D2 Species and speciation – *summary of mark schemes*

D.2.2	State that evolution involves a change in allele frequency in a population's gene pool over a number of generations. *Mark Schemes* A. natural selective pressures result in survival of advantageous alleles; B. frequency of these alleles will increase through reproduction; C. these alleles spread through population; D. basis for microevolution; E. over time many advantageous genes accumulate in a species; F. when many changes occur some members of a species cannot successfully mate with others / reproductive isolation; G. results in evolution of a new species;
D.2.3	Discuss the definition of the term species. *Mark Schemes* Exceptions to biological species concept: A. ring species; B. subspecies may be isolated in niches / minor differences in gene pool / potentially able to interbreed but do not; C. some species reproduce asexually / parthenogenesis; D. interspecific hybridization / artificial methods / IVF technology; E. species definition cannot be applied to bacteria; F. species still evolve / cannot be applied to fossils; G. difficult to know if geographically separated populations can interbreed; H. some individuals are infertile;
D.2.4	Describe three examples of barriers between gene pools. *Mark Schemes* A. Speciation is the process by which one / more species arise from previously existing species; B. populations become genetically isolated; C. natural selection acts independently on each population; D. results in changes in allele / genotype frequencies; E. inability of organisms / gametes to meet leads to reproductive isolation; F. ecological isolation occurs when two species inhabit similar ranges but have different habitat preferences (eg two species of plants grow on different types of soil) / courtship / feeding differences; G. geographical barriers (such as mountain ranges, seas, rivers) produce barrier to gene flow due to spatial separation; H. a population colonizes a new habitat that involves unique selection pressures / becomes geographically isolated; I. eg Darwin's finches; J. polyploidy; K. eg some variants of wheat; L. after prolonged separation / genetic isolation over long period of time no longer able to interbreed and speciation has occurred;
D.2.5	Explain how polyploidy can contribute to speciation. *Mark Schemes* A. named example (eg tomato, wheat, sugar beet, bagworm moth); B. alteration of number of chromosomes (euploidy) / three (or more) sets of chromosomes; C. larger nuclei / larger cells; D. larger organisms / more vigorous; E. (generally) infertile; F. alloploidy when of different species;
D.2.6	Compare allopatric and sympatric speciation. *Mark Schemes* A. Sympatric: the formation of new species by populations that inhabit the same or overlapping geographic regions

D.2.9	Discuss ideas on the pace of evolution, including gradualism and punctuated equilibrium. *Mark Schemes* A. gradualism; B. slow, continuous change over a long period of time; C. gradual accumulation of (neutral) mutations / variations; D. punctuated equilibrium; E. long periods of stability followed by sudden changes; F. fossil record supports this; G. natural selection can be intense and can cause rapid change / evolution; H. rapid evolution due to major environmental changes / volcanic eruptions / meteor impact / other example; I. only advantageous alleles ultimately survive; J. some mutations had no morphological effects so not visible in the fossil record; K. rate of evolution could have fluctuated over time;
D.2.10	Describe one example of transient polymorphism. *Mark Schemes* A. transient polymorphism: eg industrial melanism / peppered moths / any valid example; B. selection of different alleles depends on environmental changes / selection pressures / temporary presence of certain genotypes;
D.2.11	Describe sickle-cell anemia as an example of balanced polymorphism. A. balanced polymorphism: eg sickle cell anemia / any valid example; B. heterozygous advantage in malaria as more fit / heterozygotes maintained in a population due to adaptive value;