MEGA LECTURE

Definitions and Concepts for AQA Biology A-level

Topic 7 - Genetics, Populations, Evolution and Ecosystems

Abiotic factors: The non-living aspects of an ecosystem e.g. temperature, light intensity, moisture, soil pH and oxygen levels.

Adaptation: A feature of an organism that increases its chance of survival in its environment.

Allele: A version of a gene.

Allele frequency: The number of times an allele appears within a population's gene pool.

Allopatric speciation: A form of speciation that occurs when two populations become geographically isolated.

Autosomal linkage: When two or more genes are positioned on the same autosome. They are unlikely to be separated by crossing over during meiosis so are often inherited together.

Autosome: A chromosome that is not an X or Y chromosome.

Belt transect: A line along a sampled area, upon which quadrats are placed at certain intervals to determine the abundance and distribution of organisms in an ecosystem.

Biodiversity: The variety of genes, species and habitats within a particular area.

Biotic factors: The living components of an ecosystem e.g. food availability, pathogens and predators.

Carrying capacity: The average size of a population that can be supported by an ecosystem over extended periods of time. This varies depending on biotic and abiotic factors.

Chi-squared test: A statistical test used to determine whether a pattern of inheritance is statistically significant.

Climax community: The stable community of organisms that exists at the final stage of ecological succession.

Codominant: When both alleles for a gene in a heterozygous organism equally contribute to the phenotype.

Community: All of the populations of different species living together in a habitat.

Conservation: The maintenance of ecosystems and biodiversity by humans in order to preserve the Earth's resources. This typically involves the management of succession.

Degrees of freedom (X^2 test): The number of categories minus one.

Dihybrid inheritance: The inheritance of two different genes, that determine two phenotypes, on two different chromosomes.

Diploid: Describes a cell with a nucleus containing two sets of chromosomes.

Directional selection: A type of selection that favours one extreme phenotype and selects against all other phenotypes.

Disruptive selection: A type of selection that favours individuals with extreme phenotypes and selects against those with phenotypes close to the mean.

Dominant: Describes an allele that is always expressed. Represented by a capital letter.

Ecosystem: The community of organisms (biotic) and non-living (abiotic) components of an area and their interactions. It is a dynamic system.

Epistasis: Describes a relationship between genes where the allele of one gene affects the expression of a different gene.

Evolution: The gradual change in the allele frequencies within a population over time. Occurs due to natural selection.

Gene: A length of DNA on a chromosome that codes for the production of one or more polypeptide chains and functional RNA.

Gene pool: All of the different versions of genes (alleles) in the individuals that make up a population.

Genetic drift: Variations in allele frequencies in small populations due to chance.

Genetic variation: Differences in genotypes between members of a population which may occur due to mutations, meiosis, or random fertilisation.

Genotype: An organism's genetic composition. Describes all alleles.

Habitat: The region where an organism normally lives.

Hardy-Weinberg principle: A model that predicts that the ratio of dominant and recessive alleles in a population will remain constant between generations if the following five conditions are met: no new mutations; no natural selection; no migration; large population; and random mating. It provides an equation for calculating the frequencies of alleles:

$$p^2 + 2pq + q^2 = 1.0$$

where p is the frequency of the dominant allele, and q is the frequency of the recessive allele.

Heterozygous: When someone has two different alleles of a gene e.g. Ff.

Homozygous: When someone has two identical alleles of a gene e.g. ff.

Interspecific competition: A type of competition that takes place between members of different species.

Intraspecific competition: A type of competition that takes place between members of the same species.

Locus: The position of a gene on a chromosome.

Mark-release-recapture: A method of estimating the population size of motile organisms. It involves capturing a sample of the population, marking them and releasing them. At a later date, another sample is captured and the number of marked individuals recorded. The population size can be estimated using the following equation:

$$\text{estimated population size} = \frac{\text{number of individuals in first sample} \times \text{number of individuals in second sample}}{\text{number of marked individuals in second sample}}$$

Monohybrid inheritance: The inheritance of one gene.

Multiple alleles: When a gene has more than two potential alleles.

Natural selection: The process by which the frequency of beneficial alleles gradually increases in a population's gene pool over time. This theory was developed by Charles Darwin.

Niche: Describes how an organism 'fits' into an ecosystem and its role in that environment.

Phenotype: An organism's observable characteristics. Due to interactions of the genotype and the environment.

Pioneer species: Species that can survive in hostile environments and colonise bare rock or sand e.g. lichens.

Population: All organisms of the same species living with one another in a habitat at the same time.

Predator: An organism that eats other organisms.

Prey: An organism that is eaten by predators.

Quadrat: A square grid of a known area used in sampling to determine the abundance of organisms in a habitat. There are two types: point quadrats and frame quadrats.

Random sampling: A sampling technique used to avoid bias e.g. creating a square grid and generating random coordinates.

Recessive: Describes an allele that is only expressed in the absence of a dominant allele. Represented by a small letter.

Selection pressures: Environmental factors that drive evolution by natural selection and limit population sizes e.g. competition, predation and disease.

Sex-linkage: The presence of a gene on an X or Y chromosome.

Speciation: The formation of new species due to the evolution of two reproductively separated populations. Two forms: allopatric and sympatric speciation.

Species: A group of similar organisms that are able to breed with one another to produce living, fertile offspring.

Stabilising selection: A type of selection that favours individuals with phenotypes close to the mean (average) and selects against extreme phenotypes.

Succession: Describes changes in the community of organisms occupying a certain area over time.

Sustainable: The ability to maintain something for future generations.

Sympatric speciation: A form of speciation that occurs when two populations within the same area become reproductively isolated.

Systematic sampling: A sampling technique used to determine the abundance and distribution of organisms along an area at periodic intervals e.g. along a belt transect. This is commonly used in ecosystems where some form of gradual change occurs.

Variation: The differences between individuals due to genes, the environment or a combination of both.