

# OCR (B) Biology A-level

## 4.3.1 - Photosynthesis, food production, managing environment

### Flashcards

This work by [PMT Education](https://www.pmt.education) is licensed under [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)



Describe the structure of a chloroplast.



## Describe the structure of a chloroplast.

- Double membrane (envelope)
- Thylakoids = flattened discs. Components for the light dependent stage include light harvesting complexes, photosystems, electron transport chain, and ATP synthase.
- Stroma = fluid-filled matrix containing enzymes, site of light independent stage.



Outline the overall reaction of photosynthesis.



Outline the overall reaction of photosynthesis.

In light-dependent stage, light energy breaks strong covalent bonds in water. Oxygen is released into the atmosphere.

In light-independent stage (Calvin cycle), useful molecules are produced from carbon dioxide.



Name the processes in the  
light-dependent reaction.



Name the processes in the light-dependent reaction.

- Photoionisation
- Electron transfer chain
- Chemiosmosis

Non-cyclic only:

- Reduction of NADP
- Photolysis of water



Explain how light energy results in release of electrons from chlorophyll.





Explain how light energy results in release of electrons from chlorophyll.

Chlorophyll molecules absorb energy from photons of light.

This 'excites' 2 electrons (raises them to a higher energy level), causing them to be released from the chlorophyll.



Explain how the electron transfer chain results in production of ATP.



Explain how the electron transfer chain results in production of ATP.

Electrons released from chlorophyll move down a series of carrier proteins embedded in the thylakoid membrane & undergo a series of redox reactions. Energy released used in proton pumping. Protons flow back down concentration gradient through ATP synthase, producing ATP.



Explain how the electron transfer chain results in production of reduced NADP.



Explain how the electron transfer chain results in production of reduced NADP.

NADP acts as a final electron acceptor, and is subsequently reduced.



Name the 3 main stages in the Calvin cycle.



Name the 3 main stages in the Calvin cycle.

1. Carbon fixation
2. Reduction
3. Regeneration



# What happens during carbon fixation?





## What happens during carbon fixation?

- Reaction between  $\text{CO}_2$  & ribulose biphosphate (RuBP) catalysed by enzyme RuBisCo.
- Forms unstable 6C intermediate that breaks down into  $2 \times$  glycerate 3-phosphate (GP).



What happens during reduction (in the Calvin cycle)?



## What happens during reduction (in the Calvin cycle)?

- $2\times$  GP are reduced to  $2\times$  triose phosphate (TP)
- Requires  $2\times$  reduced NADP and  $2\times$  ATP formed during the light-dependent reaction
- Forms  $2\times$  NADP and  $2\times$  ADP that enter the light-dependent reaction



What happens during regeneration (in the Calvin cycle)?



## What happens during regeneration (in the Calvin cycle)?

- After 1C leaves the cycle, the 5C compound RuP forms
- RuBP is regenerated from RuP using  $1 \times \text{ATP}$
- Forms  $1 \times \text{ADP}$



Name factors that can limit the rate of photosynthesis.



Name factors that can limit the rate of photosynthesis.

- Light intensity (light-dependent stage)
- Light wavelength (absorption by chlorophyll)
- CO<sub>2</sub> levels (light-independent stage)
- Temperature (enzyme-controlled steps)
- pH (enzyme-controlled steps)



How are nutrients produced as a result of photosynthesis?





## How are nutrients produced as a result of photosynthesis?

- Formation of amino acids from GP (requires nitrates and sulfates)
- TP molecules used to produce sugars e.g. glucose, fructose, sucrose



How does respiration depend on photosynthetic products?



How does respiration depend on photosynthetic products?

Respiration uses glucose and oxygen, which are produced by photosynthesis.



# What is meant by the compensation point?



What is meant by the compensation point?

The point at which the rate of photosynthesis is equal to the rate of respiration. Significant in crop production as it maximises the rate of growth.



Outline the roles of microorganisms in the nitrogen cycle.



Outline the roles of microorganisms in the nitrogen cycle.

- Nitrogen-fixing bacteria e.g. *Rhizobium* in roots and *Azotobacter* in soil, convert gaseous nitrogen into ammonia.
- Nitrifying bacteria e.g. *Nitrosomonas* convert ammonium compounds into nitrites.  
*Nitrobacter* then convert nitrites to nitrates.



Outline the role of microorganisms in environmental monitoring.





Outline the role of microorganisms in environmental monitoring.

Luminescent microorganisms can be used as biosensors. They light up in the presence of certain substances.



How is *Rhizobium* cultured in vitro?



## How is *Rhizobium* cultured in vitro?

1. Sterilisation; aseptic technique.
2. Inoculation; microorganism introduced to agar plate by streaking, seeding, or spreading.
3. Incubation; placed in warm environment for 24-48 hours to grow.



What must the agar plate used in the culturing of *Rhizobium* contain?



## What must the agar plate used in the culturing of *Rhizobium* contain?

- Agar
- Mannitol (energy source)
- Yeast extract (nitrogen source)
- Magnesium sulfate (source of essential ions)
- Sodium chloride (buffer)
- Dipotassium phosphate



What is biomass and how is it transferred through a food chain?



What is biomass and how is it transferred through a food chain?

The total weight of living matter in a certain area. Transferred through a food chain by consumption.



Give the formula for efficiency of biomass transfer.





Give the formula for efficiency of biomass transfer.

$$\text{Efficiency} = \frac{\text{biomass transferred}}{\text{biomass intake}} \times 100$$



How might efficient biomass transfer  
maximise sustainability?



How might efficient biomass transfer maximise sustainability?

High energy efficiency means animals require less food (maize), so fewer animals (cattle) are needed to be reared, and less land is cleared for agriculture.



Describe the role of ruminants in the human food chain.



## Describe the role of ruminants in the human food chain.

- Ruminants ferment their food prior to digestion, through the use of microorganisms which form an ecosystem.
- These break down cellulose to be utilised by the animal. Other bacteria produce fatty acids.
- Ruminants are a very good source of protein.



Define ecosystem and give an example.



## Define ecosystem and give an example.

- All the living organisms found in one area, and the non-living aspects of their environment e.g. a farm.
- Living (biotic) components include predators and disease.
- Non-living (abiotic) components include light and temperature.



Discuss the conflict between agriculture  
and conservation.





Discuss the conflict between agriculture and conservation.

- Hedgerow removal destroys habitat of many organisms
- Use of pesticides damages environment
- Disposal of farm waste often harmful
- Schemes in place to protect countryside



# What is meant by primary succession?



What is meant by primary succession?

Where an area previously devoid of life is colonised by a community of organisms.



Summarise the process of primary succession.



Summarise the process of primary succession.

- Pioneer species, able to survive in harsh conditions, colonise the area.
- They die, decompose, and add nutrients to the ground.
- Over time, this allows more complex organisms to survive.



What is the climax community and how is it reached?



What is the climax community and how is it reached?

The final stage of succession, where the ecosystem is balanced and stable. It is reached when the soil is rich enough to support large trees or shrubs, and the environment is no longer changing.



# What is deflected succession?





# What is deflected succession?

Where succession is interrupted, often through land management practices such as forestry and agriculture.

