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| **4.1.U1** | **Species are groups of organisms that can potentially interbreed to produce fertile offspring.** |
| **4.1.U2** | **Members of a species may be reproductively isolated in separate populations.** |

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| **4.1.U3** | | **Species have either an autotrophic or heterotrophic method of nutrition (a few species have both methods).** |
| **4.1.U4** | **Consumers are heterotrophs that feed on living organisms by ingestion.** | |

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| **4.1.U5** | **Detrivores are heterotrophs that obtain organic nutrients from detritus by internal digestion.** |
| **4.1.U6** | **Saprotrophs are heterotrophs that obtain organic nutrients from dead organisms by external digestion.** |

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| **4.1.U7** | **A community is formed by populations of different species living together and interacting with each other.** |
| **4.1.U8** | **A community forms an ecosystem by its interactions with the abiotic environment.** |

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| **4.1.U9** | **Autotrophs obtain inorganic nutrients from the abiotic environment.** | |
| **4.1.U10** | | **The supply of inorganic nutrients is maintained by nutrient recycling.** |

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| **4.1.U11** | | **Ecosystems have the potential to be sustainable over long periods of time.** |
| **4.1.S1** | **Classifying species as autotrophs, consumers, detrivores or saprotrophs from a knowledge of their mode of nutrition.** | |

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| **4.1.S2** | **Testing for association between two species using the chi-squared test with data obtained from quadrat sampling.** |
| **4.1.S3** | **Recognizing and interpreting statistical significance.**   * Calculate a chi-square statistic based on observed and expected values. * State the null and alternative hypothesis of statistical tests. * Determine if the null hypothesis is supported or rejected given a critical value and a calculated statistic. * State the minimum acceptable significance level (p value) in published research. * Explain the meaning of a “statistically significant” result, including the probability of chance having a role in the result. |

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| **4.1.S4** | | **Setting up sealed mecocosms to try to establish sustainability. (Practical 5)** | |
| **4.1.** **NOS** | **Looking for patterns, trends and discrepancies- plants and algae are mostly autotrophic but some are not.** | | |
| **4.2.U1** | | | **Most ecosystems rely on a supply of energy from sunlight.** |
| **4.2.U2** | | | **Light energy is converted to chemical energy in carbon compounds by photosynthesis.** |

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| **4.2.U3** | **Chemical energy in carbon compounds flows through food chains by means of feeding.** |
| **4.2.U4** | **Energy released from carbon compounds by respiration is used in living organisms and converted to heat.** |

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| **4.2.U5** | **Living organisms cannot convert heat to other forms of energy.** |
| **4.2.U6** | **Heat is lost from ecosystems.** |

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| **4.2.U7** | | **Energy losses between trophic levels restrict the length of food chains and the biomass of higher trophic levels.** |
| **4.2.S1** | **Quantitative representations of energy flow using pyramids of energy.** | |

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| **4.2.** **NOS** | **Use theories to explain natural phenomena- the concepts of energy flow explains the limited length of food chains.** |

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| **4.3.U1** | **Autotrophs convert carbon dioxide into carbohydrates and other carbon compounds.** |
| **4.3.U2** | **In aquatic ecosystems carbon is present as dissolved carbon dioxide and hydrogen carbonate ions.** |

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| **4.3.U3** | **Carbon dioxide diffuses from the atmosphere or water into autotrophs.** |
| **4.3.U4** | **Carbon dioxide is produced by respiration and diffuses out of organisms into water or the atmosphere.** |

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| **4.3.U5** | **Methane is produced from organic matter in anaerobic conditions by methanogenic archaeans and some diffuses into the atmosphere or accumulates in the ground.** |
| **4.3.U6** | **Methane is oxidized to carbon dioxide and water in the atmosphere.** |

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| **4.3.U7** | **Peat forms when organic matter is not fully decomposed because of acidic and/or anaerobic conditions in waterlogged soils.** |
| **4.3.U8** | **Partially decomposed organic matter from past geological eras was converted either into coal or into oil and gase that accumulate in porous rocks.** |

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| **4.3.U9** | **Carbon dioxide is produced by combustion of biomass and fossilized organic matter.** | |
| **4.3.U10** | | **Animals such as reef-building corals and Mollusca have hard parts that are composed of calcium carbonate and can become fossilized in limestone.** |

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| **4.3.A1** | **Estimation of carbon fluxes due to processes in the carbon cycle.** |
| **4.3.A2** | **Analysis of data from air monitoring stations to explain annual fluctuations.** |

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| **4.3.S1** | | **Construct a diagram of the carbon cycle.** | |
| **4.3.** **NOS** | **Making accurate, quantitative measurements-it is important to obtain reliable data on the concentrations of carbon dioxide and methane in the atmosphere.** | | |
| **4.4.U1** | | | **Carbon dioxide and water vapor are the most significant greenhouse gases.** |
| **4.4.U2** | | | **Other gases including methane and nitrogen oxides have less impact.** |

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| **4.4.U3** | **The impact of a gas depends on its ability to absorb long wave radiation as well as on its concentration in the atmosphere.** |
| **4.4.U4** | **The warmed Earth emits longer wavelength radiation (heat).** |

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| **4.4.U5** | **Longer wave radiation is absorbed by greenhouse gases that retain the heat in the atmosphere.** |
| **4.4.U6** | **Global temperatures and climate patterns are influenced by concentrations of greenhouse gases.** |

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| **4.4.U7** | **There is a correlation between rising atmospheric concentrations of carbon dioxide since the start of the industrial revolution 200 years ago and average global temperatures.** |
| **4.4.U8** | **Recent increases in atmospheric carbon dioxide are largely due to increases in the combustion of fossilized organic matter.** |

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| **4.4.A1** | **Threats to coral reefs from increasing concentrations of dissolved carbon dioxide.** |
| **4.4.A2** | **Correlations between global temperatures and carbon dioxide concentrations on Earth.** |

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| **4.4.A3** | | **Evaluating claims that human activities are not causing climate change.** |
| **4.4.** **NOS** | **Assessing claims- assessment of the claims that human activities are producing climate change.** | |