can interbreed to produce fertile offspring ☐ I can state that **biodiversity** as the variety of living things in an ecosystem. ☐ I can state that a **population** is the number of individuals of the same species in an area. ☐ all the populations (plant & animal) in an ecosystem is called the **community** ☐ I can state that an **ecosystem** consists of all the organisms (the community) living in a habitat and the non-living components with which the organisms interact.
Food chains		☐ I can construct **a food chain** to show the relationship where one organism feeds on the previous one in a series and in turn provides food for the next one ☐ I can state that a **producer** is an organism (usually a green plant) which can create its own food ☐ I can state that the arrows in a food chain or food web show the flow of energy between species ☐ I can state that a **consumer** is an organism which eats another organism for food ☐ I can state that **herbivores** eat plant matter, **carnivores** eat meat and **omnivores** eat both meat and plants ☐ I can state that a **predator** hunts other animals for food and that **prey** is the animal that is hunted for food.
Food Webs		☐ I can state that interconnected food chains from an ecosystem are called a **food web** ☐ I can construct a food web ☐ I can explain what happens to other species when one species is removed from a food web. ☐ I can state that food webs with many interconnections are more stable than those with few interconnections
Niches		☐ I can state that a **niche** is the role that an organism plays within a community. ☐ I can explain that a niche relates to the **resources** an organism requires in its ecosystem, such as light and nutrient availability and its **interactions** with other organisms in the community ☐ I can explain that the niche of an organism involves **competition** and **predation** and the **conditions** it can tolerate such as temperature
Competition		☐ I can state that competition in ecosystems occurs when resources are in short supply. ☐ I can state that **interspecific** competition occurs amongst individuals of different species for one or a few of the resources they require. ☐ I can state that **intraspecific competition** occurs amongst individuals of the same species and is for all resources required. ☐ I can explain that intraspecific competition is **more intense** than interspecific competition because it occurs amongst individuals of the same species and is for all resources required.

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Biotic & Abiotic Factors		☐ I can give examples of **biotic** factors, including competition for resources, disease, food availability, grazing and predation. ☐ I can give examples of **abiotic** factors, including light intensity, moisture, pH and temperature.
Measuring Abiotic Factors		☐ I can measure **abiotic** factors such as light intensity using a **light meter**, soil moisture using a **moisture meter**, pH using a **pH meter** and temperature using a **thermometer**. ☐ I can state a **source of error** in measuring each of light intensity, soil moisture, pH and temperature. ☐ I can state how to **minimize error** when measuring each of light intensity, soil moisture, pH and temperature. E.g. ○ using a light meter take readings at same time of day and ensure no one is shading the light sensitive panel ○ using a **moisture meter** wipe the probe between uses, to avoid moisture from one reading affecting the next ○ using **pH meter** wipe the probe between uses, to avoid one sample affecting the next reading ○ using a **thermometer** wait until the liquid has stopped moving before taking the reading ☐ I can state that when measuring abiotic factors results will be more **reliable** if more than one reading is taken and an average is calculated.
Sampling organisms		☐ I can sample plants using quadrats. ☐ I can sample animals using pitfall traps. ☐ I can describe potential sources of error in the use of quadrats and pitfall traps and how to minimize them. E.g. ○ to avoid unrepresentative results the quadrats should be placed **randomly** ○ a pitfall trap should be buried in the soil, its upper edge at the same level as the soil. ○ a pitfall trap may have **ethanol** added to kill the trapped organisms and prevent animals being eaten by another trapped animal ○ a pitfall trap may have a **lid** resting above the upper edges, allowing insects to be trapped but preventing birds eating them ☐ I can explain the need to take samples which are **representative** of the habitat and the need to **replicate** the sampling adequately. ☐ I can describe the **effect of biotic and abiotic factors on biodiversity** and the distribution of organisms, such as stating the factors which can cause an increase or a decrease in biodiversity.
Keys		☐ I can use **paired-statement keys** to identify organisms. ☐ I can construct **paired-statement keys** to identify organisms.
Indicator Species		☐ I can state that **indicator species** are organisms that by their presence or absence show environmental quality/levels of pollution ☐ I can state that indicator species can indicate pollution in **water and air**.

		By the end of the lesson you should be able to
photosynthesis		☐I can give the **word summary** of the process of photosynthesis. ☐I can state that the **two stages** of photosynthesis are light reactions and carbon fixation.
light reactions		☐I can state that in the light reactions, the **light energy** from the sun is trapped by **chlorophyll** in the **chloroplasts** and is converted into **chemical energy** which is used to generate **ATP**. ☐I can state that in the light reactions, **water** is split to produce **hydrogen** and **oxygen** which diffuses out of the cell.
carbon fixation		☐I can state that in carbon fixation, a series of **enzyme-controlled reactions** occur, which use **hydrogen** and **ATP** (produced by the light reactions) with **carbon dioxide** to produce **sugar (glucose)**.
uses of glucose		☐ I can state that the **chemical energy** in sugar is available for **respiration** or the sugar can be converted into other substances, such as **starch** (storage) and **cellulose** (structural).
Limiting Factors		☐I can state that the limiting factors of photosynthesis are **carbon dioxide**, **light intensity** and **temperature.** ☐I can explain the **impact** of carbon dioxide, light intensity and temperature on the rate of photosynthesis and so plant growth e.g. ○ **increasing** the concentration of carbon dioxide will **increase** the rate of photosynthesis until another factor limits it ○ **increasing** the light intensity will **increase** the rate of photosynthesis until another factor limits it ○ **low temperatures** will **slow the rate** of photosynthesis as it slows the enzyme reactions controlling it ○ very high temperatures will **denature** the enzymes controlling photosynthesis and so will halt the process ☐I can explain how the rate of photosynthesis is investigated by measuring the rate of **oxygen production** in an aquatic plant e.g. elodea, under different conditions => the elodea bubbler experiment ☐I can identify the limiting factor at different points on a **limiting factors graph.** ☐I can explain how horticulturalists can adjust the environmental conditions to achieve optimum photosynthesis and therefore **optimum plant growth**

N5 Biology **LE4 Energy in Ecosystems** LEARNING OUTCOMES

	-+*	by the end of each lesson you should know (including meanings of **key words**)
Energy in food chains		☐ I can state that in food chains energy is **transferred** from one level to the next ☐ I can state that animals use energy for **growth**, **movement** and generating **heat** to keep warm. ☐ I can state that some of the food in a food chain is **indigestible** e.g. stems, bones. ☐ I can state that as it transfers from one level to the next in a food chain, the **majority of the energy is lost** as heat, movement or undigested materials ☐ I can stat that only a very small quantity of the energy is used for **growth** and is therefore available at the **next level** in a food chain
Pyramid diagrams		☐ I can state that **pyramids of numbers** show the total number of each organism at each trophic level of a food chain. ☐ I can explain why **irregular shapes** of pyramids of numbers based on different body sizes can be represented as true pyramids of energy. E.g. ○ if there is a **large producer** e.g. oak tree, the pyramid will have a small base ○ if there is a **small final consumer** e.g. fleas, the pyramid will have a wide top ☐ I can state that pyramids of energy show the total energy available at each trophic level of a food chain. ☐ I can state that energy is measured as **kilojoules per metre squared per year - kJ/m^2/year**

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Increasing Crop Yield		☐I can explain that increasing human population requires an **increased food yield.** ☐I can explain that increasing food yield can involve the use of **fertilisers** and **pesticides**. ☐I can state that **fertilisers** provide chemicals such as nitrates which increase crop yield ☐I can state that plants and animals which reduce crop yield can be killed by **pesticides**
fertilisers		☐I can state that **nitrates** dissolved in soil water are absorbed into plants. ☐I can explain that nitrates are used to produce **amino acids** which are synthesised into plant **proteins**. ☐I can explain that animals **consume** plants or other animals to obtain amino acids for protein synthesis. ☐I can state that **fertilisers** can be added to soil to increase the **nitrate** content of the soil.
algal bloom		☐I can describe **eutrophication**: ○ **fertilisers** can **leach** into fresh water, adding extra, unwanted nitrates. ○ This will increase algal populations which can cause **algal blooms**. ○ Algal blooms **reduce light levels**, killing aquatic plants. ○ These dead plants, as well as dead algae, become food for **bacteria** which increase greatly in number. ○ The bacteria use up large quantities of **oxygen**, reducing the oxygen availability for other organisms. ○ algal blooms therefore result in the **death** of many aquatic organisms
pesticides		☐I can explain that **pesticides** sprayed onto crops can **accumulate** in the bodies of organisms over time. As they are passed along food chains, toxicity increases and can reach lethal levels. ☐I can state that build-up of toxic substances in living organisms is known as **bioaccumulation**.
Alternative farming practices		☐I can explain that **genetically modified** (GM) crops can be used to reduce the use of fertilisers. E.g. **GM crops** are being developed to increase the plants' ability to absorb nitrates ☐I can state that the use of **biological control** and **genetically modified (GM)** crops as alternatives to the use of **pesticides**. ☐I can state that **biological control** is the control of a pest using its natural consumer or a disease

N5 Biology **LE6 Evolution of Species** LEARNING OUTCOMES

	-+*	By the end of the lesson you should be able to
Mutations		☐ I can state that a **mutation** is a random change to genetic material ☐ I can state that mutations may be **neutral**, causing no effect or they may confer an **advantage** or a **disadvantage** to survival ☐ I can state that mutations are **spontaneous** and are the only source of **new alleles** ☐ I can explain the environmental factors, such as **radiation** (X rays / UV rays) and some **chemicals** (mustard gas), can increase the rate of mutation
Variation		☐ I can state that an **adaptation** is an inherited characteristic that makes an organism well suited to survival in its environment/niche. ☐ I can explain that **new alleles** produced by mutation can result in plants and animals becoming better adapted to their environment. ☐ I can explain that **variation** within a population makes it possible for a population to **evolve** over time in response to changing environmental conditions
Natural Selection		☐ I can explain that species produce **more offspring** than the environment can sustain ☐ I can explain that natural selection (or survival of the fittest) occurs when there are **selection pressures** e.g. lack of food, cold, predation, disease ☐ I can explain that the **best adapted** (i.e. 'fittest') individuals in a population **survive to reproduce**, passing on the favourable alleles that confer the selective advantage ☐ I can explain that these alleles **increase in frequency** within the population
Speciation		☐ I can explain that **speciation** occurs after part of a **population** becomes isolated by an **isolation barrier.** ☐ I can state that **isolation barriers** can be **geographical, ecological or behavioural** ☐ I can give **examples** of geographical barriers (e.g. rivers), ecological barriers (e.g. pH, salinity or different habitats) and behavioural barriers (e.g. diurnal vs nocturnal). ☐ I can explain that after isolation, different **mutations** occur in each sub-population ☐ I can explain that natural selection selects for different mutations in each group, due to different **selection pressures** ☐ I can explain that ultimately, each sub-population evolves until they become so genetically different that they are two different species (=> **speciation**)