

Edexcel (B) Biology A-level

Topic 5 - Energy for Biological Processes

Definitions and Concepts

5.1 - Aerobic respiration

Adenosine triphosphate (ATP) - The energy currency of cells which is composed of ribose bound to three consecutive phosphate groups and the nitrogenous base adenine.

Aerobic respiration - The process of harnessing energy (in the form of ATP) from respiratory substrates using molecular oxygen.

Anaerobic respiration - The process of harnessing energy (in the form of ATP) from respiratory substrates when molecular oxygen is unavailable.

Glycolysis - The process which occurs in the cytoplasm that converts one molecule of glucose to two molecules of pyruvate and produces energy in the form of ATP and reduced cofactors.

Krebs cycle (TCA cycle/Citric acid cycle) - The cycle of reactions which take place in the mitochondrial matrix and oxidise acetyl molecules (from acetyl CoA) to produce carbon dioxide, reduced coenzymes and ATP.

Link reaction - The production of Acetyl CoA from pyruvate in the mitochondrial matrix.

Oxidative phosphorylation - The production of ATP from ADP by the enzyme ATP synthase using a proton gradient established by an electron transport chain on the inner mitochondrial membrane.

5.2 - Glycolysis

Glycerate 3-phosphate (GP) - The molecule produced from the breakdown of hexose biphosphate.

Hexose monosaccharide - A carbohydrate molecule containing 6 carbon atoms in its structure.

NAD⁺ (Nicotinamide adenine dinucleotide) - A cofactor used in metabolic processes like respiration as an electron acceptor.

NADH - The reduced version of the coenzyme NAD⁺.

5.4 - Oxidative phosphorylation

ATP synthase - An enzyme found in the inner mitochondrial membrane which is used to harness the energy of the proton gradient to phosphorylate ADP to form ATP.

Chemiosmosis - The passive diffusion of protons from a high concentration to a lower concentration across a partially permeable membrane used in oxidative phosphorylation.

Inner mitochondrial membrane - The phospholipid bilayer which is folded into cristae and separates the intermembrane space from the mitochondrial matrix. It contains many proteins and enzymes and is the site of the electron transport chain for oxidative phosphorylation.

Outer mitochondrial membrane - The phospholipid bilayer which surrounds the mitochondria and separates the cytoplasm from the intermembrane space.

Phosphorylation - The addition of a phosphate group to a molecule.

Terminal electron acceptor - The molecule which receives the electrons at the end of an electron transport chain (this is molecular oxygen in oxidative phosphorylation).

5.5 - Anaerobic respiration

Anaerobic respiration - The partial breakdown of hexose monosaccharides to produce a limited yield of ATP in the absence of oxygen. †

Ethanol - A 2-carbon alcohol formed through anaerobic respiration in plants.

Lactate - The molecule which is produced during anaerobic respiration by the reduction of pyruvate.

5.6 - Photosynthetic pigments

Absorption spectra - A graph showing the wavelengths of light which each photosynthetic pigment absorbs during photosynthesis.

Accessory pigments - Pigments which capture energy from photons and funnel it to the reaction centre.

Action spectra - A graph showing the overall rate of photosynthesis at different wavelengths.

Photosynthetic pigment - A coloured molecule which absorbs energy from photons emitted by light sources for photosynthesis.

Photosystem - A collection of photosynthetic pigments along with a reaction centre which is used for capturing and harnessing the energy of photons.

Reaction centres - Collections of pigments, proteins and cofactors which collect the energy from the accessory pigments and are the site of the light-dependent reactions of photosynthesis.

5.7 - Photosynthesis

Chloroplast - An organelle found in photosynthetic organisms which contains chlorophyll and is the site of photosynthesis.

Cyclic photophosphorylation - The formation of ATP involving photosystem I only.

Glyceraldehyde phosphate (GALP) - A 3-carbon molecule with a phosphate group attached which is produced from glycerate 3-phosphate (GP) in the Calvin cycle and is used in the production of biomolecules like monosaccharides and amino acids.

Glycerate 3-phosphate (GP) - The molecule produced from the breakdown of hexose biphosphate.

Grana - A stack of thylakoid sacs.

Intergranal lamellae - Thin membranes which connect nearby grana.

Light-dependent reaction - The first stage of photosynthesis that uses light energy to produce ATP, reduced NADP and oxygen. It takes place in the thylakoids of the chloroplast.

Light-independent reaction - The second stage of photosynthesis, also known as the Calvin cycle, in which the products of the light-dependent stage and carbon dioxide are used to build organic molecules. It does not require light energy and takes place in the stroma.

NADP⁺ - The oxidised version of NADPH.

NADPH - A cofactor used in photosynthesis and other anabolic reactions as an electron donor.

Non-cyclic photophosphorylation - The formation of ATP and reduced NADP involving both photosystems I and II.

Ribulose biphosphate (RuBP) - A 5 carbon molecule which is combined with carbon dioxide to form glycerate 3-phosphate (GP) in the Calvin cycle.

Ribulose biphosphate carboxylase (RUBISCO) - The enzyme which fixes carbon dioxide by combining it with Ribulose biphosphate (RuBP).

Stroma - The fluid within the chloroplast double membrane.

Thylakoid - Membrane bound sacs found in the stroma of chloroplasts which contain photosynthetic pigments and are the site of the light-dependent reactions of photosynthesis.

✚ Definition taken from: [Edexcel Biology B Specification \(9BI0\) 2015 \(Pearson\)](https://www.pearson.com/9780131469092/edexcel-biology-b-specification-9bi0-2015)