Exercise walk-through

# 2.3 Biogeochemical cycles

International Baccalaureate · IB Diploma · Environmental Systems and Societies · SL

# Simpson's reciprocal index

- Site A has 10, 6 and 4 individuals; site B has 18, 1 and 1.
- Same richness, but A is shared more evenly.

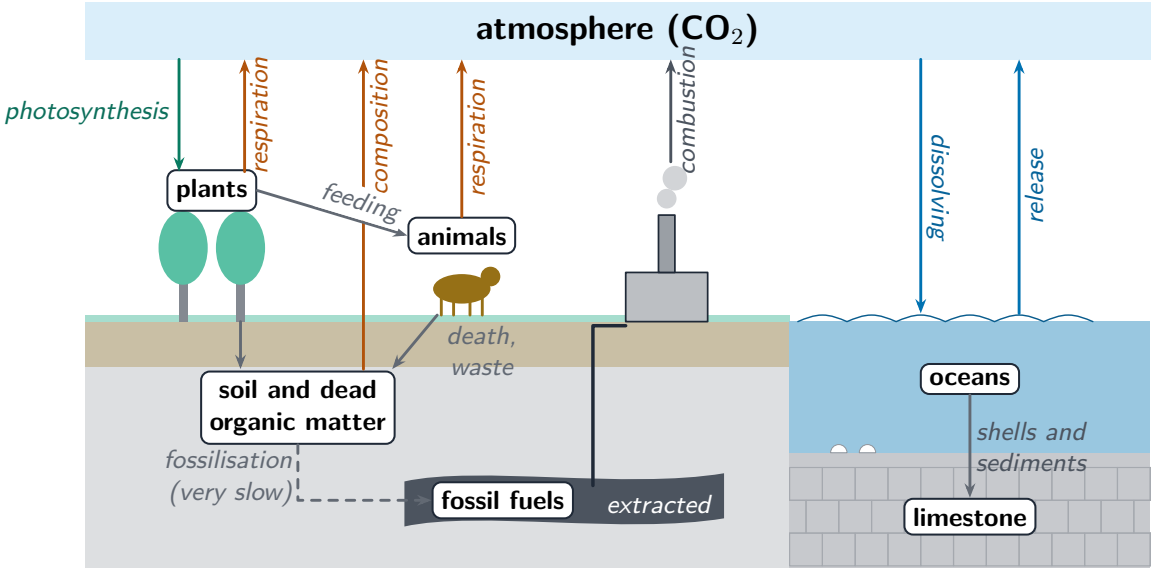
$$D = \frac{N(N-1)}{\sum n(n-1)}$$

$$D_A = \frac{380}{132} = 2.88$$

$$D_B = \frac{380}{306} = 1.24$$

These invented samples have equal richness and different evenness; compare like sampling.

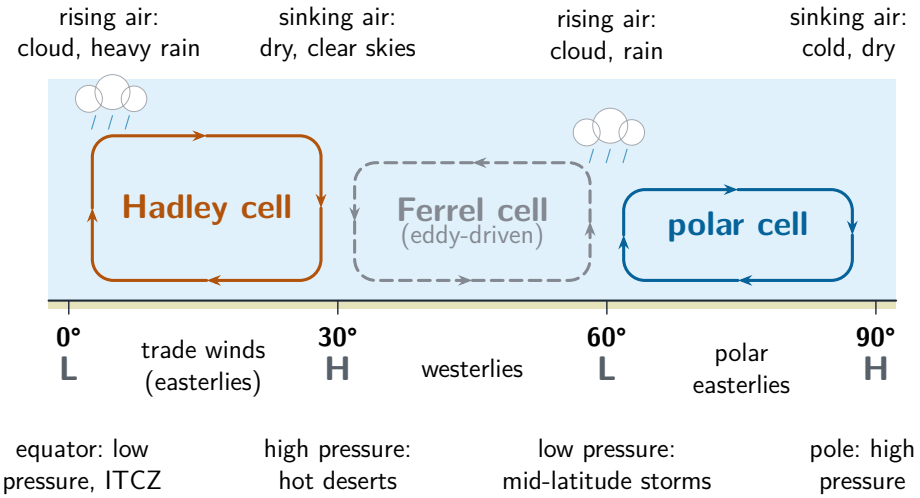
# The carbon cycle




storages in boxes, flows on arrows; not to scale

A store is an amount; a net **sink** is defined by the balance of flows over time.

# The tricellular model

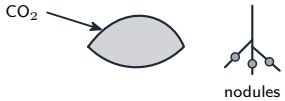



one hemisphere, idealised zonal mean; heights not to scale

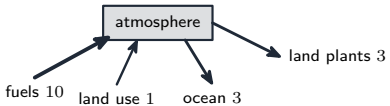
Link rising and sinking air to pressure and surface winds.

# Exercises 2.1·2.2

**2.1** Name the process: (i) $CO_2$ is taken from the air into a leaf to make glucose; (ii) $N_2$ gas is changed to ammonium in root nodules. [2]

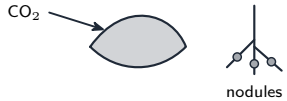



**2.2** Each year, about 10 GtC of carbon is released by burning fossil fuels and 1 GtC by land clearing; the oceans absorb 3 GtC and land plants 3 GtC more than they release. (i) Calculate the yearly change in atmospheric carbon. (ii) Identify **one** sink and **one** source in the data. [3]



# Exercises 2.1·2.2

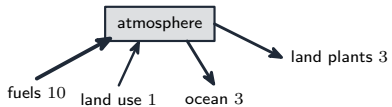
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**2.1**

(i) photosynthesis; (ii) nitrogen fixation

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**2.2**

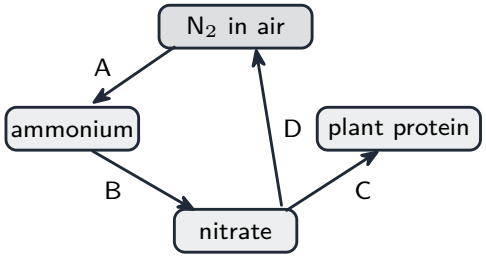
(i) $10 + 1 - 3 - 3 = +\mathbf{5}$ GtC a year; (ii) sink: oceans or land plants; source: fossil fuel burning or land clearing

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# Exercise 3.1 (a)

**3.1** The diagram shows part of the nitrogen cycle.

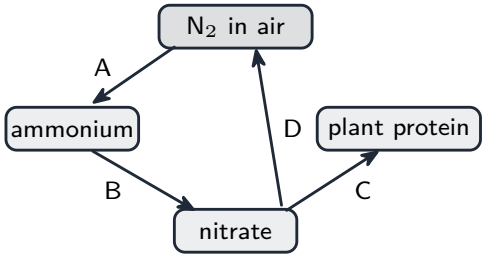
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# Exercise 3.1 (a)

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(a) A: nitrogen fixation ($N_2$ to ammonium); B: nitrification (ammonium to nitrate)

# Exercise 3.1 (b)

**3.1** The diagram shows part of the nitrogen cycle.

(b) Explain why ploughing that lets air into soil increases the nitrate in the soil. [2]

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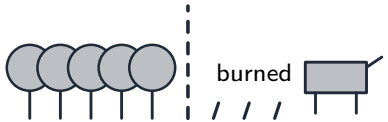
(b) Explain why ploughing that lets air into soil increases the nitrate in the soil. [2]

(b) nitrifying bacteria need oxygen; more oxygen speeds up nitrification, and denitrification slows

# Exercise 3.2 (a)

**3.2** A large area of tropical rainforest is cleared and burned for cattle pasture.

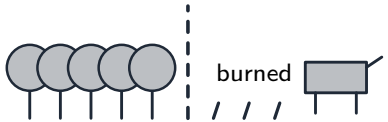
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# Exercise 3.2 (a)

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(a) Explain **two** ways this changes the carbon cycle. [4]




(a) burning moves carbon from biomass into the atmosphere quickly as $CO_2$; the forest was a sink, so less $CO_2$ is removed by photosynthesis in future, and soil carbon is lost as the soil is exposed and decomposes

# Exercise 3.2 (b)

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(b) State **one** other effect of the clearing on a biogeochemical cycle. [1]

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(b) any one: nutrients (nitrogen) are lost in runoff and leaching; cattle release methane; less transpiration changes the water cycle