

Solutions

2.1 Carbon dioxide + water → glucose + oxygen, with light energy.

2.2 Light (energy transferred from the environment); in the chloroplasts.

2.3 Curve rising to a peak then falling; optimum labelled at the peak.

3.1 Any two, each with method and economic problem: add electric lighting to increase light intensity – cost of electricity may exceed the value of extra crop; burn fuels or heat to raise CO₂ concentration – fuel cost / CO₂ release; heat the greenhouse toward the optimum temperature – heating cost.

3.2 Distance triples, so intensity falls to $(1/3)^2 =$ one ninth.

3.3 Pondweed in a beaker of water with sodium hydrogencarbonate, under an inverted funnel collecting bubbles in a test tube; lamp at measured distances, e.g. 10, 20, 30 cm, left to adjust for a few minutes each time; count bubbles per minute, repeat and take a mean; rate = bubbles ÷ time (or volume of gas per minute); controls: same temperature – water bath/thermometer; same CO₂ concentration and same pondweed length/water volume.