**Unit 3 – Life on Earth**

Learning outcomes:

*National 4 – Red*

National 5 – Black

1. **Biodiversity and the distribution of life (National 4 and 5)**
* *Food webs and the effect of the removal of a species to other members of the system.*
* *Variety of ecosystems and the different abiotic factors affecting them.*
* *Biotic factors affect population sizes, e.g. food supply, predation, disease, competition.*
* *Sampling techniques and measurement of abiotic factors.*
* *Changes in human population growth over time including projected growth.*
* *Impact of human population growth on biodiversity, e.g. habitat destruction, deforestation, over-fishing, intensive agriculture, genetic pollution, over population, climate change, acid rain, oil and chemical spills, sewage and litter.*
* *Impact of natural hazards on biodiversity eg forest fires, earthquakes, volcanic activity, tsunamis, wind.*
* *Methods of conservation of endangered species.*
* Biotic, abiotic and human influences are all factors that affect biodiversity in an ecosystem
* Grazing and predation are biotic factors; pH and temperature are abiotic factors.
* Biomes are the various regions of our planet as distinguished by their similar climate, fauna and flora. Global distribution of biomes can be influenced by temperature and rainfall.
* An ecosystem consists of all the organisms living in a particular area and the non-living components with which the organisms interact.
* A niche is the role that an organism plays within a community. It includes the use it makes of the resources in its ecosystem and its interactions with other organisms in the community including competition, parasitism, predation, light, temperature and nutrient availability.
1. **Energy and Ecosystems (National 4 and 5)**
* At each level in a food chain 90% of energy is lost as heat, movement or undigested materials. Some losses can be accounted for through decomposition.
* Definitions and comparison of pyramids of biomass, energy and numbers. Irregular shapes of pyramids of numbers based on different body sizes are represented as true pyramids of energy and of biomass.
* *Nitrogen is needed to make proteins.*
* *Nitrogen is recycled in different froms in a cycle and bacteria play a role in this process. Nitrogen needs to be converted into nitrates to be used by plants.*
* Nitrogen in ecosystems: Animal and plant proteins are produced from nitrates. The roles of nitrifying, denitrifying, root nodule and free-fixing soil bacteria.
* Decomposers convert proteins and nitrogenous wastes to ammonium and nitrate. Fertilisers supply nitrates to increase yield.
* Competition in ecosystems: Interspecific competition is when individuals of different species compete for the same resource in an ecosystem.
* Intraspecific competition is when individuals of the same species compete for exactly the same resources. Competition examples can include food, light, and water.
1. **Sampling techniques (National 4 and 5)**
* Pupils will have the opportunity to develop the following knowledge and understanding:
* Sampling plants and animals using quantitative techniques including quadrats and pitfall traps.
* Evaluation of limitations and sources of error in pitfall traps and quadrats.
* Measuring abiotic factors including light intensity, temperature, pH and soil moisture.
1. **Adaptations and evolution of new species (National 4 and 5)**
* *Give examples of structural, physiological and behavioural adaptations e.g. polar bear’s blubber.*
* *Explain the significance of these adaptations for survival e.g. polar bear’s blubber allows it to survive in cold waters.*
* State that a mutation is a random change to genetic material.
* State that mutations are spontaneous, they are the only source of new alleles and may be neutral, confer an advantage or disadvantage.
* State that environmental factors such as radiation and chemicals can increase the rate of mutation.
* State that an adaptation is an inherited characteristic that makes an organism well suited to survival in its environment/niche.
* Explain that variation within a population makes it possible for a population to evolve over time in response to changing environmental conditions.
* Describe natural selection/survival of the fittest as a process whereby more offspring are produced than the environment can sustain, only the best adapted individuals survive to reproduce, passing on the genes that confer the selective advantage.
* Describe speciation as a process whereby a population becomes isolated and natural selection follows a different path due to different conditions/selection pressures.
1. **Human impact on the environment (National 5)**
* State that the increasing human population requires an increased food yield.
* Describe the process whereby fertilisers leach into fresh water, causing algal blooms and a reduction in oxygen levels.
* Explain that pesticides sprayed onto crops can accumulate in the bodies of organisms over time and as they are passed along food chains, toxicity increases and can reach fatal levels.
* State that indicator species are species that by their presence or absence indicate environmental quality/levels of pollution.
* State that biological control and GM crops may be alternatives to mitigate the effects of intensive farming on the environment.
1. **Fertiliser design (National 4)**
* *Explore the use of natural and artificial fertilisers and the advantages and disadvantages of each (e.g. cost, specificity, purity, NPK composition)*
* *Investigate the effects of fertilisers (e.g. algal bloom)*
* *Investigate blue flag beaches nationally and internationally*
1. ***Learned behaviour (National 4)***
* *State that innate behaviour is “built-in” a species for example imprinting.*
* *State that learned behaviour is a result of experience for example habituation.*