Solutions

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

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

2.1

transfer: matter moves place without changing form, e.g. runoff or a river flow; transformation: matter or energy changes form or state, e.g. evaporation or condensation

2.2

(i) open: energy and matter (water, animals, nutrients) enter and leave; (ii) closed: energy enters and leaves, but almost no matter; (iii) closed: light enters and heat leaves, but no matter

2.3

(i) negative: less food raises deaths and lowers births, so the population falls back; (ii) positive: methane is a greenhouse gas, so warming causes more thawing and more warming

3.1

(a) evaporation (liquid to gas)

(b) inputs = outputs at steady state: $120 + 30 = 40 + x$; $x = \mathbf{110}$ units a day

(c) inputs exceed outputs by 30 units a day, so the lake storage rises

3.2

(a) warming melts sea ice, exposing darker water; albedo falls, so more solar energy is absorbed; the water warms and more ice melts, so the change grows

(b) a threshold beyond which the system changes to a new state; e.g. once summer ice is lost, warm open water may stop it re-forming, and the change is hard to reverse

(c) any one: simplifies processes such as clouds or ocean currents; depends on future emissions, which are unknown; limited past data

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