Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

(i) photosynthesis; (ii) nitrogen fixation

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

2.3

waterlogged soil has little oxygen; denitrifying bacteria then change nitrate to N_2 gas, which is lost to the air; legumes have nitrogen-fixing bacteria in root nodules, which add ammonium to the soil when the plants die or are ploughed in

3.1

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

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

3.2

(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

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

3.3

(a) CO_2 dissolves in surface water; it reacts with water to form carbonic acid, so the pH falls

(b) award up to [4]: the ocean slows the rise of atmospheric CO_2 and so slows warming; but acidification harms corals, shellfish and plankton with carbonate shells, and the food webs that depend on them; warmer water dissolves less CO_2, so the sink may weaken; conclusion: the ocean delays the problem and creates another, so emissions still must fall

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