

- ii** Reactions are slow at low temperatures (1), because the molecules have little kinetic energy (1) and therefore there are fewer successful collisions between enzyme molecules and substrates (1). Water is a raw material for photosynthesis (1).
- c** The photosynthesis reaction uses / takes in light energy (1) and converts it into chemical energy stored in the glucose / starch produced (1).
- 2 ▶ a i** To remove any water / sap on the outside of the cylinder (1).
- ii** To allow an average to be calculated / to check reliability of results (1).
- iii** So they all had the same surface area to volume ratio (1).
- b i** 3 mol per dm³ sucrose solution has a lower water potential / lower concentration of water / higher concentration of solutes than potato cells (1), so water moves out of the cells and into the sucrose solution (1), resulting in a decrease in mass of the cylinder (1).
- ii** (Approximately) 0.75 mol per dm³ (1), because there is no change in mass (1), as there is no net movement of water (1).
- c** Repeat experiment with more cylinders (1), use more concentrations of sucrose between 0 and 1 mol per dm³ (such as 0.2 mol per dm³, 0.4 mol per dm³, etc.) (1).
- 3 ▶ a i** A = xylem (1) because it carries water to the leaf (1).
B = phloem (1) since it is the other vascular tissue in the vein, but is not carrying water (1).
- ii** 1 = transpiration stream / under pressure / mass flow (1).
2 = osmosis (1).
3 = evaporation / diffusion (1).
4 = transpiration / evaporation (1).
- b** Any two adaptations and explanations from
- Palisade layer cells / spongy mesophyll cells contain many chloroplasts (1) which absorb light (1)
 - Spongy mesophyll is a gas exchange surface (1) for exchange of CO₂ and O₂ (1)
 - Stomata allow entry of CO₂ (1) a raw material for photosynthesis (1)
 - Xylem supplies water (1), which is a raw material of photosynthesis (1)
 - Phloem takes away (1) sugars / amino acids / products of photosynthesis (1)
- c** Carbon dioxide enters through the stomata (1) but stomata need to be closed to prevent loss of water (1).
- 4 ▶ a i** (Positive) phototropism (1).
- ii** Any three from:
Auxin produced in tip of shoot (1) diffuses back down the shoot (1), auxin moves away from light source (1) causes growth on the dark side of the shoot (1).
- iii** The plant receives more light for photosynthesis (1).
- b i** Any two from:
Most curvature takes place at a wavelength of about 430 nm (1), light wavelengths above about 500–550 nm produce no curvature (1), there is a smaller increase in curvature with a peak at about 370 nm (1).
- ii** Any two for two marks from:
The tip / something in the tip only absorbs these wavelengths of light (1), cannot absorb other wavelengths (1), these wavelengths are present in sunlight (1).
- c i** Gravity (1).
- ii** Root grows towards gravity / positive geotropism (1), shoot (in some species) grows away from gravity / shows negative geotropism (1).
- iii** Shoots grow upwards towards light needed for photosynthesis (1), roots grow down towards source of water (1).
- 5 ▶ a i** B (1). **ii** F (1). **iii** E (1).
- b** Any two for 2 marks:
- large petals
 - brightly coloured petals
 - stamens enclosed within flower
 - stigma enclosed within flower.
- c i** H (1). **ii** G (1). **iii** C (1).
- d i** Pollination is the transfer of pollen from the anther to the stigma (1). Fertilisation is the fusion of the nucleus of the pollen grain with the nucleus of the ovum (1).
- ii** Self-pollination means transfer of pollen from the anther of a plant to the stigma of the same plant (1). Cross-pollination is when pollen is transferred to the stigma of another plant (1).
- 6 ▶** Any six points for 6 marks:
- pollen grains placed in sucrose solution / in range of concentrations of sucrose solutions, and pollen grains placed in water (Control)
 - grains from same species / same plant / same flower
 - stated number of grains in each treatment (minimum 10)
 - (use microscope to) count the number of grains that germinate / grow pollen tube
 - (after) suggested time period (minimum 1 hour)
 - calculate % germination in each treatment
 - same temperature / light intensity / other suitable controlled variable

UNIT 4 ANSWERS

CHAPTER 14

1 ▶ D

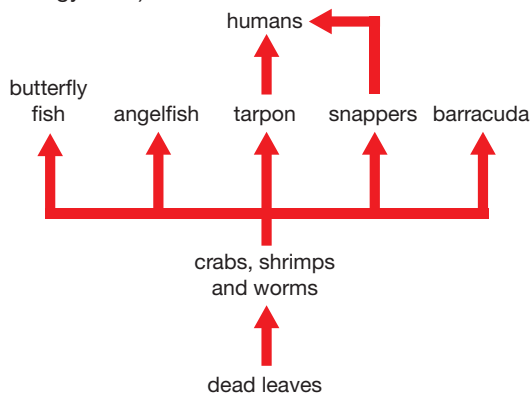
2 ▶ B

3 ▶ A

4 ▶ C

5 ▶ a Habitat: place where an organism lives; community: all the populations of living organisms in an ecosystem; environment: the non-biological components of an ecosystem; population: all the organisms of a particular species in an ecosystem.

- b** Plants = producers; animals = consumers; decomposers = breakdown of dead material.
- 6 ▶ a** **i** Plankton. **ii** Krill.
b Quaternary consumer / top carnivore.
c Very large amounts of photosynthesis / production by the plankton can support this number of trophic levels.
- 7 ▶ a** Any two from:
 • trees → moths → small birds → owls
 • trees → moths → small birds → weasels
 • trees → moths → small birds → shrews
 • trees → moths → beetles → shrews
b Vole or small bird.
c Reduction in dead leaves means there will be fewer earthworms and beetles, so less food for shrews.
d In the pyramid of numbers there are only 200 trees, but each tree has a very large mass, and the pyramid of biomass shows the total mass of the trees.
- 8 ▶ a** X = ammonia; Y = nitrate; Z = decomposer.
b Active transport.
c Bacteria that convert nitrogen gas into ammonia.
d In urine / faeces and in death.
- 9 ▶ a** $(125/3050) \times 100 = 4.1\%$.
b As urine / faeces, and as heat from metabolic processes / respiration.
c Eaten by other herbivores, or ends up in dead matter / passes to decomposers.
- 10 ▶ a** (For simplicity, crabs, shrimps and worms can be put together. Arrows should point in the direction of energy flow.)



- b** Any suitable food chain with four organisms, such as:
 • dead leaves → crabs → tarpon → humans
 • dead leaves → shrimps → snappers → humans
- c** **i** Carbon dioxide.
ii Decomposers feed on the detritus; their respiration produces carbon dioxide as a waste product.

- 6 ▶ a** The concentration of carbon dioxide is increasing.
b The increase is due to increased burning of fossil fuels.
c In the summer there is more photosynthesis, which lowers the concentration of carbon dioxide. In the winter there is less photosynthesis, so carbon dioxide levels increase.
- 7 ▶ a** Any two: carbon dioxide, methane, water vapour, CFCs
b Without a greenhouse effect, the temperature on the Earth's surface would be much colder than it is now, and life would not be able to exist. (One estimate is that the average temperature would be 30°C lower.)
c Malaria is spread by mosquitoes, which are found in warmer regions of the world. If global warming occurs, mosquitoes will spread to more northerly parts of Europe.
- 8 ▶ a** Rain washes fertiliser into the pond, causing the algae to grow.
b Rain washes the fertiliser down hill away from the pond.
c Algae are photosynthetic organisms (protocists). An increased temperature increases their rate of photosynthesis, so they grow faster.
- 9 ▶** Sewage causes growth of bacteria in the water. The bacteria need oxygen for growth, using up the oxygen in the water, so that the fish suffocate / die.
- 10 ▶ a** Pesticides kill pests (insects etc.) so less crop eaten; fertilisers supply minerals that increase the growth of crops.
b Use manure as fertiliser. After the crop has been harvested, dig in remains of plants, allowing them to decay and release nutrients. Use crop rotation including leguminous plants to produce nitrates. Use biological control methods to reduce pests.

END OF UNIT 4 QUESTIONS

- 1 ▶ a** **i** Any of the following for 1 mark:
 • plankton → sea butterfly → arrow worm → herring
 • plankton → small crustaceans → large crustaceans → herring
 • plankton → copepods → sand eel → herring
ii Primary consumer = sea butterfly / small crustaceans / copepods (1 mark for correct organism from food chain used).
 Secondary consumer = arrow worm / large crustaceans / sand eel (1 mark for correct organism from food chain used).
iii Herring (1). It is a secondary consumer when it feeds on other small crustaceans, and a tertiary consumer when it feeds on sand eels or arrow worms (1).
- b** **i** Pyramid drawn correctly, with relative amounts of energy at each trophic level approximately correct (1).
ii $(892/8869) \times 100 = 10.1\%$ (1 for correct values in calculation, 1 for answer).
iii $(91/892) \times 100 = 10.2\%$ (1 for correct values in calculation, 1 for answer).

CHAPTER 15

- 1 ▶** B **2 ▶** A **3 ▶** A **4 ▶** C
- 5 ▶** Because of the great increase in the human population, the need to produce food to sustain the population, and the industrial revolution and growth of technology.